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Abstract

Purpose – Psychological perspective has been omitted or considered a secondary issue by past studies focused on e-commerce recommendation systems (RS). However, this perspective is key to gaining a better understanding of consumer behaviours when these systems are used to support purchasing processes at online stores. The paper aims to discuss these issues.

Design/methodology/approach – The field study consisted of a simulated online shopping process undertaken by a sample of internet users with a recommender system at a real online store (Pixmania). The authors applied rigorous and detailed exploratory and confirmatory factor analyses to assess the empirical validity of the model.

Findings – The proposed sequence of psychological outcomes is valid, with the exception of one hypothesized relationship. In particular, satisfaction with an online store's recommender has a strong influence on a consumer's willingness to purchase one of the items related to his/her shopping goal. However, this satisfaction has no direct effect on a consumer's intention to make add-on purchases based on the recommender's suggestions. On the contrary, the results support the idea that add-on purchases are conditioned by a previous purchase related to the consumer's initial shopping goal. On the other hand, a consumer's flow state while shopping improves all his/her psychological outcomes linked to an online store's recommender. The influence of flow state is particularly interesting when seeking to gain a better understanding of consumers' unplanned purchases based on the recommender's suggestions. These findings have important implications for practitioners.

Originality/value – This paper discusses in detail and empirically test a set of psychological outcomes that emerge when an e-vendor's recommender is used to assist a consumer's shopping process. To the best of the knowledge, this is the first attempt that empirically tests most of the hypothesized relationships within an online store's RS context.

Keywords Consumer, Online store, Psychological perspective,
Responses to recommendation system

Paper type Research paper

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1. Introduction

Information overload is a problem in e-commerce, since individuals are incapable of processing all the information available on the web (Shih *et al.*, 2002). However, the problem can be eased by personalizing the offers provided at online stores (Pine and Gilmore, 1999). Information becomes valuable when it can be localized, filtered and organized, so that information that is useful to the consumer can be communicated. Here, the so-called e-commerce recommendation systems (RS) play a highly significant role (Choi *et al.*, 2011; Martínez-López and Martínez-López, 2010; Wang and Doong, 2010). RS are tools that help the consumer to take decisions, since they proactively suggest the offers and the content that are most suited to each consumer (Chen and Chen, 2005). They make it easier for the consumer to take decisions by optimizing the quality of the selection process and by filtering the information available; this reduces the search effort required (Ansari *et al.*, 2000; Häubl and Trifts, 2000). Consumers are more likely to be persuaded by recommendations in the first stages of the decision process (Ho and Tam, 2005). To be specific, Xiao and Benbasat (2007) state that e-commerce RS serve to simplify the stages of searching and making an initial selection of alternatives, in addition to the stages of comparison and evaluation. For example, RS are useful for finding lower prices for products/services of interest to the consumer (Diehl *et al.*, 2003).

The recommendations are based on the preferences of consumers as observed in their purchase history or with reference to other consumers with similar profiles. Following analysis of the profiles of users, their wishes and preferences for products shown, their most valued attributes, their navigation behaviour at an e-vendor's web site, etc., offers that are personalized and specific to each consumer can be presented (Pu *et al.*, 2011; Liu *et al.*, 2013). This enables the e-vendor to improve the added value they offer their customers, creating an ideal environment for profitable exchanges. Notable benefits for companies include an increase in sales and an improvement in customer loyalty (Bodapati, 2008; Zhang *et al.*, 2011).

Based on an extensive literature review, Park *et al.* (2012) show the ever increasing attention paid to RS as a research topic during the last decade. Nevertheless, despite the importance of the marketing and consumer perspective here, the predominant approach in the literature on RS is the technical approach (i.e. information systems and computer science) (Xiao and Benbasat, 2007). This research has mainly been based on study of the system (process) algorithms in order to generate personalized recommendations based on the preferences of the user, and on how to improve predictions about these preferences (Knijnenburg *et al.*, 2012). To a lesser extent, other research has focused on RS from the perspective of the RS user's experience. This research has studied the influence on user perceptions of RS of other objective aspects of the system, related not only to the internal process through which the recommendation is generated, but also to the inputs (Pommeranz *et al.*, 2012) and outputs of the system (Knijnenburg *et al.*, 2012; Xiao and Benbasat, 2007).

Studies on e-commerce RS with a focus on marketing and, specifically, on consumers and their decision making, are harder to find. Nevertheless, this approach is important to gaining an understanding of the adoption and use of e-commerce. We are interested in the sequence of psychological responses that are made once consumers use a RS and eventually decide to buy a recommended item. This research question has been overlooked, although more research is necessary in order to gain more knowledge about how RS influence consumers' behaviour at online stores. As a basis for our approach, we use the theoretical proposal by Martínez-López *et al.* (2010) for this purpose.

The remainder of this paper is as follows. First, we present a specific review of the literature containing the main contributions to modelling issues related to the adoption and use of RS focused on the consumers' psychological approach. Then, the theoretical model is presented and its hypotheses discussed in detail. Next, the methodology of our study is outlined. In Section 5, we present information related with the detailed exploratory and confirmatory factor analyses (EFA and CFA) performed in order to assess the validity of our model and proposed scales. Finally, theoretical conclusions and implications for practitioners are presented.

2. Background

Most of the research has focused on technical aspects, mainly related with the process followed by RS to generate outputs; i.e. performance and evaluation of the algorithms used to generate recommendations (Pu *et al.*, 2012); these topics lie outside the interests of our research, and so we will not consider them in greater depth (for an up-to-date in-depth review, see Park *et al.*, 2012). However, from the perspective of the consumer, the effectiveness of an e-vendor's RS depends on other factors besides technical factors. In addition to the objective aspects of a RS (e.g. RS type, algorithms, process, inputs, outputs, visual design, presentation of recommendations, etc.), other factors are also influential, most notably those related with subjective and personal aspects of the consumer. Subjective aspects (e.g. overall opinion of an e-vendor's RS), the result of how the consumer processes the objective aspects of a RS, are particularly important when seeking to understand issues related with the adoption and use of this technology (Pu *et al.*, 2012). Behaviour and interaction with RS, and their influence on the online decision process, ultimately depend on the perceptions of consumers (Pu *et al.*, 2012; Murray and Häubl, 2009; Knijnenburg *et al.*, 2012; Martínez-López *et al.*, 2010). In the literature, there are various interesting proposals – both theoretical proposals and those with empirical support – for gaining a better understanding of issues related to the adoption and/or use of e-commerce RS which attach greater importance to the psychological, subjective perspective of users. However, they are comparatively few in number among all the RS-related papers.

In Table I we present a synthesis of the most outstanding contributions. The models proposed are usually based on classic consumer theories, models (e.g. theory of reasoned action (TRA), planned behaviour theory) and subjective variables (e.g. beliefs, attitude, trust, intention), as well as on models of technology acceptance (e.g. TAM, Trust-TAM), in order to explain the use and consequences of use of an e-vendor's RS. On the other hand, there are models that have only been theoretically formulated (e.g. Xiao and Benbasat, 2007, 2014; Martínez-López *et al.*, 2010) or empirically supported (e.g. Pu *et al.*, 2011; Benlian *et al.*, 2012); furthermore, the models proposed can have an integrative approach to the whole process of adoption and use (e.g. Xiao and Benbasat, 2007, 2014; Martínez-López *et al.*, 2010), or a partial approach, focusing on particular issues of the system's process of acceptance and use (e.g. Bodapati, 2008; Hostler *et al.*, 2012).

Moreover, we have found few studies centred on the subjective perspective of the user that also develop their proposals from a marketing perspective; i.e. applying a consumer-oriented approach to RS users and their behaviour (e.g. Benlian *et al.*, 2012; Dabholkar and Sheng, 2012; Kwon and Chung, 2010; Martínez-López *et al.*, 2010).

3. Theoretical foundations

3.1 Theoretical model: overall view

Our model is based on the integrative, theoretical model proposed by Martínez-López *et al.* (2010). It focuses on a specific and especially interesting part of these authors'

Paper	Type of study	What is the contribution about?
Xiao and Benbasat (2007)	Theoretical, conceptual model	Conceptual model explaining the outcomes of a RS and intention to adopt an RS in the future. It is based on a dual focus: (1) consumer's decision processes; and (2) user's subjective evaluation (e.g. trust, usefulness or satisfaction) of RS. A set of 28 propositions are presented, based on five theoretical perspectives: theory of interpersonal similarity, theories of trust formation, theories of human information processing, technology acceptance model (TAM) and theories of satisfaction
Jones and Pu (2007)	Theoretical and empirical (experimental, within-subject comparative study, questionnaire and analysis of variance)	Study to understand the initial adoption of a RS by a new user about whom the system has no prior information and his/her initial perceptions of the system. Two music recommendation systems were compared (*Pandora*, a content-based recommender; and *Last.fm*, based on collaborative filtering). In the case of the first, users listened to the recommended songs shortly after interacting with the system, whereas in the case of the second RS, the user had to install a "plug in" and wait five days to receive the recommendations The results showed that the level of preference and general satisfaction of the user was much higher in the case of the first system, in which recommendation was almost immediate. According to the results obtained, in addition to less initial effort being required to receive the recommendations, a simple interface design and the qualities perceived in the system (e.g. subjective accuracy, enjoyment and novelty of the recommendations) are key factors in the design, which improve the capacity of the web site to attract users
Asosheha *et al.* (2008)	Theoretical and empirical (questionnaire and estimation of models by structural equation modelling)	A comparison is made of various RS adoption models, both for mass consumer products and for banking services. The adoption models evaluated are based on classical theories of adoption of new behaviours and specifically of new technologies, namely the following theories: theory of reasoned action (TRA), theory of planned behaviour (TPB), technology acceptance model (TAM) and unified theory of acceptance and use of technology (UTAUT) The authors empirically show (for both types of products considered) the influence of attitude towards the RS on intention to use them, and in turn, the influence of their use on the choice and purchase of products and services
Bodapati (2008)	Proposal of econometric model. Empirical, tested with real purchase data	An analysis is made of the role of recommendations in modifying customers' buying behaviours relative to what they would do with and without the intervention of the recommendation system. The paper highlights a key aspect: it is important not only to focus on products with a high probability of purchase that would very possibly be sold without the recommendation, but also to focus on products that have a high probability of purchase due to their high sensitivity to the recommendation action. This can contribute to add-on and cross-selling. An econometric model is proposed which is tested on purchase data from a US e-seller. The analysis draws on data relating to a total of 932 customers and 1,681 products

(*continued*)

Table I.
Summary of contributions (in chronological order) explaining aspects of the adoption and/or use of e-commerce RS which pay more attention to the psychological/subjective perspective of users

Table I.

Paper	Type of study	What is the contribution about?
Martínez-López *et al.* (2010)	Theoretical, conceptual model	The authors present an integrative conceptual model to explain the consumer's adoption and use of an e-vendor's RS. This contribution addresses the research problem from a psychological perspective, paying particular attention to the consumer's subjective aspects. It adapts and integrates the following consumer and technology adoption theories and models: theory of reasoned action, theory of planned behaviour, technology of acceptance model (TAM), Trust-TAM model and theories of flow in online environments. The proposed model is formed by 20 constructs and 20 propositions that are theoretically discussed
Pu and Chen (2010)	Theoretical, conceptual model	The authors propose a conceptual model (ResQue) to evaluate the perceived qualities of a RS from the experience of the user with the system. These perceived qualities are considered to be antecedents of the beliefs and attitudes of the users towards the system, which serve to predict behavioural intentions as a result of these perceptions. It is a model formed by 15 constructs related with four sequentially ordered blocks: (1) the qualities of a RS as perceived by the user, (2) beliefs, (3) attitudes and (4) behavioural intentions
Pu *et al.* (2011)	Theoretical and empirical (questionnaire and estimation of models by structural equation modelling – SEM)	The conceptual model proposed by two of the three authors in Pu and Chen (2010) is tested. All the hypotheses are supported. For example, variables such as satisfaction, perceived ease of use and usefulness are significant when seeking to determine the user's intention to use a RS in the future. On the other hand, the user's trust in a RS exerts an important influence on his/her intention to buy a recommended item
Choi *et al.* (2011)	Theoretical and empirical (experiment,questionnaire and estimation of models by SEM)	This study analyses the effects of a consumer's perceived social presence when using a recommender on evaluations of a personalized e-vendor's recommendation system. The specific dependent variables in the proposed model are trust in and intention to reuse the recommender. Several experiments were conducted with a sample of 368 undergraduate students in South Korea. Two types of products (hedonic and utilitarian) were used and their moderating influence was also tested. The theoretical model was estimated using AMOS. The main conclusion is that social presence has a positive effect on trust and intention to reuse
Knijnenburg *et al.* (2012)	Theoretical and empirical (experiment,questionnaire and estimation of models by SEM)	The authors propose and test a model to explain the user's experience with an e-commerce RS that goes beyond the objective aspects of a RS that are typically used. They employ a user-centric approach that links objective with subjective system aspects which, in turn, eventually influence the user's behaviour (i.e. experience and interaction) with a RS; in parallel, situational and personal characteristics of the RS's user are also considered. This model is tested and validated by gathering data from four field trials and two controlled experiments, which are analysed using structural equation modelling. The conclusions underline the considerable importance of the subjective system aspects and experience variables in explaining the user's behaviour with an e-vendor's RS

(*continued*)

Paper	Type of study	What is the contribution about?
Benlian *et al.* (2012)	Theoretical and empirical (experiment,questionnaire and estimation of models by partial least squares – PLS)	The authors analyse the differential effects of both an e-commerce recommender and consumers' reviews (CRs) on consumer beliefs; here, they consider trust, perceived usefulness, perceived ease of use and finally, perceived affective quality. Also, these beliefs are said to influence the consumers' intention both to use online product recommendations and make a purchase based on these in the future. Data came from an experiment (2×2) using Amazon.com. Then, participants completed an online questionnaire. Finally, this model was tested using partial least squares. Most of the hypotheses were supported. Furthermore, the different influence on beliefs of recommendations made by the recommender and consumer reviews is confirmed
Hostler *et al.* (2012)	Theoretical and empirical (experiment,questionnaire and estimation of models by SEM and PLS)	This study uses a simulated online shopping environment with a recommendation system (based on collaborative filtering data) to analyse the effect of such a recommender on the e-vendor environment. In particular, the authors propose a four-variable model with the following recursive sequence: use of recommender, recommender's effectiveness, consumer's satisfaction with the e-vendor's site and finally, consumer's loyalty to the e-vendor's site. A lab-controlled, between-subject experiment was conducted using the MovieLens database and applied to a sample of 251 undergraduate students. The authors conclude the effectiveness of a collaborative filtering-based recommender
Xiao and Benbasat (2014)	Theoretical, conceptual model	This paper updates the earlier paper written by Xiao and Benbasat (2007). The authors offer an up-to-date review of the literature, considering significant RS-related papers published between 2006 and 2012. They conclude that, with a few exceptions, most of the articles reviewed extended, rather than tested, their conceptual model of 2007. Furthermore, based on their review, four topic areas are highlighted: preference-elicitation (an input characteristic), explanation (an input/out characteristic), RS type and the social aspects of RAs. Finally, the authors decide to update their original conceptual model by (1) distinguishing between functional and social RA characteristics and (2) incorporating social presence in user evaluation of RS

Table I.

theoretical model: the psychological outcomes linked to the use of an e-vendor's RS. It works with a set of four constructs as psychological responses related to the use of an e-vendor's RS: the consumer's perception of the RS's performance; satisfaction with the RS; willingness to buy a searched item based on the RS's recommendation; and finally, willingness to make a cross-/add-on purchase based on the system's suggestions. Furthermore, three antecedents are included for such responses. One is the consumer's attitude towards the e-vendor's RS, whose logic is based on the original formulation of TAM (Davis, 1986), in turn inspired by the TRA (Ajzen and Fishbein, 1980). The other two, attention to such a system and flow state experienced during the online shopping process, come from the theory of flow (see Csikszentmihalyi, 1990). They are probably the most important and those which are applied most in online shopping environments, when the theory of flow is used in online consumer behaviour models (e.g. Hoffman and Novak, 1996). In all, there are a total of seven constructs, a synthetic description of which appears in Table II.

Figure 1 shows the model, whose components and relationships are clear to see. Next, and before discussing the hypotheses of the model, the constructs of the model are introduced.

3.2 Development of hypotheses

3.2.1 Attitude towards an e-vendor's RS. Attitude is usually associated with the individual's affective response or general evaluative response towards the object of the attitude (see Ajzen and Fishbein, 1980). In this model we use the same logic to define attitude towards a specific online store's RS, that is to say, the general or global evaluation that the consumer makes of this system. Furthermore, it is important to mention now that this attitude can be formed on the basis of other variables (see Martínez-López *et al.*, 2010, 2011 for a detailed theoretical analysis of this point). However, this issue lies outside the interests of this research, and therefore we will begin by considering it as an exogenous variable in our model. To be specific, it is proposed as a direct antecedent of two variables: the level of attention paid by consumers to the suggestions made by the online store's RS; and the consumer's perception of the RS's level of performance. Next, we discuss both relationships.

Users' attitude towards a technology has been positively linked in the literature to its perceived performance when used (see Parkes, 2013). Various studies have proposed

Table II. Description of the model's constructs/variables

Construct/variable	Brief description
Attitude towards e-vendor's RS	Consumer's overall opinion (affective response) of an e-vendor's recommendation system
Attention to recommendation	Consumer's level of attention to the items suggested by an e-vendor's recommendation system
Flow state	Consumer's mental state of optimal experience when deeply involved in an navigation/online shopping process
Performance of e-vendor's RS	Consumer's perceptions of the level of performance of an e-vendor's recommendation system
Satisfaction with e-vendor's RS	Consumer's level of satisfaction with an e-vendor's recommendation system
Willingness to buy	Consumer's willingness to buy a searched item based on an e-vendor's recommendation system
Willingness to make an add-on purchase	Consumer's willingness to make an add-on purchase based on an e-vendor's recommendation system

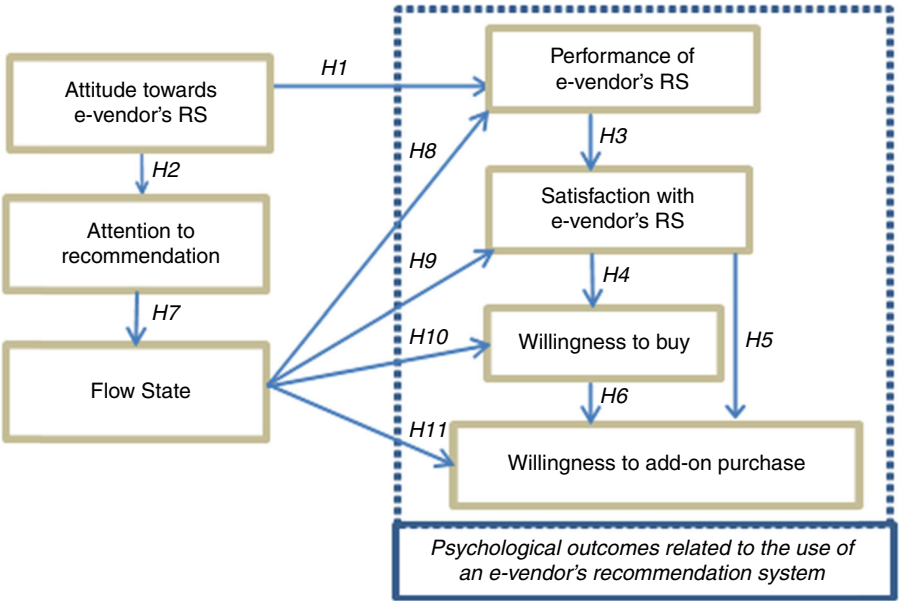

Figure 1.
Theoretical model

integrating the Task-individual Technology Fit model and the TAM model to theoretically justify a positive influence of users' attitude on their perception of an information system's performance (e.g. Dishaw and Strong, 1999; Goodhue and Thompson, 1995). On the other hand, the performance of a system for decision support could be measured using different approaches (see Hung *et al.*, 2007). In the case of our model, characterized by a psychological, subjective-based approach, we focus on a subjective measure of performance, based on the consumer's perception of an online store RS's performance. Hence, we omit consideration of other possible objective-based measurements that could also be taken into account (e.g. time used to make a decision while shopping with the support of such a system). At all events, in a recent study, Liu *et al.* (2011) analysed the relationship between the users' attitude towards a technology and its performance, considering both approaches to performance, i.e. subjective/perceptual and objective. They concluded that there is a significant, positive effect of attitude on the users' subjective perception of a system's performance. Therefore, we hypothesize that:

H1. The more positive the consumer's attitude towards an e-vendor's RS is, the more positive his/her perceived performance of such a system will be.

Our model includes two variables from the theories of flow in online environments (e.g. Hoffman and Novak, 1996; Novak *et al.*, 2000): focused attention and flow; the latter will be introduced in a separate section, where we discuss its influence on the psychological outcomes related to the online store's RS which are established in this model.

Individuals' attention is one of the topics that has generated most interest among researchers in psychology and cognitive neuroscience. Moreover, it occupies an important place in the discipline of consumer behaviour and it has been incorporated as a variable into some of the global classic behaviour models (e.g. Howard and Sheth, 1969). In particular, focused attention is a voluntary type of attention directed towards a task or a specific stimulus in the environment; if maintained for a certain period

of time, it enables the individual to concentrate on the activity being performed (e.g. Csikszentmihalyi, 1990). It is associated with resistance to distraction and the capacity to distinguish between relevant and irrelevant information. Hoffman and Novak (1996) defined it in the context of online environments as the concentration of the individual on a limited field of stimuli, such as the computer screen. In the context of our study, the field of stimuli refers to an online store's RS and its suggestions. Here, it is proposed that a consumer's attitude towards an e-vendor's RS influences the level of attention he/she pays to its recommendations. We therefore hypothesize that:

H2. The more positive the consumer's attitude towards an e-vendor's RS is, the greater his/her focused attention on such a system will be.

3.2.2 Relationships between the psychological outcomes related to the use of an e-vendor's RS. Satisfaction from a consumer's perspective has been widely considered as a unidimensional variable, usually of an affective type (e.g. Andaleeb, 1996; Ganesan, 1994; Oliver, 1981). This is the approach we follow here, regarding satisfaction with an e-vendor's RS as the consumer's overall satisfaction with such a system.

Oliver's classic consumer satisfaction-dissatisfaction paradigm posits performance as an outstanding antecedent of satisfaction (see Oliver, 1996). Various studies have concluded that there is a strong direct relationship between the perceived performance of a product or service and consumer satisfaction with it (e.g. Burton *et al.*, 2003; Page and Spreng, 2002; Tam, 2011). In online environments, McKinney *et al.* (2002) concluded that there is a relationship between customers' perceived performance of a commercial web site and their satisfaction with it. Therefore, in the context of our research, consumer satisfaction with an e-vendor's RS must be a direct consequence of the perceived performance or result provided by this system. However, to the best of our knowledge, although it has been theoretically suggested (see Martínez-López *et al.*, 2010; Xiao and Benbasat, 2007), this relationship still lacks empirical support. On this basis, we hypothesize that:

H3. The higher the consumer's perceived performance of an e-vendor's RS is, the higher his/her satisfaction with such a system will be.

The concept of customer satisfaction has been established and concluded as determinant of several positive outcomes for companies over time; e.g. customer loyalty, willingness to pay higher prices, firm profitability, positive referrals, etc. (see Homburg *et al.*, 2005). In particular, one of its outstanding effects is increasing consumers' willingness to (re) purchase a product or service that they are satisfied with. This fact has been widely dealt with in the literature on consumer behaviour (see Ha *et al.*, 2010; Voss *et al.*, 2010). However, despite extensive analysis in offline consumption situations, the relationship between satisfaction and purchase intentions has scarcely been studied and tested in a context of online services (Gounaris *et al.*, 2010); a recent and remarkable pioneer study of this relationship in a context of e-commerce recommenders (a DVD rental e-tailer) can be seen in Wu *et al.* (2013). Here, we consider that it is reasonable to use previous research into the link between satisfaction and purchase as a basis and extend this to the context of our study.

In particular, an e-vendor's RS is expected to increase the likelihood of the user purchasing not only a recommended item matching his/her primary search interest (e.g. a flight ticket to a specific destination, and with a particular airline and itinerary), but also (an) other product(s)/service(s) related with such a search, and therefore of interest to the user (e.g. a rent-a-car service, hotel, etc., at destination) (e.g. Senecal and Nantel, 2004). These

kinds of recommended items are the result of so-called add-on selling strategies (i.e. cross-selling and up-selling suggestions) implemented through that recommender (see Changchien *et al.*, 2004). These suggestions, viewed separately from the recommendations matching the consumer's primary search, represent another of the important functions attributed to e-commerce RS (Bodapati, 2008) and they can also influence unplanned purchases (Hostler *et al.*, 2011). Based on the above, we would put forward the following hypotheses:

H4. The higher the consumer's satisfaction with an e-vendor's RS is, the greater his/her willingness to purchase one of the suggestions made by the e-vendor's RS that matches his/her primary search interest will be.

H5. The higher the consumer's satisfaction with an e-vendor's RS is, the greater his/her willingness to purchase items related to add-on selling suggestions made by this system will be.

Finally, consumers are more willing to consider and eventually purchase other vendors' offers in a given decision process, once they have made a purchase (Kumar *et al.*, 2008; Shah *et al.*, 2012). Companies know this, so it is standard practice for many of them to offer add-on products to customers who have previously purchased a base product (Erat and Bhaskaran, 2012). In electronic markets, add-on offers are usually made by RS at e-vendors' web sites. It has been suggested that their presence has a positive influence on add-on purchases (Pathak *et al.*, 2010). Hence, we hypothesize that:

H6. Consumer willingness to purchase an RS-suggested product has a positive influence on his/her willingness to purchase RS-recommended add-ons.

3.2.3 Relationships related to the consumer's flow state. Flow state is the state of concentration and immersion, holistic feeling and optimal experience of an individual in an activity that he/she is engaged in. It is a mental state of intrinsic, gratifying and pleasurable enjoyment which can be achieved both in exploratory activities and in goal-directed activities (Sánchez-Franco and Roldán, 2005). In particular, flow state has been highlighted for its role in facilitating consumers' optimal navigation processes and shopping experiences (for an in-depth review of flow in online consumer behaviour, see Esteban-Millat *et al.*, 2014).

However, before discussing the effects of a consumer's flow state in the context of our study and model, first we will consider its relationship with focused attention, one of the variables that is used most in flow studies; it has even been said that this aspect is key to a consumer's experience of flow (Ku, 2011). In the literature on flow, it is considered that in order for an individual to enter a flow state, he/she needs to focus all his/her attention on the environment from which the stimuli originate. Therefore, flow studies consider the relationship between focused attention and flow (e.g. Hoffman and Novak, 1996; Jackson and Csikszentmihalyi, 1999). To be specific, focused attention is regarded as a direct antecedent of flow in various models of flow in online environments (e.g. Novak *et al.*, 2000; Pilke, 2004). We therefore hypothesize that:

H7. The greater the consumer's focused attention on an e-vendor's RS is, the higher his/her flow state experienced while engaged in his/her shopping process at such an e-vendor's web site will be.

In this study, we posit that a possible flow state experienced by a consumer when engaged in an online shopping process with the aid of an e-vendor's RS should have positive effects on the set of psychological outcomes related to the use of such a system

(see also Martínez-López *et al.*, 2010): performance, satisfaction and willingness to purchase a recommended item matching the consumer's primary search, as well as to make an add-on purchase based on such a system's suggestion.

When consumers experience flow state online, their involvement with a specific task they are engaged in (e.g. an online shopping process) is so intense that they even lose the notion of time and self-consciousness (Chen *et al.*, 2000), i.e. they leave thoughts and perceptions that are not relevant to performing such a task to one side. Hence, possible flow states experienced while engaging in a shopping process at an online store will make consumers have a more intense and interactive experience with the e-vendor's RS, and become more aware of its performance. We therefore hypothesize that:

H8. The higher the consumer's flow state while engaged in a shopping process at an e-vendor's web site is, the more positive his/her perceptions about the performance of an e-vendor's RS will be.

Consumers' satisfaction with an e-vendor's RS has been considered, usually as a dependent variable, by various studies modelling specific aspects related with the adoption and use of online stores' RS (e.g. Dabholkar and Sheng, 2012; Ho *et al.*, 2011). However, flow state has not been analysed as a possible variable that influences this kind of satisfaction. This said, Zins and Bauernfeind (2005) previously proposed a relationship with a similar logic, but with a different dependent variable. They concluded that flow state had a weak but significant influence on consumers' satisfaction with a recommender's web site. Let us consider, therefore, that customers experiencing flow state are likely to be more appreciative of suggestions and support provided by an online store's RS, a worthwhile consideration in the context of this study. Hence, we hypothesize that:

H9. The higher the consumer's flow state while engaged in a shopping process at an e-vendor's web site is, the greater his/her satisfaction with such an e-vendor's RS will be.

When consumers experience flow state, they are more likely to conclude an online shopping process with a purchase, as flow states make it easier to assimilate information and evaluate products (Novak *et al.*, 2000; Smith and Sivakumar, 2004). Moreover, in a flow state, consumers' cognitive dissonance is reduced, they are more likely to follow suggestions (see King, 2003) and, as a result, buy one of the recommended products related to their primary search interest. Therefore, we hypothesize that:

H10. The higher the consumer's flow state while engaged in a shopping process at an e-vendor's web site is, the greater his/her willingness to purchase one of the RS's suggested items that matches his/her primary search interest will be.

Likewise, as previously noted, e-commerce RS are said to increase consumers' unplanned purchases (Hostler *et al.*, 2011). We propose, however, that experiencing flow states might also have a positive influence on consumers' willingness to purchase items other than those related with the shopping goal directing their primary search. First, when online shopping, consumers in flow are expected to develop exploratory behaviours (e.g. Huang, 2003; Pace, 2004) which should encourage them to look at other suggestions beyond their primary interests and eventually make a purchase (see Korzaan, 2003). On the other hand, flow states facilitate joyful and gratifying subjective experiences while navigating (Huang, 2006; Skadberg and Kimmel, 2004);

these feelings are said to favour unplanned purchases too (Beatty and Ferrell, 1998). On this basis, we hypothesize that:

H11. The higher the consumer's flow state while engaged in a shopping process at an e-vendor's web site is, the greater his/her willingness to purchase items related to add-on selling suggestions of such a system will be.

4. Research methodology

4.1 Procedure for data collection

In order to obtain the information, fieldwork was conducted in two stages. In the first stage, participants were convened in a room with IT equipment, where we informed them of our interest in evaluating their opinion on aspects of the online shopping process; they were not informed of our specific interest in matters related to RS. We placed them in an artificial situation with a purchasing decision problem which they were asked to resolve. For this purpose, an activity was proposed which they had to complete in 15-20 minutes, consisting in a simulated online shopping process at a commercial web site with RS. Our aim here was that the participant should have prior and recent experience with the e-tailer and its RS. This would make it possible to obtain more accurate and reliable responses for empirical analysis of the hypotheses. Furthermore, this study did not involve a laboratory experiment with a fictitious web interface and a RS designed ad hoc (e.g. Cooke *et al.*, 2002). We preferred to work with a real web site. Using a real e-tailer's well-designed web site and RS with the ability to respond suitably to any consumer's choices while he/she is shopping is the best option for ensuring the authenticity of a simulated online shopping process to be carried out before completing a questionnaire. The objective in this case was to increase the validity of the results obtained. To be specific, the activity was staged on the web site of Pixmania, one of the biggest European e-tailers. To ensure that participants would use their recommender system, they were asked to try and base their shopping process on the recommendations provided by Pixmania.

To maintain participants' degree of involvement with both the object of their search and the searching task (see Zins and Bauernfeind, 2005), rather than specifying a product that they were all to look for, we asked them to choose, from Pixmania's vast range, one that that they needed and were thinking of acquiring in the near future. This also ensured that the search process would be credible and of interest to the participants.

In the second stage, which took place after completion of the purchase process, we presented the participants with a questionnaire, which was the same for all of them (see the section on measurement scales).

4.2 Sample

We collected an initial sample of 300 participants/questionnaires, of which 292 were valid questionnaires (male: 48.6 per cent; female: 51.4 per cent). A convenience sampling procedure was applied among university students in Barcelona (Spain), all of them internet users, during the months of October and November 2012. Around 97 per cent of the sample were in the 18-30 age group. This age range constitutes the largest segment of the internet user population; for example, approximately 90 per cent of social networking site users belong to the 18-30 age group (Pew Research Center, 2013).

4.3 Measurements

In certain cases we adopted measurement scales which had already been validated by previous studies; e.g. flow state, where the three-item scale proposed by Novak *et al.* (2000)

is used. However, the newness of some of the model constructs made it difficult to find scales used by previous studies. In these cases, we adapted validated scales which were applied to the same concepts, but with different measurement objects from those of this research, i.e. the RS of a particular web site. Here, we basically changed the measurement object, usually a company's web site, to the RS of Pixmania. The Appendix provides comprehensive details of the whole set of measurement scales used for each construct. All measurements used seven-point Likert-type scales anchored at strongly disagree (1) and strongly agree (7).

5. Data analysis and results

We followed the widely accepted two-step procedure proposed by Anderson and Gerbing (1988), first assessing measurement reliability and validity (i.e. analysing our measurement model), and then evaluating the full structural model (i.e. testing our hypotheses) (see also Martínez-López *et al.*, 2013). We conducted our analyses using both SPSS 15.0 and LISREL 8.80.

5.1 Measurement model analysis

5.1.1 EFA. We performed a principal component EFA with varimax rotation. The results confirmed that the number of factors equalled the number of latent variables under consideration, and that the explained variance value was over 0.6 in every case. We also found that all the indicators were significant, with factor loadings over 0.5, except for the last item of the variable attitude (attitude_5); this was dropped after confirming that it was loading significantly on another factor.

After refining the scales on the basis of studying their unidimensionality, we evaluated their reliability and validity by means of EFA. The values we obtained for each proposed scale were satisfactory. Each variable comfortably exceeded 0.7, the minimum acceptable threshold for Cronbach's α (see Table III). Furthermore, the item-total correlation was high in all the indicators.

5.1.2 CFA. Our measurement model was estimated on the basis of a joint confirmatory analysis of all the scales included in our proposed theoretical model (see Anderson and Gerbing, 1988). We subsequently evaluated the overall model's goodness of fit and the quality of the measurements used, and verified their unidimensionality, reliability and convergent and discriminant validity. Given the model's conditions (e.g. non-multinormal distribution of data, rating scales and the use of a polychoric correlation matrix), we applied the robust weighted least squares (RWLS) estimation method, which is recommended as the most appropriate means of dealing with the relevant shortcomings and providing proper solutions (see Martínez-López *et al.*, 2013).

We verified that the model was correctly identified, that its degrees of freedom were above 0, that its error variances were significant and positive in every case, and that the (standardized) parameter estimations all gave values of over 0.5 (Hair *et al.*, 2008). The confirmatory model's goodness of fit indicated that our proposed factor structure had been correctly specified. Our results pointed to a good model fit (χ^2/df: 1.717; GFI = 0.912; RMSEA = 0.049; CFI = 0.961; TLI = 0.953; NFI = 0.913; IFI = 0.962).

After analysing the measurement model's overall goodness of fit, we carried out a study of the reliability and validity of the scales corresponding to the model's constructs. The convergent validity of the instruments confirmed that the indicator loadings on their corresponding latent variables were significant. Subsequently, their reliability and discriminant validity were verified. In accordance with Steenkamp and Van Trijp (1991),

Table III.
λ loadings and reliability

	Attitude towards e-vendor's RS	Attention to e-vendor's RS	Flow state	Performance of e-vendor's RS	Satisfaction with e-vendor's RS	Willingness to buy	Add-on purchase
Attitude towards e-vendor's RS_1	0.59						
Attitude towards e-vendor's RS_2	0.7						
Attitude towards e-vendor's RS_3	0.86						
Attitude towards e-vendor's RS_4	0.82						
Attention_1		0.67					
Attention_2		0.82					
Attention_3		0.84					
Attention_4		0.67					
Flow_1			0.88				
Flow_2			0.88				
Flow_3			0.86				
Performance of e-vendor's RS_1				0.8			
Performance of e-vendor's RS_2				0.67			
Performance of e-vendor's RS_3				0.64			
Performance of e-vendor's RS_4				0.86			
Satisfaction with e-vendor's RS_1					0.84		
Satisfaction with e-vendor's RS_2					0.79		
Willingness to buy_1						0.88	
Willingness to buy_2						0.94	
Willingness to buy_3						0.81	
Add-on purchase_1							0.86
Add-on purchase_2							0.6
Add-on purchase_3							0.76
Cronbach's α	0.83	0.84	0.9	0.83	0.78	0.91	0.72
Composite reliability (CR)	0.857	0.842	0.906	0.879	0.79	0.912	0.722
Variance extracted (AVE)	0.506	0.573	0.762	0.596	0.654	0.776	0.486

we tested the scales' convergent validity by verifying that the loadings corresponding to the observable variables (indicators) with the latent variables were significant and above 0.5. We also analysed the average variance extracted (AVE) to confirm the convergence of the model's scales (Ping, 2004), obtaining satisfactory results for all of them. The constructs' CR results, meanwhile, were above the recommended cut-off value of 0.7 (Hair *et al.*, 2008) in every case (see Table III).

With respect to the discriminant validity of the model's latent variables, we applied two methods, consisting of a confidence interval (95 per cent) for the correlation between pairs of constructs, without detecting unity in any case; and the square root of each construct's AVE, the value of which generally exceeded the relevant construct's correlations with the model's other constructs (see Table IV).

In summary, our CFA not only confirmed a correct fit between the factor structure and the proposed model's data, but it also demonstrated the reliability and the convergent and discriminant validity of these scales.

5.2 Structural model testing

In order to test the structural model, based on the same reasons presented above, we applied a RWLS method. Model fit indices were generally quite satisfactory (χ^2/df: 1.813; GFI = 0.897; RMSEA = 0.053; CFI = 0.954; TLI = 0.947; NFI = 0.904; IFI = 0.954). The estimation of the model's structural coefficients showed all our hypotheses to be significant, with the exception of *H10*. The results showed that there is no direct relationship (although there is an indirect relationship through the predisposition of the consumer to purchase) between the user's satisfaction with the RS-WS and his/her predisposition to make a crossed purchase or a more expensive purchase. In other words, individuals who are satisfied with the RS are generally more inclined to purchase what the system recommends in relation to their primary search object, but they will not be more inclined to purchase products/services outside their primary shopping goal, related to add-on selling suggestions. To be specific, consumers will only be more inclined to purchase add-on products to their primary shopping goal (i.e. cross-/up-selling) when they intend to follow the recommendations of the RS in relation to their initial search. This is when they are willing to accept and follow other suggestions made by the recommender about other products that complement their initial shopping goal or are more expensive.

To our understanding, the logic behind this result is that individuals do not feel more inclined to follow add-on selling suggestions made by an online vendor's RS until they are sure about purchasing one of the recommendations related with their initial shopping goal. At all events, we should check in future research that this interesting sequential logic is also maintained in other samples.

With any modification to the model altering its structure, we proceeded to re-estimate the model in accordance with the widely accepted protocol. We undertook a first reformulation of the model we had initially proposed, excluding only the insignificant relationship, that of *H10*. A previous examination was also made of the modification indices provided by the structural equation modelling software used. These did not suggest the incorporation of any other causal relationship into the model. The fit indices for the new model improved the previous results, showing a better fit to the data (χ^2/df: 1.805; GFI = 0.909; RMSEA = 0.052; CFI = 0.954; TLI = 0.947; NFI = 0.904; IFI = 0.955). All our hypotheses in this reformulated causal model were tested successfully. Figure 2 shows the coefficients obtained for each envisaged relationship between constructs. Additionally, the high R^2 values of some of the model's endogenous constructs should be

Table IV.
Analyses for discriminant validity

	Attitude towards e-vendor's RS	Attention to e-vendor's RS	Flow state	Performance of e-vendor's RS	Satisfaction with e-vendor's RS	Willingness to buy	Add-on purchase
Attitude towards e-vendor's RS	0.71						
Attention to e-vendor's RS	(0.32-0.55)						
	0.43	0.76					
Flow state	(0.25-0.48)	(0.39-0.6)					
	0.36	0.49	0.87				
Performance of e-vendor's RS	(0.45-0.6)	(0.29-0.52)	(0.25-0.48)				
	0.52	0.4	0.36	0.77			
Satisfaction with e-vendor's RS	(0.5-0.65)	(0.34-0.58)	(0.31-0.55)	(0.53-0.65)			
	0.57	0.46	0.43	0.59	0.81		
Willingness to buy	(0.44-0.63)	(0.35-0.56)	(0.3-0.52)	(0.56-0.73)	(0.61-0.75)		
	0.53	0.45	0.41	0.64	0.68	0.88	
Add-on purchase	(0.31-0.56)	(0.33-0.58)	(0.26-0.51)	(0.35-0.59)	(0.34-0.6)	(0.51-0.71)	
	0.43	0.45	0.38	0.47	0.47	0.61	0.70

Notes: Correlations between constructs and 95 per cent confidence intervals in brackets. Diagonal values are the square root of each construct's AVE

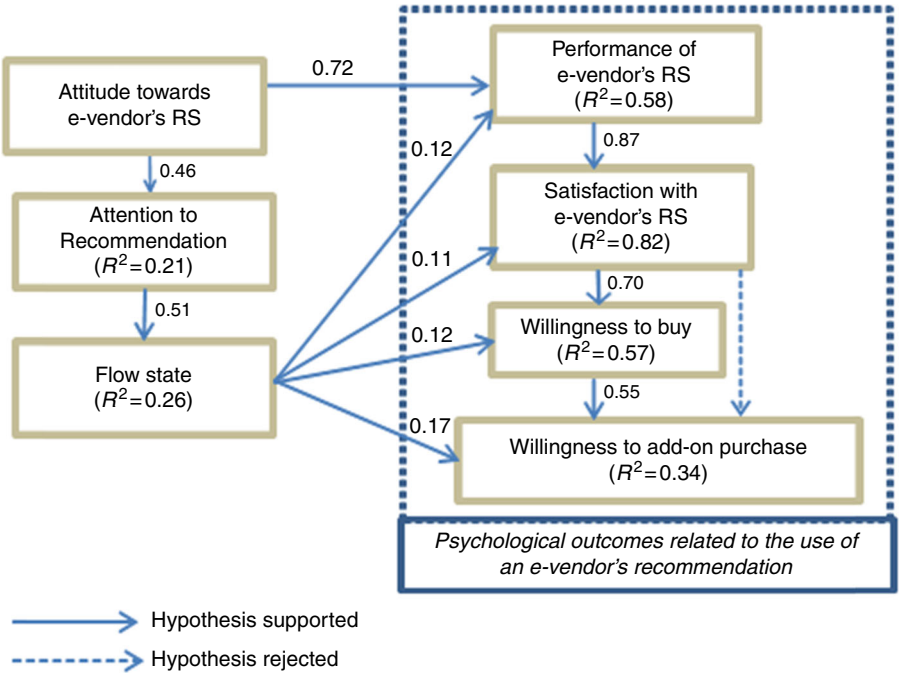

Figure 2.
Estimated structural model

Notes: Standardized coefficients – level of significance of all structural coefficients with p-value < 0.01. R^2 of endogenous constructs in brackets

noted, particularly those corresponding to RS-WS satisfaction ($R^2 = 0.82$), RS-WS performance ($R^2 = 0.58$) and predisposition to purchase ($R^2 = 0.57$).

The results supported the considerable influence of a consumer's attitude towards an e-vendor's RS on his/her perceived performance of such a system (*H1*; $\beta = 0.72$). Confirmation was also received of the influence of attitude on the level of attention paid by the consumer to the recommendations of the system (*H2*; $\beta = 0.46$). On the other hand, as we anticipated on the basis of the studies on flow state in online environments, the level of attention paid by the individual to the recommendations of the system clearly contributes to inducing flow states in the online shopping process pursued at an e-vendor's web site (*H3*; $\beta = 0.51$).

Likewise, all the relationships of dependency identified between the variables set as psychological outcomes linked to the use of an online store's RS were tested, with the exception of *H10* (as mentioned above). To be specific, we observed the considerable influence of the consumer's perceived performance of an e-vendor's RS on his/her satisfaction with such a system (*H8*; $\beta = 0.87$). Confirmation was also received of the considerable influence of consumers' satisfaction with an e-vendor's RS on their predisposition to purchase one of the suggestions related to their initial shopping goal (i.e. primary search interest) (*H9*; $\beta = 0.70$). Finally, it was confirmed that once consumers show a predisposition to purchasing one of the recommendations provided by the system in relation to their shopping goal, they will also consider other recommendations related with complementary products or more expensive items (cross-/up-selling) (*H11*; $\beta = 0.55$). Therefore, as we observed earlier, the degree of

consumers' satisfaction with an e-vendor's RS does not have a direct influence on their predisposition to consider add-on selling recommendations. On the contrary, the influence is indirect, through the predisposition to purchase one of the recommendations made by the system for the consumer's initial shopping goal.

On the other hand, we concluded that the consumer's flow state has a positive and direct influence on the block of psychological outcomes related to the use of an e-vendor's RS. To be specific, experiencing flow states when engaging in a shopping process at an e-vendor's web site slightly improves consumers' perceived performance of such an e-vendor's RS (*H4*; $\beta = 0.12$) and their satisfaction with such a system (*H5*; $\beta = 0.11$). It also increases their predisposition to purchase items suggested by an e-vendor's RS related to their primary shopping goal (*H6*; $\beta = 0.12$) but with add-on selling recommendations (*H7*; $\beta = 0.17$). This last result is interesting. Likewise, our results suggest that consumers' flow states are even more important with regard to explaining the purchase of unplanned products recommended to them while shopping online with the support of an e-vendor's RS. This information is interesting, for example, for online stores that wish to promote cross-selling and up-selling purchases among its customers.

By way of summary, we provide an overview of the hypotheses and the empirical support for these in Table V.

6. Conclusions

Our results clearly support the theoretical model that we worked with. First, the structure of psychological responses linked to the use of an e-vendor's RS, originally proposed by Martínez-López *et al.* (2010) in their integrative model, but specifically developed and discussed here, is valid. The basic sequence of perceived performance→satisfaction→willingness to purchase (suggested item matching consumer's initial shopping goal)→willingness to make an add-on purchase is empirically

Hypotheses	Antecedent variable	Dependent variable	Expected result	Empirical result	Conclusion
H1	Attitude towards e-vendor's RS	Performance of e-vendor's RS	Positive	Positive	Supported
H2	Attitude towards e-vendor's RS	Attention to recommendation	Positive	Positive	Supported
H3	Performance of e-vendor's RS	Satisfaction with e-vendor's RS	Positive	Positive	Supported
H4	Satisfaction with e-vendor's RS	Willingness to buy	Positive	Positive	Supported
H5	Satisfaction with e-vendor's RS	Willingness to add-on purchase	Positive	Not significant	Not supported
H6	Willingness to buy	Willingness to add-on purchase	Positive	Positive	Supported
H7	Attention to recommendation	Flow state	Positive	Positive	Supported
H8	Flow state	Performance of e-vendor's RS	Positive	Positive	Supported
H9	Flow state	Satisfaction with e-vendor's RS	Positive	Positive	Supported
H10	Flow state	Willingness to add-on purchase	Positive	Positive	Supported
H11	Flow state	Willingness to add-on purchase	Positive	Positive	Supported

Table V. Results of hypotheses tests

proved. Furthermore, based on the structural coefficients obtained for such relationships, the degrees of influence of one response on the other are considerable. However, there is a hypothesized relationship, namely the relationship between the consumer's satisfaction with an online store's RS and his/her willingness to make add-on purchases (*H5*), which is not finally supported. This said, an interesting conclusion can be drawn from this result: consumers need to be satisfied if they are to eventually purchase one of the items suggested by the e-vendor's recommender, although it is probable that no add-on purchase will be made, based on such a recommender, unless the consumer has previously bought one recommended item related to his/her primary shopping goal. This result has important implications. On the one hand, it reinforces the idea that unplanned and impulse purchases would appear to be more likely in e-commerce contexts where consumers have previously bought other items (see Jeffrey and Hodge, 2007). In the specific context of online shopping decisions with the aid of recommenders, this means that consumers should first use an online store's RS to support a planned purchase (i.e. their initial shopping goal). Subsequently, related add-on purchases could take place.

Second, consumers' attitude towards an online store's RS is shown to be a strong antecedent of both their perceived performance of such a system and the attention they focus on it. Beyond the context of this model, this result supports the idea that the user's attitude towards a technology (an e-vendor's RS in this case), originally proposed in the first version of the TAM (see Davis, 1986), plays an important role in understanding issues related to its adoption and use. As discussed earlier (see Section 3.2.1) and also based on others (e.g. Martínez-López *et al.*, 2010; Pu and Chen, 2010), this variable was expected to enhance an understanding of the consumers' set of psychological responses linked to the use of an e-vendor's RS, due to its direct and indirect effects, and this is empirically demonstrated.

Third, flow theory applied as a complementary source in order to better understand consumers' psychological outcomes linked to the use of e-commerce RS is adequate. The most important conclusion is that consumers' flow states when using an online store's RS have an influence on their psychological responses linked to its use. In particular, with respect to the set of variables considered in this study, flow theory slightly enhances each of the variables in the sequence of four that we worked with, i.e. performance→satisfaction→willingness to purchase→willingness to make an add-on purchase. Most notably, flow states have a particular influence on unplanned purchases.

7. Implications for practitioners

Some major implications and practical suggestions related to the aforementioned theoretical observations are highlighted in the following points:

- Companies interested in fostering unplanned and impulse purchases at their online stores, and in so doing improving the efficiency of their cross- and up-selling strategies, should design their RS with the primary purpose of helping customers find items they are interested in, before they purchase these.
- A good attitude towards an online store's RS is a factor of influence on consumers who ultimately make a purchase based on the recommender's suggestions. The interesting issue, then, is how to ensure that e-vendors' customers have good attitudes towards their recommenders. However, as stated previously, this matter lies beyond the scope of our research. This said, considerations such as trying to make recommenders easy to use, useful and reliable could be relevant to this purpose (see Martínez-López *et al.*, 2010; Pu *et al.*, 2011).

- e-Vendors will probably obtain higher sales if they help their customers to achieve flow states when shopping online. This idea is based on the influence that flow states have on purchasing not only suggested items related to the customers' shopping goals, but also other items originating from add-on selling recommendations. In this respect, recommenders that capture the attention of consumers need to be designed. Here, as we stated earlier, consumers' attitude towards the RS plays an important role as a direct and strong antecedent. Moreover, recommenders should be designed so that consumers perceive a good balance between their skills and the challenges that using such a recommender involve (see Hoffman and Novak, 1996). In particular, consumers need to find it easy to browse and modify the set of recommendations provided by an e-tailer's system. If, on the other hand, it is not simple to use or smooth interaction does not prevail, with waiting times and interruptions during the consumer's shopping process, for example, consumers' flow states will be compromised or difficult to reach. Likewise, companies should design recommenders to offer outcomes which correspond appropriately to consumers' searching interests. As demonstrated, the purchase of an item closely related to a consumer's primary search is key to the eventual purchase of recommended add-ons. If recommenders are designed to provide consumers with primary interest items (e.g. flights to a city) and add-ons (e.g. hotels, rent-a-car service, etc., in this city) in equal measure from the beginning of the shopping process, then consumers can lose focus, possible flow states fade and they decide to quit. However, recommenders designed in the first instance to help consumers with their searching needs and then to satisfy e-tailers' interests in selling more by offering add-ons are expected to be more profitable.

8. Limitations and future research

Samples obtained by means of convenience sampling do not have the same degree of rigour as those obtained using probability sampling methods, limiting scope for the generalization of results (Peterson, 2001). Nevertheless, they are useful for studies of online consumer behaviour (see Lin and Lu, 2000). Furthermore, this sampling procedure is an acceptable option for successfully testing proposed causal models (Kardes, 1996).

Finally, we would like to conclude by briefly pointing out some ideas for future research, which, in addition, might help to solve other limitations of this study. First, it would be interesting to cross-validate this model with new data, in such a way that it could be replicated with other e-tailers' RS. Second, new variables could be considered, such as the number of recommendations made by an e-vendor's RS that the consumer focused attention on, the relationship of this variable to his/her flow state during an online shopping process assisted by such a system, and its effects on psychological outcomes. Third, new studies could look in greater depth at specific RS features that enhance flow, given the phenomenon's importance.

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Appendix. Measurement scales

Here, we present a breakdown of the measurement scales applied to our model's constructs. Participants were provided with a questionnaire containing these scales in Spanish.

Attitude towards Pixmania's RS was measured adapting the six-item scale used by Chen and Wells (1999) for attitude towards the site:

- Pixmania's RS makes it easy for me to build a relationship with this company.
- I would like to use this RS again in the future.
- I am satisfied with the service provided by Pixmania's RS.
- I feel that using Pixmania's RS is a good way to spend my time.
- Compared with other companies' RS, I would rate Pixmania's system as one of the best (finally removed after refinement analyses; see Section 5.1.1).

Attention given to Pixmania's RS was measured adapting the measurement scale validated by Ghani *et al.* (1991) for concentration/attention focus: While using Pixmania's RS …:

- … I was absorbed intensely in the activity.
- … My attention was focused on the activity.
- … I concentrated fully on the activity.
- … I was deeply engrossed in the activity.

Flow state while engaging in the online shopping task at Pixmania used a three-item scale adapted from the scale used by Novak *et al.* (2000) to measure flow in online environments. Furthermore, following the same procedure as these authors, a brief description of what flow is about was presented to the interviewees:

- Do you think you have ever experienced flow on Pixmania's web sites?
- F2: in general, how frequently would you say you have experienced flow while navigating at Pixmania?
- F3: most of the time I have been at Pixmania.com I feel that I was in a state of flow.

A semantic differential scale was used for perceived performance of Pixmania's RS, inspired by the scale validated by Huang (2005) to assess a web site's performance: In general, how would you characterize the performance of Pixmania's RS:

- Useless-Useful.
- Unpleasant-Pleasant.
- Weary-Entertaining.
- Awful-Nice.

Satisfaction with the e-vendor's (Pixmania's) RS was measured adapting the measurement scale validated by Yang *et al.* (2005) for overall satisfaction with a web site:

- All in all, I am very satisfied with the support offered by Pixmania's recommendation system.
- Pixmania's recommendation system largely fulfils my needs at this stage.

A three-item scale was used to measure the consumer's willingness to purchase some of the recommendations made by the e-vendor's RS, related to the product/service that his/her search process is focused on. This scale has been adapted from the validated scale used by Grewal *et al.* (1998) to measure a consumer's general predisposition to buy a product. These authors' scale is, in turn, an adapted and simplified version of the original scale proposed by Dodds *et al.* (1991):

- If I were going to buy the product I am searching for, the probability of buying one of the options offered by Pixmania's RS is high.

- The probability that I would consider buying one of the options provided by Pixmania's RS in relation to my search is high.
- The likelihood that I would purchase one of the recommendations related to my search interests is high.

Due to the lack of validated scales for consumers' willingness to make an add-on purchase based on the e-vendor RS's suggestions, we adapted the aforementioned scale, based on Grewal *et al.* (1998):

- If I were going to make a purchase related to the main product I am searching for, it is probable that I would also buy other suggestions made by Pixmania's RS to complement it.
- The probability that I would consider buying a recommended item which costs more than what I had planned to spend at first is high.
- The likelihood of purchasing a recommended item, related to my search interests, of higher quality (and with a higher price) than the item I had first thought of buying, is high.

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