Effects of Gamification to Private Data Collection

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Gamification is used to motivate people to complete arbitrary tasks. It gains more attention recently as the advertisement companies started using gamification globally on the Internet. The Internet infrastructure is mostly funded by advertisements globally right after its commercialization in the early-nineties. Global advertisement agencies tend to collect as much personal data as possible to better target audiences and increase profits. This leads to the discussion of whether people's privacy is at the sake to continue using the Internet. The aim of the study is to demonstrate the effects of gamification to private data collection. The effects are measured in a questionnaire in a gamified context. People's statements and their behavior is observed together with their demographic distribution. The most influential result indicates that it is possible to deviate people's behavior unwittingly. Therefore, practitioners in the area should take utmost care building ethical gamified setups.

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Oyunlaştırmanın Kişisel Veri Toplanmasına Etkisi

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Oyunlaştrma, kişilerin gelişigüzel görevleri tamamlamasını güdülemekte kullanılır. Internet altyapısının doksanlı yılların başında ticarileşmesiyle birlikte reklam gelirleri ile bu altyapı fonlandı. Böylece küresek reklam şirketleri, hedef kitleye daha iyi odaklanmak ve karlılığı artırmak için olabildiğince çok kişisel veri toplamayı hedefler. Bu amaçla uyumlu olarak, reklam şirketlerinin İnternet üzerinden küresel çapta kullanmaya başlamalarıyla oyunlaştırmaya ilgi artmıştır. Bu yaklaşım kişilerin İnternet'i kullanmayı sürdürmek için özlük bilgilerinin gizliliğinden ödün vermesi gerektiği tartışması ortaya çıkarmaktadır. Bu çalışma oyunlaştırmanın kişisel veri toplanmasına etkisinin gösterilmesini amaçlar. Etkiler, oyunlaştırılmış bir ortamda yürütülen bir anketle ölçülmüştür. Kişilerin beyanları ve demografik bilgileri, davranışları ile örtüştürülerek gözlenmiştir. Çalışmanın ortaya koyduğu en dikkat çekici sonuç; kişiler farkına varmadan davranışlarının değiştirilebileceğidir. Bu durumda, oyunlaştırma uygulamalarını sürdüren kişilerin etik değerlerle çelişmemek için son derece dikkatli olmaları gerekir.

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1. INTRODUCTION

Gamification is the usage of game concepts, such as mechanism design, in non-game areas to benefit from game relevant knowledge base. Gamification is used in many sectors including advertising, physical training and banking. Many of these applications aim to make boring tasks enjoyable by introducing simple challenges in a game-like concept. On the other hand, one may misuse gamification to joyfully steer people to do some task. The aim of this paper is measuring the effect of gamification to private data collection. In this manner, this study exemplifies a straightforward experimental setup to collect private data by manipulating people's behavior. The main contributions of the paper are as follows:

- Presenting private data collection violations on a gamified setup;
- Compiling data on whether people are aware of gamification or else could recognize gamified setups;
- Discussing potentially harmful usage of gamification.

The definition of gamification is using game design elements in non-game contexts (Fernández-Luna et al., 2014). These game design elements include leaderboards, points, badges, challenges, time constraints and more. The main aim of such elements in the games is introducing a challenge to a person to motivate them to continue doing a simple task more often and better. Hence, users of a game could enjoy completing tasks and self-motivate to go further. Moreover, computerized games could keep track of users' progress and report these results neatly on online social platforms to attract more users. Similarly, gamified contexts may utilize the game concepts to motivate their users. For instance, completing a daily sports routine for a long period of time may be visible on online leaderboards to motivate the users to continue training daily to not to lose their position on the leaderboard.

Related work on gamification and privacy violations in gamified systems are given in Section 2. Psychological background is presented in Section 3. The reasoning of the utilized experimental setup is explained in Section 4. Section 5 is spared to discuss the methodology of knowledge

extraction from the collected data. Finally, results are presented in Section 6 and interpreted in Section 7.

2. RELATED WORK

Gamification is helpful to motivate users in a context. Therefore, there are examples where it is used in customer services. Notifications of success are shown to customer service agents throughout the day as a positive feedback. Moreover, made up competitions in between customer agents are used. As a result, such a setup creates mood for competition and appreciation of success (Makanawala et al., 2013).

Tourism is another area where gamification is visible. Loyalty cards and frequent flying programs are designed with gamification in mind. Users gain some fraction of their costs as points to spend later. This motivates people to use the services more frequently, or at least stay loyal to a company. This behavior is observed in a study that discusses the effects of loyalty programs on customers (Meyer-Waarden, 2007). These approaches have a secondary use as the presented gamified setup is used in advertisements as a feature. Brands build their popularity and prestige, in the meantime people stay loyal to the now prestigious brand. Hence, gamification is mutually beneficial for both the business and the customers (Xu et al., 2013).

One interesting use of gamification is protein analysis. *Foldit* utilizes a gamification effort to solve protein folding puzzles which is an important and difficult problem for genetic engineering. The collaborative effort on solving these puzzles may help to prevent or treat diseases. The leaderboards as a competitive motivator is used (Pirker and Gütl, 2015).

E-learning platforms, or in general, most of all learning activities uses gamification to motivate students. Specific to e-learning applications, the aim is to introduce more enjoyable challenges to motivate students stay in the e-learning environment. Badges, progress bars, points, positive feedback are typical game design elements used in e-learning environments. The interactivity of the gamified learning experience

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must be comparable to a traditional classroom, if not more than that (da Rocha Sexias et al., 2016).

Gamification is also used in the area of relationships. Kahnoodle was the first mobile application that supports couples to give presents, do considerate actions to collect points to fill the Love Tank. Also, in this application, couples can use these points to get a redeemable coupon in the real life. Even though, it was the first application focused on this topic, it does not exist right now (Bohyun, 2015).

Gamification can be a motivator to use earphones to reduce the possible risk of Radio Frequency (RF) emissions. BrainSaver is an Android mobile application that tracks the user behavior and gives feedback according to earphone usage. The joyful dog wallpaper is changing to a wallpaper with negative mood if the user is not wearing earphones (Burigat and Chittaro, 2014).

Everchanging Microsoft Office featured Microsoft RibbonHero. This application designed to teach users the beneficial and unknown features of the Microsoft Office. It gives points to the users that complete the given actions (Xu, 2012).

Stack Overflow is known as the biggest question and answer platform for developers. It uses gamification to regulate the content of the platform. A user can earn points by editing the content, answering the questions and getting up or down votes. Also, user can earn badges after some interaction series (Hunter and Werbach, 2015).

Gamification app called ``Classroom Live'' is used for undergraduate students of computer science to enhance their engagement to the course by using experience points, levels and rewards (Nah et al.,2014).

NikeFuel which is used in Nike+ platform as points generated by measurements gathered from sensors on Nike shoes and Apple iPod or iPhone regarding the sport activities of the user. Hence, users can visualize their progress and compare their performances with others (Blohm and Leimeister, 2013).

Duolingo is a gamified language learning website that is basically a paid text translation crowdsourcing platform. Students are earning badges and experience points by progressing in languages (Lamprinou and Paraskeva, 2015).

MySugr is a health-care gamified application for diabetes. Users of this application keep a virtual monster which can be timed by logging data, being active and staying in range. Also, the monsters give feedback based on the health data given by the users (Tóth and Tóvölgyi, 2016).

iXiGo.com is a guess the destination website that shows pictures of destinations in India to the users. In the limited time, users try to guess which picture relates to which destination to get points and badges. Also, users can share their progress on social media (Sigala, 2015).

Blockholm is based on MineCraft that uses real cartography. Users can create the next generation city in their minds, so that their ideas can be real because this platform supported by Swedish Center of Architecture and Design (Fonseca et al., 2017).

Khan Academy is another e-learning platform using gamification elements. Users earn points, badges and energy points as they progress in the lectures (Morales et al., 2016).

Fitocracy is a sport assistant gamified application that application sets goals for training and users can monitor their progress using it (Huotari and Hamari, 2017).

Emotional Flower is a gamification system in work that each employee has one virtual flower that grows by positive facial expressions, and flowers are displayed at shared screen (Kuramoto et al., 2013).

Zombies, Run! is a mobile application which is available on both Android and Apple. Players are acting as a survivor from an apocalypse, and if the players run more, the players get more rewards as supplies in the story (Morford et al., 2014).

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Yahoo Answers is a gamified question and answer platform like Stack Overflow, but the audience do not need to be registered users. It has leaderboard, points and badges system for gamification purposes (Schacht and Maedche, 2014).

Freshdesk is a gamified platform for employees. It converts everyday tasks like commenting to Facebook/Twitter posts, receiving telephone calls to virtual tickets and assign them to employees. Employee can earn points by completing these tickets. Also, employees can be on the leaderboard and get badges for their work (McCarthy et al., 2014).

SuperBetter is a gamified application which sets goals to overcome for people recovering from concussion. Also, it encourages the people using it (Wylie, 2014).

Opower is a gamified application that encourages to save energy. It sets goal for users, and display comparisons of related users (Zica et al., 2018).

Contrary to many benefits, gamified systems pose a major danger. The owner of a gamified system has access to users' actions. On one hand, these actions are required to be collected and interpreted to design a fair game; on the other, they disclose detailed user behavior and intentions. Given that, the system owner would like to compile such information, the likelihood of privacy invasions is high. Worse, a malicious system owner could use the gamified motivations to collect more private data. A study suggests that, a malicious party can guess the swiped unlock pattern of a mobile device at first try 62\% better if the user data is collected beforehand through a swiping game. The success rate is 76\% for three successive estimates (Acharya et al., 2019).

One typical example of gamification misuse is a discount card named *Payback* that appeared around 2000. The card offers shopping discounts based on users shopping habits. The purchasing behavior of users are collected and sold without the consumers consent (Walz and Deterding, 2015).

Another counter example is the *HealthSeeker* application. In contrast to exercise motivating health applications, HealthSeeker collects private health data for the pharmaceutical industry where the collected data is used for advertisements or passed to third party companies (Walz and Deterding, 2015).

In the light of the current discussion, one may conclude that wearable devices that keep track of daily activities of consumers could be problematic as the devices could detect a users' location continuously, their daily habits, sleeping periods or trips (Goodman, 2015).

FourSquare is a concrete example of location-based gamification usage. It helps people to socialize by featuring badges and virtual rewards. On the other hand, it attracts burglars and stalkers to infer data about their (Walz and Deterding, 2015).

Privacy concerns of people are increasing as recent technologies are continuously presented to better refine user data. A website called *Boundless AI* uses reinforcement learning, an effective machine learning algorithm, to classify enjoyable content for their users. The website suggests actions to take, then rewards users with cute cat videos or a funny animation that make users laugh. So that, users release dopamine, which is the hormone that feedbacks the neural system on enjoyable events, and become more addict. Even though this is an innovative and fun gamification setup, it could be quite dangerous as user behavior and preferences are determined in depth. In a malicious setup, a third party may manipulate users after they become addicted.

3. PSYCHOLOGICAL FOUNDATIONS OF GAMIFICATION

Psychological studies suggest that gamification is a powerful tool as it is a strong motivator (Sailer et al., 2017). Business domain utilizes this tool as it enables to steer consumers to start and then continue the desired action. Recent studies on the success of gamification suggests six perspectives of the types of players. These are described below (Sailer et al., 2014):

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Trait Perspective These players are stable over time and in changing contexts. Achievements, status reports, memberships and progress bars are the gamification elements that motivates people with trait perspective.

Behaviorist Learning Perspective These players are motivated with the rewards and immediate feedback.

Cognitive Perspective For this type of players, individual goals are important. Goal orientation, mastery orientation or performance orientation are attractive for these players. Clear and achievable goals, resulting consequences of user actions are attractive motivators.

Perspective of Self-determination Competence, autonomy and social relatedness are the focus of attracting this kind of players.

Perspective of Interest These players are heavily depending on individual preferences and contents. Adapting the difficulty level, direct feedback, providing clear goals are preferable gamification mechanisms for people with this perspective.

Perspective of Emotion Roles of emotions in cognitive and motivational processes are the main concern of these players. Decreasing negative feelings and increasing positive feelings are key points of gamification.

The provided perspectives could be mapped to actual gamification elements. This mapping is described below (Sailer et al., 2014):

Points Behaviorist learning perspective and perspective of interest.

Badges Trait perspective, cognitive perspective, perspective of self-determination and perspective of interest.

Leaderboards Trait perspective and perspective of self-determination.

Progress bars Cognitive perspective and perspective of interest.

Quests Cognitive perspective and perspective of interest.

Meaningful stories Perspective of self-determination, perspective of interest and perspective of emotion.

Avatars Perspective of self-determination and perspective of interest.

4. EXPERIMENTAL STUDY

The aim of the designed experiment is to measure people's private data disclosing habits. A basic set of survey questions is prepared in this manner. Then, a game setup is prepared to observe the effects of an

environment that contains gamification elements to people's behavior. Finally, their statements are compared with the observed behavior.

The experimental setup includes a video game as its main asset. The video game includes a simplified car driving virtualization in a virtual environment. Therefore, the experiment is not performed in a gamified environment, but directly in a game. This setup is chosen as it is extremely familiar for most people. The simplified car driving controls flattens the learning curve to a bare minimum so that the game is readily playable in the first second.

The countdown timer is intuitively set up to a shorter time span that most of the players face difficulties finishing the tour within the given interval. This approach enables to re-run the survey questions one more time or offering a bait to continue the game after the players experience the game. Therefore, comparisons of people's private data disclosure preferences could be observed by asking them direct questions and also by trying to steer them off of their initial preferences in a gamified context.

The developed experiment and the survey questions could be found online (Review, 2019). Experiments took four months with a total of 256 participants.

The video game has the clearest goal that is driving as fast as possible to meet the girlfriend that is waiting in front of her house for a date. This goal is interesting for players with cognitive perspective, perspective of interest and perspective of emotion, since it provides a clear achievable goal that promotes positive feelings inside the player. Also, using countdown timer provides continuous feedback which appeals players with trait perspective and behaviorist learning perspective. Moreover, by storing the time left in the leaderboard, players can compete, so this game mechanic is interesting for players with perspective of self-determination. To sum up, the video game has game mechanics that appeals all 6 types of players with different perspectives.

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5. METHODOLOGY

After publishing the game created for the experiment, social media is used as a tool to promote it. There are four types of flow in the game to get information from four group of users:

G1 Demographic questions before game and private questions inside the game. All questions are optional to answer.

G2 Demographic questions before game and private questions inside the game. Only demographic questions are optional to answer.

G3 Demographic questions and private questions inside game. All questions are optional to answer.

G4 Demographic questions and private questions inside game. Only demographic questions are optional to answer.

Two sets of questions are prepared in the experiment; a set of demographic questions and another set of privacy-invasive questions. Privacy invasive questions also ask for a claim whether participants prefer to disclose private information.

The demographic data is collected to validate that the sample is composed of a diverse set of people based on age, gender, income and profession. And, private questions are based on gamification materials used by companies such as supermarket cards and coffee cards. These questions could be answered by choosing among a set of predefined values.

Experimental setup is carefully designed to observe players to support the contributions mentioned in § 1. First two hypotheses in the experiment is placed to test if gamification might cause any data collection violation. The third hypothesis is placed to show people's awareness of gamified setups. Harmful usage of gamification is discussed in § 7, after presenting the experiment results.

H1 The number of answered questions should be greater in groups G2 and G4 than in groups G1 and G3. In G2 and G4 groups, participants are forced to answer questions to continue the game. Therefore, the effect of gamification is expected to be more visible. If this

hypothesis holds, this indicates forcing players to disclose data in a gamified environment results in more data being collected.

H2 The number of answered questions should be greater in groups G3 and G4 than in groups G1 and G2. In G3 and G4 groups, questions are asked within the game. Therefore, it is expected that participants are already motivated to continue the game even if they are asked to disclose more information. If this hypothesis holds, this indicates gamified setup motivates players to disclose their personal data more.

H3 There must be participants who disclose personal data during the game even if they state the opposite. The number of participants who change their opinion is determined within the game. If this hypothesis holds, this indicates gamified setups could be utilized to change people's opinion, at least temporarily.

The reason why demographic questions are optional to answer is to get more information from the users without frustration, and let them enjoy the game without thinking about privacy. Groups G2 and G4 are experimented in this way to find out if winning the game is a strong tool enough to make user share their private information. If ratio of information sharing in G2 combined with G4 is greater than G1 combined with G3, then it can be said that forcing users to share information is an effective method. This supports the H1 in the experiment.

Another result can be extracted by comparison of G1 combined with G2 and G3 combined with G4. If the users of G3 combined with G4 share more information, then it can be said that the reason behind it is gamification. This supports the H2 in the experiment.

Finally, people are expected to keep their opinions stable if there exist no environmental motivator. The only motivator in the experimental setup is the game itself. Therefore, we could conclude if a deviation in people's opinions exists, the cause is the gamified setup.

This experimental setup could shed light on whether the aforementioned hypotheses holds. It is expected that participants are tend to share their personal data more in a gamified environment and

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especially when they are forced to. Additionally, it is expected that gamification will cause deviations in people's opinions.

6. RESULTS

The results are obtained after four months of observation with a total of 256 participants, including four groups. Even if the collected data set does not include personal identifiers, the results are presented in aggregated fashion to eliminate further inference[1].

Figure 1 includes the demographics of the participants in all four axes. Even though the participants could leave questions unanswered, it is observed that majority of them willingly answered all of the demographic questions.
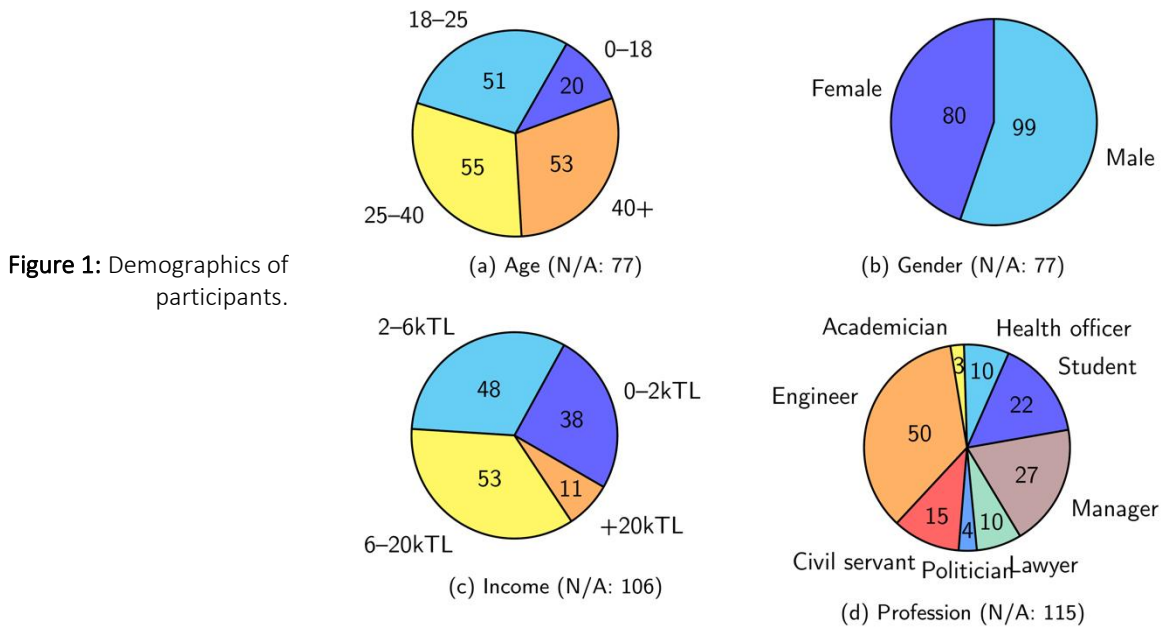

Figure 1: Demographics of participants.

(a) Age (N/A: 77)

(b) Gender (N/A: 77)

(c) Income (N/A: 106)

(d) Profession (N/A: 115)

Figure 2 includes the summary of the experiment that will be used to determine if hypotheses H1 and H2 are valid. In this figure, the answer rates of the questions per group and question type can be seen as well as the total participants and participants who left the experiment.

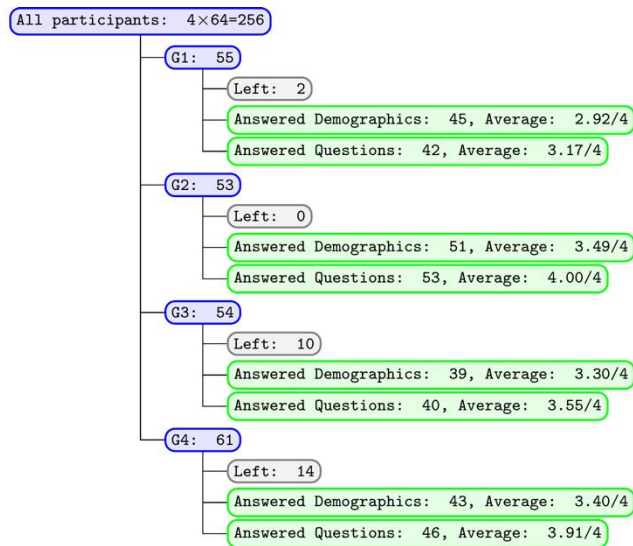[1] The collected anonymous data is available for researchers upon contact to the corresponding author.

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The number of participants and demographic diversity of each group is in balance as presented in **Figure 2**. The number of participating people in groups G3 and G4 is less than the number of participants in groups G1 and G2. This observation was expected as the joyful game people played is interrupted with questions. This acts as a demotivator and make people leave the experiment. Still, the number of initial participants and the number of people that participated the questionnaire are still in balance. This observation indicates that the participation bias in the experiment could be omitted.

Participants are also asked about their privacy preferences. These questions are considered privacy-invasive as privacy preferences are private itself. The set of questions are presented below:

- Do you prefer to share your personal information?
- Do you use loyalty cards of coffee shops (E.g. Coffee franchise card to have one cup of coffee for free after ten purchase)?
- Do you use supermarket loyalty cards for discounted purchase?
- Would you like to share your personal information when you get a service in return?

Figure 3 reveals the statistics of the first question in demographics manner. People older than 25 pay more attention to their privacy than younger. Also, men are more conservative than women about their personal life. People with higher salaries are willing to share their

private data. From the professions' perspective, the less careful people are politicians where the most careful ones are the engineers.
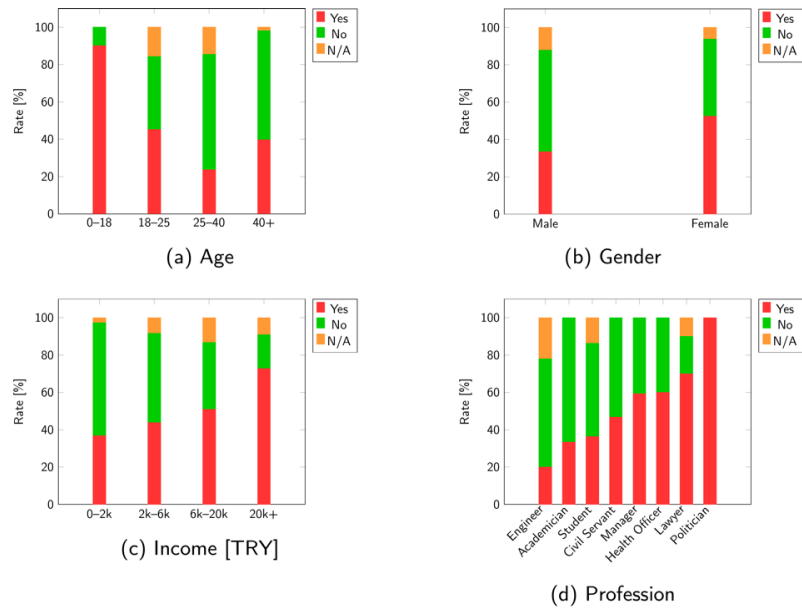

(a) Age

(b) Gender

Figure 3: Willingness to share.

(c) Income [TRY]

(d) Profession

Figure 4 unearths the details of the second question in four demographic axes. Gift cards are popular for 0-18 age group and women use gift cards more than men. Also, people earning in the range of 6K-20K use gift cards more than others. The profession axis shows that lawyers are using gift cards more than others.
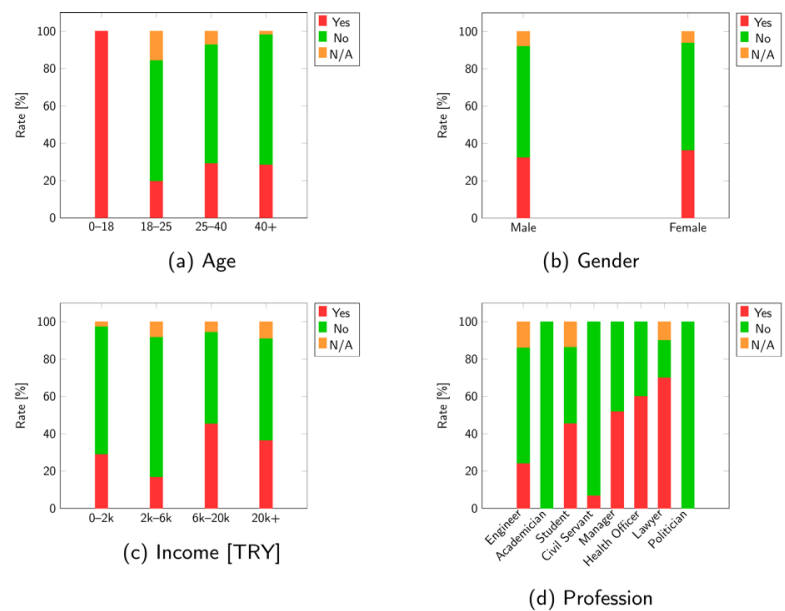

(a) Age

(b) Gender

Figure 4: Gift card usage.

(c) Income [TRY]

(d) Profession

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Figure 5 includes the details of the third question per four demographic group. Discount card usage is increasing with age, and men are using discount cards more than women. People with the income range of 6K-20K are using discount cards more than others. All of the politicians participated the experiment prefer to use discount cards.

(a) Age

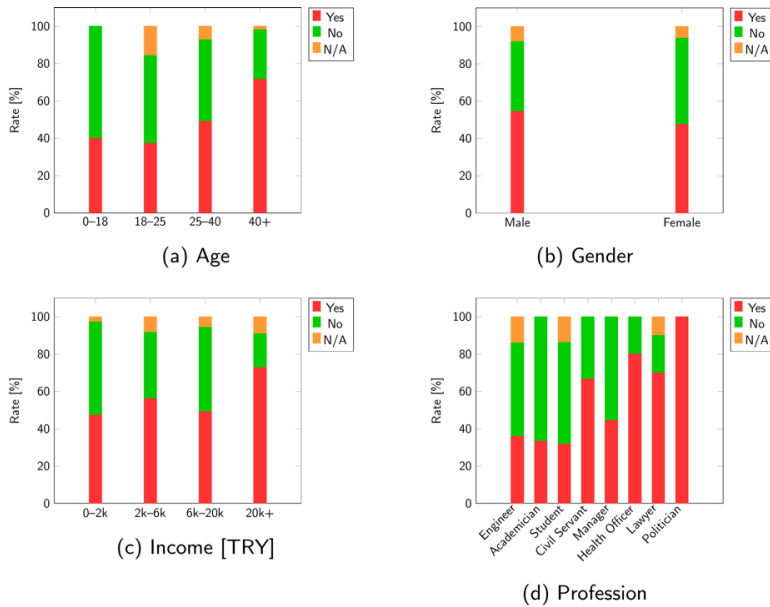(b) Gender

(c) Income [TRY]

(d) Profession

Figure 5: Discount card usage.

Figure 6 shows the details of the last question in demographic manner. Age group of 0-18 is more tendentious to get private data in exchange for a service. Also, women are apt to share more data in exchange for a service than men. Wealthier people share their private data to get benefits. The results in the profession axis suggests that the lawyers accept to get benefits in exchange for disclosing personal data.

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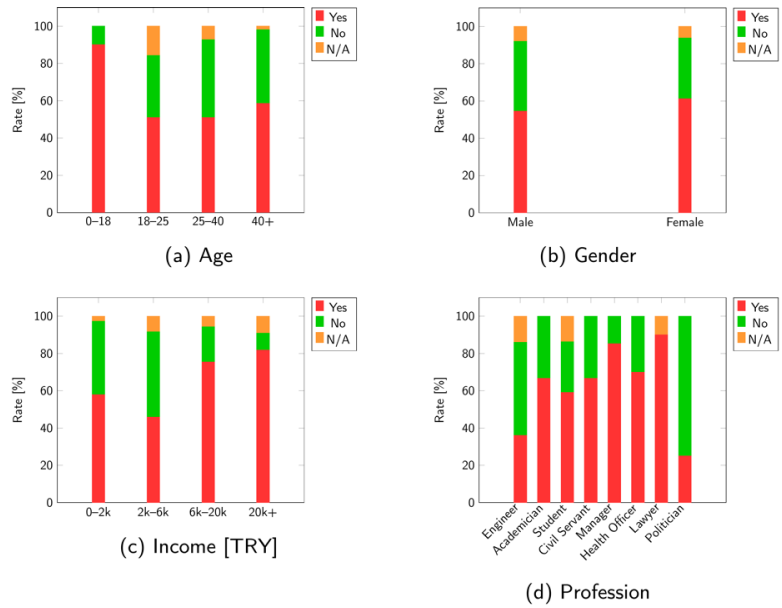
Figure 6: Willingness to exchange private data for benefit.

In order to show the hypotheses holds, total number of collected personal items are determined and presented in **Figure 7**. The raw observations are as follows:

G1 A total of 168 out of 212 questions have been answered.

G2 A total of 212 out of 212 questions have been answered.

G3 A total of 156 out of 176 questions have been answered.

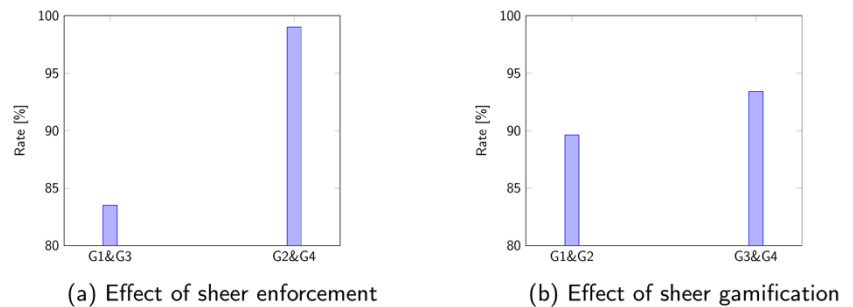G4 A total of 184 out of 188 questions have been answered.

Figure 7: Percentage of shared personal data in a gamified context with respect to motivators.

Considering **Figure 7a**, the participants of the experiment answer more questions when forced. Also, **Figure 7b** indicates that the participants of the experiment are affected from gamification and disclosed more data. The results clearly indicate that the first two hypotheses, H1 and H2 holds. It should be noted that all of the answers to the personal questions are able to be collected in group G2. This group utilizes both

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the game itself as the motivator and also enforces users to disclose more information to continue to play.

Participants actual behavior is compared with their answers to reveal the effects of gamification to people's self-conscious opinion. It is observed that 99 people out of 115 changed their minds to continue to play. Initially, they state that they are not willing to share their personal data. However, in a gamified environment more than 86 % of them disclose information. Again, 100 % of the participants change their mind for G2, where both gamification and enforcement are used as motivators.

The experiment tries to materialize the main hypotheses by showing that people are willing to share their personal information in a gamified environment. Also, they disclose more when they are motivated with game elements. Moreover, it is shown that people tend to modify their opinions in a gamified context.

7. DISCUSSION

According to the results, the experiment reached to a diverse set of participants based on age, gender, income and profession. The number of participants is considerable to cancel out oddities in the presented statistics. Moreover, it is observed that the participants are evenly distributed among the groups; thus, participation bias is negligible.

One can conclude that majority of the people release their demographic information easily. Besides, the results indicate that people tend to release their personal information in a gamified environment more than they believe. This is an important inference as this is an evidence that people could be steered to behave against their basic preferences unconsciously by gamification.

This study concludes that users of gamified environments are less careful about protecting their private information. This conclusion is in line with Payback and FourSquare examples (Walz and Deterding, 2015).

The most successful setup is achieved by luring the participants into the gamified environment without any hassle at first, then enforcing user

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to disclose personal information to go on with the game. The experiment shows 100 % success rate of collecting information and changing people's mind in this setup. This setup is in line with several legal or illegal applications in practice such as social networks, drug addiction or sect memberships.

Therefore, as basically non-preferred actions could be realized with the joyful mood of gamified virtual benefits, gamification practitioners should take utmost care to not to induce privacy violations. The intentionally malicious gamification designs are hard to recognize for individuals. Therefore, privacy violating malicious collection should be observed carefully by regulatory bodies to protect the community**.**

References

Acharya, S., Matovu, R., Serwadda, A., and Griswold-Steiner, I. (2019). Gamification of Wearable Data Collection: A Tool for Both Friend and Foe. In *Proceedings of the 2019 3rd International Conference on Compute and Data Analysis, ICCDA 2019* (pp. 68-77). New York: Association for Computing Machinery.

Bilbey, T. (2019). Oyunlaştırma Anketi. Retrieved from: <http://game.tolgabilbey.com/>

Blohm, I. and Leimeister, J. M. (2013). Design of It-Based Enhancing Services for Motivational Support and Behavioral Change. *Business and Information Systems Engineering 5*, 275–278.

Bohyun, K. (2015). Gamification, Examples, Definitions and Related Concepts. *Understanding Gamification 51*, 5–9.

Burigat, S. and Chittaro, L. (2014). De- Signing A Mobile Persuasive Application to Encourage Reduction of Users' Exposure to Cell Phone of Emissions. *(Re)Defining Gamification: A Process Approach 8462*, 13–24.

da Rocha Seixas, L., Sandro Gomes, A., and de Melo Filho, I. J. (2016). Effectiveness of Gamification in The Engagement of Students. *Computers in Human Behavior* 58, 48–63.

Fernández-Luna, J. M., Huete, J. F., Rodríguez-Avila, H., and Rodríguez-Cano, J. C. (2014). Enhancing Collaborative Search Systems Engagement through Gamification. *In Proceedings of the First International Workshop on Gamification for Information Retrieval, GamifIR '14* (pp. 42–45), New York: Association for Computing Machinery.

Fonseca, D., Villagrasa, S., Navarro, I., Re- dondo, E., Valls, F., and Sánchez, A. (2017). Urban Gamification in Architecture Education. In Rocha, Á., Correia, A.

M., Adeli, H., Reis, L. P., and Costanzo, S., (Eds), *Recent Advances in Information Systems and Technologies* (pp. 335–341). Cham: Springer International Publishing.

Goodman, M. (2015). Future Crimes: Inside the Digital Underground and The Battle for Our Connected World. New York: Knopf Doubleday Publishing Group.

Hunter, D. and Werbach, K. (2015). Practical Gamification. *The Gamification Toolkit: Dynamics, Mechanics, and Components for the Win*. Philadelphia: Werbach School Press.

Huotari, K. and Hamari, J. (2017). A Definition for Gamification: Anchoring Gamification in The Service Marketing Literature. *Electronic Markets* 27, 21-31. doi: 10.1007/s12525-015-0212-z.

Kuramoto, I., Ishibashi, T., Yamamoto, K., and Tsujino, Y. (2013). Stand Up, Heroes!: Gamification For Standing People On Crowded Public Transportation. In Marcus, A. (Ed), *Design, User Experience, and Usability DUXU 2013: Health, Learning, Playing, Cultural, and Cross-Cultural User Experience Proceedings* (pp. 538– 547). Berlin, Heidelberg: Springer. https://doi.org/10.1007/978-3-642-39241-2_59.

Lamprinou, D. and Paraskeva, F. (2015). Gamification Design Framework Based on SDT For Student Motivation. In *2015 International Conference on Interactive Mobile Communication Technologies and Learning (IMCL)* (pp. 406–410). IEEE. doi:10.1109/IMCTL.2015.7359631.

Makanawala, P., Godara, J., Goldwasser, E., and Le, H. (2013). Applying Gamification in Customer Service Application to Improve Agents' Efficiency and Satisfaction. In Marcus, A. (Ed), *Design, User Experience, and Usability DUXU 2013: Health, Learning, Playing, Cultural, and Cross-Cultural User Experience Proceedings* (pp. 548– 557). Berlin, Heidelberg: Springer. https://doi.org/10.1007/978-3-642-39241-2_59.

McCarthy, I., Kietzmann, J., Robson, K., Plangger, K., and Leyland, P. (2014). Understanding Gamification of Consumer Experiences. *Advances in Consumer Research* 42, 325-356.

Meyer-Waarden, L. (2007). The Effects of Loyalty Programs on Customer Lifetime Duration and Share of Wallet. *Journal of Retailing* 83, 223–236. doi: 10.1016/j.jretai.2007.01.002

Morales, M., Amado-Salvatierra, H. R., Hernán- dez, R., Pirker, J., and Gütl, C. (2016). A practical experience on the use of gamification in mooc courses as a strategy to increase motivation. In Uden, L., Liberona, D., and Feldmann, B. (Eds), *Learning Technology for Education in Cloud – The Changing Face of Education* (pp. 139–149). Cham: Springer International Publishing.

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Morford, Z. H., Witts, B. N., Killingsworth, K. J., and Alavosius, M. P. (2014). Gamification: The Intersection Between Behavior Analysis and Game Design Technologies. *The Behavior Analyst 37*, 25–40.

Nah, F. F.-H., Zeng, Q., Telaprolu, V. R., Ayyappa, A. P., and Eschenbrenner, B. (2014). Gamification of Education: A Review of Literature. *HCI in Business, LNCS 8527*. Cham: Springer International Publishing.

Pirker, J. and Gütl, C. (2015). Educational Gamified Science Simulations. In Reiners, T. and Wood, L. C. (Eds). *Gamification in Education and Business* (pp. 253–275). Cham: Springer International Publishing.

Sailer, M., Hense, J., Mandl, J., and Klevers, M. (2014). Psychological Perspectives on Motivation Through Gamification. *Interaction Design and Architecture Journal* 19, 28–37.

Sailer, M., Hense, J., Mayr, S., and Mandl, H. (2017). How Gamification Motivates: An Experimental Study of The Effects of Specific Game Design Elements on Psychological Need Satisfaction. *Computers in Human Behavior* 69, 371–380.

Schacht, S. and Maedche, A. (2015). Project Knowledge Management While Simply Playing! Gaming Mechanics in Project Knowledge Systems. In Reiners, T. and Wood, L. C. (Eds), *Gamification in Education and Business* (pp. 593–614). Cham: Springer International Publishing.

Sigala, M. (2015). Gamification for Crowdsourcing MarKeting Practices: Applications and Benefits in Tourism. In Garrigos- Simon, F. J., Gil-Pechuán, I., and Estelles-Miguel, S. (Eds), *Advances in Crowdsourcing* (pp. 129–145). Cham: Springer International Publishing.

Tóth, Á. and Tòvölgyi, S. (2016). The Introduction of Gamification: A Review Paper About the Applied Gamification in The Smartphone Applications. In *7th IEEE International Conference on Cognitive Infocommunications* (CogInfoCom) (pp. 213–218). IEEE.

Walz, S. P. and Deterding, S. (Eds) (2015). The Gameful World: Approaches, Issues, Applications. Cambridge: Mit Press.

Wylie, J. (2014). Fitness Gamification: Concepts, Characteristics, And Applications [Technical report]. Elon University.

Xu, F., Weber, J., and Buhalis, D. (2013). Gamification in Tourism. In Xiang, Z. and Tussyadiah, I. (Eds), *Information and Communication Technologies in Tourism 2014 (*pp. 525–537). Cham: Springer International Publishing.

Xu, Y. (2012). Literature Review on Web Application Gamification and Analytics [Technical report]. University of Hawaii.

Zica, M. R., Ionica, A. C., and Leba, M. (2018). Gamification in the Context of Smart Cities. In *IOP Conference Series: Materials Science and Engineering* 294 (pp. 12-45).

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