An Exploratory Study on the Outcomes of Influence Strategies in Mobile Application Recommendations

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Abstract. The rapid growth in the mobile application market presents a significant challenge to find interesting and relevant applications for users. Recommendation systems deal with ends such as movies and consumer goods that are consumed by users where similarity between consumer tastes is generally taken into account. On the other hand, recommendation systems for mobile applications differ from traditional systems in terms of the characteristics of the ends they recommend. They present applications that are not just the ends for consumption but also means to reach various ends. In almost all application stores mobile applications are grouped under headings that employ consensus or authority influence strategies such as the most popular, most downloaded, editor's choice or applications of the day. However in the literature, there is limited information about the users' perception of such influence strategies and underlying factors that lie beyond the users' preferences. The traditional persuasion literature suggests that people are more likely to accept recommendations when the sources display persuasive messages during the interaction. However the effect of visibility modality in the display has not been extensively studied. The effects of visible and semi-visible persuasive messages are analyzed and compared in this study. The users' compliance with persuasive messages in the mobile application recommendation domain is examined. The question of how the persuadability of users affects their compliance is further explored.

Keywords. Persuasion, mobile application recommendations, recommender systems

1   Introduction

Technology that is intentionally designed to change a person's attitude or behavior is called persuasive technology [1]. Persuasive technology of today is based on attitude and behavior change theories and uses information technology as a tool to change users' attitudes or behaviors. Persuasive technology can be used in software and information systems as well as welfare, commerce, education and health [2]. Persuasive systems have recently become popular in many domains such as energy saving, health, mobile and ubiquitous commerce.

Persuasive Technologies employ influence strategies to attain their goal. Fogg [1] describes 40 strategies, Cialdini [3] describes 6 strategies and Torning and Oinas-Kukkonen [4] describes 28 strategies. Among them the most extensively studied grouping by Cialdini [3] identifies the reciprocity, commitment and consistency,

liking, scarcity, authority and social proof principles of persuasion. These six principles are described as the means of influence that can affect the tendency of people to comply with a request.

Reciprocity refers to the fact that people feel obligated to the future repayment of any favor, gift or like they receive. The obligation to repay is easily triggered by obligation to receive. Although not requested or chosen, a favor or gift makes a person feel indebted and obliged to return the favor. Consistency is a central motivator for human behavior that is highly valued in society whereas inconsistency is perceived as an undesirable personality trait. The commitment and consistency principle refers to the fact that individuals tend to be consistent with their prior choices, statements and actions. When an individual makes a commitment such as taking a stand or going on record to do something, compliance will be attained through the pressures of consistency. Liking refers to the principle that people are more likely to accept requests from people that they know and like. It is known that people respond favorably to requests from people they like than those they dislike. The physical attractiveness of people, their physical, mental or personal similarities with the self, familiarity and positive associations increase the tendency for liking. Scarcity indicates the fact that the opportunities are more valuable when their availability is limited. When there is limited supply of a good or limited time left to purchase an item or service, people are more inclined to buy and own it.

The authority principle means that individuals are influenced by those that they perceive to be in authorized positions and tend to accept the requests coming from them. Authority may be symbolized by titles and signatures, style of dress or uniforms or by credentials certifying their expertise. However there are controversial issues related to the influence of authority figures in regard to the relevance of their expertise and trustworthiness. People's perception of a threat for their freedom to choose can also lead to resistance for compliance [5]. Lack of social interaction and cues such as eye contact, voice tone and wearing a uniform may also affect the power of authority figures in online interactions. Guadagno and Cialdini [6] point out that the authority principle is successful when used as a decision heuristic in cyberspace, but is far less influential when used in an online interactive discussion.

The social proof principle, also known as the consensus principle, covers the idea that when many people are doing something, it becomes socially acceptable to do the same thing. The perception that other people find an alternative as appropriate and desirable offers others a shortcut to the choice of that alternative. The claim that a product is the bestselling or the most liked one gives enough evidence for most people to buy that product. However, the opposite can also be true in that, people also have a desire to consider themselves to be unique and different from the majority, thus this strategy should be handled carefully and subtly applied [7].

The effectiveness of social influence strategies in persuasive systems has been studied by examining how an individual's attitudes can be affected by verbal messages presented by others. According to Chaiken [8] there are two primary decision making strategies available to individuals; a heuristic approach as using rules of thumb and shortcuts to make decisions or a systematic approach which involves the rational and careful scrutinizing of the facts. Another model develo-

ped for persuasive communications is Elaboration Likelihood Model (ELM). There are two routes to persuasion in ELM. An individual may be persuaded either by the central route as carefully evaluating the content of the persuasive messages, or through the peripheral route where the individual uses simple cues or rule of thumb [9]. Elaboration on the persuasive messages means that the individual scrutinizes the message and underlying influence strategies according to his motivation and ability. When the persuasive message is presented obviously and visibly, it is likely that elaboration likelihood will be high. High elaboration likelihood can trigger argumentation and cause resistance to persuasion. To avoid resistance to persuasion, influence strategies may be embedded in a semi-visible modality in persuasive messages. This refers to the subtleness of the persuasive messages under evaluation.

Persuasion profiles are defined as the expected effects of different influence strategies for a specific individual. These profiles are supposed to be based on user profiles such as demographics, personality traits, persuadability and behavioral data [10]. Persuadability is an important scale in identifying persuasion profiles. To measure persuadability, the need for cognition [11] is widely used as a scale for a person's compliance with persuasive requests. Kaptein et al. [12] created a 12 item questionnaire to measure an individual's susceptibility to the six persuasion principles of Cialdini [3]. They showed that their scale is more powerful than the need for cognition scale defined by Cacioppo [11] . Later, Kaptein et al elaborated on the items of the questionnaire and developed a new scale called Susceptibility to Persuasive Strategies Scale (STPS) [13]. The questionnaire that is used in this study to determine persuadability levels of participants is adopted from Kaptein et al. [13][14]. Rather than using the full scale, only the items presented under the consensus and authority principles are used due to their relevance to the focus of the study. In the mobile application recommendation domain, implementations of consensus and authority influence strategies are predominantly used on the basis of the most popular ones, most downloaded ones, editor's choice, applications of the day.

Persuasive technology has promising features to foster mobile persuasion. Mobile users predominantly prefer to use mobile applications rather than browsers to access internet services. Application markets have grown rapidly as a result of vesting user interest in mobile applications. Mobile application recommendation websites and services fulfill the growing need to filter, rank and recommend the best applications from the hundreds of thousands available. Some of these sites operate in the official application marketplaces like the Genius of iTunes App Store and the recommendations in Google Play. Other marketplaces like Amazon Appstore, Yandex, Opera App Store also display recommendations for the users.

Recommender systems often aim to persuade people and thus they may be accepted as adaptive persuasive technologies [10]. These systems have been successfully employed in recommending goods or information and enjoyed by many users especially in the e-commerce field. They may suggest items to the users according to their needs and preferences which help users to prune the huge information bulk that is mostly useless. To prune information, there are two well-known methods [15]: The first method, content-based recommendation, is based on recommending items similar to the items the user has preferred in the past.

The second method, collaborative recommendation, suggests items that other customers with similar tastes and preferences liked in the past. In addition to the underlying methods, user profiles and persuasion profiles may be processed and added on the recommendation systems which can then be used to build personalized relevant outputs.

Little is known about the recommendation mechanism of Genius of iTunes App Store or Google Play. Commercial mobile application recommendation systems such as AppBrain, AppJoy and AppsFire are also developed to offer recommendations to users. Among these systems, AppsFire allows users to form friendships and share the applications they like. AppJoy [16] automatically measures application usage patterns and recommends applications based on a collaborative filtering method. AppBrain monitors the installation history and provides recommendations in the same category.

Recommender systems that are used for applications, may make use of persuasive technologies and user persuasion profiles. Although they offer a promising field of study, none of the previous research has studied the influence strategies employed or that can be employed in the context of mobile application recommendations. The main contribution of this paper is that the effects of influence strategies are explored and then a comparison is undertaken with no influence strategies for the first time in this domain. Furthermore the effects of visible and semi-visible influence strategies are compared and examined in terms of user compliance in an experimental context.

The remainder of this paper is organized as follows. In section 2 methodology is described. The design of the experiment and methodology is given in section 3. The results and discussion are provided in section 4 followed by conclusion and future work in section 5.

2   Experiment Design and Methodology

There are two phases in this research; first employing a questionnaire to learn about the user context and behavior in mobile environment, second conducting experimental surveys in the field with visible and semi-visible persuasive messages.

2.1   Measuring Persuadability

In the first part of the research, the participants were invited to complete a persuadability questionnaire. The following 8-item persuadability scale which was adopted from Susceptibility to Persuasive Strategies Scale (STPS) [8] was used to assess a participant's persuadability score. The items were scored on a 7-point Likert scale ranging from totally disagree (1) to totally agree (7). The items were as follows:

Authority
– I always follow advice from my general practitioner.

– I am very inclined to listen to authority figures.

– I always obey directions from my superiors.

– I am more inclined to listen to an authority figure than to a peer.

Consensus

– If someone from my social network notifies me about a book, I tend to read it.

– When I am in a new situation I look at others to see what I should do.

– I often rely on other people to decide what I should do.

– It is important for me to fit in.

The scale reliability is considered to be sufficient since the Cronbach Alpha value was 0.819 for authority and 0.752 for consensus constructs. We computed the persuadability scores for each of the authority and consensus strategy dimensions. The overall persuadability score was calculated as the average of the 2 dimensions. This score was used to discriminate users as high, low and moderate persuadables. The lowest quartile was addressed as low persuadables and the highest quartile as high persuadables. The participants with scores in between were considered to be moderate persuadables.

2.2 Experimental Design

In the second phase of the study, an experimental design was conducted to test the impact of influence strategies. The participants were assigned to two groups based on their overall persuadability scores obtained in the first phase of the study. The high and low persuadables were assigned to two groups with equal proportion. One group was used as the control group with no treatment and the other group was given treatments with persuasive messages employing authority and consensus influence strategies. After the first experimental study with visible persuasive messages, a second study was conducted which presents semi-visible persuasive messages to the same persuasion group. The control group received no influence strategies in either phase of the study

Prior to the experiments, the participants were informed that the purpose of the study was to measure their involvement or interest in mobile applications. The participants were asked to judge a total of 8 mobile application introductions against a series of descriptive scales according to how they perceive the introduction. The mobile applications were evaluated online in two sessions each covering 4 applications. The participants were also informed that the names of the applications had been changed in order to eliminate any bias and/or commercial conflict.

Applications from major application categories, which may be of interest to the participants, such as productivity, shopping, tools, personal life and messaging were chosen. A pre-test was conducted to establish content validity in terms of product involvement and to improve the questions, format and scales. A total of 10 people tested the applications and instruments in the field and their feedback was incorporated into the final revision.

The participants were presented with mobile application introductions on separate screens and were expected to proceed one by one. The control group was given the application introduction in 3 or 4 sentences as presented in the summaries of application introductions in application markets like iTunes App Store or Google Play. The persuasion group was presented with introductions that employ persuasive messages such as the examples given below. The arguments contained in the messages were selected by carrying out a preliminary study on mobile application recommendation systems and mobile application advertisements. For each application introduction, one of the persuasive messages was utilized. In the visible version, the persuasive messages were given separately at the end of the introduction and in semi-visible version the persuasive messages were embedded in the introduction text. An example of one of the applications, a voice recorder, with authority influence strategy is given below as an example. In visible presentation the authority figure, namely IT News Magazine, was highlighted as the recommender of the application. In semi-visible presentation, the persuasive message was given in the body of the introduction subtly embedded in the sentence.

Voice Recorder (Visible version)

Voice Recorder is a mobile application to record voices. You can use this application to record your classes, memos, greeting messages or other events. With 14 distinct sound effects you can add special effects, alter the tempo and convert your recordings to different formats. You can upload your recordings to Dropbox or Google Drive and send/share them whenever you want.

This voice recording application is recommended by IT News.

Voice Recorder (Semi-visible version)

Voice Recorder is a mobile application to record voices that is recommended by IT News magazine. You can use this application to record your classes, memos, greeting messages or other events. With 14 distinct sound effects you can add special effects, alter the tempo and convert your recordings to different formats. You can upload your recordings to Dropbox or Google Drive and send/share them whenever you want.

The persuasive messages used for other applications in the visible versions were as follows:

* This application is recommended by authorities of the field
* This application is the editor's choice in Google Play.
* This application is a trending popular application.
* This application is downloaded more than N times.
* This application is most popular in its category in 2013.

The participants were invited to evaluate each mobile application introduction. The relevance of the mobile application to the participant, the attitude towards the mobile application introduction and the purchase intention were used as const-

ructs for evaluation purposes. The constructs that are measured by 7 item Likert scale given below were adapted from prior research to ensure that the scales were reliable.

• Product Involvement (Importance); from unimportant to important [17]

• Product Involvement (Relevance); from of no concern to me to of concern to me [17]

• Attitude towards; from disliked to liked a lot [18]

• Purchase intention; definitely would not purchase to definitely would purchase [18]

2.3   Participants

The empirical data was collected in December of 2013, using a questionnaire which is e-mailed to the undergraduate and graduate university student lists of a well-known university in Turkey. Of the 381 people who completed the questionnaire, only 283 provided a contact e-mail. Therefore the invitation to participate in the experiment was sent to these 283 participants based on their overall persuadability index. The participants were offered a choice of two gifts for their participation (either a 8 $ cinema ticket as a gratis or donation for a sapling on their behalf). Among them, 180 participants completed the experiments, 80 of them from persuasion group and 100 from control group. The overall persuadability of the participants was distributed as 40 high persuadables, 45 low persuadables and 95 moderate persuadables. The average age of participants was 21.7 and just under half of the participants (47 %) were female.

2.4   Hypotheses

Prior to the experiments we formulated the following hypotheses:

H1: Evaluation of mobile applications does not differ between high, moderate and low persuadables.

H2: Evaluation of mobile applications does not differ according to gender.

H3: Evaluation of mobile applications does not differ with operating systems used.

H4: Evaluation of mobile applications does not differ between a user group subject to persuasive messages and a user group not subject to persuasive messages.

H5: Users who are subject to authority persuasive messages will comply equally with those users who are subject to consensus persuasive messages.

H6: Users who are subject to consensus persuasive messages will comply equally with those users who are not subject to any persuasive messages.

H7: Low persuadable users who are subject to authority persuasive messages will comply equally with consensus persuasive messages.

H8: High persuadable users who are subject to authority persuasive messages will comply equally with consensus persuasive messages.

H9: Users who are subject to visible persuasive messages will comply equally with users who are subject to semi-visible persuasive messages.

3   Results and discussion

The normality of data is checked for all test variables with the Kolmogorov-Smirnov Test and Shapiro-Wilk Test using SPSS. The results obtained from these tests show that the data is normally distributed hence t-test, paired sample t-test and ANOVA test are used for hypothesis testing.

3.1   Persuadability

Figure 1 shows the mean scores of persuadability measurements in terms of three different levels of persuadability. Oneway ANOVA is used to evaluate the impact of the overall persuadability index on user perception (H1). The ANOVA results indicate significant differences in the participants' perceived importance ($F_{(2, 177)} = 4,027$, $p = 0.019$), perceived relevance ($F_{(2, 177)} = 4.292$, $p = 0.015$) and Likeness ($F_{(2, 177)} = 3.642$, $p = 0.028$). However, purchase intention ($F_{(2, 177)} = 51.866$, $p = 0.128$) does not significantly differ between the high, moderate and low persuadables at the 0.05 alpha value.

To determine which persuadability levels are different from others, Bonferroni post hoc test is employed. For the perceived importance and perceived relevance, the high persuadables and low persuadables are significantly different with $p= 0.018$ and $p = 0.012$ respectively. For Likeness, the high persuadables and moderate persuadables' evaluation differ significantly with $p = 0.04$ whereas for Purchase Intention there is no significant difference in participants' perception.

In Figure 2 the average scores of the users' responses to the persuasive messages by gender distinction (H2) are shown. According to t-test results, females score significantly higher on perceived importance ($t = 2.341$, $p = 0.02$), relevance ($t = 2.437$, $p = 0.016$), likeness ($t = 2.929$, $p = 0.004$) and purchase intention ($t = 3.179$, $p = 0.002$). Similarly, the effects of operating system (OS) being used (H3) is given in Figure 3. The response from Android and iOS device users is significantly different for relevance ($t = -2.625$, $p = 0.010$) and purchase intention ($t = -2.701$, $p = 0.008$) whereas the difference between perception on importance and purchase intention is not significant for importance ($t = -2.625$, $p = 0.010$) and for purchase intention ($t = -2.625$, $p = 0.010$).
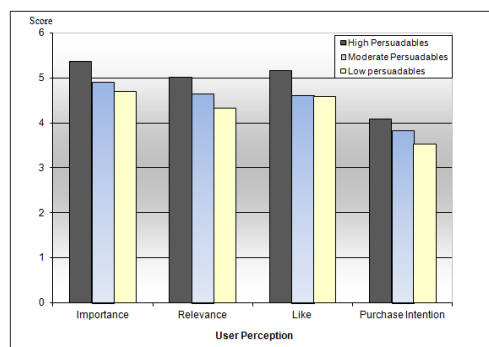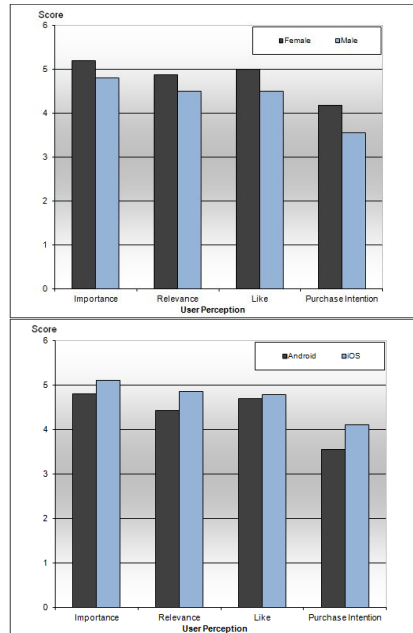

Fig. 1. Effects of Persuasion Profiles on User Perception

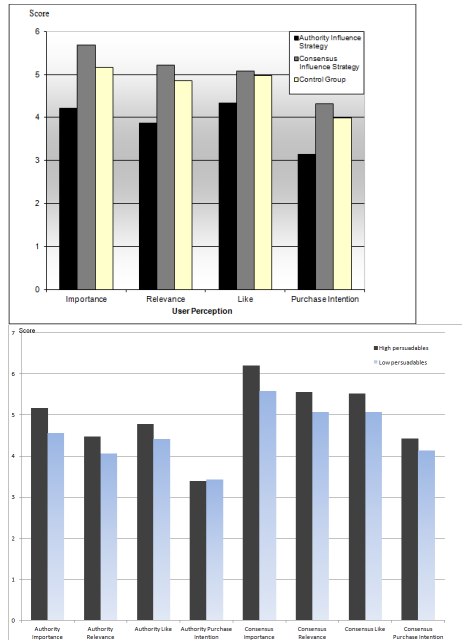**Fig. 2.** Effects of Gender on User Perception   **Fig. 3.** Effects of OS on User Perception

3.2   Authority and Consensus Influence Strategies

The mean scores in user perception for authority, consensus and no influence strategies are given in Figure 4.

The hypothesis for evaluation of mobile applications does not differ between the user groups that are subject to persuasive messages and those that are not subject to persuasive messages. (H4) is rejected at 0.05 alpha value for purchase intention (t=-2.037 p=0.043), importance (t = -2.78, p = 0.006), relevance (t = -2951, p = 0.004) and likeness (t = -3.336, p = 0.001).

The users who are subject to authority persuasive messages will comply equally with the users who are subject to consensus persuasive messages (H5) is rejected at 0.05 alpha value for importance (t = -9.316, p < 0.001), relevance (t = -8.211, p < 0.001), likeness (t = -6.079, p < 0.001) and purchase intention (t=-8.225 p < 0.001).

The users who are subject to the consensus persuasive messages will comply equally with the users who are not subject to any persuasive messages (H6) is rejected for importance (t = 3.071, p = 0.002) and relevance (t = 2.133, p = 0.034) but cannot be rejected for likeness (t = 0.533, p = 0.595) and for purchase intention (t=-1.305, p=0.193) at 0.05 alpha value.

Fig. 4. Effects of Authority and Consensus Influence Strategies on User Perception

Fig. 5. Effects of Authority and Consensus Influence Strategies for High and Low Persuadables

The mean scores in user perception for authority and consensus influence strategies for the high and low persuadables are given in Figure 5. For each of the persuadability group whether there is a significant difference in users' perception of consensus and influence strategies is further tested.

The hypothesis (H7) that low persuadable users who are subject to authority and consensus persuasive messages will comply equally is rejected at 0.05 alpha value for importance (t=-2. 477 p=0.018) and relevance (t = -2.62, p = 0.013). However for likeness (t = -1.621, p = 0.114) and purchase intention (t = -1.952, p = 0.059) null hypothesis cannot be rejected.

Similarly, hypothesis (H8) that high persuadable users who are subject to authority and consensus persuasive messages will comply equally is rejected at 0.05 alpha value for importance (t=-2. 916 p=0.006) and relevance (t = -2.648, p = 0.012). For likeness (t = -1.819, p = 0.078) and purchase intention (t = -1.878, p = 0.069) null hypothesis cannot be rejected as in the case of low persuadables.

3.3   Visible and Semi-Visible Persuasive Messages

Figure 6 shows the pairwise comparison results which revealed that perception of semi-visible persuasive messages scored significantly higher than the visible messages. The fifth hypothesis (H5) that the users who are subject to visible persuasive messages will comply as equally as those users who are subject to semi-

visible persuasive messages is rejected at 0.05 alpha value for four of the evaluation factors. The null hypothesis (H9) is rejected for importance (t = -3.38, p = 0.001), relevance (t = -3.56, p = 0.001), likeness (t = -3.775, p $<$ 0.001) and purchase intention (t=-3.052 p=0.003).
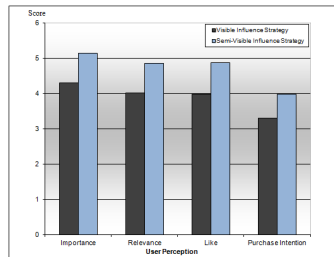
Fig. 6. The effects of the visibility of the influence strategies on user perception

3.4   Discussion

The findings of this study provide an insight into the mechanisms of user perception in the context of mobile application recommendations. Multiple conclusions can be drawn from this research. First, the overall persuadability index provides a viable instrument for user profiling through its influence on user perceptions. More persuadable individuals who are generally more likely to accept recommendations and who have a tendency to align with authority expressed higher compliance with persuasive messages as expected. In other words, high persuadable individuals are more likely to develop a positive attitude towards persuasive messages whereas low persuadable individuals are more inclined to develop distrust.

Gender and operating system being used are other instruments that exhibit significant differences on user perception. It is shown that females scored significantly higher on perceived importance, relevance, likeness and purchase intention with remarkably low significance levels. We can assume that females are high persuadables compared to males. A similar comparison on the effects of operating system being used indicate that iOS device owners score significantly higher on purchase intention and relevance whereas there is not a significant difference in terms of importance and likeness dimensions.

The second conclusion we reach is that persuasive messages may result in a concern about the frankness and smartness of the system and may lead to a decline in the users' perception of the system's trustability and hence the users' compliance with persuasive messages. However, the influence strategy deployed in persuasive messages is distinctive in this context. The consensus influence strategy leads to higher compliance levels than the authority influence strategy whereas the authority influence strategy actually worsens the compliance level of the members of the control group that is not subject to any persuasive messages. Additionally, when the persuadability levels are considered, it is demonstrated that the consensus influence strategy leads significantly higher scores for perceived importance and relevance for both high and low persuadables.

The third conclusion is that the compliance level is lower when the persuasive messages are visible to the users compared with the semi-visible persuasive messages. This result is consistent with previous research that noted the users' resistance to persuasion when the persuasion intent is disclosed [5].

4   Conclusion and Future Work

This study is important for its contribution to a recently developing field. There are not many empirical studies conducted in this field especially in mobile application recommendations. This study has provided results that can be used for future research about consumer behavior and the persuasion profiles affecting it. The model and findings may provide a useful framework for business model developers and actors in the mobile application market.

Based on the results reported in this paper, it appears that the use of persuasive messages should be tackled cautiously. On average persuasive messages may decrease the overall user compliance. In our framework, the consensus influence strategy yielded a higher compliance in the persuasion group than the control group that received no treatment. On the contrary, utilizing authority influence strategy decreased user compliance. For user compliance, it does matter how the persuasive messages are presented to the user. Semi-visible persuasive messages effects are higher than the visible persuasive messages. Furthermore, the persuadability of the users is an important determinant on users' compliance with recommendations. When designing recommendation systems for users these findings can be used to increase the efficiency of the system.

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