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# Understanding the Influence of Personalized Recommendation on Purchase Intentions from a Self-Determination Perspective: Contingent upon Product Categories

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**Abstract:** While consumers experience shopping convenience through personalized recommendations, they are increasingly concerned about their consumption behavior being manipulated, leading to psychological resistance towards personalized recommendations. As such, research on how personalized recommendation services influence consumers' perceptions of self-determination (which further influences their intentions to purchase) is called for. To address the gap, this current research adopts a self-determination perspective to investigate how the three basic psychological needs of self-determination (autonomy, competence, and relatedness) mediate the relationship between personalized recommendations and consumers' purchase intentions. Moreover, this research examines whether the influence of personalized recommendations on consumers' perceptions of self-determination is contingent upon product categories. The results of a hypothetical scenario experiments study demonstrate that competence and relatedness are critical mediators between recommendation novelty and purchase intention. The results also reveal that the impact of recommendation diversity on autonomy is contingent upon product categories, while the influence of recommendation novelty on relatedness is also contingent on product categories. This study contributes to the literature on personalized recommendations by providing an underlying mechanism for the influence of personalized recommendations on consumers' purchase intention from the self-determination perspective, and especially by unravelling how the influence of personalized recommendations on consumers' perceptions of self-determination is contingent upon product categories.

**Keywords:** personalized recommendations; self-determination; product categories; purchase intention; S-O-R

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## 1. Introduction

A personalized recommendation provides consumers with products or services to match their interests and preferences, based on consumers' browsing and purchasing data on e-commerce platforms [1]. Precise personalized recommendation services can improve consumer decision-making quality by narrowing down the range of product searches and reducing decision-making time [2], rapidly increasing the activity and click-through rates of e-commerce platforms [3], and guiding consumers to make the purchase decisions expected by e-commerce platforms [4]. Personalized recommendations are commonly used in digital platforms such as e-commerce, video and information due to their "tailoring to taste" characteristics, helping platforms to accurately match consumers' diversified content needs and increase consumer activity. For example, Tmall has been able to recommend

products of interest to consumers based on their data, greatly enhancing their shopping experience. Personality can reflect consumers' internal characteristics and preferences, and personality-based recommendations can provide a deeper understanding of consumers from a psychological perspective. Therefore, personalized recommendation has become a common digital marketing tool for e-commerce platforms as a technical means to prevent consumers from experiencing the obstacle of excessive information selection.

However, personalized recommendations may also have unintended effects on consumer purchase decisions [5]. When e-commerce platforms frequently recommend specific products, consumers perceive the intention of manipulation by the merchants and show psychological resistance [6]. Additionally, high-accuracy recommendations raise serious concerns to consumers about their privacy in some recommendation scenarios [7]. Despite providing shopping convenience through personalized recommendations, consumers are increasingly concerned about personal details being leaked and abused, and their consumption behavior being manipulated, which leads to negative psychological perceptions, such as privacy concerns and psychological resistance towards personalized recommendations [8]. Given the two-pronged influence of personalized recommendations on the positive and negative effects of consumers' psychological perception, the intrinsic psychological motivation of whether personalized recommendation service promotes consumers' purchase intention should be further explored from the consumers' perspective; this will be a way to help e-commerce platforms better satisfy consumers' preferences and needs, which will become a key success factor enabling e-commerce platform companies to adopt personalized marketing. Although existing research has demonstrated that personalized recommendations have a positive effect on consumers' purchase intentions, they focus on exploring the impact of consumers' attitudes, trust, acceptance, and purchase decisions towards personalized recommendation using the technology acceptance model, consumer search theory, and elaboration likelihood model [9–11]; however, these studies have considered the impact on consumers mainly in terms of recommendation content, recommendation style, and trust perception. Thus far, There is a lack of research exploring the process of personalized recommendation's influence on consumers' purchase intention from the user's perspective, and the reasons for tracking consumers' behavioral intention through their psychological state have been neglected. The relationship between consumers' intrinsic psychological motivation and personalized recommendation remains an important gap in the relevant literature.

The self-determination theory suggests that intrinsic consumer motivation is formed by satisfying three basic psychological needs: autonomy, competence, and relatedness [12], providing theoretical support for consumer behavioral motivation. When the external environment supports the satisfaction of these three needs, consumers are more likely to understand the rules, norms, and practices of the shopping environment, which promotes the formation of autonomous motivation and shapes new consumer behavior that may be sustained in the long term [13,14]. Existing research has confirmed that the satisfaction of self-determination needs promotes consumer participation in brand co-creation activities [15], supports their motivation to generate user-generated content [16], and enhances their willingness to accept marketing activities in retail environments [17]. Although these studies have used basic psychological needs to address various consumer behavior management issues, scholars have paid little attention to the formation of intrinsic consumer motivation from the perspective of psychological need satisfaction [18], and there is a lack of research modeling autonomy, competence, and relatedness as independent variables to address unique marketing problems. Furthermore, although researchers have emphasized that consumers' needs for autonomy, competence, and relatedness are predictive and mediating factors for consumer behavior outcomes, such as the study by Gilal et al.

that demonstrated the mediating role of the satisfaction of these three basic psychological needs in the relationship between product design and brand loyalty, it remains unknown how the satisfaction of these needs as indirect factors is influenced by the external effects of personalized recommendations on consumer purchasing behavior [19]. Based on these research gaps, this study aims to propose a consumer-centric S-O-R model based on the self-determination theory, focusing on analyzing consumers' autonomy, competence, and relatedness as three basic psychological needs; furthermore, these will be used as an intermediate mechanism to identify and link the intrinsic psychological driving relationship between personalized recommendation as an external stimulus factor (marketing environment) and consumers' shopping behavior intentions (marketing outcomes).

It is more difficult (and more time-consuming) to evaluate the quality of certain types of goods than that of others. Thus, consumers' purchasing preferences online also differ across product categories [20]. Accordingly, some studies in the marketing field propose product categories as a potential moderator for the relationship between consumers' perceived value for hedonic and utilitarian benefits of sales promotion tools, and for the relationship between the determinants of online reviews and sales performance [21,22]. Nevertheless, it is not yet understood whether the influence of personalized recommendations on consumers' perceptions of self-determination is contingent upon product categories. To address this gap, this study further investigates the moderating effect of product category on the impact of personalized recommendations on consumers' perception of self-determination.

The current study has the following marginal contributions. First, the current research fills the gap in the literature by explaining the underlying mechanism for personalized recommendation's influence on consumers' purchase intentions from a self-determination perspective. Previous studies have examined the impact of personalized recommendations on consumers' online purchase intentions [11,23], but there has been little research that examines how personalized recommendation influences consumers' purchase intention from the self-determination perspective. This study applies the S-O-R theory, proposes a theoretical model that the three key dimensions of personalized recommendation influence purchase intention by satisfying consumers' basic needs, examines the influence of personalized recommendation on consumers' intrinsic psychological motivation, and supplements the research content of self-determination theory in the field of the recommender system. Additionally, it expands the research context of self-determination theory in the field of personalized recommendation. Previous research has indicated that consumers' purchasing preferences vary across product categories, and they have to use different assessment strategies and have different psychological feelings when making shopping decisions [24], but little research examines the moderating effect of product categories on the relationship between personalized recommendations and consumers' perceptions of self-determination. This study examines how the influence of personalized recommendations on consumers' perceptions of self-determination is contingent upon product categories, and its results provide a theoretical basis for understanding the impact of personalized recommendations on online sales of product categories. This study also helps e-commerce platform companies to develop differentiated personalized recommendation strategies for different product categories to adapt to consumers' rapidly changing perceptions of technology.

This study is structured as follows. First, we introduce the theoretical foundation of this study, discussing the concept of personalized recommendation and its three common indicators. Subsequently, we develop a theoretical model to examine how the basic psychological needs of self-determination mediate the relationship between personalized recommendations and consumers' purchase intentions, and whether the influence of personalized recommendations on consumers' perceptions of self-determination is contingent upon product categories. Thereafter, we describe the research methodology. The results of

the data analysis are then reported, followed by a discussion of the study's contributions to the literature, limitations, and future research directions.

## 2. Theoretical Background

### *2.1. Self-Determination Theory*

Self-determination theory (SDT) provides a framework for understanding the extent to which individual behavior is self-determined by intrinsic and extrinsic motivation [25]. Intrinsic motivation leads to stronger intentions and higher levels of engagement, while those experiencing extrinsic motivation often perform poorly and have low levels of engagement [26]. Intrinsic motivation is driven by the satisfaction of three basic psychological needs: internal, universal, and central [12]. Previous research has indicated that social factors influence intrinsic motivation by satisfying the three basic needs of self-determination, namely high levels of autonomy, competence, and relatedness, which promote the formation and internalization of psychological regulation and increase the intrinsic motivation of actions [27]. The satisfaction of the three basic psychological needs emphasizes the importance of intrinsic motivation in driving human behavior and provides a way to understand how the environment affects an individual's intrinsic motivation.

Autonomy is defined as a feeling that individuals enjoy a sense of active choice and free will in what they engage in, indicating that they can decide and control their behavior [28]. Competence refers to an individual's belief in his/her ability to effectively complete specific tasks or behaviors [15], similar to the concept of self-efficacy. Relatedness can be conceptualized as a sense of connection to or identification with others and the surrounding environment, indicating the extent to which individuals perceive themselves as cared for, respected, and understood [17]. Positive experience always stems from the satisfaction of individual psychological needs. The satisfaction of autonomy, competence, and relatedness provides a solution to promote a positive experience. When the social environment supports and promotes the satisfaction of these basic needs, it increases individuals' engagement in activities [29]. Unlike the physical attraction attributes of traditional retail spaces, the attractiveness of online shopping depends on the psychological perception of shoppers. By understanding the internal psychological perception of self-determined behavior, the role that personalized recommendations play in supporting or inhibiting consumer autonomy in online shopping can be understood [30]. From the perspective of the basic psychological needs of the self-determination theory, social events such as advertisements, charity donations, and hot topic promotions, as well as sales events such as product descriptions, purchase evaluations, and after-sales services, all stimulate consumers' basic needs and thereby influence their online purchase and repurchase behavior.

### *2.2. Stimulus-Organism-Response Model*

The Stimulus-organism-response theory (S-O-R theory) states that stimuli in the environment influence individuals' behavioral decisions by affecting their emotional performance [31]. The environment can not only reveal the causes of human behavior but also predict future behavior to some extent [32]. A complete S-O-R model typically includes a stimulus variable, one or more sets of mediating variables, and a response variable, with the mediating variables effectively expressing the relationship between stimulus and response. Due to its simplicity and rationality, the S-O-R model has been widely used as a theoretical framework for explaining the impact of shopping environment factors on consumer behavior [33]. In this model, the stimulus (S) is the factor in the environment that stimulates and promotes human action, including environmental factors that affect individuals' intrinsic emotions and cognition. The organism (O) is an internal process that mediates between external stimuli and final responses. It transforms external stimuli

into effective information that serves as the basis for subsequent behavior. It primarily refers to individuals' emotional states and cognitive levels, such as sensory, perceptual, and emotional factors. The response (R) is the ultimate behavior outcome of the stimulus object, including psychological and behavioral responses, such as participation, sharing, and purchase decisions [34]. Based on the S-O-R theoretical framework, this study posits that personalized recommendation, as an external environmental stimulus, affects consumers' intrinsic motivations of autonomy, competence, and relatedness, thereby playing a role in enhancing purchase intentions.

### *2.3. Personalized Recommendations*

The core of personalized recommendation is the vast and complex algorithm behind the recommendation system, which is reflected by evaluation indicators [35]. Evaluation indicators are specific measures of recommendation processes and outcomes, guiding the development of recommendation systems. From the perspective of recommendation outcomes, evaluation indicators of personalized recommendation include user satisfaction, accuracy, diversity, novelty, serendipity, credibility, and coverage [36]. To evaluate the performance of recommendation systems, most studies focus on recommendation accuracy, which is mainly measured by calculating the distance between recommended items and consumers' actual preferences [37]. Researchers and companies have recognized that recommendation diversity is also an important criterion for evaluating recommendation performance, measuring the degree of differentiation among recommended items in the recommendation list [38]. Research shows that recommendation diversity has become an indispensable component of recommendation systems [39]. Recommendation novelty refers to the difference between recommended items and consumers' experience, which requires that consumers are provided with new products or services that differ significantly from their expected purchase experience [40]. Some studies point out that although recommendation accuracy, novelty, and diversity are not the only dimensions of recommendation systems, they are fundamental dimensions [40]. As such, this study selects accuracy, diversity, and novelty as three personalized recommendation indicators of external environmental stimuli for online shopping consumers.

### *2.4. Product Categories: Search and Experience*

Because of the difficulty of consumer product quality evaluation, previous research divides consumer goods and services into three categories: search, experience, and credence, hence the SEC framework [41,42]. Consumers can confidently evaluate the quality of search goods (such as mobile phones and best-selling books) before purchase, and consumers evaluate the quality of experience goods (such as shoes and perfume) through experience after consumption. Further, consumers find it difficult to evaluate the quality of credence goods (such as vitamin tablets and financial investments) for a long time after purchase. The uncertainty of quality evaluation increases as consumers move from search to experience and to credence goods [43]. Previous studies on the impact of online purchasing on product sales have focused on search and experience goods. This may be due to the digitization of e-commerce transactions deepening consumers' digital perception of goods. The experience, trust, and "touch" before purchasing can be reflected in virtualized data, while the experience after purchase is consistent with offline physical purchases. Therefore, most discussions in the e-commerce environment focus on the influence of the ease of quality evaluation before and after purchase on consumers' behavior, excluding credence goods, and considering it as a future research direction. Previous studies have also shown that different factors have a significantly different impact on consumers' online purchases between search and experience goods. Li et al. find that online reviews have a greater

impact on the purchase of experience goods than search goods [21]. Senecal and Nantel show that online recommendations have a greater impact on consumers' purchase of experience goods than search goods [9]. Thus, it is likely that the influence of personalized recommendations on consumers' perception of self-determination may be contingent on product categories.

## 3. Research Model and Hypotheses

### *3.1. Theoretical Model*

Based on self-determination theory and the S-O-R theoretical framework, this study proposes a research model to investigate the mechanism underlying the influence of personalized recommendations on consumers' purchase intention (see Figure 1). In this model, three indicators for personalized recommendations (namely accuracy, diversity, and novelty) act as "stimulation" factors in the external environment, which affect the ultimate "response" (purchase intention) of consumers through the "organism" (namely autonomy, competence, and relatedness). Further, product categories moderate the relationship between personalized recommendations and the three basic psychological needs of consumers (i.e., autonomy, competence, and relatedness).

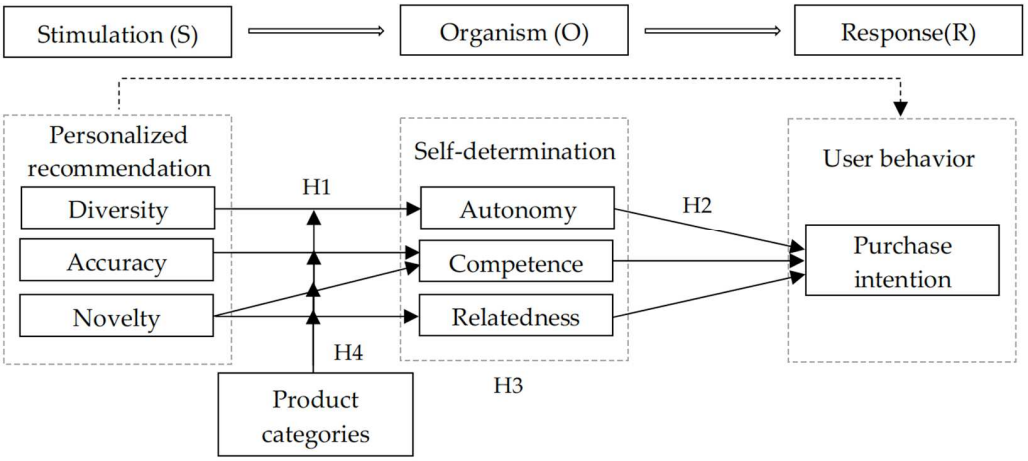



**Figure 1.** Theoretical model.

### *3.2. Hypothesis Development*

#### 3.2.1. Direct Effect

Consumer preferences are constantly changing with time and the environment, resulting in a high degree of uncertainty in predicting their preferences [44]. Li et al. show that a recommendation list with more differentiated options between items can provide consumers with a wider range of purchasing choices and help to address the uncertainty in predicting consumer preferences [45]. Dealing with preference uncertainty, diversified recommendation makes consumers feel that the e-commerce platform understands them better than they understand themselves [46], gives them a sense of ownership over their product purchase choices, and makes them feel that the recommended products align with their sense of free will and freedom of choice [47]. Therefore, it is likely that recommendation diversity can enhance consumers' autonomy in their purchase decisions. Thus, the following hypothesis is proposed:

**H1a:** *The diversity of personalized recommendations is positively related to consumers' autonomy.*

Recommendation accuracy reflects the degree to which consumers feel the proposed recommendations match their interests and preferences, based on what has been previously

browsed or purchased. Accurate recommendations provide consumers with a sense of familiarity by connecting them to their previous interactions and experiences with the product [48]. Familiarity provided by accurate recommendations promotes the formation of a reinforced knowledge structure in consumers' further evaluation of the value of the recommended product [49], thereby enhancing their self-efficacy in purchasing the recommended product and helping them perceive a sense of control and mastery over the recommended product selection and purchase [50]. In addition, accurate recommendations may help consumers overcome limitations in cognitive abilities by narrowing the search scope as well as reducing decision-making time and burdens [51]. Therefore, it is likely that recommendation accuracy increases consumers' competence in the purchase process while enhancing their decision-making efficiency. This leads to the following hypothesis:

**H1b:** *The accuracy of personalized recommendations is positively related to consumers' competence*.

The actual preferences of consumers during the process of product selection are unstable and difficult to predict [40]. Consumers not only need relatively accurate and diverse product recommendation information but also need some unfamiliar and related products [52]. Novel recommendations can capture users' various interests by providing a set of different items, stimulating users to explore potential areas of interest [53]. Recommending popular products that consumers have not seen or purchased before, especially those that are novel to them, may enhance their competence in evaluating the value of recommended products that align with their potential interests, thereby promoting higher purchasing decision-making control. Hence, the following hypothesis is suggested:

**H1c:** *The novelty of personalized recommendations is positively related to consumers' competence*.

Previous research on consumer behavior suggests that individuals purchase products not only for their functional and experiential value but also for their symbolic or expressive value [54]. In the e-commerce context, an individual's online identity may not necessarily be associated with their offline identity, while consumers may want to present a new identity or further describe and differentiate themselves [55]. Novel products may relate to a self-presentation of the identity or image that they project in the e-commerce network space [56], thereby helping consumers experience a sense of intimacy with the e-commerce platform, and feel connected and supported by similar others [57]. In other words, it is expected that recommendation novelty will have a positive impact on consumers' relatedness. Thus, the following hypothesis is proposed:

**H1d:** *The novelty of personalized recommendations is positively related to consumers' relatedness*.

The feeling of self-determination can lead individuals to engage more deeply in activities they pursue, resulting in positive experiences [58]. The feeling of freedom of choice leads them to find congruence between personal values and external tasks and to drive their internal motivation to act [59]. In the context of this study, consumers' autonomy is manifested as personalized recommendations of products and services that match consumers' interests and preferences, satisfying their freedom of choice [60]. When consumers have a higher autonomy regarding personalized recommendations, they are more likely to integrate the value of recommended products into their personal value identity, and thus their internal motivation to purchase becomes stronger, leading to a higher tendency to accept the recommended products. This leads to the following hypothesis:

**H2a:** *Consumers' autonomy is positively related to their purchase intention for the recommended products*.

Individuals with high competence are more likely to engage in related behaviors than others [61], as the feeling of competence can stimulate individuals' desire to interact with the environment and to match personal goals with external ones [62]. In contrast, when individuals feel incompetent, they may experience motivational rule limitations that restrict them from taking required actions [63]. In the context of this study, competence refers to consumers' perceived ability to understand the functionality and quality of recommended products. When consumers feel that they have sufficient judgment ability regarding recommended products, they tend to identify the benefits of their actions and match them with their purchase needs [64]. When consumers feel that they can accurately judge the value of recommended products, they are more likely to purchase the products. This leads to the following hypothesis:

**H2b:** *Consumers' competence is positively related to their purchase intention for the recommended products*.

Relatedness is associated with people's general desire to establish connections with others and to experience the feeling of being cared for and caring for others [58]. This need for social connection stimulates exploration and interaction with others, emphasizing the relationship between individual goals and those of others [65]. Kim and Drumwright demonstrated that customers who experience a closer relationship with service providers are more willing to engage in subsequent participation behaviors than those who lack relatedness [66]. Satisfying this feeling of being cared for may trigger an emotional attachment to the recommended product, leading to subsequent purchase intention [67]. This leads to the following hypothesis:

**H2c:** *Consumers' relatedness is positively related to their purchase intention for the recommended products*.

#### 3.2.2. Mediation Effect

Existing research shows that the satisfaction of self-determination needs promotes consumer participation in brand co-creation activities [15], supports their motivation to produce user-generated content [16], and enhances their willingness to accept marketing activities in retail environments [17]. Gilal et al. demonstrate the mediating role of satisfaction of these three basic psychological needs (autonomy, competence, and relatedness) in the relationship between product design and brand loyalty [19].

Diversified recommendations with differentiated options can avoid the redundancy of similar recommendation services, expand the consumer's choice range to some extent, solve the sparsity and cold start problems of recommendation systems, and effectively improve consumer satisfaction with recommended results [45]. From this perspective, diversified recommendations not only provide suitable recommendations but also broaden the consumer's choice of vision, enabling them to compare different recommended items based on their past interests and experiences, and better understand alternative product information [68]. In other words, a deeper understanding of recommended alternative products will promote consumers' autonomy, which in turn will increase their intention to purchase recommended products [47]. Thus,

**H3a:** *Autonomy mediates the relationship between recommendation diversity and consumers' to purchase intention for recommended products*.

Accurate recommendations that match consumers' interests and preferences can connect with consumers' previous purchase and usage experiences, minimize information search time and alternative range, and promote consumers' perception of control over purchasing recommended products or services [51]. The competence in evaluating the value of recommended products further helps consumers make quick purchase decisions, thereby increasing actual purchases [7]. Thus, the following hypothesis is suggested:

**H3b:** *Competence mediates the relationship between recommendation accuracy and consumers' purchase intention for recommended products.*

Novelty recommendations based on historical usage records proactively provide them consumers products that satisfy their curiosity and potential interests, reducing the non-monetary costs of purchasing goods while also increasing consumers' recognition of the recommendation system's efforts, and promoting their self-efficacy beliefs in evaluating the value of recommended products. The competence formed by individuals' perceived self-efficacy beliefs influences their behavior that matches external goals [61]. Thus, based on the promotion to cross-selling [53], recommendation novelty may affect consumers' purchase intention of recommended products through their perceived competence in evaluating the value of recommended products. Thus,

**H3c:** *Competence mediates the relationship between recommendation novelty and consumers' purchase intention for recommended products.*

Some studies suggest that recommendation system users may prefer to find some level of surprise in the recommendations they receive [40]. From the consumer's perspective, novel recommendations enrich the consumption experience over time, broaden their awareness of goods, and satisfy their explicit intention to discover new things, develop new interests, and learn [69]. Consumers perceive that the recommendation of novel goods highlights their desire to explore unknown events and reflects their interest in unknown areas, and establishes an interactive connection between consumers and the presentation of diverse goods, making them feel as if they are integrated into the social circle of the e-commerce platform; they also experience a sense of understanding and care from the platform, gradually forming an emotional dependence on the platform, promoting their trust and interaction with recommended products, and thus generating a higher purchase intention [70]. Therefore, recommendation novelty may affect consumers' purchase intention of recommended products by promoting their relatedness to the e-commerce platform. The following hypothesis is suggested:

**H3d:** *Relatedness mediates the relationship between recommendation novelty and consumers' purchase intention for recommended products.*

#### 3.2.3. Moderation Effect

Although recommendation diversity may have a positive impact on consumers' autonomy, the effects may differ across different types of goods. Consumers cannot directly assess the value of the goods from the parameters given by the merchant, making it difficult to evaluate the quality of experience goods before purchase [17]. In addition to using objective information and past consumer reviews to evaluate the quality of experience goods, consumers have to consider the personal and environmental factors of the past consumers providing these reviews [71]. Consumers typically rely on the overall experience of the reviewers to determine the quality of experience goods [72]. Compared to purchasing search goods, consumers tend to seek as much information as possible about experience goods,

and thus pay more attention to the comparison of multiple products and past consumer review information and are more likely to make their choices based on comprehensive information [73]. Thus, recommendation diversity eliminates consumers' uncertainty about the selection of experience goods by providing more product and review information, enhancing their identification with recommended products and awareness of autonomous choice [74]. Therefore, the relationship between recommendation diversity and consumers' autonomy may be contingent upon product categories. For experience goods that can only be accurately evaluated after use, the effect of recommendation diversity on autonomy is stronger. Thus,

**H4a:** *Product categories moderate the relationship between recommendation diversity and consumers' autonomy. The effect of recommendation diversity on consumers' autonomy is stronger for experience goods than for search goods.*

As previously mentioned, recommendation accuracy may affect consumers' competence, but this effect may vary across different types of goods. Compared to choosing search goods, consumers need to have a more careful and comprehensive understanding of all the information provided about experience goods to reduce purchase risk [75]. The quality details of experience goods are likely only obtainable during use and mainly come from consumers' perceptions [76]. Consumers can evaluate the quality of experience goods through the evaluation information of other users, but they tend to be more skeptical of subjective information [77]. Consumers often combine their purchasing and usage experiences to determine the quality of experience goods, which seems to be consistent with the logic that loyalty of repeat purchasers of experience goods may be higher than that of search goods purchasers [78]. Therefore, accurately recommended products reflecting consumers' previous purchase preferences effectively link consumers' previous usage experiences and habits, reducing the complexity and cognitive effort of their evaluation of experience product quality, and thus bringing about self-efficacy in evaluating product quality [51]. Based on consumers' extensive knowledge of experience goods before browsing, recommendation accuracy can enhance their competence in purchasing experience goods. Thus, the impact of recommendation accuracy on consumers' competence may be contingent upon product categories, leading to the following hypothesis:

**H4b:** *Product categories moderate the relationship between recommendation accuracy and consumers' competence. The effect of recommendation accuracy on consumers' competence is stronger for experience goods than for search goods.*

A higher degree of novelty in recommendations requires that consumers are provided with new products or services that differ significantly from their purchase experience. For search goods, this differential recommendation has little impact on consumers' quality evaluations because the functionality and quality parameters of search goods are more standardized, and therefore consumers can judge the quality of the product based on the indicators displayed by the merchant. In comparison, for experience goods, consumers need to obtain more comprehensive information about novel products to accurately judge the quality of the goods. The additional product evaluation information brought by the novel recommendation can make consumers feel more in control of the quality of the experience goods, enabling them to evaluate the quality of the recommended product and understand the consequences of the purchase before making a purchase decision. Therefore, the relationship between recommendation novelty and competence may be contingent upon product categories, leading to the following hypothesis:

**H4c:** *Product categories moderate the relationship between recommendation novelty and consumers' competence. The effect of recommendation novelty on consumers' competence is stronger for experience goods than for search goods.*

The previous statements reveal a positive relationship between recommendation novelty and consumers' relatedness, which may also be contingent upon the types of goods. Since the quality information of search goods is easy to obtain during the purchase process and can be used to evaluate quality with relatively high accuracy, the quality information of recommended novel search goods is usually clear and objective [71]. In this case, consumers can obtain quality information through a search and make accurate quality evaluations of recommended novel products, forming a weak relationship with the e-commerce platform. As network theory suggests, the advantage of weak ties is the ability to quickly acquire new knowledge horizontally [79]. For experience goods, consumers evaluate quality by combining explicit and implicit knowledge. Nevertheless, since implicit knowledge is not fully disclosed by past consumers, consumers need to invest more time and effort to collect available information containing deep implicit knowledge of experience goods. When consumers invest time and effort to establish personal data and show their identity to the recommendation system, a strong relationship with the e-commerce platform's network space can be established in a personalized way [80]. According to the homophily principle in sociology, strong ties depict more similar people than weak ties [81]. This conforms to a characteristic of social networks, where people who pursue the same novelty tend to gather together, interact, and form strong relationships that help them experience intimacy, feel connected to others, and receive support. Thus, the following hypothesis is proposed:

**H4d:** *Product categories moderate the relationship between recommendation novelty and consumers' relatedness. The effect of recommendation novelty on consumers' relatedness is stronger for experience goods than for search goods.*

## 4. Research Methodology

We empirically assessed our model using a hypothetical scenario experimental method. The scenario method, also known as a vignette or policy-capturing method, uses vignettes that "present subjects with written descriptions of realistic situations and then request responses on several rating scales that measure the research variables of interest" [82]. The scenario method allows an individual's behavior to be measured prospectively and provides a methodological advantage in matching past behavior with theoretical constructs in the current survey [83]. Moreover, scenario-based methods provide a way to enhance the realism of decision-making situations by providing contextual detail, while simultaneously ensuring that these details are uniform across participants who are asked to make a decision based on their role within that particular situation. For these reasons, we use the scenario method to understand the psychological mechanisms by which personalized recommendations influence consumers' intention to purchase recommended products.

### *4.1. Scenario Design*

To ensure that our results reflect the impact of product categories on the effect of personalized recommendation, we designed two different shopping scenarios based on the largest mobile shopping platform in China, Mobile Taobao, by selecting two types of goods: smartphones and shoes. These two types were chosen because they represent goods whose quality is evaluated before and after purchase, and have been used in other studies (e.g., [24]). Smartphones represent search goods, as the quality information of electronic products can be easily judged by browsing parameters, brand information, and user reviews, while shoes represent experience goods, as clothing and shoe products

require personal experience before an accurate evaluation of whether they are suitable. In the scenarios, participants were consumers with a demand for a certain type of good, who used mobile Taobao to search and browse the goods they intended to purchase, and were then followed up after some time to complete our survey. To minimize any confusion caused by brand or design elements influencing the participants' recognition of recommendations, the study design did not specify the brand of the product. Participants were assigned to different situations and made judgments independently on three indicators of personalized recommendation, the three basic psychological needs of self-determination, and purchase intention.

### *4.2. Measurement of Variables*

Measurement items used in this study were adapted from previously validated instruments where possible and measured using a five-point Likert-type scale (1 = strongly disagree, 5 = strongly agree). Two three-item scales derived from Pu and Chen's measure of perceived accuracy and novelty were used to measure recommendation accuracy and novelty [84]. Recommendation diversity was based on the three criteria of diversity measure from Vargas et al. [85], and developed based on the perceived diversity measure from Pu and Chen to form the three-item scale [84]. Both autonomy and relatedness were measured using adaptations from Thomson, and three-item and four-item scales were used, respectively [86]. The three-item scale was adapted from Dahl and Moreau to measure competence [87]. Purchase intention was measured via a three-item scale used by Kim and Han [88].

It has been shown that gender, age, income, frequency of internet usage, and price offers of products affect consumers' online purchase intention in most studies. Based on the sample characteristics, gender, internet usage frequency, and perceived benefits were used as control variables in this study. The control variable of perceived benefits was measured using scales adapted from Davis et al. and developed as a two-item scale [30], while the other control variables, such as gender and internet usage frequency, were measured using single items. Table 1 presents all of the scales with their measurement items.

**Table 1.** Measurement items of variables.

| Variables | Measurement Items | Source |
| --- | --- | --- |
| Recommendation accuracy (RA) | The goods recommended on Taobao are of interest to me<br>Taobao understands my needs and preferences for goods<br>The products recommended by Taobao match my interests | Pu and Chen (2010) [84] |
| Recommendation diversity (RD) | Taobao recommends a variety of goods<br>Taobao recommends products that satisfy different aspects of my interests<br>Taobao recommended items contain multiple brands or types | Vargas et al. (2014) [85]; Pu and Chen (2010) [84] |
| Recommendation novelty (RN) | Taobao can recommend some novelty goods<br>Taobao's recommended items will give me a feeling of freshness<br>Taobao's recommendations help me discover new items | Pu and Chen (2010) [84] |
| Autonomy (AU) | Taobao's recommended content will make me feel free to express my thoughts and opinions<br>Taobao's recommendations make me feel that my choices are based on my genuine interests<br>Taobao's recommendations give me the freedom to shop the way I want to | Thomson (2006) [86] |
| Competence (CO) | Taobao's recommendations make me feel that I am efficient in shopping<br>Taobao's recommendations have equipped me with a lot of knowledge, information, and experience about goods or services<br>I believe I can get the shopping information I need from Taobao recommendations | Dahl and Moreau (2007) [87] |
| Relatedness (RE) | Taobao's recommendations make me feel that I am being cared about<br>Taobao's recommendations make me feel like I am engaging with people who care about me<br>I feel that Taobao's recommendations have brought me much closer to the Taobao platform | Thomson (2006) [86] |
| Perceived benefits(PB) | I like to browse Taobao's recommended product information<br>I feel the recommended item is cheaper than the expected purchase price<br>I think the recommended products are more favorable | Davis et al. (2023) [30] |
| Purchase intention (PI) | I would consider buying the products recommended by Taobao<br>I intend to buy the goods recommended by Taobao<br>I am likely to buy products recommended by Taobao | Kim and Han (2014) [88] |

### 4.3. Participants

Young people are an active group of online shoppers and are suitable as participants for this survey. Hence, the participants in this study were drawn from the online shopping group of students enrolled in three Chinese universities. The participants were not aware of the experimental purpose and had never participated in a similar experiment before. First, with the help of the lecturers, we explained to the student participants that this was a study on the relationship between personalized recommendation and users' purchase intention, and distributed experimental questionnaires with hypothetical scenarios through the internet. Students could ask questions of the investigators if they did not understand anything during the completion process. We limited the period of time available for filling out the questionnaire and confirmed completion of the questionnaire. To motivate participants to take the experimental task seriously, we informed them that they would receive scores for course practice. In total, 705 questionnaires were obtained, with females accounting for 59.57%, and the age range mainly distributed between 18 and 22 years old (95.03%), with undergraduates accounting for 43.40%. There were 313 questionnaires for the smartphone experimental scenario, with females accounting for 81.15% and undergraduates accounting for 40.26%, and 392 questionnaires for the shoe scenario, with females accounting for 42.35% and undergraduates accounting for 45.92%.

### 4.4. Data Analysis

We employed the PROCESS macro program in the statistical software SPSS 23.0 to conduct bias-corrected bootstrap analyses with 5000 iterations to examine the mediating effects [89]. The partial least squares structural equation model (specifically smart PLS) was used to analyze measurement and structural models with multiple item constructs, including direct, indirect, and interaction effects [90]. This method has been widely used in fields such as marketing and management information systems research [91,92]. We also used Harman's single-factor test for the effect of common method bias [93]. An unrotated principal component analysis showed that a total of five factors had eigenvalues greater than one, with the first factor explaining 35.654% of the variance (below the critical threshold of 40%). Thus, the impact of common method bias is limited.

## 5. Hypothesis Testing and Results

### 5.1. Measurement Reliability and Validity

As illustrated in Table 2, Cronbach's alpha (CA) and composite reliability (CR) scores for the latent variables met the recommended threshold of 0.70, indicating good reliability of the measures. All average variance extracted (AVE) values (Table 2) were higher than 0.5, demonstrating satisfactory convergent validity [94]. Additionally, each square root of all AVE was higher than the value of the corresponding off-diagonal correlation coefficients in the respective rows and columns (Table 3), indicating good discriminant validity [94].

**Table 2.** Descriptive statistics, CAs, CRs, and AVE values.

| Construct | Mean | Std Dev. | Items | CA | CR | AVE |
|---|---|---|---|---|---|---|
| Gender | 0.596 | 0.491 | 1 | - | - | - |
| Internet usage frequency(IF) | 2.965 | 1.537 | 1 | - | - | - |
| Perceived benefits (PB) | 2.865 | 0.833 | 2 | 0.766 | 0.791 | 0.830 |
| Recommendation accuracy (RA) | 3.320 | 0.734 | 3 | 0.823 | 0.829 | 0.741 |
| Recommendation diversity (RD) | 3.443 | 0.715 | 3 | 0.775 | 0.773 | 0.680 |
| Recommendation novelty (RN) | 3.329 | 0.741 | 3 | 0.801 | 0.794 | 0.706 |
| Product categories (PC) | 0.556 | 0.497 | 1 | - | - | - |
| Autonomy (AU) | 3.061 | 0.761 | 3 | 0.836 | 0.815 | 0.726 |
| Competence (CO) | 3.129 | 0.761 | 3 | 0.806 | 0.764 | 0.677 |
| Relatedness (RE) | 2.885 | 0.787 | 4 | 0.805 | 0.813 | 0.634 |
| Purchase intention (PI) | 3.184 | 0.712 | 3 | 0.828 | 0.821 | 0.734 |

Note: N = 705.

**Table 3.** Correlation of constructs and the square root of the AVE.

| Construct | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.Gender | 1 | | | | | | | | | | |
| 2.IF | −0.102 ** | 1 | | | | | | | | | |
| 3.PB | −0.012 | −0.048 | **0.902** | | | | | | | | |
| 4.RA | 0.163 ** | 0.103 ** | 0.294 ** | **0.861** | | | | | | | |
| 5.RD | 0.084 * | −0.001 | 0.357 ** | 0.561 ** | **0.825** | | | | | | |
| 6.RN | 0.043 | 0.031 | 0.395 ** | 0.493 ** | 0.624 ** | **0.840** | | | | | |
| 7.PC | −0.393 ** | 0.158 ** | −0.008 | −0.097 ** | −0.149 ** | −0.096 * | 1 | | | | |
| 8.AU | 0.056 | −0.010 | 0.544 ** | 0.486 ** | 0.510 ** | 0.521 ** | −0.068 | **0.852** | | | |
| 9.CO | 0.044 | 0.016 | 0.507 ** | 0.437 ** | 0.490 ** | 0.528 ** | −0.045 | 0.646 ** | **0.823** | | |
| 10.RE | 0.031 | −0.017 | 0.547 ** | 0.405 ** | 0.366 ** | 0.446 ** | −0.022 | 0.642 ** | 0.641 ** | **0.796** | |
| 11.PI | 0.103** | 0.055 | 0.453 ** | 0.524 ** | 0.500 ** | 0.534 ** | −0.067 | 0.544 ** | 0.534 ** | 0.500 ** | **0.857** |

Note: N = 705, * $p < 0.05$, ** $p < 0.01$; Square root of the AVE are the bolded diagonal values. Off-diagonal elements are correlations among constructs.

### *5.2. Evaluation of the Mediation Effect*

Table 4 presents the regression results for the effect of personalized recommendations on consumers' purchase intentions through three basic psychological needs. Controlling for relevant variables, significant positive correlations were found between recommendation diversity and autonomy (β = 0.375, $p < 0.01$), recommendation accuracy and competence (β = 0.325, $p < 0.01$), recommendation novelty and competence (β = 0.394, $p < 0.01$), and as recommendation novelty and relatedness (β = 0.280, $p < 0.01$), thereby supporting hypotheses H1a, H1b, H1c, and H1d. Significant positive relationships were also found between consumers' autonomy and purchase intention (β = 0.390, $p < 0.01$), competence and purchase intention (β = 0.379, $p < 0.01$), and relatedness and purchase intention (β = 0.13, $p < 0.01$), supporting H2a, H2b, and H2c. Furthermore, after adding the independent variables recommendation diversity, accuracy, and novelty respectively, significant positive influences were observed between consumers' autonomy on purchase intention (β = 0.279, $p < 0.01$), competence on purchase intention (β = 0.265, $p < 0.01$; β = 0.253, $p < 0.01$), and relatedness on purchase intention (β = 0.213, $p < 0.01$), preliminarily indicating the mediating effects of basic psychological needs between personalized recommendation and purchase intentions. We further examined the mediating effects using the PROCESS macro.

**Table 4.** Regression results of personalized recommendation influenced purchase intentions.

| Variables | AU | PI | PI | CO | PI | PI | CO | PI | RE | PI | PI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 | M7 | M8 | M9 | M10 | M11 |
| Gender | 0.044 (0.046) | 0.132 ** (0.045) | 0.107 * (0.043) | −0.007 (0.048) | 0.138 ** (0.045) | 0.061 (0.043) | 0.050 (0.046) | 0.125 ** (0.043) | 0.019 (0.049) | 0.156 ** (0.046) | 0.133 ** (0.043) |
| IF | 0.007 (0.015) | 0.037 * (0.014) | 0. 034 * (0.014) | 0.002 (0.015) | 0.032 * (0.014) | 0.014 (0.014) | 0.013 (0.015) | 0.027 * (0.014) | −0.001 (0.016) | 0.039 ** (0.015) | 0.031 * (0.014) |
| PB | 0.381 ** (0.029) | 0.194 ** (0.031) | 0.165 ** (0.030) | 0.379 ** (0.029) | 0.211 ** (0.031) | 0.178 ** (0.029) | 0.326 ** (0.030) | 0.165 ** (0.029) | 0.416 ** (0.031) | 0.226 ** (0.032) | 0.158 ** (0.031) |
| RD | 0.375 ** (0.033) | | 0.272 ** (0.034) | | | | | | | | |
| RA | | | | 0.325 ** (0.034) | | 0.319 ** (0.032) | | | | | |
| RN | | | | | | | 0.394 ** (0.033) | 0.296 ** (0.033) | 0.280 ** (0.035) | | 0.336 ** (0.032) |
| AU | | 0.390 ** (0.034) | 0.279 ** (0.036) | | | | | | | | |
| CO | | | | | 0.379 ** (0.033) | 0.265 ** (0.033) | | 0.253 ** (0.035) | | | |
| RE | | | | | | | | | | 0.313 ** (0.034) | 0.213 ** (0.033) |
| Constant | 0.589 ** (0.143) | 1.117 ** (0.143) | 0.650 * (0.137) | 0.969 ** (0.142) | 1.079 ** (0.130) | 0.645 ** (0.129) | 0.766 ** (0.141) | 0.656 ** (0.133) | 0.733 ** (0.150) | 1.270 ** (0.130) | 0.693 ** (0.133) |
| R2 | 0.405 | 0.342 | 0.396 | 0.348 | 0.341 | 0.424 | 0.386 | 0.407 | 0.356 | 0.304 | 0.398 |
| r2_a | 0.401 | 0.338 | 0.392 | 0.344 | 0.337 | 0.419 | 0.382 | 0.403 | 0.352 | 0.300 | 0.394 |
| F | 119.053 ** | 90.833 ** | 91.760 ** | 93.200 ** | 90.392 ** | 102.711 ** | 109.866 ** | 95.926 ** | 96.650 ** | 76.403 ** | 92.409 ** |

Note: N = 705, * $p < 0.05$,** $p < 0.01$; The table shows the unstandardized regression coefficients, the standard errors are in parentheses.

Table 5 shows the results of the mediating effect, as estimated using 5000 iterations of the bootstrapping technique of psychological mechanisms of personalized recommendations influencing consumers' purchase intention in SPSS 23.0, and the significance and path coefficients of each pathway that were obtained while controlling for relevant variables. Path 1 shows that recommendation diversity can positively influence consumers' purchase intention through autonomy (β = 0.105, 95% CI [0.065, 0.149]). Thus, H3a is supported. Path 2 indicates that recommendation accuracy can positively influence consumers' purchase intention through competence (β = 0.086, 95% CI [0.056, 0.121]), as suggested by H3b. Confirming H3c, path 3 suggests that recommendation novelty can positively influence consumers' purchase intention through competence (β = 0.100, 95% CI [0.064, 0.195]). Path 4 reveals that recommendation novelty can positively influence consumers' purchase intention through relatedness (β = 0.060, 95% CI [0.035, 0.122]), supporting H3d.

**Table 5.** Bootstrap mediation test results.

| Path | Indirect Effect | SE | 95% CI |
|---|---|---|---|
| Path1: Recommendation diversity → Autonomy → Purchase intention | 0.105 | 0.021 | [0.065, 0.149] |
| Path2: Recommendation accuracy → Competence → Purchase intention | 0.086 | 0.017 | [0.056, 0.121] |
| Path3: Recommendation novelty → Competence → Purchase intention | 0.100 | 0.019 | [0.064, 0.195] |
| Path4: Recommendation novelty → Relatedness → Purchase intention | 0.060 | 0.013 | [0.035, 0.122] |

Note: N = 705; CI = confidence interval, unstandardized regression coefficients in the table; The confidence interval is based on 5000 correction bias bootstrap.

We further examined the mediating effect using PLS-SEM. Following the mediation analysis guidelines proposed by Hair et al. [95], a mediation effect was considered not to be valid if the indirect effect was not significant in the PLS-SEM results. If the indirect effects were significant, the variance accounted for (VAF) was calculated to determine the proportion of the mediating effects [96]. A VAF value of less than 0.2 is seen as indicating no mediation, a value larger than 0.2 but less than 0.8 as indicating partial mediation, and a value greater than 0.8 as indicating full mediation.

The results of the PLS-SEM mediation analysis in Table 6 show that autonomy does not have a significant mediating effect in the indirect effect between recommendation diversity and purchase intention (ab = 0.053, $t$ = 1.876, $p$ = 0.061), indicating that autonomy does not mediate the relationship between recommendation diversity and purchase intention. H3a is not supported. Although competence has a significant mediating effect in the indirect effect between recommendation diversity and purchase intention (ab = 0.027, $t$ = 2.001, $p$ = 0.045), the VAF value is 11.79%, which is less than 20%, so we consider that competence does not mediate the relationship between recommendation diversity and purchase intention. Therefore, hypothesis H3b is not supported. In addition, the indirect effects of recommendation novelty on purchase intention through competence (ab = 0.048, $t$ = 2.178, $p$ = 0.029) and relatedness (ab = 0.045, $t$ = 2.162, $p$ = 0.031) are significant. Since the VAF values are between 20% and 80%, we consider that competence and relatedness partially mediate the relationship between recommendation novelty and purchase intention. Therefore, hypotheses H3c and H3d are supported.

**Table 6.** Mediation analysis in PLS-SEM.

| Path | Indirect Effect (ab) | Direct Effect (c′) | Standard Deviation | *t* Value | *p* Value | Total Effect | VAF | Conclusion |
|---|---|---|---|---|---|---|---|---|
| Recommendation diversity → Autonomy → Purchase intention | 0.053 | | 0.028 | 1.876 | 0.061 | 0.141 | 37.59% | Non-significant |
| Recommendation diversity → Purchase intention | | 0.088 | 0.051 | 1.728 | 0.084 | | | |
| Recommendation accuracy → Competence → Purchase intention | 0.027 | | 0.013 | 2.001 | 0.045 | 0.229 | 11.79% | Unaccepted |
| Recommendation accuracy → Purchase intention | | 0.202 | 0.045 | 4.541 | 0.000 | | | |
| Recommendation novelty → Competence → Purchase intention | 0.048 | | 0.022 | 2.178 | 0.029 | 0.213 | 22.54% | Accepted |
| Recommendation novelty → Purchase intention | | 0.165 | 0.049 | 3.400 | 0.001 | | | |
| Recommendation novelty → Relatedness → Purchase intention | 0.045 | | 0.021 | 2.162 | 0.031 | 0.210 | 21.43% | Accepted |
| Recommendation novelty → Purchase intention | | 0.165 | 0.049 | 3.400 | 0.001 | | | |

Note: N = 705; The table shows the analysis results without adding moderation variables.

### *5.3. Structural Model Test*

To test the moderating effect in the overall research structure, we used 5000 bootstrap iterations to estimate the theoretical model and hypothesized relationships in Smart PLS 4.0, as shown in Figure 2. The results of the structural model estimation show that the interaction effect between product category and recommendation diversity has a positive influence on autonomy (β = 0.215, $p < 0.01$), supporting H4a. Surprisingly, the interaction effects of product categories and recommendation accuracy (β = 0.054, $p = 0.511$) and recommendation novelty (β = 0.032, $p = 0.706$) on competence are not significant. Therefore, hypotheses H4b and H4c are not supported. Consistent with H4d, product categories positively moderate the relationship between recommendation novelty and relatedness (β = 0.164, $p < 0.01$).

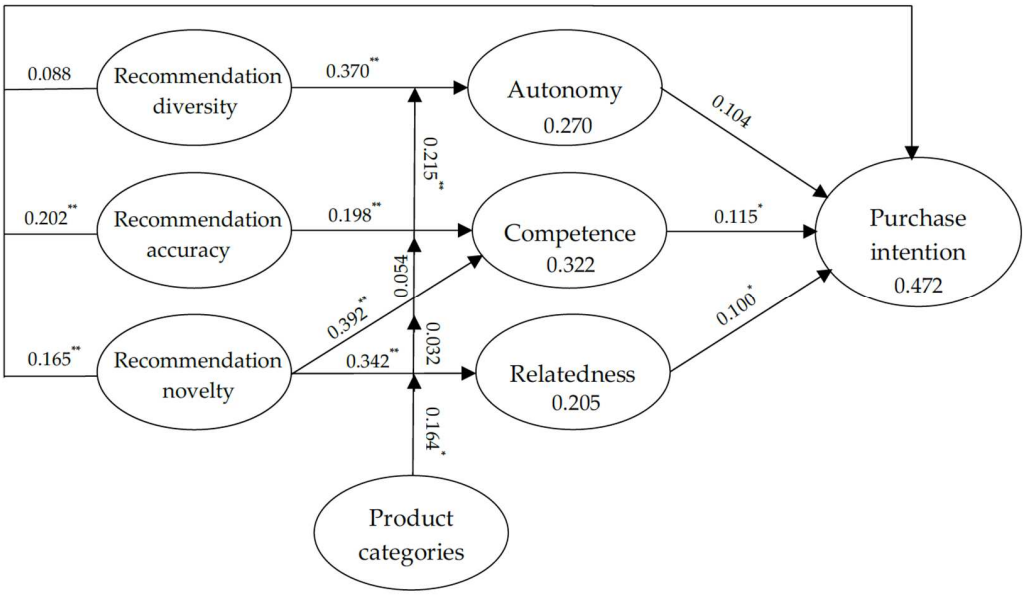



**Figure 2.** PLS-SEM results (Betas for the paths and $R^2$ for the variables; * $p < 0.05$,** $p < 0.01$).

## 6. Discussion and Conclusions

This study investigated how three basic psychological needs (autonomy, competence, and relatedness) mediate the effects of three personalized recommendation indicators (accuracy, diversity, and novelty) on consumers' purchase intentions, and further examined whether the influence of personalized recommendations on consumers' perceptions of self-determination is contingent upon product categories. Results demonstrated that the positive relationships between recommendation diversity and autonomy, recommendation accuracy/novelty and competence, and recommendation novelty and relatedness were sup-

ported, while the positive effects of autonomy, competence, and relatedness on consumers' purchase intention were also validated. The mediating and moderating mechanisms revealed that competence and relatedness mediated the relationship between recommendation novelty and purchase intention, and product categories moderated the relationships between recommendation diversity and autonomy and between recommendation novelty and relatedness.

### *6.1. Theoretical Contributions*

Our study aims to identify the underlying psychological reasons why personalized recommendations promote consumers' online purchase intention from the perspective of self-determination. The findings help us to better understand the relationships among personalized recommendations, product categories, self-determination, and purchase intention. The theoretical contributions of this study are summarized as follows.

First, our study provides a theoretical model for the motivational mechanism of personalized recommendation that drives consumers' potential psychological needs, by applying the S-O-R model and focusing on the three basic psychological needs from self-determination theory. The model demonstrates the impact of the personalized recommendation on consumers' intrinsic psychological motivation, provides empirical evidence for the unique psychological mechanism of personalized recommendation, and supplements the research on self-determination theory in the field of recommendation systems. Previous studies have examined the positive impact of personalized recommendations on consumers' online purchase intentions [11,23], but there is a lack of research on the influence process of personalized recommendation on consumers' purchase intention from the perspective of consumers' psychological motivation, and the reasons for tracking their behavior intention through consumers' psychological state are ignored. Our study fills this theoretical gap by discovering the mediating role of the three basic psychological needs in self-determination between personalized recommendation and consumers' purchase intention, which can help scholars better understand the mediating effect of consumers' intrinsic psychological motivation on the impact of recommendation systems on online purchase behavior.

As expected, recommendation diversity positively predicted consumers' autonomy, which in turn positively influenced their purchase intention for the recommended products. However, the mediating effect of autonomy between recommendation diversity and purchase intention was not supported, indicating that while diversified recommendations based on consumers' past interests and experiences may help them better understand the alternative product information [97] and increase their freedom of choice, such diversity may also lead to information overload, making it difficult for consumers to make purchase decisions through autonomous mental activities. While the positive effects of recommendation accuracy on competence and of competence on purchase intentions were supported, the mediating effect of competence between recommendation accuracy and purchase intentions was not supported. Previous studies have shown that recommendation accuracy reflects the degree to which recommended products match consumers' interests and preferences, and accurate recommendations can reduce decision time and search scope, thus improving decision efficiency [51]. Therefore, highly matched accurate recommendations increase consumers' self-efficacy in mastering and controlling the recommended products. Moreover, consumers' self-efficacy for accurate recommendations is not a necessary condition for their purchase of the recommended products if they are already familiar with or have used them before. These results reflect the differences in how personalized recommendations affect consumers' intrinsic psychological states in different ways, which is consistent with previous research findings that when e-commerce platforms frequently

recommend similar products that consumers have already purchased, consumers perceive the seller's manipulation intentions and may resist and refuse to purchase [8].

We confirmed the partial mediating effects of competence and relatedness between recommendation novelty and purchase intentions. This result indicates that novel recommendations that are related to consumers' purchase needs and past experiences and integrated into their interest circles can enhance consumers' self-efficacy and close relatedness, effectively increasing their purchase intention for the recommended products. As consumers' interests are complex, highly dynamic, context-dependent, and even heterogeneous and contradictory [40], recommendation novelty expands the scope of possible item types and features targeted by recommendations, beyond overly narrow user interest circles, and becomes an important strategy to address consumers' preference uncertainty [98]. Moreover, this effect is not due to the "paid ranking" mechanism, as pure "paid ranking" does not consider consumers' personalized data. The findings also reflect the upgrading of consumers' diversified consumption needs in the era of information interconnection, and novel recommendations should become a key factor in fully leveraging the personalized recommendation capability of recommendation systems to meet consumers' curiosity needs.

Secondly, our study examined the moderating effect of recommendation diversity on autonomy and recommendation novelty on relatedness contingent upon product categories, refining and deepening the relevant research on product categories in the field of personalized recommendation in e-commerce contexts. Our study divided product categories according to the ease of consumers' quality evaluation before and after purchase; the results demonstrated that, compared with search goods with easy quality evaluation before purchase, diversified recommendations for experience goods that can only be accurately evaluated after use have a stronger impact on consumers' autonomy, and novel recommendations have a stronger impact on consumers' relatedness. This finding provides a theoretical basis for predicting the impact of personalized recommendations on online sales of different product categories based on consumers' psychological motivations. Previous research has indicated that an important factor affecting the purchase of experience goods is consumers' previous purchase and use experiences [24]. For recommended experience goods, consumers may realize the need to analyze and compare diversified products and review information in the recommendation list, to improve their purchase choices based on their own experiences or the information they obtain. Therefore, for experience goods that can only be evaluated after use, recommendation diversity promotes consumers' autonomy to a greater extent. This conclusion is consistent with a user survey finding that "people with high experience openness are more willing to accept diversified recommendations" [99].

Recommended novelty products represent differences from consumers' past experiences but are still relevant to their purchase needs [100]. To some extent, novel recommendations make consumers feel that the personalized recommendation system is communicating and interacting with them in real time, mining their potential interests and purchase preferences in a predictive form. Thus, they may experience a close connection and support from the e-commerce platform, establishing a link that matches their network-mapped identity and promoting their identification and emotional dependence on the e-commerce platform's recommendation system. The research results also found that the interaction between types of goods and the accuracy and novelty of recommendations did not significantly affect consumers' competence. This may be because, for experience goods that can only be accurately evaluated after use, consumers find it difficult to accurately assess the quality and suitability of recommended products for their needs from the parameters given by the merchant or the information in online reviews [21].

### 6.2. Practical Contributions

Our findings have certain guiding implications for business practice. Personalized recommendation systems provide consumers with personalized information services and decision-making support, while e-commerce platforms value personalized recommendations to improve the efficiency of product value conversion and make more adequate use of platform traffic [101]. The current study explored and examined the three basic needs of self-determination as an intermediate transmission mechanism for a personalized recommendation. The findings suggest that e-commerce platforms can leverage the accuracy, diversity, and novelty of personalized recommendations to capture the content that users are interested in from massive product data and enhance their purchase intentions by satisfying consumers' intrinsic psychological needs. At the same time, the research results also provide guidance for e-commerce platform companies in designing different recommendation methods; it indicates that they can consider the perspectives of self-determination theory when designing recommendation methods and think about specific measures to transform external recommendation activities into users' internal psychological identification for purchases. This might include, for example, providing explanations for recommended products and displaying complex recommendation algorithms to users in simple and understandable language to promote users' trust and recognition of recommended products.

Additionally, due to the different impacts of certain indicators of personalized recommendations on consumers' intrinsic psychological needs in types of goods being affected by the ease of evaluating product quality before consumer purchase, e-commerce platform operators should be aware that personalized recommendations can be combined with different types of goods to achieve better recommendation results. For example, diversified recommendation methods can be considered for experience goods that can only be accurately evaluated after use. Currently, the products recommended by e-commerce platforms are all based on the pay-per-click promotion model, and only a small portion of the best-selling products that achieve platform market leadership are selected by the platform to enter the product recommendation pool free of charge. In this case, e-commerce merchants should consider the category, innovation level, and target groups of their products to choose whether to make corresponding paid recommendations.

### 6.3. Limitations and Future Research

This study has several limitations that also suggest directions for future research. First, this study examined two types of goods: search and experience goods. However, people may have varying concepts of different product categories [102]. Further research could consider other categorization methods or conduct an age group comparative study to examine their contingent effects. Second, from the perspective of feedback on purchasing needs, users only make purchasing decisions because of their purchasing intentions, and personalized recommendations are just a way of catering to the needs of users, and therefore survey data are not sufficient to provide feedback on the real situation. Future research could consider obtaining actual panel data from shopping platforms to replace the measurement of purchase intention with actual purchase behavior, and further assess the actual effects of personalized recommendation. Third, participants in this study were university students, which may limit the generalizability of the research. Although young people are an active group of online shoppers and are suitable as participants for this study, further evidence is needed to generalize to different social groups, such as working professionals and consumer groups of different ages. Future research could examine the research model in participants from different social groups.

### 6.4. Conclusions

From a self-determination perspective, this empirical research investigated how the three basic psychological needs of self-determination (autonomy, competence, and relatedness) mediate the relationship between personalized recommendations and consumers' purchase intentions. This research further examined whether the influence of personalized recommendations on consumers' perceptions of self-determination is contingent upon product categories. The results of the data analysis demonstrate that competence and relatedness are critical mediators between recommendation novelty and purchase intention. Further, the results reveal that the impact of recommendation diversity on autonomy is contingent upon product categories, while the influence of recommendation novelty on the perception of relatedness is also contingent on product categories. This study contributes to the literature on personalized recommendations by providing an underlying mechanism for the influence of personalized recommendations on consumers' purchase intention from the self-determination perspective, and especially by unravelling the contingent effects of product categories. Given the universality of personalized recommendations, such research is certainly warranted.

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