The Effect of Personality Traits on Persuading Recommender System Users

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ABSTRACT

Persuasive Recommender System is a relatively new research direction that emphasizes on using persuasive approaches to increase user's acceptance of the recommendations. Recent studies have demonstrated the feasibility of deploying the six persuasive principles of Cialdini as explanations besides the recommended items. These principles, however, should not be treated in a one-size-fits-all approach. Instead, they should be deployed in a personalized manner. The factors that help to personalize these principles for the users of recommender systems have not been fully explored. To fill this gap, this paper investigates one of these factors, which is personality traits. In particular, it explores the influence of the Big Five Personalities on recommender system users' susceptibility to Ciladini's persuasive principles. The study contains two parts; the impact of personality traits as an independent variable, and the impact of personality traits in conjunction with the application domain. We explored these factors through a questionnaire disseminated online. The analysis of the data received from (279) responses shows that personality traits are an important factor that influences the efficiency of the six principles of Cialdini. Moreover, the effect of personality traits becomes more significant if they are considered in combination with the application domain.

Author Keywords

Persuasive Recommender System; Big Five Personality; Six Weapons of Influence.

CSS Concepts

• Human-centered computing ~ Interaction design ~ Interaction design theory, concepts and paradigms.

INTRODUCTION

We can define *Persuasion* as influencing people's behaviours or attitudes without any deception or coercion [4]. *Persuasive Technology (PT)* is a technique that uses human psychology to change people's behaviour or attitude[1]. *Recommender Systems* (RSs) are software systems that help people to find information, products, services and more based on their interests or preferences [4]. Based on these definitions, RSs cannot be considered as PT because RSs are typically designed with the primary goal of assisting people in deciding not to change their

attitude. Incorporating persuasive features to these systems, however, is gaining increased attention in the literature; recent researches have begun using some persuasive approaches to tailor users' decisions toward desired products (energy-saving products, for instance [14]). Also, recent studies have shown evidence of the feasibility of including persuasive statements as explanations, along with the recommended items [6]. The main goal of this research direction is to increase users' acceptance of the recommended items.

At the beginning of the current decade, Yoo et al. [18] introduced the conceptual framework for persuasive RS, which is adapted from the communication-persuasion paradigm [18]. This framework suggests that the interaction between an RS and its users is like a communication process, which can be convincing based on different factors. The framework also outlines the relationship between the key constructs of a persuasive RS, which are the *source* (the RS itself), the *message* (the recommendation), the *target* (the user), and the *context*. After introducing the concept of persuasive RS, there became increasing attention toward this idea. Most of the effort in this research is emphasized around the third construct (i.e., the target) while they ignored other constructs. In particular, the current work is concentrated around investigating how users' characteristics affect their persuadability to different persuasive principles.

There is a wide range of persuasive principles introduced by the psychologists. Among these principles, the six principles of Cialdini [4] (discussed in section 2.1) are the most commonly used in the persuasive technology area. Researchers have recently started investigating how users respond to these six principles. Nonetheless, a limited number of researches discussed the influence of users' personalities on the effect of these principles, and most of these researches were not designed for the RS area. Besides, the existed studies discuss the impact of personality in isolation of other factors, such as the application domain. This paper aims to fill this gap by investigating the effect of personality traits and their interaction with the application domain on RS user's susceptibility to the six principles of Cialdini. To do so, we deployed an online questionnaire that consists of two main parts; personality test and persuasion test. The persuasion part is divided into three sections, which are the eCommerce domain, the movie domain, and the general (no

domain) sections. In each section, participants were asked to rate six sentences that represent the Cialdini's principles. The main goal of this study is to answer the following research questions:

- **RQ1**: *Do personality traits of RS's users affect their response to Cialdini's principles of persuasion?*
- **RQ2**: *To what extent does a user's susceptibility to different persuasion principles affected by the combination of the user's personality trait and the recommender's application domain?*

This study is different than the previous studies in two ways: first, it is designed and deployed for a particular application, namely Recommender Systems. Second, it discusses the effect of users' characteristics (personality traits) in conjunction with context characteristics (application domain), instead of considering users' aspects in the separation of other factors. Our results show that: 1) users' personalities affect their responses to the six persuasive principles, 2) the context in which these personalities interact with the system plays an essential role in changing users' responses to these principles.

The rest of this paper is organized as follows: Section 2 provides a brief introduction about persuasive principles and personality traits, and it discusses the related work. Section 3 talks about the study design. Then the results are analyzed in section 4. Discussion and design guidelines are provided in section 5. Finally, section 6 concludes the paper.

BACKGROUND AND RELATED WORK

In this section, we introduce the main concepts used in this work, which are persuasive principles and personality traits. Then we discuss the related work.

Persuasive Principles

In the literature of social sciences, there are various persuasive principles. For instance, the forty (40) principles of Fogg [4], over 100 groups of persuasive strategies by Kellermann and Tim [9], and the six principles of Cialdini [6]. In this study, we deployed the Cialdini's principles (a.k.a. the six weapons of influence). We considered these principles because they have been widely used in the literature, and they have been verified as global persuasive approaches [14]. Also, these principles *"provide a solid framework in order to investigate the persuasive power of messages as peripheral cues in recommender systems"* [14]. The six weapons of influence are *Reciprocity*, *Scarcity*, *Authority*, *Social Proof* (or *Consensus*), *Liking*, and *Commitment* (or *Consistency*).

Reciprocity means that people have an obligation to give back to others what they have received first or to return favours. For instance, if your friend sent you a birthday gift, then you owe that friend a future gift. This principle is used in many computerized systems where they give new users a gift (such as a voucher or a free service for a limited time). The second principle, *Scarcity*, states that people want more

of scarce things, and they consider these things as more valuable. Displaying numbers of availability for products is an example of implementing this principle. eCommerce websites (e.g., Amazon) use this principle by providing a limited-time-only promotion, which is often presented as a countdown timer showing the time remaining before the offer expires. The next principle, *Authority*, indicates that people are more inclined to follow others who have legitimate authority. For instance, it is more likely to give change for a parking meter to a stranger if she wears a uniform rather than casual clothes, and it is more likely to buy a toothpaste if a well-known dentist recommends it.

The fourth principle, *Social Proof*, means that people tend to do what others do. When people are uncertain, they look to the actions of others to decide. Widespread deployment of this principle is checking the reviews of others. For instance, when people want to book a reservation in a resort, they usually check out the reviews of that resort. This principle is widely implemented in the computerized system, and it is implemented in different ways, such as showing ratings, emphasizing the number of followers or fans, or presenting testimonials. The fifth principle is called *Liking*, and it states that people are most likely to accept the request made by those that they like. For instance, people may prefer one store over the other only because they like the employees in that store. In online communication, you also need your customers (or users) to enjoy your service. So, the service or product should be presented attractively. The last principle is *Commitment*. It indicates that people tend to be consistent with the things they have previously said or done. The basis of this principle is that if a person committed to do small requests, it will be easier to persuade them to do larger requests. Commitment is implemented online by different means, such as asking the customer to test a new feature in your application for free and to write a review about it. If the customer used and wrote a good review of the service, then she is more likely to continue using this service as a kind of commitment.

These principles provide approaches that cause one person to say yes to another one. That is, appropriately implementing these principles can increase the acceptance of your requests, or your products.

Personality Traits

Psychologists have extensively studied humans' personalities and their characteristics. The Big Five Model (a.k.a the Five-Factor Model, FFM) [17] is the most widely accepted personality theory in the psychology literature. It is a hierarchical organization of the personality traits of humans. The FFM contains five core factors, usually known by the acronym CANOE or OCEAN. Following are these five factors, along with their adjectives (or facets) [9]:

- *Openness*: Artistic, Curious, Imaginative, Insightful, Original, and Wide interest.
- *Conscientiousness*: Efficient, Organized, Planful, Reliable, Responsible, and Thorough.

- *Extraversion*: Active, Assertive, Energetic, Enthusiastic, Outgoing, and Talkative.
- *Agreeableness*: Appreciative, Forgiving, Generous, Kind, Sympathetic, and Trusting.
- *Neuroticism*: Anxious, Self-Pitying, Tense, Touchy, Unstable, and Worrying.

These five factors are known as relatively stable; they are stable throughout individuals' lives, with some slight exceptions. A study by Soto & John [15] investigated the developmental trends of the Big Five traits. They found that some factors are increased or decreased slightly with ages. However, the researchers concluded that the changing trends were more in the facets rather than in the Big Five traits.

Related Work

This section highlights the most recent studies related to our study. Thus, the section does not focus on how to incorporate persuasive capabilities to RSs. Instead, it discusses the works that investigate the relationship between the six weapons of influence on one side, and the big five personalities and the application domain on the other side.

Some researchers discussed the susceptibility of different groups to the Cialdini's principles. For instance, Oyibo et al. [11] investigated Nigerians' vulnerability to the six principles of Cialdini. They also discuss the effect of gender on Nigerians responses to these principles. The study found that Nigerians are susceptible to all principles, and gender affects their susceptibility. In another study [12], Oyibo et al. provided a comparative analysis of the Nigerians' susceptibility to persuasive strategies compared to Canadians. They found that the vulnerability of Nigerians is different than the Canadians for all strategies except for Commitment strategy.

Up to our knowledge, the feasibility of using persuasive statements along with the recommendations has been introduced by Gkika and Lekakos [6]. They deployed persuasive strategies as explanations in RSs. In particular, they developed RS for their study, and they incorporated the six weapons of influence as statements beside every recommended item. Then they asked the participants to rate each sentence based on how it may affect their decision to watch the recommended movie. The results showed that using persuasive principles as explanations may affect the decision of RS's users to accept the recommended movie.

The research in the direction of the relationship between personality traits and the six weapons of influence is relatively limited [13], especially in the area of RSs. Three recent studies (Oyibo et al., [13], Alkış and Temizel [2], and Sofia et al., [14]) discussed the effect of the big five personalities on users' susceptibility to the six weapons of influence. The main difference between these three studies is the sample of study (i.e., the number and the origins of the participants). The three studies shared a general conclusion that personality traits may affect people's susceptibility to the six weapons of influence. However, a recent survey by Alslaity and Tran [3] compared the results of these three studies. They found that although these studies share the same general conclusion, their results are not consistent to a high degree. Thus, the authors suggest that other factors that may affect users' persuadability should be discovered.

As a response to their call, Alslaity and Tran investigated the effect of application domain on the susceptibility of RS's users to the six weapons of influence [3]. Based on a study of (107) participants, they compared the effect of the six principles on two RS domains, namely, eCommerce and Movie RSs. The results indicated that the application domain is an essential factor that should be considered when designing a persuasive RS. To the best of our knowledge, this is the only study that discusses the effect of the domain on RS users' susceptibility to the six weapons of influence.

Despite the existence of some research in the area of personality and persuasiveness in RS, the literature still has the following limitations: first, most of the work focus on a single factor (mainly users' characteristics) while ignoring other important factors. Second, they discuss a single factor in isolation of other factors that may have a significant effect if combined (i.e., if the interaction effect is considered). Our work aims to fill this gap by investigating the influence of personality traits and the application domain of RSs on the performance of the six principles of Cialdini. The next section presents the design of this study.

STUDY DESIGN

Our study is based on a questionnaire that consists of two main sections: personality test, and persuasion test. In the personality test, we deployed the Big Five Inventory (BFI), which is one of the most popular questionnaires for the FFM. It was introduced in the late 1980s [4]. The inventory is known as BFI-44 because it consists of 44 short-phrase items. On average, the BFI-44 needs about five minutes to be answered. The second section (the persuasion test), consists of three parts that represent different application domains, which are: 1) eCommerce domain, 2) Movie domain, and 3) a general part (i.e., it is not tailored to a particular domain). Each of these subsections contains six persuasive cues (or statements) that represent the six weapons of influence. We selected the eCommerce and Movie domains because they are of the most known applications of RSs. Also, they are widely used such that a very high portion of the people is familiar with both domains. This popularity makes it easier for us to reach a sufficient number of participants who can complete all parts of the questionnaire, which is necessary for the within-subject design of this study.

It is noteworthy to mention that we adopted the persuasive explanations designed by Sofia et al. [14] to develop our persuasive cues. Mainly, we used the same statements used

Principle	Domain	Cue
Reciprocity	eComm	A friend of you, who bought the item that you suggested to him/her in the past, recommends you this item!
	Movie	A Facebook friend, who saw the movie that you suggested to him/her in the past, recommends this movie!
	General	Giving you something for free (e.g., samples, gift, or free delivery)
Scarcity	eComm	The recommended item will be available for two months only!
	Movie	The recommended movie will be available for two months only!
	General	Display a countdown, beside an item, indicating the time remaining for an offer on that item
Authority	eComm	The recommended item won 3 prizes as the best-manufactured product!
	Movie	The recommended movie won 3 Oscars!
	General	Presenting an image of an expert uses the recommended item (ex: a doctor suggests particular exercises for his/her patients, or a security guard uses the recommended security lock)
Social Proof	eComm	87% of users rated the recommended item with 4 or 5 stars!
	Movie	87% of users rated the recommended movie with 4 or 5 stars!
	General	Presenting the "best sellers" or the "most watched" items.
Liking	eComm	Your Facebook friends bought this item!
	Movie	Your Facebook friends like this movie!
	General	Well designed (Fancy and professional) website's interface and product's presentation.
Commitment	eComm	This item belongs to the kind of items you usually buy.
	Movie	This movie belongs to the kind of movies you enjoy watching.
	General	Using "*add to wish list*" option.

Table 1. Persuasive cues used in the questionnaire (eComm = eCommerce)

in [14] for the movie RS. Then, we used the same convention to design persuasive cues for the eCommerce RS. We adopted the study of Sofia et al. because the authors followed a robust approach to develop their persuasive statements; they relied on three experts in the persuasive technologies and seventeen experts in the domain of information systems and marketing to come up with these explanations. Also, this study is the most related one to ours as it is designed for the same application, namely recommender systems. For the general part, we relied on persuasive techniques that are known as practical implementations of Cialdini's principles. Table 1 summarizes the persuasive cues that we used for the three parts.

Each cue is followed by a seven-point Likert scale. The seven scales are distributed as follows: 1 to 5 options are scaled from very low to very high effect. Zero (0) indicates no effect, and (-1) means a negative impact. The users were asked to give a rating for each cue. The rating reflects the impact of the cue on their acceptance of a recommendation. Particularly, the participants were asked to imagine that they use an RS. Then they need to rate each cue based on the question: "*To what extent do you think that each of the following statements will influence your decision to buy an item (or to watch a movie) recommended to you*?"

We built and disseminated the questionnaire online using the "SurveyMonkey[1]" website. We followed a within-subject design, where we asked each participant to complete all parts of the questionnaire. The participants were recruited through different means, including paper posters posted and online channels (such as emails and social media). We received 329 responses. After filtering the responses by removing incomplete records, we retained a total of 279 responses. Table 2 summarizes the demographic information of the participants.

Subject	(count, percentage)
Ages	16-25 (53, 19%), 26-35 (129, 46%), 36-45 (59, 21%), 46+ (38, 14%)
Gender	Male (177, 63%), Female (98, 35%), preferred not to mention (4, 2%)
Continent	Asia (75, 27%), Europe (13, 5%), North America (186, 67%), South America (2, 1%), Oceania (3, 1%)

Table 2. Demographic Information (N=279)

DATA ANALYSIS

This section discusses the results of our study. It is divided into two subsections according to our research questions; first, it discusses the effect of personality traits in isolation of other factors. Then, it examines the interaction between personality traits and the application domain.

For the results significance test, we deployed the Analysis Of Variance (ANOVA), which is a set of statistical models. ANOVA analysis is mainly used to investigate the differences between groups in a sample. For ANOVA analysis, the persuasive principles are considered as the dependent (or within-subject) variable, while the other two factors (i.e., Personality traits and application domain) are included as independent variables. The significance level (α) is set to be (0.05) for all ANOVA analysis.

The reliability of the results was measured by McDonald's omega (ω) reliability test. The McDonald's omega reliability test is the non-parametric equivalent of Cronbach's alpha (ρ) reliability test [5]. The (ω) results indicate that our data is highly reliable ($\omega >= 0.7$) for *Reciprocity* and *Scarcity*, and it is moderately reliable for the remaining principles ($\omega >= 0.55$).

The effect of Personality Traits

This section answers our first research question; it discusses the relationship between personality traits of RS's users and the six persuasive principles. Also, it shows which persuasive principle is more effective for each personality trait.

Figure 1 depicts the average ratings for the persuasive principles grouped based on personality traits. The figure shows that all means are larger than the neutral value (Zero), which means that all personalities are susceptible to the six principles. The degree of susceptibility, however,
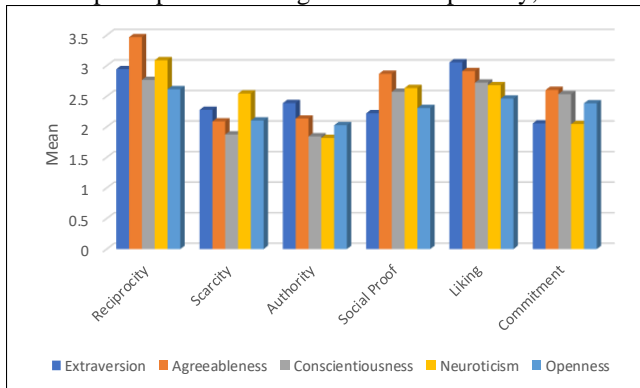

Figure 1. Mean rating based on the personality traits

varies from one personality to another. The figure also shows that *Agreeable* people are the most susceptible to three persuasive principles, which are *Reciprocity*, *Social Proof*, and *Commitment*. *Extrovert* people are the most vulnerable to *Authority* and *Liking* principles.

The ANOVA analysis shows that the differences between the five personalities regarding the *Reciprocity* principle are significant [$F = 4.378$, $P = 0.002$]. A Tukey posthoc test revealed significant pairwise differences between *Agreeableness* and each of *Conscientiousness* and *Openness*. The test also shows that the mean rating of *Agreeable* people is 0.7 and 0.85 more than *Conscientious* and *Open* people, respectively, which means that *Agreeableness* is more vulnerable to the *Reciprocity* principle. Regarding the other principles, the data did not provide enough evidence that the differences are statistically significant (as illustrated in Table 4), but it shows that there are differences. This conclusion is not surprising, taking into consideration that the personality traits represent continuums; Individuals may fall anywhere in the continuum for each trait.

Table 3 depicts the persuasion profile for each personality. By persuasion profile, we mean the order of the persuasive principles. That is, a persuasion profile shows the order of the persuasive principles based on their ability to persuade the corresponding personality; Each row in Table 3 represents the persuasion profile of the corresponding personality. The principles are ordered descendingly from the most influential principle (order 1) to the least influential (order 6). For instance, the first row of Table 3 depicts the persuasion profile of the *Extraversion* personality. It shows that *Liking* is the most influential principles, followed by *Reciprocity*, *Authority*, *Scarcity*, *Social Proof*, and finally, *Commitment* (which is the least influential one).

As general observations, Table 3 indicates that *Reciprocity* and *Liking* are the most influential principles, where *Reciprocity* is more influential than *Liking*. On the other side, *Scarcity* and *Commitment* are the least influential for *Agreeableness* and *Extraversion*, respectively, where *Authority* is the least influential strategy for the remaining three personalities. Besides, the table depicts some similarities between the persuasion profiles. For instance, four out of six principles occupy the same order in each of the following pairs of personalities: *Agreeableness & Conscientiousness*, *Conscientiousness & Neuroticism*, and *Conscientiousness & Openness*.

	Reciprocity	Scarcity	Authority	Social Proof	Liking	Commitment
F-value	4.378	0.89	0.765	1.627	0.908	0.939
P-value	**0.002**	0.47	0.549	0.168	0.46	0.442

Table 4. ANOVA results based on the effect of the personality traits

Personality	Reciprocity	Scarcity	Authority	Social Proof	Liking	Commitment
Extraversion	2	4	3	5	1	6
Agreeableness	1	6	5	3	2	4
Conscientiousness	1	5	6	3	2	4
Neuroticism	1	4	6	3	2	5
Openness	1	5	6	4	2	3

Table 3. Persuasion profiles based on the five personalities

The results presented in this section suggest that users' responses to the Cialdini's principles diverge based on their personality traits. This divergence becomes more significant for users' responses to the *Reciprocity* principle as the ANOVA analysis showed. The next section adds up into this section by discussing how users' personalities affect their reactions to Cialdini's principles in different application domains.

The Interaction with the Application Domain
The previous section shows that there are some differences in the effect of personality traits on users' responses to the persuasive principles. This section answers the second research question; It adds another dimension to the analysis, which is the persuasive context (presented by the application domain). As we have mentioned above, recent researchers have found that the application domain is an essential factor that may affect the persuadability of the persuasive principles [3]. Therefore, instead of studying the impact of personality traits in isolation of other factors, this subsection investigates how the interaction between personality traits and the application domain affects users' vulnerability to the persuasive principles.

Figure 2 depicts a comparison between users' responses to the persuasive principles in the eCommerce domain compared to the movie domain. The figure contains five charts; each chart represents the results regarding one personality. The y-axis shows the mean values, while the x-
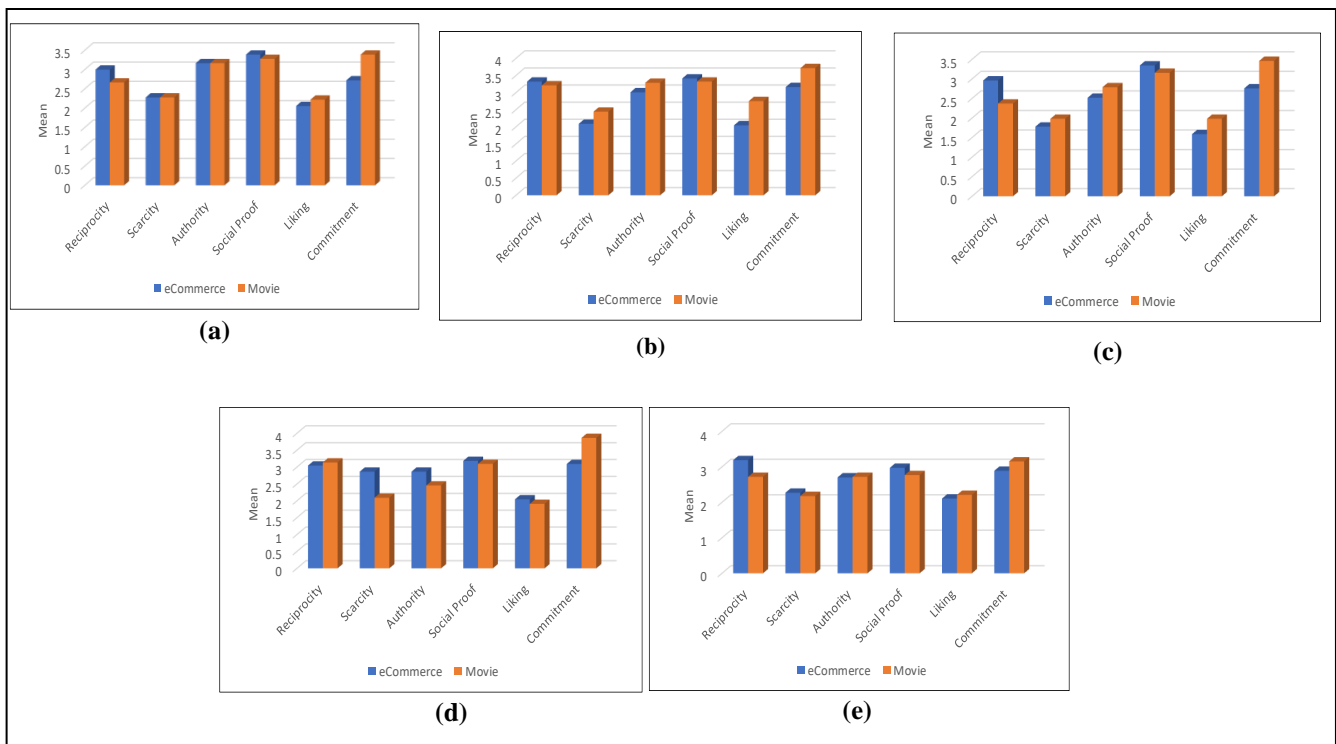
Figure 2. Mean rating based on the personality traits and application domain; a) Extraversion, b) Agreeableness, c) Conscientiousness, d) Neuroticism, e) Openness.

axis shows the persuasive principles. For each principle, there are two columns; one represents the mean rating in the eCommerce domain while the other is for the movie domain.

The common observation between the five charts in Figure 2 is that the means of all persuasive principles are different. For instance, in regard to the *Agreeableness* personality (Figure 2-b), the means for all principles vary from one domain to the other; *Reciprocity* and *Social Proof* were rated slightly higher in the *eCommerce* domain, while the other four principles were rated higher in the movie domain. The only two exceptions to the observation mentioned above are related to the *Extraversion* personality (Figure 2-a); the figure shows that *Scarcity* and *Authority* have similar means in both domains; the other four principles have different means, though.

Table 5 depicts the persuasion profiles for each personality over both domains (eCommerce and Movie). This table has a similar structure to Table 3. The only difference is that the table is divided horizontally into five parts based on personality factors. Each of these five parts is divided into two rows that represent the eCommerce (eComm) and the movie domains. For instance, the first row shows that *Social proof* is the most effective strategy for *Extraversion* personality in the eCommerce domain, and *Commitment* is the most influential in the movie domain.

Several points can be inferred from Table 5; first, it shows that in most of the cases, the persuasion profiles in the eCommerce domain are different than that for the movie domain, although they are for the same personality traits. More precisely, the table shows six congruent cases only (for readability purposes, we distinguished these cases by the bolded text). Second, the persuasion profiles for *Agreeableness* and *Conscientiousness* personalities are entirely different. That is, none of the persuasive principles occupies the same order in both profiles. For the other three personalities, the table shows that their profiles are different

to a high extent. Third, in the eCommerce domain, *Liking* and *Scarcity* are the least and the second least influential strategies for all personalities. Forth, *Commitment* is the most influential strategy for all personalities in the Movie domain.

To test the significance of the interaction between personality traits and the application domain, we deployed the Repeated Measure ANOVA (RM-ANOVA). As Table 6 depicts, we found that the interaction between personality traits and the domain of RSs have a statistically significant effect on users' susceptibility to three persuasive principles; namely *Reciprocity* (F= 2.296, p = 0.05), *Scarcity* (F = 2.897, p = 0.023), and *Liking* (F = 2.305, p = 0.049). Comparing to the results of the previous subsection, we can say that the impact of personality traits, in term of their responses to the six principles, become more significant if it is studied in combination with application domains. This section shows that the differences between personalities are statistically significant for three principles, while the previous section shows that the results were statistically significant for one principle only. These results suggest that there is a more significant effect of the personality traits when they are considered in combination with the application domain.

DISCUSSION

Personalized recommendations have shown great success in the RS area; Giving suggestions that are tailored to every user, have increased users' acceptance of the recommendations. An important question that may arise here is, "*would persuasion still be useful if the recommended list of items is already personalized?*" the answer to this question would be "yes." In other words, the persuasive principles focus on "*how to recommend*" instead of "*what to recommend.*" Persuasive principles could stand as a cutting-edge to reduce users' hesitation toward making a final decision.

Personality	Domain	Reciprocity	Scarcity	Authority	Social Proof	Liking	Commitment
Extraversion	eComm	3	**5**	2	1	**6**	4
	Movie	4	**5**	3	2	**6**	1
Agreeableness	eComm	2	5	4	1	6	3
	Movie	4	6	3	2	5	1
Conscientiousness	eComm	2	5	4	1	6	3
	Movie	4	6	3	2	5	1
Neuroticism	eComm	3	**5**	**4**	1	**6**	2
	Movie	2	**5**	**4**	3	**6**	1
Openness	eComm	1	5	**4**	**2**	6	3
	Movie	3	6	**4**	**2**	5	1

Table 5. Persuasion profiles; the interaction between Personality & Domain and Persuasive principles

	Reciprocity	Scarcity	Authority	Social Proof	Liking	Commitment
F-value	2.296	2.897	1.018	0.25	2.305	1.12
P-value	0.05	0.023	0.398	0.91	0.049	0.348

Table 6. RM-ANOVA based on the effect of the interaction between personality traits and the domain

Our results show that RS users are vulnerable to all of Cialdini's principles. The results also show that personality traits can be an essential factor that may influence the decisions of RS users. That is, users' personality is an important factor that should be considered when we design a persuasive RS. It is noteworthy to mention that the ANOVA results did not give enough evidence to reject the null hypothesis for some cases. Besides, our study considered two recommendation areas only. Accordingly, we suggest that wider studies that considers more recommendation domains are still required to generalize these results.

The following subsection provides general tips for designing persuasive RSs. We inferred these tips based on our analysis.

Design Guidelines

The previous section answered the research questions by presenting the results obtained from our study. It shows that users' personalities may affect their responses to the persuasive principles, and the effect of personality traits becomes more significant if it is considered in combination with the domain of the recommendation. Based on these results, this section provides general guidelines to design persuasive RSs.

- *Personality traits are an essential factor that should be considered when we design a persuasive RS*. The results show that the influence level of the six principles varies from one personality to another. So, a one-size-fits-all approach should not be used when we design a persuasive RS. Instead, an RS designer should consider users' personalities in order to select the correct influencing approach to the right person.
- *Personalities are not treated in a black-and-white basis*. As the results shown, our analysis did not show clear evidence that differences between personalities are statistically significant for most of the cases. Thus, we do not recommend treating users' personalities on a binary basis if your design depends on the FFM. Instead, we suggest two solutions; first, consider the combination between the traits, such that categorizing the users as a combination between the existence and the absence of traits. Promising work in this direction is introduced by Sofia et al., [14], where they suggest paths of combined traits that lead to a high acceptance of each persuasive principle. This work, however, still limited, such that it does not consider all the combinations of traits. The second solution is to deploy

persuasive approaches on a percentile basis. That is, for each personality trait (T), we use the persuasive principle (X) with percentage (P_{TX}) and principle (Y) with percentage (P_{TY}), and so on. This solution requires a study to find the correct percentages to be used.

- *Personality traits are more effective when combined with other factors.* The previous section demonstrated that treating the same personality in different contexts could change its behaviour. Accordingly, we recommend considering the interaction between personality traits and other factors (the application domain in particular). Other factors (such as culture, age, etc.) could also be useful if they are combined with personality traits. However, we are not aware of any study that considered this combination in the RS domain.

CONCLUSIONS AND FUTURE WORK

The use of persuasive principles has been recently introduced to the RS area, and it has shown promising results in terms of increasing users' acceptance of the recommendations. These principles should be personalized in order to improve their persuasiveness. As a first step to personalize them, we need to explore the factors that may help in this personalization process. Our work explores the effect of personality traits and the application domain on RSs users' susceptibility to Cialdini's principles of influence. It also explores the persuasive profiles for each personality trait under two application domains. The analysis of the results received from (279) responses to our questionnaire revealed that personality traits affect users' responses to the persuasive principles, and this effect becomes more significant if we considered the interaction between personality traits and the application domain. Based on these results, we suggested some general guidelines that should be considered for designing a personalized persuasive RS.

As future work, we are working on exploring other factors that are expected to affect RS users' responses to the Six weapons of influence. These factors include, but not limited to, users' age, gender, and culture. Also, we should investigate the interaction between all (or part of) these factors, and how this interaction may affect the influence of persuasive principles. Besides, it is necessary to study the impact of the persuasive principles in other RSs domains, such as music and education RSs.

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