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Recommendation agents: an analysis of consumers' risk perceptions toward artificial intelligence

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Abstract
Tools that use artificial intelligence to improve consumer experiences and automate processes, such as recommendation agents have been widely adopted by companies. However, the use of this type of technology can increase a user's perception of a risk to data privacy. This article aims to go more in-depth into what is known about the variables that impact this perception of risk related to recommendation agents. By way of an exploratory study with in-depth interviews followed by a survey, it was possible to identify how aspects such as a concern with data and the perceived risk in online shopping increase the sense of a risk to privacy. Consumers are generally unaware of how recommendation agents work, which makes them unsure about their usability and purpose. Consumer trust, however, mediates this relationship by mitigating the negative effects of risk perception.

Keywords Recommendation agents · Online consumer behaviour · Data privacy · Risk · Trust

1 Introduction

Artificial intelligence (AI) has helped companies deliver a better experience to consumers by introducing enhanced convenience into routine activities and supporting consumer decision-making [21]. This type of technology has been disrupting the

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market, especially in retailing contexts. Using tools such as recommendation agents (RAs) and predictable algorithms, companies can offer products that match consumers' interests, thus facilitating the decision-making process and providing a personalized experience [4, 13, 22]. Recommendation agents, also known as computerized recommendation systems, detect items which are considered relevant based on the previous browsing and purchase history of the customer and display these products or services in an attractive way [11].

Even though AI offers benefits like experience personalization, it can also spark consumer fear and distrust [29], either because companies are not fully transparent with their customers about using their data [6], or because customers are unaware of how the technology works [9]. This lack of knowledge influences user trust and can even impact the perception of risk that a website or transaction represents to customer privacy [28]. Other aspects that may also influence privacy concerns are the perception of how risky it is to purchase in an online environment [18], and the concern that some people have about the use of their data [14, 19]. Perceived risk is related to the uncertainty someone recognizes in a certain situation or technology [25]. People react in different ways to risk perceptions, including avoiding a situation that is seen as threatening. For this reason, it is essential to understand the aspects that influence the perception of a risk to privacy in the context of online shopping.

Perceptions of risk related to data privacy and the use of technology have been the focus of recent theoretical discussions [9, 15]. Research about RAs is mostly focused on technology acceptance [25, 26], the comprehension of the impact of trust on usage and the willingness to accept a recommendation agent's suggestions [25, 29]. Moreover, previous studies are dedicated to understanding the impact of RAs on a consumer's preferences and purchase intentions [10, 29], or how to improve recommendation accuracy and a company´s performance [11, 22]. Nonetheless, there is still a lack of research into privacy risk perceptions, trust and especially the impact that knowledge about the recommendation systems has on consumer behaviour.

To the existing literature about trust in the RA [29], this research adds the following variables: concern with personal data use, perception of risk, and knowledge one has about RA. Although recent research has considered the impact of risk perception on trust and intention to adopt this technology as a decision aid [25], previous knowledge about the technology was not considered. Furthermore, in this research, the focus is not on technical aspects of RA [22] or technology acceptance [25], but on risk to privacy perception, therefore adding to a broader discussion about consumer perceptions and the use of new technologies throughout the consumer journey.

This study contributes not only to a theoretical advance in the subject of risk perception [15, 25] but also to how knowledge about technology and trust can mitigate perceptions of risk [16]. Besides, this research answers the call to advance our understanding of the role played by transparency related to technology from the perspective of a shopper [17]. Since recommendation systems are seen as one of the most important components of e-commerce platforms due to their impact on profitability and reduction of transaction costs for customers [3, 11], this research also provides insights for companies that use artificial intelligence as a tool to improve business and consumer experiences [21].

2 Recommendation agents and risk perceptions

Artificial intelligence has the potential to influence consumer behaviour and perceptions [9]. Among the tools used in marketing to advise and assist the consumer are recommendation agents (RAs), a type of AI that shows products and services to consumers based on their previous choices and behaviour online [11]. Examples of such are the Netflix platform, which uses each subscriber's profile and the contents already consumed by them to recommend similar films and series [10], or Amazon which offers the consumer new products based on previous purchases [21]. A RA can use different strategies to process information and recommend new products: collaborative filtering suggests new purchases based not only on the user´s behaviour but also on other individuals with similar interests and beliefs; content-based filtering suggests new items based only on the previous behaviour of the consumer; and the hybrid filtering that uses a combination of both methods [22].

Overall, RAs can serve as an instrument for consumers by helping them make better buying decisions, and by advising them according to their interests. In addition to simplifying decision-making by reducing the complexity of the search, comparison, and choice, RAs also reduce the sense of information overload [4, 25] and increase the personalization of the shopping journey [13, 21].

Despite all these positive aspects, the use of consumer data to customize and optimize offers and the experience raises concerns about the disadvantages of this technology, since users usually share personal information with the platform to get assertive recommendations. Aspects such as breaches of privacy, bias, and discrimination generated by AI have been widely discussed. These possible outcomes are related to risk perceptions, which refer to an unpleasant outcome of a decision resulting in a possible loss [23]. Risk perceptions vary among individuals, and although users accept some level of risk when they disclose personal information to companies, some consumers do not clearly understand how companies use their data [9, 23].

Higher concerns about privacy and personal information tend to be related to higher risk perception and can even discourage consumers to adopt technologies due to the kind or amount of data it requires, which may be seen as a hazard to privacy [1, 16]. Privacy concerns are positively related to protection motivation, which means that users tend to adopt behaviours focused on protecting themselves when dealing with threats such as information leakage and other outcomes often associated with technologies that collect personal data [8]. According to the rationale of protection motivation, we expect that more concern with the way a RA uses personal data will influence perceptions of risk to privacy. Therefore:

H1: A greater concern with the use of personal data has a positive influence on the risk to privacy perception.

This concern may be associated with the extent to which a person perceives a particular situation to be unsafe. Individuals have different attitudes towards risk, and this impacts their propensity to engage in situations they perceive as such. In the interaction with a RA, the perceived risk could be related to the improper handling of consumer information, the tracking of consumer behaviour, intrusion, surveillance or even identity disclosure [16]. A consumer may perceive risk not only related to

the company (e.g., the retailer) but also towards the online purchase itself, which can influence purchase intentions, loyalty, and the relationship with the brand [12].

In the specific case of e-commerce, it is already known that individuals who perceive higher levels of risk in an online purchase situation usually avoid sharing their information online and may even stop buying online [18]. Moreover, there is a positive relationship between risk perceptions of e-commerce platforms and privacy issues related to this purchase channel [16]. Based on the theoretical framework, it is proposed that:

H2: The perception of risk in an online purchase has a positive influence on the risk to privacy perception.

3 Trusting recommendation agents

Another aspect that may influence customers' online behaviour is trust, which is the positive expectation regarding services in a situation perceived as risky [25, 29]. Specifically considering RAs, consumers have little knowledge of this technology either about how it operates, or how it influences decision-making. Familiarity often minimizes people's uncertainty or privacy concerns regarding new platforms [16]. Therefore, it is important to understand what levels of transparency and details consumers expect about data collection and use related to product recommendation systems, in the sense that knowledge about how the technology works can contribute to the mitigation of privacy concerns [17].

In the literature, trust is usually a mediator between technology and customer responses [13]. It makes users believe that the online service provider, which is using the agent on its website, will collect, store, and use their personal information appropriately, thus reducing the risks associated with a lack of privacy [29]. Previous research has already shown that explanations of an RA's reasoning logic strengthened users' trusting beliefs in the RA's competence [29], however, it has not tested the effect of trust in the relationship between knowledge about the technology (e.g., RA) and risk perceptions.

If understanding technology influences how an individual trusts it, and has an impact on the perceived risk, it is expected that this effect will also occur with recommendation agents. Therefore, the following hypothesis is suggested:

H3: Trust is a relationship mediator between knowledge of recommendation agents and the risk to privacy perception.

Figure 1 details the proposed and tested connections in this article, where the concern about data and the perceived risk in online shopping have an impact on the risk to privacy perception. Knowledge of RAs would generate increasing trust concerning the technology, thus reducing the perception of privacy risk.

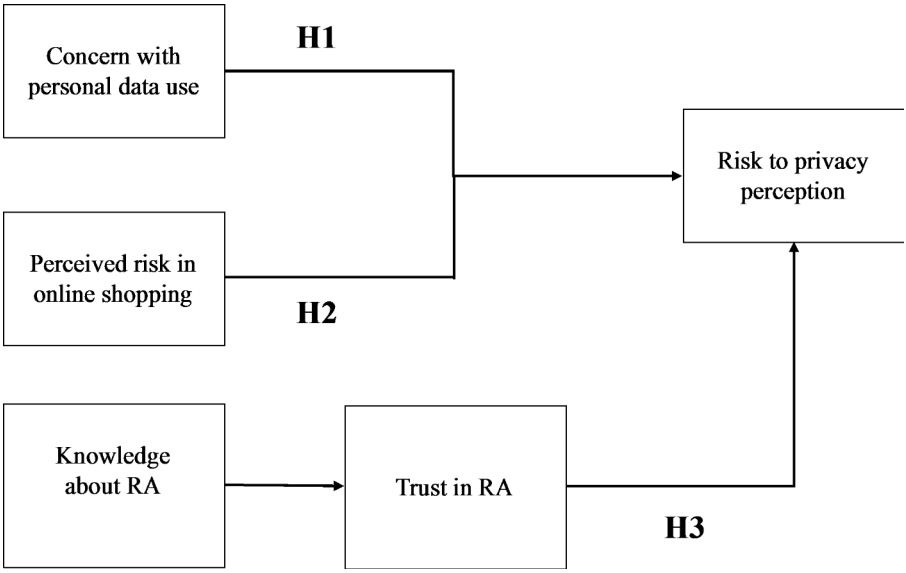

Fig. 1 Research Framework

4 Method

Two studies were performed using a qualitative and a quantitative approach, respectively. Study 1 included in-depth interviews with consumers who frequently buy products online, to better understand the purchase process and the relationship consumers had with AI and RAs. Study 2 was a survey that aimed to provide data to test the hypotheses.

The target population of this study comprised Brazilian consumers who shop online. The focus on Brazilian consumers is because of the size and potential of this market. In 2020 e-commerce reached the historical milestone of more than BRL 87 billion (approx. Euro 16 billion) in sales, which represents a 41% increase compared to the previous year and a total of 79.7 million individuals purchasing online [7]. In 2021 the online sales reached BRL 161 billion (approx. Euro 30 billion) and the projections show further increase in the next years.

5 Study 1

5.1 Subjects and procedures

The objective of this study was to understand in a more exploratory way the online buying process, and the perception of consumers about the functionality of recommendation agents, their impact on decision making, and the privacy and data protection issues that permeate this context.

Seventeen consumers who had made frequent online purchases in the previous year (on average once a month), were interviewed. Since the subjects were part of

a convenience sample, we tried to keep the participants as diverse as possible, their ages ranged from 22 to 56 (Mean = 36 years old), half of them were female and there was a wide range of occupations (e.g., intern, manager, etc.). The interviews were performed through videoconference and took on average 23 min. All of them were recorded, transcribed, and analysed using a qualitative content analysis approach with the following categories: online buying process and risk perceptions, the RA and its influence on online shopping, and concerns with data privacy.

5.2 Results

The first category of analysis was the online buying process and risk perceptions. Most respondents (71%) indicated that they order at least once a month from e-commerce, and a smaller number (17%) do so every week. This shows that the sample was composed of individuals using e-commerce quite frequently. Factors such as price, website usability, convenience, and the opinions of other users were the most mentioned motivators in their decision to shop virtually.

Even though most consumers are already used to making purchases online, we still have some individuals that have some reservations about e-commerce, such as Interviewee 7 "*I am kind of suspicious about online purchase. Returning a product, for instance, is much more difficult than in a physical store"*. This may be related to the extent that individuals trust online shopping. It was evident that brand and recognising of large companies are factors those respondents take into consideration when assessing a website's credibility. When the page is from a well-known organization, they feel more comfortable buying a product from it.

For some respondents, verifying the website's security key is also necessary as another way of confirming the reliability of a page. These findings confirm what previous literature has suggested about trust having a buffer effect on privacy concerns and levels of new technology adoption [16, 19]. Some respondents feel more comfortable and already know how to check if a website is trustworthy by looking for safety cues, while others seem to be not so sure and therefore use online channels only from big retailing brands that they already know from the brick and mortar´s context. The main findings related to the online shopping process are summarized in Table 1.

The second category was related to recommendation systems and the perceived influence this technology has in online shopping. When respondents were asked what an RA was, many did not know. Interviewee 15 mentioned "*I am not sure about it*", while interviewee 1 said, "*I don't know if it is a person or an algorithm that is recommending a product or a website*". This lack of knowledge of how the recommendation system works suggests that even though consumers have already heard of AI sometimes they are unaware of its applications and purposes. Therefore, it seems necessary to clarify how the mechanism works to reduce possible resistance to consumption in these channels.

Table 1 – Summary of interviewees´ perspectives on the online shopping process

Unknown sites	Known sites	Recommendation	Security cues
Interviewers do not trust sites they do not know or have not been recommended to.	Interviewers prefer large companies with a famous brand, which is associated to safety.	As a way of getting to know a website they are not familiar with, respondents seek the opinions of other consumers on review websites (e.g., *Yelp, Reclame Aqui*) or by talking to close friends.	Respondents look for security cues when purchasing online. Two-factor authentication and verification seals, keep consumers shopping on the Internet.

Respondents generally believe that agents influence their choice process. Interviewee 7 said: "*Yes, for sure. Sometimes I don´t even realize I need a certain product, but I end up buying it because the website suggested something, and it was helpful*". This perspective suggests some level of accordance with the idea that perceived personalization, meaning the website recommending products that are relevant for the client, can enhance the intentions to adopt the recommendation agent either as a decision aid or even to delegate the decision to the artificial intelligence because the user feels it is easier or more accurate [25].

Some respondents, however, feel that the agent does not influence their choice. One possible explanation for this may be related to the perceptions of control associated with these systems [13]. By confirming that they are influenced by AI, the consumer is admitting that their control in terms of e-commerce is reduced, and this can make them feel psychologically uncomfortable.

Some respondents believe that RAs can be programmed with ulterior motives, as suggested by Interviewee 11 "*If the recommendation system recommends a certain item and doesn't recommend another, it has a reason, but it could also do it in bad faith*". This sentence explains the fear that RAs do not necessarily consider the interests of the consumer. When consumers perceive a retailer technology, in this case, the RA, as providing more benefits to the retailer than to the consumer it affects confidence and behavioural intentions [19], which the interview seems to corroborate. This is an interesting aspect that can also be improved by organizations, through consumer education or transparency on the website itself. This is aligned with findings about the positive impact of higher transparency from companies regarding the use of technology on consumer responses [17]. Companies seem to find positive results not only by offering a clear idea about how data from consumers is being stored and used but also by contextualizing how personal data can improve the shopping experience. Table 2 summarizes the understanding respondents have about the RAs.

The third category of data analysis was related to concerns with data privacy. When using AI, all respondents seem concerned with the security of their data. Several respondents said that they would not give their data to a recommendation agent. This is evident in Interviewee 12's statement "*It would depend on what data the RA wants. If it wants to map out my digital behaviour, I'll feel invaded, because I don't want to feel manipulated and I wouldn't trust that this recommendation is for me*".

Table 2 – Perceptions of the recommendation agents

Knowledge of RAs	RA's influence	RA's functionality
Respondents do not know exactly how a RA works and confuse the terms.	Overall, most respondents realize that RAs influence the online buying process, whether through advertisements, images, or suggestions. This influence occurs even if the user cannot identify the RA.	Among the recognized functions of RAs is the simplification of the research process and consumer buying decisions. But they emphasize that this recommendation should intend to facilitate the purchase based on customers' interests, rather than the companies' goals.

Table 3 – Concerns with data privacy

Overall privacy concern	Security when using RAs and AI
Respondents care about data privacy but understand that there is an incentive to disclose personal information related to the improved browsing and shopping experience in exchange for personal data.	Respondents seem used to interacting with AI, even if they are not clear as to how this technology works. However, most respondents say they would not feel safe sharing their data with a RA. The choice would depend on the purpose or the perceived benefits of data disclosure.

Interviewee 2 corroborates this argument "*Not to a recommendation agent, no. I think I'd just give the data when it's time to place the order*". Besides the clear privacy concern demonstrated in their speech, by stating that they would not feel safe supplying their data, respondents seem to have no real understanding that when accessing the e-commerce site, the user is usually automatically disclosing their data to the company by accepting the terms and conditions of the platform.

One aspect that seems to mitigate this insecurity is the understanding that the company can provide a better experience and even assist in decision-making using the customer's data, as suggested by Interviewee 10 "*If I need something and this artificial intelligence… this agent can be useful to me, so yes, I provide my data to help me do what I want*". These findings support the idea of clearly showing what are the uses and benefits offered by the technology in question [2, 21], so that consumers can assess the sensitivity of data that is shared and the benefits it will provide, to decide whether they think this personalization paradox is worth it [20]. Table 3 summarizes these findings.

5.3 Discussion

Overall, the interviews suggest that consumers are used to making online purchases and they pay attention to safety cues on the website when deciding which retailer to purchase from. Respondents also take into consideration the suggestions of RA´s and in general perceive the use of recommendation systems as a tool that improves the shopping experience by offering relevant suggestions and even saving time in the shopping journey. Nonetheless, they seem suspicious about sharing their data with

this kind of technology and sometimes they say they would not willingly use an RA because they consider it risky. Some respondents mention that they are not sure about how a RA works, and this seems to be related to perceptions of potential jeopardy to one´s privacy and data. To check the impact of all these variables on the risk perception considering a larger sample we performed Study 2. The academic and managerial contributions of these results will be addressed in session 7.

6 Study 2

6.1 Procedures

The goal of Study 2 was to understand more fully the risk dimensions and privacy perceptions that appeared in the interviews, in addition to consulting a larger number of individuals regarding their perception of RAs. To be able to test the hypotheses we ran an online survey with the same population as Study 1. Initially, we distributed the survey on social media and used a snowball technique by asking respondents to share the questionnaire. The requirement to answer the survey was to be a consumer that makes online purchases. The final sample comprised 308 valid questionnaires and data was analysed using SPSS software version 23.

For data analysis, we initially checked the scales used with Cronbach's Alpha coefficient as a reliability measure. We used descriptive statistics to better understand the respondents' profiles (means, standard deviations, and frequencies). Moreover, to check for differences between groups and main effects we used Analysis of Variance (ANOVA), which is a statistical formula used to compare variances across the means of different groups. To check the main effect, we ran a linear regression so that we could predict the variance of the dependent variable based on its antecedents. Finally, the mediation of trust in the model was verified with Model 4 of the Macro Process for SPSS, which checks for the effect of a variable in the relationship between an independent and a dependent variable and calculates the confidence interval via bootstrap.

6.2 Measures

The survey included an adapted scale of concern with online data (alpha = 0.874) with 4 items (e.g., "How concerned are you about your online personal privacy when using Recommendation Agents in websites") [14], a risk perception in online purchase scale (alpha = 0.707) with 3 items (e.g., "I feel that purchasing products over the internet is risky") [18], and a privacy risk scale (alpha = 0.853) with 9 items (e.g., "Overall, the perceived privacy risk involved when using the website is very risky") [28]. We measured trust in the recommendation system with an item developed by the authors "how confident do you feel about exposing your data to a recommendation agent?" and RA's influence perception was measured with one item "how do you perceive the RA's influence in the decision making?". All responses used 5-point Likert scales (e.g., totally disagree/totally agree). The survey also included demographic questions and exploratory items about the purchase process (see Appendix).

6.3 Results

The sample of 308 valid respondents was mostly (64%) female and had an average age of 35 years (s.d. 11.32). Of the total, 57% had completed their higher education or had a post-graduation qualification. 33% of the sample had an individual income of 3 to 6 minimum wages, 31% earn between 1 and 3 minimum wages and the other 36% were distributed among other categories. Regarding shopping frequency, almost half the individuals, 42.2%, usually engage in online shopping 1 to 3 times in 6 months, 20.8% buy 4 to 6 times, and 19.8% buy more than 10 times. The results show that people who participated in this research usually buy online.

Among the aspects that consumers observe on a website when placing an order, they mentioned the credibility of the site, price, information quality and platform usability, in this order. Regarding the perception of an RA's influence on the decision-making process, 54% considered recommendation agents to be influential or very influential in the online purchase decision process. In addition, 34% signalled that they would buy a product at the suggestion of the algorithm. Demographic variables were used as control and no difference was identified in the perception of risk between the different levels of income, age, gender, and education.

We ran an ANOVA to check if there is a difference in the privacy concerns between those who perceive the influence of RAs as high or low. The results confirmed that there is a difference in privacy concerns ($F(1, 307) = 2.45$, $p = .04$), with those who perceive little influence from RAs on their purchases reporting higher levels of concern about their privacy ($M = 4.33$, $S.D = 1.18$) than people who perceive the influence to be high ($M = 3.6$, $S.D = 0.90$).

We ran a linear regression to verify the effect of 'concern with the use of personal data and 'risk perception in online purchases on the perceptions of risk to one's privacy. In the model, the construct of privacy risk was used as a dependent variable (DV) and perceived risk in online shopping and concern with data as independent variables (IVs). Both variables had a significant and positive impact on the perception of risk to privacy, while concern with data had a greater effect ($b = .36$, $t = 6.94$, $p = .001$) than the perception of risk of buying online ($b = .23$, $t = 4.30$, $p = .001$). The model explained 23% of the variation in risk to privacy perception. These results corroborate both hypotheses H1 and H2.

To test Hypothesis 3, Macro from Process was used in a mediation test (Model 4). There was a positive impact of knowledge on trust ($F(1, 306) = 29.46$, $p = .001$, $t = 5.43$, $p = .001$), which also had a negative effect on risk perception ($F(2, 305) = 33.27$, $p = .001$, $t = -7.73$, $p = .001$). The indirect effect was negative ($b = -0.12$, CI from -0.18 to -0.06), which means that there is a full mediation of trust. In other words, trust and knowledge of a recommendation system reduce how one perceives the risk to the privacy of using such technology, therefore, H3 was confirmed.

6.4 Discussion

The survey corroborated hypotheses H1, H2 and H3. These findings confirm that indeed the concern with personal data and the risk consumers associate with online shopping positively influence the perceptions of risk to privacy. Moreover, under-

standing how the RA functions help to build trust in this technology which has a mitigating effect on risk perceptions.

The findings also show that consumers who perceive a greater influence of the RA on their shopping decisions have lower concerns about their privacy. This result may be intriguing since one could expect that a higher perception of the technology influence would be associated to lower control of the decision-making process and hence increase concerns about data privacy. However, this effect may be explained by the theory of psychological and cognitive adaptation. Frequent use of RAs increases the likelihood of understanding what is this technology and its benefits for the consumer, hence, reducing the perception of new technology as a threat. In other words, adapting to this new AI tool is a coping mechanism that may reduce concerns about data safety. For marketers these outcomes suggest that it may be a good idea to help users to understand how recommendation systems work, considering that consumers seem to associate lower levels of risk with privacy when they can make sense of the technology used. Further contributions to theory and marketing practice are discussed in the session that follows.

7 Conclusion

Artificial intelligence has been transforming not only marketing strategies but also how consumers behave [5]. Its use by organizations has given rise to a new environment in e-commerce [20]. Therefore, this study aimed to analyse the role of recommendation agents, one of the AI techniques, in the decision-making process and how RAs can be related to the perception of risk to data privacy. The findings of two studies help to understand the consumer purchase habits related to the online environment and their understanding of RAs and their influence on trust and risk perceptions.

7.1 Theoretical contributions

The findings of this research suggest that aspects such as online buying perceptions, risky transactions and concerns about data increase the perception that RAs may represent a risk to privacy in the eyes of consumers, but there are ways to reduce this negative perception. Overall, this research contributes to the literature in two main aspects.

First, the findings corroborate previous research on the impact of risk perception towards online purchases on the perceptions of risk to privacy [18], although it advances the field of knowledge by considering a new technology used in e-commerce platforms, the recommendation agent. This kind of technology has been the target of several discussions either from a technical or economic perspective by improving the assertiveness of suggestions or reducing search costs [22, 30], or by the consumer behaviour aspects involved including privacy concerns and risk perceptions [25]. This research adds to the consumer behaviour perspective by considering broader aspects that may influence consumers´ wellbeing, browsing behaviour and purchase intentions.

Second, it contributes to the research about the impact of trust on mitigating privacy concerns and risk perception [16, 19], while investigating the influence of the knowledge about the technology on these perceptions. As far as the authors are aware this is the first research that shed some light on these variables considering the recommendation system, which despite being vastly used in e-commerce platforms still triggers suspicion in consumers who cannot fully understand how technology deals with data and make purchase suggestions.

Research findings demonstrated that consumers sometimes do not understand how the recommendation agent works and how it influences their choices. If they do not know about the topic, it is difficult for them to trust the algorithm and feel comfortable revealing their data to companies that use such technology. This occurs because the individual's confidence in the tool and its usability is impaired and tends to increase the perception of a risk to their privacy [9, 14].

Moreover, consumers who are frequent users of online shopping realize the influence of RAs, and those who understand how RAs work also report lower levels of concern regarding data security, which may indicate an adaptation process, since when using the technology intensively the individual's fears about data privacy and management may reduce. In summary, this research increases our understanding of the topic of online shopping and artificial intelligence [9, 21] by connecting privacy risk perceptions, trust, and overall knowledge about how recommendation systems work.

7.2 Managerial contributions

This research investigates perceptions of Brazilian consumers, which is a market that has been reaching increasing amounts of online transactions but has received little attention from the literature. Besides the rising levels of online purchases, there is still a relevant part of the population with limited internet access and hence AI mechanisms related to this environment, such as recommendation agents. The managerial relevance, however, is not restricted to Brazilian consumers since it may be considered an insight for retailers and e-commerce platforms in other emerging countries [24].

It is essential that companies: (a) declare their privacy policies clearly and transparently so that consumers can understand that the company is concerned with this topic; (b) offer benefits to users who agree to share their personal information; and (c) grant consumers control over data collection and management [6]. Another possible insight might be the fact that individuals who have a better understanding of how the RA works seem to perceive less risk to their data privacy in online transactions and interactions with the technology. Improving consumers' understanding of the technology might be an interesting goal to be pursued by companies that use recommendation agents as a marketing strategy.

Even though RAs provide several benefits to the customer experience, they can also spark uncertainty, so not only academics but also marketers must pay attention to these results. Considering adopting AI can be seen negatively by customers [5], the information must be clear and easily accessible to those who visit e-commerce sites.

Greater integrity in terms of transparency of an algorithm can result in a higher probability of building initial trust in algorithms based on artificial intelligence, especially when users are not familiar with such technologies. Agency and autonomy are features related to human behaviour but can also be used in algorithms. Therefore, explaining how the system works may increase the sense of control the user has over the said technology [2], hence stimulating trust and positive behavioural outcomes.

7.3 Limitations and Future Research

Among the limitations of this study, we would mention the sample. Personal and cultural aspects may play a relevant role in trust and privacy concerns, so we suggest that further studies include collecting data from other customer contexts and profiles. This was a cross-sectional study based on interviews and a survey, therefore the results should be considered with caution and are not to be generalized to all consumers who shop online, since they may not behave equally. Hence, future studies could also use experimental methods to test for explanatory mechanisms and boundary conditions related to these effects. Another suggestion would be to check how consumer behaviour evolves with time by performing a longitudinal study which would allow comparisons in terms of adaptation and knowledge acquisition about new technologies such as recommendation systems.

Furthermore, we suggest addressing the relationship of AI with online consumer behaviour and data privacy in a more detailed way [15], to understand and explore possible new behaviours, or the reasons why consumers may feel safer in the virtual environment and how it affects their buying decisions or the intentions to disclose personal information to companies and websites [10, 25]. Finally, research involving consumer reactions to poor decisions or failures that may be influenced by RA is another avenue for future research [21, 24].

8 Appendix

CONSTRUCT	AUTHOR	QUESTIONS
Risk perception in online purchase	Miyazaki e Krishnamurthy (2005)	Buying items online is safe
		In general, I feel that purchasing products or services over the internet is risky.
		I am usually comfortable using the internet to purchase goods or services.
Concern with online data	Lwin, Wirtz e Williams (2007)	How concerned are you…
		that your personal data will be used for purposes other than the RA's suggestions
		with the privacy of your data when using RAs on websites
		that sites use RAs, based on searches done on other sites
		that the site may use a RA to share your personal information with third parties

CONSTRUCT	AUTHOR	QUESTIONS
Data Privacy risk	Wang (2019)	I am confident that the website's privacy statements reflect its commitments to protect my personal information.
		With privacy statements, I believe that my personal information will be kept private and confidential by the website.
		I believe the site's privacy statements are an effective way to demonstrate your commitments to privacy.
		Revealing my personal information on the site will help me get the information, products or services I want.
		I need to provide my personal information to get exactly what I want from these sites
		I believe that because of disclosing my personal information, I will benefit from a better and more personalized service
		I feel insecure when posting my personal information on the website
		Overall, I find it risky to post my personal information on the site.
		The privacy risk I perceive when using the site is very high.
RA's influence perception	-	How do you perceive the RA's influence in the decision process when making an online purchase
Trust on RA	-	How confident do you feel about exposing your data to a RA
Purchase process	-	What is the relevance of the following items when trying to make an online purchase convenience / easiness / variety of products
		In a period of 6 months, how often do you usually shop online
		What do you observe on a shopping website? Rank in order of importance website credibility / time saving / layout / other buyer's opinion / price / quality of information / usability
		What aspects of a website do you associate with trusting the platform security keys / websites of well-known companies / recommendations from other users / number of complaints
Demographics	-	Age / Gender / Income / Education Level

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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