ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL

GAMIFICATION EFFECTS ON PRIVATE DATA COLLECTION

M.Sc. THESIS

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Department of Game and Interaction Technologies

Game and Interaction Technologies Program

JULY 2021

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KİŞİSEL VERİ TOPLANMASINDA OYUNLAŞTIRMANIN ETKİSİ

YÜKSEK LİSANS TEZİ

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Tolga Bilbey, a M.Sc. student of ITU Graduate School student ID 529181018 successfully defended the thesis/dissertation entitled "GAMIFICATION EFFECTS ON PRIVATE DATA COLLECTION", which he prepared after fulfilling the requirements specified in the associated legislations, before the jury whose signatures are below.

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To gamification users,

FOREWORD

As the usage of gamification increases in multiple areas now, it should be considered it has effects on privacy. The end users should be careful before using a gamified application. Private data of the user can be used in many ways that can harm the user.

I could not be successful now if I did not get any support. First, I am grateful to my family for their support. After that, I should thank my advisor Dr. SANDIKKAYA on this thesis for his help.

June 2021

Tolga BİLBEY
(M.Sc. Student)

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GAMIFICATION EFFECTS ON PRIVATE DATA COLLECTION

SUMMARY

Gamification is used in many applications to support users to do certain jobs in a fun way. It can use one or multiple game design elements such as leaderboards, points, progress bars. It stimulates the reward center of the human brain, so it is fun to do even boring tasks.

Gamification is mostly used in the health, learning and advertisement sectors. The increasing usage of wearables like smart watches keeps track of medical information like oxygen saturation, heartbeat, stress levels with emotional information given by users. In learning applications, it motivates users to keep forward, keep track of their progress and compete with their friends. In advertisement, it motivates users to give their private data to provide best results for their search.

Gamification also has a foundation on psychology. Gamers in the world seek different things to play the game. Some of them want to discover new places, some of them need proper directions and others want competitiveness. It is unearthed by research that there are six types of gamers with different needs. Also, researchers grouped them with different game design elements to indicate psychology behind gamification.

The purpose of this research is to discuss if gamification has effects on the privacy of people. It is using a survey that has some private and demographic questions inside, and a simple time trial car drive game is used. Survey and game are published on one gamification platform that has two gamification elements inside: challenge and leaderboard. The game is created in a way to compliment all six types of gamers. Users are redirected to the versions of the game randomly in four groups. One group answer only the demographic questions optionally before the game and private questions in the game, the other group answers both demographic and private questions optionally in a row like the first group. Other 2 groups are like the first two groups, but all questions are answered in the game. Hence, user behavior is tracked in multiple conditions. Users who answered in the game questions get more time to finish the game, so the gamification environment is also motivating the users. The purpose is to see if users are willing to give their private data to get a reward.

KİŞİSEL VERİ TOPLANMASINDA OYUNLAŞTIRMANIN ETKİSİ

ÖZET

Oyunlaştırma günümüzde uygulamaların daha fazla kullanmaya başladığı bir tekniktir. Amacı kullanıcının sıkıcı işleri bile daha eğlenceli bir şekilde yerine getirmesini sağlamaktır. Bunu yaparken de oyun öğelerinden faydalanır. Oyun öğelerine örnek olarak sıralama tabloları, puan sistemleri, ilerleme çubukları verilebilir.

Oyunlaştırmanın kullanıldığı alanlar günümüzde hızla artmaktadır. Bunun sebebi şirketlerin kullanıcılarına daha iyi bir deneyim sunmak istemesidir. Oyunlaştırma öğelerini kullanarak kullanıcılarının bir profili çıkartmak ve bu profil doğrultusunda kendini geliştirmek şirketlerin hedefidir.

Eğitim alanında oyunlaştırma kullanıcıların kendi gelişimlerini takip etmesi, birbirleriyle rekabet halinde olmasını ve başka konular hakkında bilgi sahibi olmak konusunda onları motive etmesini sağlamak için kullanılır. Örnek olarak Udemy dersler sırasında bitirme yüzdesini gösterir. Dersin bitiminde de bir sertifika düzenler. Bu sertifikanın gerçek dünyada bir değeri olmasa bile kullanıcıya kendisini iyi hissettirir.

Sağlık alanında da oyunlaştırma çokça kullanılmaktadır. Giyilebilir teknolojiler bu konuda öncülük etmektedirler. Spor uygulamaları kullanıcının oksijen, nabız ve stres bilgilerinizi kaydederken kullanıcı da arkadaşlarıyla yarışabilir.

Reklamcılık alanında kişilerin tercihlerine göre reklam gösterilmesi çok önemlidir. Satın alım başına komisyon kazanılan gelir modelleri de bundan doğmuştur. Kullanıcıya oyun içerisinde reklam göstererek ve davranış takip edilerek kullanıcının profili çıkarılmaya çalışılmaktadır.

Turizm alanında oyunlaştırmaya en iyi örneklerden birisi havayolu şirketleri tarafından sunulan sadakat programlarıdır. Miles&Miles örnek olarak her uçuş sonrası hesabınıza belirli bir oranda mil tanımlar ve sonra miller kullanılarak bedava bilet alınabilmektedir.

İşyerlerinde de oyunlaştırma etkenleri görülebilir. Aylık olarak performans analizine dayalı sıralamalar çıkarılabilir. İlk sıradaki kişiye bir madalya verilebilir. Bu tarz uygulamalar oyunlaştırmaya örnektir.

Duolingo yabancı dil öğrenme konusunda oldukça kullanılan bir uygulamadır. İçeriğinde size her ders sonunda puan vererek ödüllendirme tercih edilmiştir. Oyunlaştırma öğesi olarak ayrıca nişanlar verilmektedir.

FourSquare, kullanıcıların yerlerini arkadaşlarıyla paylaşmalarını sağlayan bir uygulamadır. Bu uygulama nişanlar ve çeşitli ödüller sayesinde kullanıcılarına bir oyunlaştırma örneği sunar.

Foldit oyunlaştırma öğeleri içeren ve genetik alanında çok önemli bir konu olan protein sentezleme üzerine kurulu bir uygulamadır. Bu uygulamanın yardımıyla 2012 yılında

HIV virüsünün protein dizilimi bulunmuştur. Bunun dışında da hastalıklara karşı protein sentezleri araştırılmaktadır.

Yukarıdaki oyunlaştırma örnekleri dışında oyunlaştırmanın kötüye kullanıldığı örnekler de mevcuttur. Bir desen eşleme oyunu üzerinden telefonunuzun açılış şifresinin bulunması oyunlaştırmanın zararlı örneklerinden biridir. Boundless AI ismindeki yeni uygulama oyunlaştırmayı kullanarak kullanıcılara bazı işler yaptırdıktan sonra sevimli kedi videoları göstererek onların dopamin salgılayarak gülmesini sağlamaktadır. Bu da ileride kullanıcıları manipüle etmek için kullanılabilecek bir uygulama olduğundan oyunlaştırmanın zararlı bir örneğidir.

HealthSeeker uygulaması kullanıcılarının sağlık verilerini toplayan bir oyunlaştırma uygulamasıdır. Kullanıcılara oyunlaştırmanın gerektirdiği gibi destek verip pozitif bir hava içinde olmasını sağlasa da sonrasında bu verilerin eczacılık sektöründeki şirketlere satıldığı öğrenilmiştir. Bu da kişisel verilerin aslında korunmadığını ve yanlış ellerin eline geçebildiğinin göstergesidir.

Oyunlaştırmanın ayrıca psikolojik bir yanı da bulunmaktadır. Araştırmalar oyuncuları altı grupta incelemişlerdir. Her grubun kendine has özellikleri bulunmaktadır. Bir grup yeni yerler keşfetmek isterken diğer bir grup oyunun ödüllendirme kısmıyla ilgilenmektedir. Araştırma sonucunda oyun öğeleriyle altı oyuncu tipi arasında bir ilişki bulunmuştur.

Oyunlaştırma sosyolojik sınıflar da oluşturmuştur. Bununla ilgili ilk araştırma sonucunda dört adet sınıf bulunmuş olsa da araştırmalar içinde bu sayılar değişmektedir. Sınıfları bulurken kullanıcıların hangi oyunlaştırma öğesine ne tepki verdiği de gözlenmiştir. Bu araştırma oyunlaştırmanın sosyolojik kısmını incelemiyor olsa da sonraki çalışmalarda bu yönü de araştırılabilir.

Literatür taraması kısmında oyunlaştırmanın birçok alandaki etkilerine yönelik kaynaklar seçilmiştir.

Bu araştırmada içinde demografik bilgilerle birlikte kişisel bilgileri de sorgulayan bir anket kullanılmıştır. Demografik olarak kullanıcının cinsiyeti, yaşı, işi ve maaşı gibi etkenlere bakılmıştır. Kişisel sorular ise aşağıdaki gibidir.

- Kişisel bilgilerinizi paylaşır mısınız?
- Kahve dükkânlarının sadakat kartlarını kullanır mısınız?
- İndirimli alışveriş için süpermarket kartlarını kullanır mısınız?
- Bir hizmet karşılığında kişisel bilgilerinizi paylaşır mısınız?

Anketin oyunlaştırılması için zamana karşı yarışılan bir araba yarışı oyunu hazırlanmıştır. Bu aslında hazırlanan oyunlaştırma platformunda kullanıcılara verilen bir görevdir. Kullanıcılar bu görev sonucunda kendi isimlerini sıralama tablosunda görmektedirler. Bu platform görev ve sıralama tablosu olmak üzere iki oyunlaştırma öğesi kullanır. Oyun hazırlanırken altı oyuncu tipinin de özellikleri göz önünde bulundurulmuştur. Oyun normalde kısa bir zamanda bitiremeyecek şekilde tasarlanmıştır. Bu sayede oyunu tamamlamak isteyenler oyun içerisinde yerleştirilmiş olan anketi tamamlamak zorunda kalacaktır. Anketi tamamlayanlara oyunda ekstra süre verilmiştir. Ankete aşağıdaki şekilde dört farklı grup katılmıştır.

- Oyun öncesinde opsiyonel demografik sorular sorulup oyun içinde zorunlu kişisel sorular sorulanlar

- Oyun öncesinde opsiyonel demografik sorular sorulup oyun içinde opsiyonel kişisel sorular sorulanlar
- Oyun içerisinde opsiyonel demografik sorular sorulup zorunlu kişisel sorular sorulanlar
- Oyun içerisinde opsiyonel demografik sorular sorulup opsiyonel kişisel sorular sorulanlar

Bu anket dört ay sürmüş olup 256 kişi katılmıştır. Her bir grupta 64 kişi bulunmaktadır. Demografik olarak oldukça fazla alandan olan bu katılımcılar bu çalışmanın aslında katılımcılar yönünden bir sapma olmaması için önemlidir. Anket basitçe oyun kullanımın kişisel bilgilerin verilmesinde bir etkisinin olup olmadığını sorgulamaktadır. Ankette toplanan verileri değerlendirmek için ise üç hipotez kurulmuştur.

- Grup 2 ve Grup 4 içerisindeki kullanıcılar Grup 1 ve Grup 3 içindeki kullanıcılara göre daha fazla soruya yanıt vermiş olmalıdırlar. Bu sayede kullanıcılar zorlandığında daha fazla veri toplandığı görülmüş olacaktır.
- Grup 3 ve Grup 4 içerisindeki kullanıcılar Grup 1 ve Grup 2 içindeki kullanıcılara göre daha fazla soruya yanıt vermiş olmalıdırlar. Burada sorular oyun içi sorulmuştur. Oyuna devam edebilmek için sorulara daha fazla yanıt vermeleri beklenmektedir.
- Opsiyonel sorular yardımıyla başta kişisel verilerini vermek istemediğini belirten kişiler oyun sırasında geçici süreyle de olsa bu düşüncelerinde değişiklik yapmalıdırlar. Bu oyunlaştırmanın insanların fikirleri üzerinde nasıl bir etkiye sahip olduğunu göstermektedir.

Araştırma sonuçları açıklanırken katılımcıların demografik bilgilerine yer verilmiştir. Genel bir katılımcı dağılımı dışında hangi grupta kaç kişinin oyunu oynadığına, kaç kişinin platformu ankete cevap vermeden terk ettiğine ve son olarak da demografik ve toplam cevap oranlarına yer verilmiştir. Kişisel sorular ise demografik dağılımlarıyla birlikte gösterilmiştir. Hipotezlerin doğruluğunu göstermek amacıyla katılımcıları zorlamanın etkisini, oyunlaştırmanın etkisini ve eski düşüncesini değiştirerek kişisel bilgilerini paylaşanlarla ilgili sonuçlar derlenerek 2 farklı grafikle sunulmuştur. İlginç görülen bazı sonuçların ise psikolojik bazı nedenlerine sonuçlar kısmında yer verilmiştir.

Tartışma bölümünde bulunan sonuçlar üzerinden yorumlar yapılmıştır. Bunun dışında önceki çalışmalara atıflar yapılarak sonuçlar desteklenmiştir.

1. INTRODUCTION

1.1 Definition and Usage

Gamification is the term used to describe using game design elements in non-game context (Fernández-Luna et al., 2014). The purpose of it can vary, but the main purpose is making boring tasks more fun. Nowadays, it is used in many areas such as health, learning and business.

The difference between game and gamification is sometimes hard to answer. Çeker and Özdamlı (2017) stated in their study that game is defined as joyful rule-oriented actions, but gamification is expressed as specific actions in an area with a game element. Also, they stressed that gamification has mostly fewer game elements than game.

Game design elements are the term to describe game mechanics such as points, leaderboards, and badges. Designers can select one to many game design elements to use in the system.

In the health sector, gamification can be used to motivate users to run for 1 KM while recording the heartbeats which are then interpreted by a cardiology doctor. Another application could be a fitness program that users input the exercises to get points and show how much exercise the user does in the leaderboard.

In the learning sector, gamification is mostly used to motivate users to keep progress. Progress bars, points, badges are the most used game design elements. Learners could easily share their progress on social media or compete.

In the business sector, employers easily adapt a gamification method in the office. An application using points and leaderboards would be the easiest one to implement.

1.2 Psychology of Gamification

Sailer et al. (2014) unearthed the fact that gamification is the strong motivation tool, and it helps users to start and to continue doing tasks. Successful gamification designs

are then investigated, and Sailer et al. (2017) indicated that there are six types of perspectives of players.

1.2.1 Trait perspective

Players with this perspective are attracted with progress bars, achievements, and memberships. They are balanced people and seek changing environments. Badges and leaderboards are main game design elements to use in gamified environments for this type.

1.2.2 Behaviorist learning perspective

Players with this perspective are interested in feedback and rewards in application. Point system is the main game design element to use in a gamified environment for this type.

1.2.3 Cognitive perspective

To attract players with cognitive perspective, setting a clear personal goal is particularly important. They want to see the actions they take change the environment. Badges and progress bars are the main game design element to use in a gamified environment for this type.

1.2.4 Perspective of self-determination

Competing in a social way is a strong motivator for players with self-determination perspectives. Badges, leaderboards, and meaningful stories are the main game design elements to use for this type.

1.2.5 Perspective of interest

Personal preferences like game difficulty are especially important for players with a perspective of interest. They want to see lots of feedback and clear goals to achieve in the game. Points, badges, progress bars, avatars and meaningful stories are the main game design elements to use in a gamified environment for this type.

1.2.6 Perspective of emotion

Increasing positive emotions in the game is the main motivator of this kind of player. They want to see the roles of emotions in the game. Avatars and meaningful stories are the main game design elements to use in a gamified environment for this type.

1.3 Social Interactions of Gamification

There are player types of gamified environments to consider when it comes to social interactions between players. It is related to the psychology of an individual, but since it is interactions between players, this topic is examined here.

First, finding similarities between player types started with the study of Bartle (1996). He suggested 4 types of players. Killers, Achievers, Explorers, and Socializers. The motivations of these players can be seen in Table 1.3.1. Also, game elements have effects on these player types. Figure 1.3.2 shows the relationship of Bartle player types and game elements.

Table 1.3.1: Motivations of Bartle player types (Bartle, 1996).

Player Type	Motivation
Killers	Demoralizing other players
Achievers	Collecting more points and level up
Explorers	Discovering new features and places
Socializers	Communicating with other people

Table 1.3.1: Game element and Bartle player type relation (Kocadere and Çağlar, 2021).

Player type	**Killer**		**Achiever**		**Explorer**		**Socializer**	
Mechanic	+	-	+	-	+	-	+	-
Competition	Leaderboard Points	Gifting	Leaderboard					
Status	Leaderboard Level	Team						
Progression			Points Level		Level			
Resource Acquisition			Achievements					
Narrative					Story		Story Badge Achievements	
Reward					Badge Achievements			
Cooperation				Team		Team	Team	
Transaction				Gifting			Gifting	

Recently, it was found by Tondello et al. (2016) that player types suggested by Bartle (1996) are not enough to cover all players. Hence, they suggested hexad scale player types. The six types of players namely: Disruptor, Free Spirit, Achiever, Player,

Socializer, Philanthropist. The motivations and related game elements of player types can be seen in Table 1.3.3.

Table 1.3.2: Motivations and related game elements of hexad player types (Tondello et al., 2016).

Player Type	Motivation	Game Elements
Disruptors	Changing the system.	Innovation, voting, anonymity
Free Spirits	Exploring the environment with free will.	Exploration tasks, unlockable contents
Achievers	Competing with others.	Levels, progression, challenges
Players	Earning a reward.	Points, badges, rewards
Socializers	Communicating with others.	Guilds, teams
Philanthropists	Clear purpose.	Sharing, gifting

1.4 Real World Examples

Foldit is using gamification to solve a big problem in genetic engineering that is folding proteins to cure diseases. It has lots of international users with different backgrounds. Nonetheless, Foldit has introductory puzzles inside to start learning about proteins. It uses leaderboards as a motivator to users. In 2012, players found the enzyme that is responsible for reproduction of HIV. It could be helpful soon to treat some diseases (Pirker and Gütl, 2015).

Kahnoodle is the first relationship gamification app for couples. It was founded in 2013. The Love Tank is the feature introduced in this application. To fill it with points, partners should do thoughtful actions to each other like giving presents, helping each other for daily routine. In the end, partners can get a real-life coupon using their points in Love Tank. This application got lots of attention at first, but after some time, it just disappeared (Bohyun, 2015).

BrainSaver is developed as an Android phone application. It keeps track of the calls the user is receiving, and after each call that is longer than 20 seconds, it gives feedback about wearing earphones. Earphones are heating after 20 seconds, so the number is chosen wisely. Also, it should not bother the application of the user. This application is also using an avatar that users can choose between a dog or a skeleton. Every time the user has earphones on in the call, the avatar changes to a happier variant of it. In

order to show progress, the application resets itself every week. This application is also supporting the idea of decreasing Radio Frequency (RF) emissions (Burigat and Chittaro, 2014).

Microsoft RibbonHero is designed to show features of Microsoft Office to the users in a fun way. Microsoft Office is a good office software, and not everyone knows all of its features. Hence, this application is helping users to discover new features or unknown features of the Microsoft Office. It is a fun way to learn how to use Microsoft Office rather than reading manuals (Xu, 2012).

StackOverflow was founded by Jeff Atwood who created a good platform for software developers with the intention of creating a game like Counter Strike. Even though it has some game elements like points, levels, badges, it is not a game. It used these game elements and created competitions to motivate users to give the best answer possible to questions, editing other questions, searching other questions for answers with lots of time devotion from users. Also, this made the platform cleaner and more self-moderated (Hunter and Werbach, 2015).

Classroom Live is designed for software science undergraduate students as a gamification application. It is using game-like features like points, levels, and rewards. It is found after using Classroom Live that students started to become more engaged about the class, and they were having much more fun compared to before (Nah et al.,2014).

Nike+ platform is a gamified environment. However, it has a real-life effect. 2 million users of Nike+ platform burned 68 billion calories, and it is increasing. When Nike+ user is doing a physical activity, the sensors of Nike sport shoes send signals to the iPhone or iPod which are then used to calculate NikeFuel points for the user. Users can easily monitor their athletic performance visually with the NikeFuel system. Also, Users are getting a special badge to share online after completing milestones. Moreover, these rewards can be displayed on a trophy cabin (Blohm and Leimeister, 2013).

Duolingo is a paid text translation crowdsourcing platform. Also, it is helping students to learn foreign languages without any charge. While learning the language, students are translating other websites or documents. Moreover, students are earning points and badges for this activity. This makes Duolingo a gamified platform. Also, it has other

services to support students learning foreign languages like additional lessons (Lamprinou and Paraskeva, 2015).

MySugr is designed for diabetes to monitor their progress in a fun way. This gamified application provides a virtual monster to their users. The monster is normally wild, but users are trying to change it to a domestic version of itself by logging data that is in the healthy range and being active. Monster is also giving feedback to users looking at their logging data (Tóth and Tóvölgyi, 2016).

Yo! India is a gamified application created by iXigo.com. It is available on mobile to keep users in the application. It shows Indian destinations to the users and asks them to keep guessing destinations in a short time. Every correct answer, users are earning points. Also, it has a leveling system where users start as Beginner, and slowly proceed to Travel God. In the meantime, they are learning a lot about destinations of India and earning badges. There is a Facebook connection of the environment, so users also can share their scores on Facebook (Sigala, 2015).

Blockholm is based on MineCraft to design modern cities. All the world in the application is real. Because it is using real cartography. Also, this application is supported by Swedish Center of Architecture and Design, so the design of a user could be real in the future (Fonseca et al., 2017).

Khan Academy is another e-learning platform to support users to keep progress. It is using good subject trees visually, so that users can look at where they are at the lecture in a fun way. It gives points to correct answers, and if a user gets stuck, they offer a video about it. Moreover, Khan Academy has badges on the gamified system (Morales et al., 2016).

Fitocracy is a gamification application that is basically a personal sport assistant. It sets targets to reach for users, instructs users about workouts which are prepared by professionals. Also, users can monitor the progress they have made. After a workout, users earn points or badges. Also, users can share these badges on social media (Huotari and Hamari, 2017).

Emotional Flower is developed to increase social interactions in the office. A virtual flower is given to employees. This flower grows bigger if it sees the positive facial gesture from the owner. The more time it sees positivity, the more it grows. Moreover, flowers are displayed on a shared screen at the office. Hence, as a gamification

application, it supports positive mood in the office, and has a kind of a leaderboard as a shared screen (Kuramoto et al., 2013).

Zombies, Run! is another fitness gamification application. It is taking place after a zombie apocalypse. Survivors are trying to get rewards such as food and medicine to live. By running, they try to escape from zombies and gather more supplies. Players also should avoid obstacles while running. Moreover, Zombies, Run! has some missions inside. Every goal is clearly set, and it gives rewards to live (Morford et al., 2014).

Yahoo Answers was founded in 2005 as a gamified question and answer platform. Users are motivated to ask or answer questions. It is like StackOverflow as it gives points to the users who spend time on the platform to ask or answer questions. It also has a badge system. After some actions, users can earn a badge about it. Questions can easily be shared on social media too. The main difference from StackOverflow is that Yahoo Answers let anonymous people ask questions too (Schacht and Maedche, 2014).

It is a problem for employers to solve the issue of decreasing productivity if employees are doing the same job every day. To deal with this, Freshdesk which is a gamified helpdesk application is created. It is creating virtual tickets from telephone calls, comments on social media, and assigning these tickets to employees. After completing a ticket, they are rewarded with points. Also, users can get badges about their work. Points and badges are visible to other employees and management. It can work not only with individuals but also with teams. It has a truly clear goal to get the most points and be on top of the leaderboard (McCarthy et al., 2014).

Jane McGonigal has experienced a concussion, and at the end, she has overcome the disease, and started to help people who are experiencing the same disease. After some time, she created SuperBetter as a gamified health application. It has the target user of people who are in the pain of concussion. It is setting clear goals with obstacles for users. Also, it is supporting users psychologically in the recovery phase (Wylie, 2014).

Opower is a company that created a gamification application with the same name to save the planet with energy companies. It encourages users to save more energy to make the future greener. Also, Opower is providing badges and points to the users,

then they can monitor their progress and compare their points with neighbors (Zica et al., 2018).

Payback was designed to be a loyalty card at the beginning. After a huge success even at the time of the dotcom crash, it was acquired by American Express in 2010, and was the largest loyalty scheme in Germany. Then, they started to give discounts as points in the application. After that the leaderboard started to shape. When they started to think about giving badges using shopping information of the users, it started a fall of the company. Even though they received a first Big Brother Award after foundation, privacy, and digital rights organization FoeBuD released a negative press against them due to not giving enough information to users about data processing (Walz and Deterding, 2015).

HealthSeeker is founded by the Diabetes Hands Foundation as a mobile gamified application to support diabetes to be healthier. It sets missions as exercises and at the end gives points to the users. Also, users can share these achievements using Facebook. It encourages active life, as it has positive effects on diabetes. However, it collects private health information from users, and this data is used by the pharmaceutical industry in advertisements (Walz and Deterding, 2015).

FourSquare is a mobile location based social gamification application. Users can check in virtually to places using this application. Also, they can see the check in of their friends. FourSquare has implemented lots of game elements such as points, badges, leaderboards, mayorships, and rewards for their users. Rewards can be real life rewards like free drinks. To support competence, it is using leaderboards and mayorships, so that users can compete (Walz and Deterding, 2015).

Boundless AI is analyzing user behavior by giving them some goals. After completion of a goal, cute animations are displayed to the user to release dopamine to make them laugh. These actions are used in some reinforcement learning algorithms to analyze the user. After some point, users can become addicted to the website. It could be used as a manipulator for some third parties in the future.

1.5 Literature Review

Conaway and Garay (2014) created a survey to examine the effect of using gamification in business applications. They used Amazon’s Mechanical Turk, which

provides more diverse data at cheaper prices and Facebook is used to get responses from the university students page of the author. At the end of the study, they found women around age 24 with at least college level education are more likely to use the gamified version of the business website.

Bittner and Shipper (2014) surveyed the effects of gamification on product advertisement. 101 participants who were regularly interested in sports attended. At the end of the study, they found who has experience in gaming gave the best impression when they see gamified products. Another finding of them is that older people are not noticing the gamification clues of the gamified environment, so they are less interested in gamified products than young people.

Herzig and Ameling (2012) examined the performance of gamification on enterprise resource planning field. They created a game prototype about manufacturing scenario with some business models. They have found that, ease of use is increased by 36.123%, and engagement by 53.414%. They stated that gamification can improve job performance and employee engagement.

Gamification is also used in tourism industry. Kim et al. (2021) made a research about the effects of gamification on tourists by using letterboxing and rewards as game elements. They have found that letterboxing is increasing satisfaction and fun for tourists. They also found that using extrinsic motivation like giveaway rewards decreased the intrinsic motivation like letterboxing, so designers should select game elements carefully to avoid this issue.

de Castro-Cros et al. (2020) showed the effect of gamification on brain computer interface functional rehabilitation. They just used avatar as a game element, and it provide fun for the patience. Stroke patients felt more fun when they were in mental images session, and there were no side effects.

Kim et al. (2016) found that gamification is increasing the attendance to the engineering lab groups. They created two platforms to evaluate the results. First one was using gamification with game elements like points, badges, leader boards on the website, and second one was not using it. Students attended the first one mostly and created more threads on the website in multiple different dates. Students spent more time on the website that is gamified.

The research made by Cechanowicz et al. (2013) revealed that using gamification for surveys increased the engagement of participants. They put some game mechanics for advertising company survey which has 3 different types of questions. 600 participants attended to the survey. The effect of gamification is not relevant of the game experience of the participant or demographic features of the participant. They just impressed by the motivation gamification provides to them.

Yıldırım and Şen (2019) worked on a data about student achievements between 2010 and 2016. They used meta-analysis which is collecting lots of quantitative data from research into one to work on it. They have found that 3487 learners from 45 experiment reacted positively to gamification, and gamification increased the student achievements by 7.2% in any education level.

The research made by Shahri et al. (2014) concentrating on the effects of gamification on privacy at work. They have interviewed with gamification experts and gathered some statements. After that, they made a survey using these statements on experts from different sectors and countries. 30 out of 42 invited experts have given some points on statements. Statement number 4 and number 5 are related to private data collection using gamification. 63% of the experts agreed on statement number 4 that private data is collected by gamification, and privacy policies should be considered. Also, 70% of the experts said about statement 5 that gamification is collecting lots of information that related people are not always happy to share. Moreover, 80% of the experts indicated when collecting private data people do not even know which information about them is collected.

Kim and Werbach (2016) found that it is a difficult job to find a good theory that explains the details of problems regarding online privacy on gamification systems. Hence, it is suggested to look at this problem in a contextual integrity, so it would be related with organizations, principles, and individuals. Then, gamification is divided into 2 parts: game and real life. To exemplify the game part, the actions to manipulate users and affect them are related to the game part. Nonetheless, exploitation and harm can be examples of real-world part of the gamification. Exploitation can be defined as using the vulnerability of someone else to benefit. Since gamification is providing lots of information. It can be used to exploit individuals.

Another research has been done by Mavroeidi et al. (2019) reports the relation with game design elements and privacy requirements namely anonymity, pseudonymity,

unlinkability, undetectability and unobservability. The relation table is clearly showing that nearly all game elements violate privacy. In Table 1.5.1, the relationship between game design elements and privacy requirements are shown.

Table 1.5.1: Matching Game elements with Privacy Requirements (Mavroeidi et al., 2019).

Game Elements	Privacy Requirements				
	Anonymity	**Pseudonymity**	**Unlinkability**	**Undetectability**	**Unobservability**
Avatars	✓	✓	✓	✓	✓
Challenges	✓	-	✓	-	-
Communication with other players	✓	✓	✓	✓	✓
Competition	✓	✓	✓	✓	✓
Leaderboards	✓	✓	✓	-	-
Location	✓	✓	✓	✓	✓
Notification	✓	✓	✓	✓	✓
Profiles	✓	✓	✓	✓	✓
Quiz	✓	✓	✓	-	-
Roles	✓	✓	✓	✓	✓
Team tournaments, group tasks and collaboration	✓	✓	✓	✓	✓

Marczewski (2017) has explained in the research that the gamification is just a tool. The designer should take responsibility for the ethical use of gamification. Sesame Credit is an example of gamification introduced by Chinese government that is a calculated point using your preferences on the internet like your purchases and your friends. However, there is a non-predicted result of this application that one can lose friends or services if the Sesame Credit of the one is exceptionally low. In this example, it is also collecting lots of private information to calculate this result, so it should be discussed in the privacy area too.

In the study of Yamakami (2013) introduced gamification literacy. The reason is that the mobile game industry in Japan is developing lots of methods to manipulate users to make more money. One of the methods is completion gacha that after buying the whole set of gear in the game is rewarded with a rare in-game item. If the user wants to get the rare item, then the user should buy the whole gear set, so the company benefits from this behavior. Another technique is using data mining to enhance the game, so users are more satisfied to pay more. Gamification literacy warns users about this persuasion techniques implemented by companies to decrease the amount in pay bills.

In the study of Goethe O. and Palmquist A (2020) used the study of Kim and Werbach (2016) as base. The research is suggesting that gamification diversity elements such as culture, age and gender could create meaningful differences between gamification applications when it comes to be more successful in the area. Also, the article highlighted categories exploitation, manipulation, harm, and character which are main categories in the study of Kim and Werbach (2016). Also, the article briefly describes gamification as unethical if the user has no real benefits of doing gamified tasks.

Armando, Valle, and Isotani (2018) researched about the negative effects of gamification on learning examining 17 papers. In the result, findings are categorized to loss of performance, indifference, undesired behavior, and declining effects. Loss of Performance is the term defining the harm caused by gamification on learning. The Undesired Behavior is a problem related to many things such as bad gamification design and system problems. The Indifference refers to showing no effect of gamification on learners. The Declining Effects is the term to explain that the motivation of the learners is decreasing in time, so it is different from Loss of Performance, but it causes loss of performance in time. In Table 1.5.2, the relationship between negative gamification effect and game design element can be seen.

Table 1.5.2: Negative effects and their respective gamified designs (Armando, Valle and Isotani, 2018).

Negative Effect	# of Elements	Elements	Most Impacting Element
Indifference	8	Leaderboard, Badge, Level, Progression, Social Status, Point, Instant Feedback, Challenge	Leaderboard and Badge
Loss of Performance	11	Leaderboard, Badge, Level, Social Status, Social Interaction, Point, Avatar, Progression, Instant Feedback, Challenge, Economy	Leaderboard, Badge and Point
Undesired Behavior	11	Leaderboard, Badge, Point, Level, Instant Feedback, Progression, Social Status, Social Interaction, Avatar, Economy, Narrative	Badge and Leaderboard
Declining Effects	4	Leaderboard, Badge, Point, Level	Leaderboard and Point

Andrade, Mizoguchi and Isotani (2016) are another group that found negative effects of gamification in learning platforms. Some of the reasons are off-task behavior, undesired competition, addiction, and dependence. The user of the system is doing any task other than learning in the system is referred to as off-task behavior. Using leaderboards in the gamified system may cause undesired competition. Because low performance users may feel challenged and just stop using the system. For the part of addiction, if learners start to learn with only gamified environments that would be a problem. Because, normally, learning environments like school or university are not gamified.

Thorpe and Roper (2019) showed that firms have started using gamification as a tool to manipulate users to click the buy button on the internet. Even though there exist no perfect gamification applications, it is a growing industry, and it will improve with ethical issues in hand. Firms will pursue psychological effects of gamification to manipulate and exploit users to sell more items.

McCall and Baillie (2017) indicated in the research that gamification applications are also serious games in the category of persuasive games. Since the data collected through these applications are real world meaningful data, developers should ask for consent from the user about how this data is collected and how it will be used in the

application. Also, it is suggested that it would be a good idea to ask multiple times to cover changes in the policy after new releases.

In Table 1.5.3, similarities between this study and other studies can be seen.

Table 1.5.3: Similarities of studies with this study.

Study	Summary of Study	Usage in This Study
Conaway and Garay (2014)	Women around age 24 with minimum college degree reacts better to gamification.	This study also gathering demographic information in gender and age groups.
Bittner and Shipper (2014)	One with gaming experience reacts better to gamification. Also, young people are reacting better.	This study also gathering demographic age information.
Herzig and Amelig (2012)	Ease of use and employee engagement are increased using gamification.	This study uses gamified environment to collect more private data.
Kim et al. (2021)	Intrinsic rewards are satisfying users more than external rewards.	This study uses leaderboard and emotional story to satisfy users rather than external rewards.
de Castro-Cros et al. (2020)	Gamified environment provided more fun to sick people for their rehabilitation.	This study uses a time trial driving game, and it is creating a funny environment.
Kim et al. (2016)	Students preferred to spend more time on gamified engineering lab group.	This study is using a gamified environment to collect more private data.
Cechanowicz et al. (2013)	They used gamification to get more participants for survey.	This study is also using gamified environment to collect more data.
Yıldırım and Şen (2019)	Student achievements increased with gamification.	Using gamified environment to collect more private data.

Shahri et al. (2014)	Experts are agreed on that gamified environment is collecting private data.	This study is trying to find if gamification is a tool to collect private data or not.
Goethe O. and Palmquist A (2020)	Culture, age, and gender are defined as gamification diversity elements.	This study is collecting demographic information in a gamified environment.
Kim and Werbach (2016)	Gamification effects on ethic split to two as game and real life. Exploitation and manipulation are defining real life effects, and character and harm defining game.	This study is also trying to find if gamified environments can harm us in any way such as manipulation tool.
Mavroeidi et al. (2019)	There is a relationship between game elements and privacy requirements, and some elements do not provide privacy.	This study is trying to collect private data using gamified environment.
Marczewski (2017)	Suggested to look at gamification as a tool and explained Sesame Credit so that for ethical issues developers should be responsible.	This study is using gamification is a tool, and author deliberately try to get more private data for educational purpose.
Yamakami (2013)	Gamification literacy introduced as persuasion techniques to sell more items for companies.	This study is using gamified environment to collect more private data.
Armando, Valle, and Isotani (2018)	Negative effects of gamification on learning have 4 categories: loss of performance, undesired behavior, indifference, declining effects.	This study is trying to find if gamification can be used to collect private data which is a negative effect of gamification.
Andrade, Mizoguchi and Isotani (2016)	Negative effects of gamification on learning have 3 reasons: off-task behavior,	This study is trying to find if gamification can be used to

	undesired competition, addiction, and dependence.	collect private data which is a negative effect of gamification.
Thorpe and Roper (2019)	Companies are using gamification to persuade people to click buy button.	This study is using gamification to collect more private data.
McCall and Baillie (2017)	Gamification is categorized as a serious game. Developers should ask for consent to collect private data.	This study is using gamification to collect private data.

2. EXPERIMENTAL STUDY

The purpose of the experiment is checking if individuals are sharing their private data in a gamified environment. To achieve this, a survey with eight questions is prepared. Then, instead of using a gamification application, a basic game is created. The reason for this is to ease the whole process for participants.

The experiment took four months, and it is concluded after 256 individuals attended. The game and questions can be found online (Bilbey, 2019).

The game is a considerably basic time trial driving game. Hence, everyone who plays it can easily understand what to do. Time is carefully set for this experiment, so lots of the players are unable to see the finish line. In the case of this, the survey is shown to players. Completing the survey has a reward of extra time, so they can finish the game.

After creating a survey and game, a gamified environment is prepared. The purpose was collecting more survey data for this research with the help of the game as a task for participants to get a place in the leaderboard. Hence, the platform provides a challenge and leaderboard game elements for participants which can be defined as gamification looking at the study made by Çeker and Özdamlı (2017). Another reason is not to use all of the game elements in the system. This platform is only using two aforementioned game elements.

Psychologically the game has a mechanic for all player types. The story of the game is driving the car to get a girlfriend who is waiting in front of her house. Hence, players with cognitive perspective, perspective of interest and perspective of emotion are attracted to the game. Because the game has a clear goal and increases the positive feelings. Also, by providing the countdown, the game is giving feedback to players that is interesting for players with trait perspective and behaviorist learning

perspective. Moreover, the remaining times are stored locally to create a leaderboard, and it is the key feature that players with self-determination look for in a game.

In Figure 2.1, Figure 2.2 and Figure 2.3 are showing the game implemented. The survey is shown in the Figure 2.2.

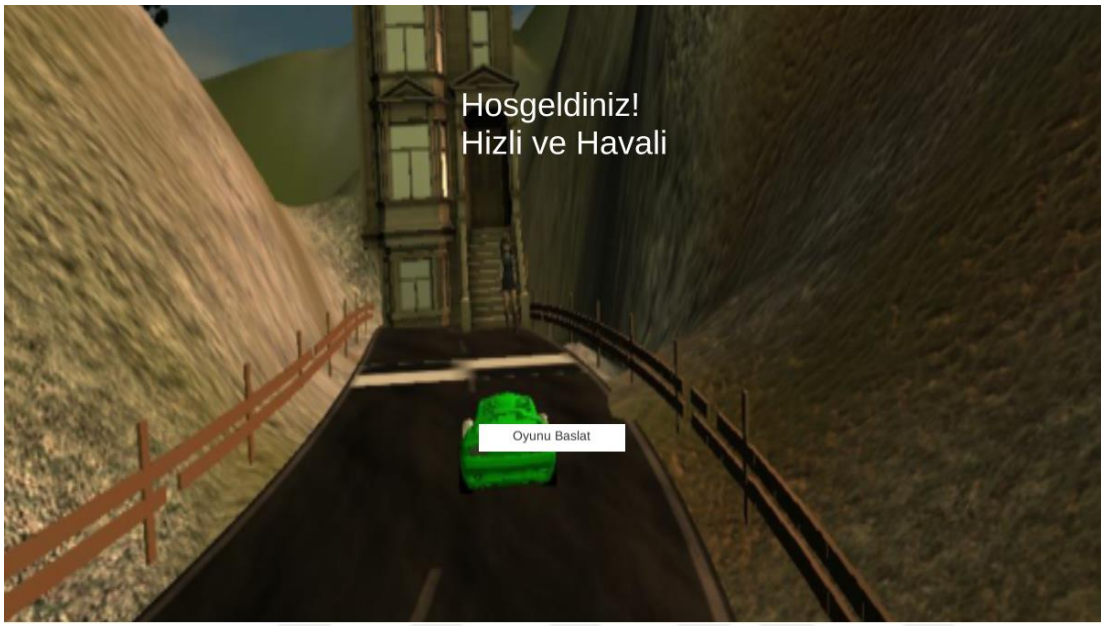


Figure 2.1: Starting of the game.

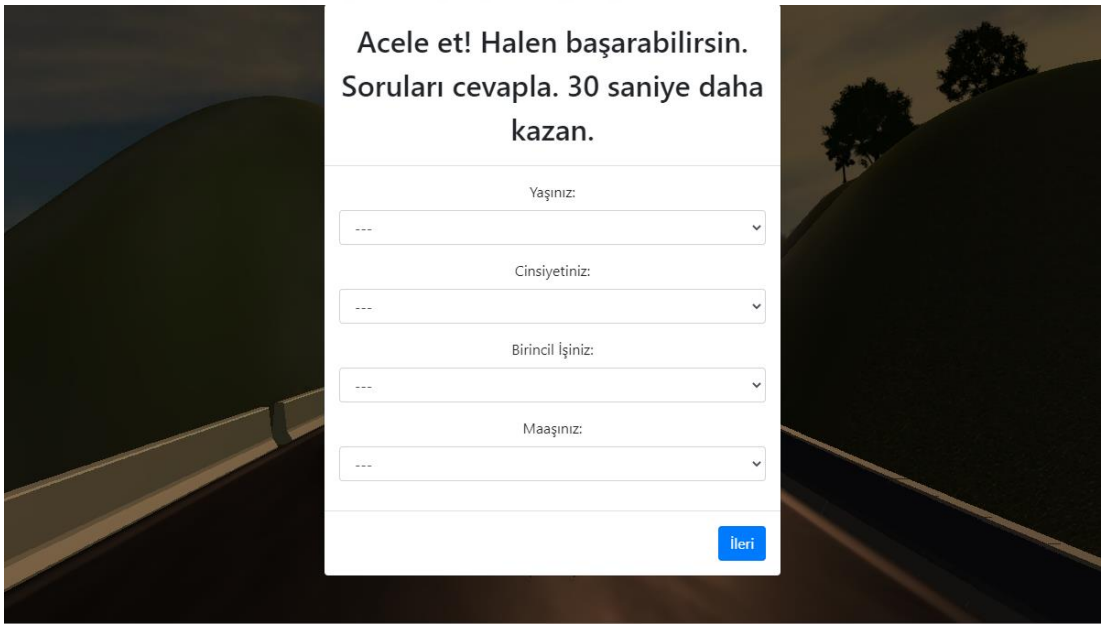


Figure 2.2: Survey popup when time is up.

Figure 2.3: End of the game.

3. METHODOLOGY

Social media is used to attract participants to the game. Participants are grouped to flows of the game.

G1. Optional demographic questions before the game followed by optional private questions inside the game

G2. Optional demographic questions before the game followed by private questions inside the game

G3. Optional demographic questions and optional private questions inside the game

G4. Optional demographic questions and private questions inside the game

There are two sets of questions in the experiment. First set is the demographic set that is used to show diversity in participants based on age, gender, job and salary. The second set is about private questions regarding gamification elements in real life like coffee tickets or supermarket cards. Also, for the privacy part, participants asked whether they are open to share their private information with other people.

There are three hypotheses for this experiment. First two hypotheses are to check if gamification is a possible reason for data collection violation. The last hypothesis is just evaluating the awareness of people about gamified environments.

H1. The total number of answers supplied by G2 and G4 should be higher than the total number of answers supplied by G1 and G3. This indicates that forcing players to answer with mandatory private questions results in more private data.

H2. The total number of answers supplied by G3 and G4 should be higher than the total number of answers supplied by G1 and G2. This indicates that participants are motivated by the game to share their private data.

H3. There must be participants claiming they do not share their private data, but they change their mind and share their private data to get extra time in the game. This

hypothesis supports the research of Kim and Werbach (2016) as gamification is used as a manipulation tool.

Demographic questions in the survey are optional to answer. Because they should not be scary for participants to play the game. Participants in G2 and G4 are investigated in this direction to see if finishing a game is a motivator enough to share their private information. This flow is supporting the hypothesis H1.

Playing a game should be fun. Participants in G3 and G4 are experimented in this manner to see if playing the game is a good motivator to share private information. This flow is supporting the hypothesis H2.

Normally people are stable creatures without any intervention. If any participant of the survey changes an opinion and shares private information, then gamified setups can be a manipulator. This flow is also supporting the hypothesis H3.

4. RESULTS

The results are collected from 256 participants from four different groups. Also, results are aggregated even if collected data does not include the personal identifiers.

Figure 4.1 is showing demographic information of participants. They can leave demographic questions empty, but they mostly answered questions.

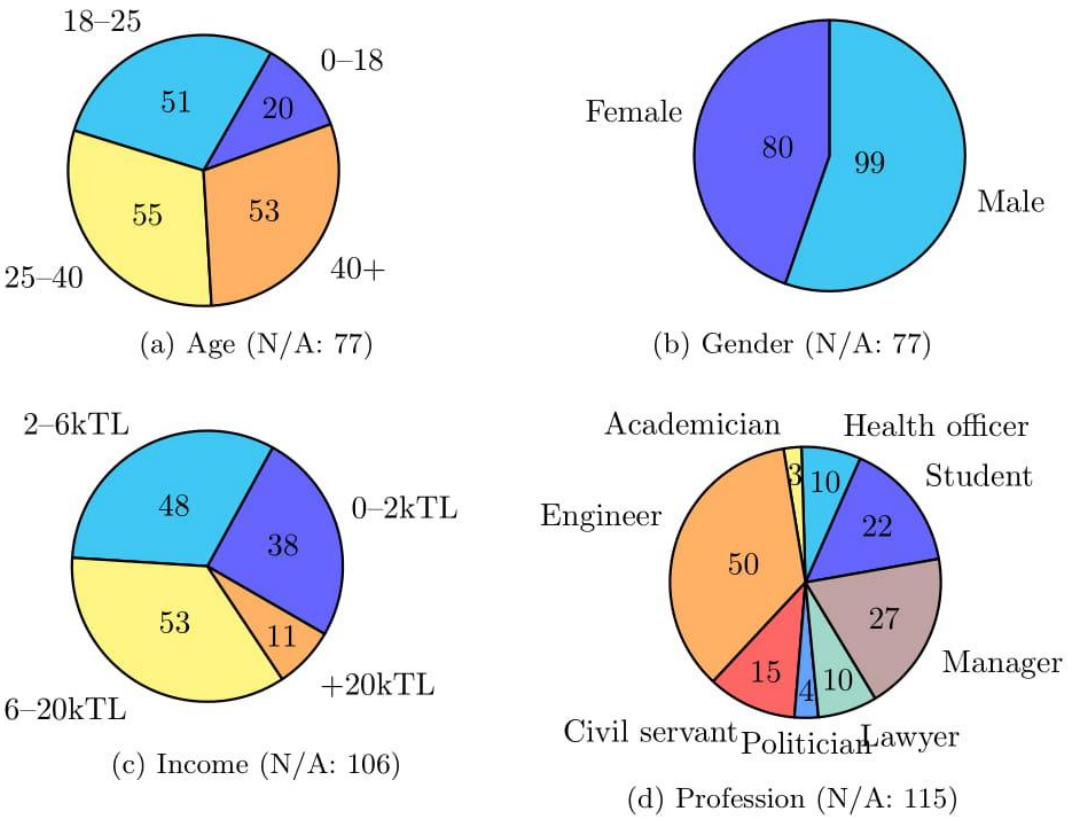


Figure 4.1: Demographic information of participants (Bilbey and Sandıkkaya, 2020).

Figure 4.2 consists of lots of information. The total number of participants, the number of participants by group, the number of the participants who left after seeing a survey question, the number of participants who answered demographic questions with ratio and the number of participants who answered private questions with ratio.

This figure is used to evaluate the validity of H1 and H2 hypotheses.

It can be seen from Figure 4.2 that the total number of participants in G3 and G4 are less than the total number of G1 and G2. Because participants of G3 and G4 want to play a game only and seeing some questions in the game makes them uncomfortable, so they left the game. It is totally normal for this situation. Another finding is that the total number of participants who play the game in G3 and G4 are higher than total number of participants in G1 and G2. Psychologically, participants in G1 and G2 might be disappointed about seeing some questions instead of game as they visit the application to play the game. Nevertheless, the total number of participants of each group are the same initially, so the bias regarding participation can be eliminated.

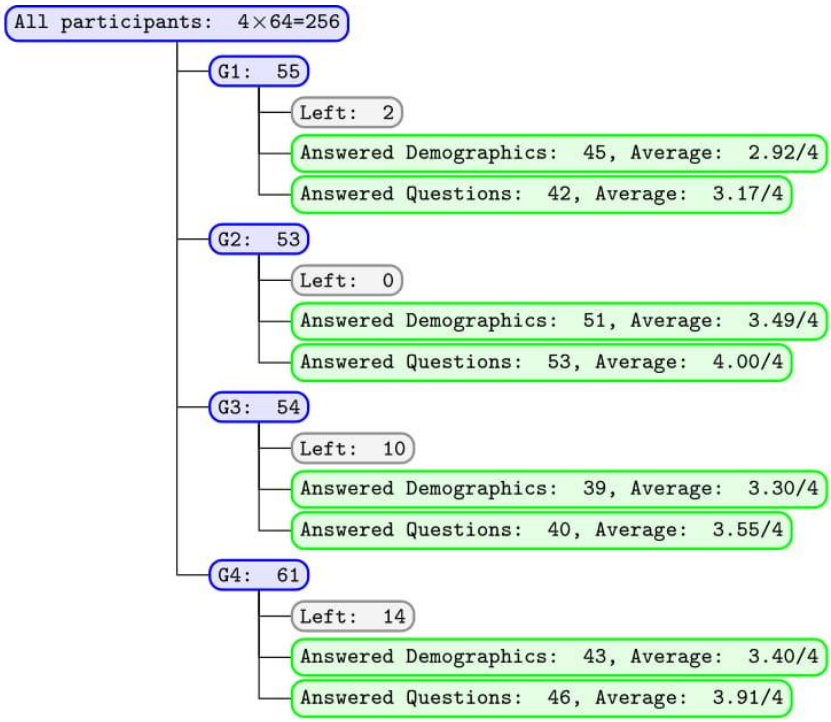


Figure 4.2: Reactions of participants to survey questions (Bilbey and Sandıkkaya, 2020).

The private questions in the survey can be seen below.

Q1. Do you prefer to share your personal information?

Q2. Do you use loyalty cards of coffee shops (E.g., Coffee franchise card to have one cup of coffee for free after ten purchases)?

Q3. Do you use supermarket loyalty cards for discounted purchases?

Q4. Would you like to share your personal information when you get a service in return?

Figure 4.3 shows the demographic distribution of participants against Q1. People older than 25 are trying to protect themselves from privacy violations. Also, women tend to share private information quicker than men. Looking at income levels, people sharing private information earn more. Moreover, engineers are protecting themselves from private information leaks.

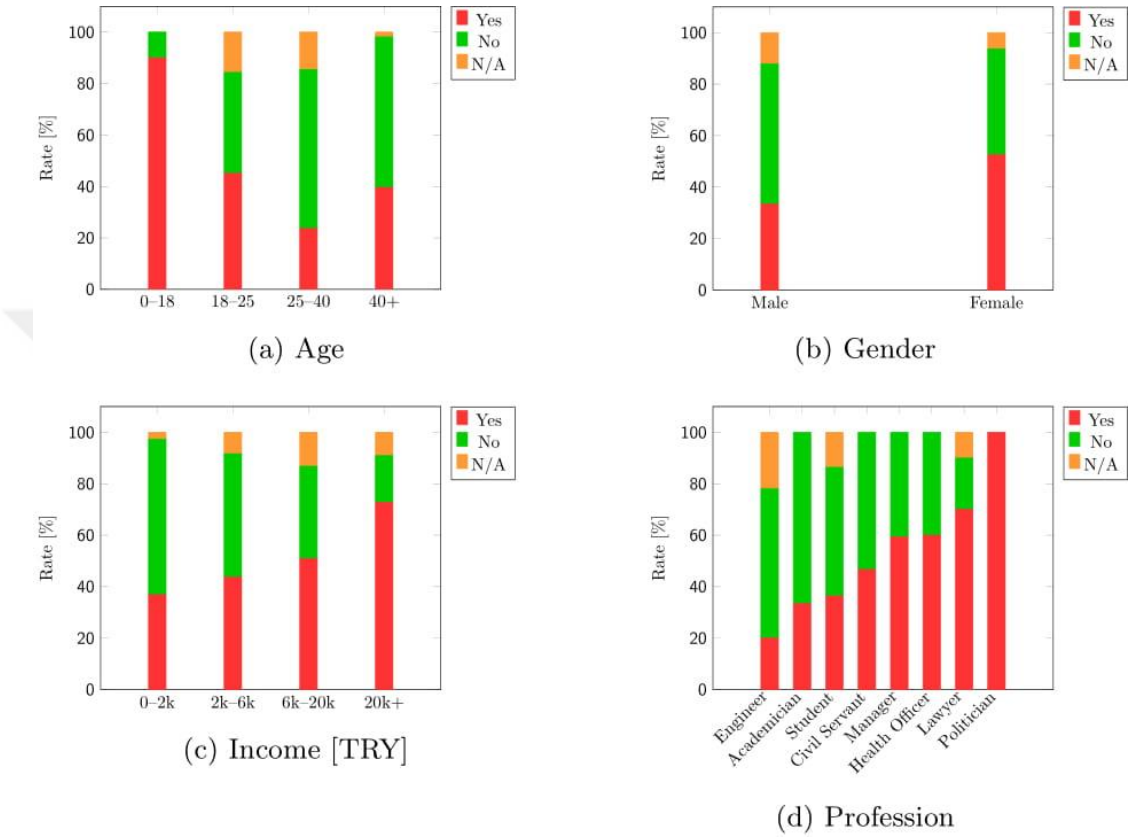


Figure 3.3: Willingness to share private information (Bilbey and Sandıkkaya, 2020)**.**

Figure 4.4 includes answers for Q2. People in the age range of 0-18 are using gift cards more than others. Women prefer to use gift cards more than men. The income range from 6k-20k is the group of participants that use gift cards the most. For the professional side, lawyers are using gift cards the most.

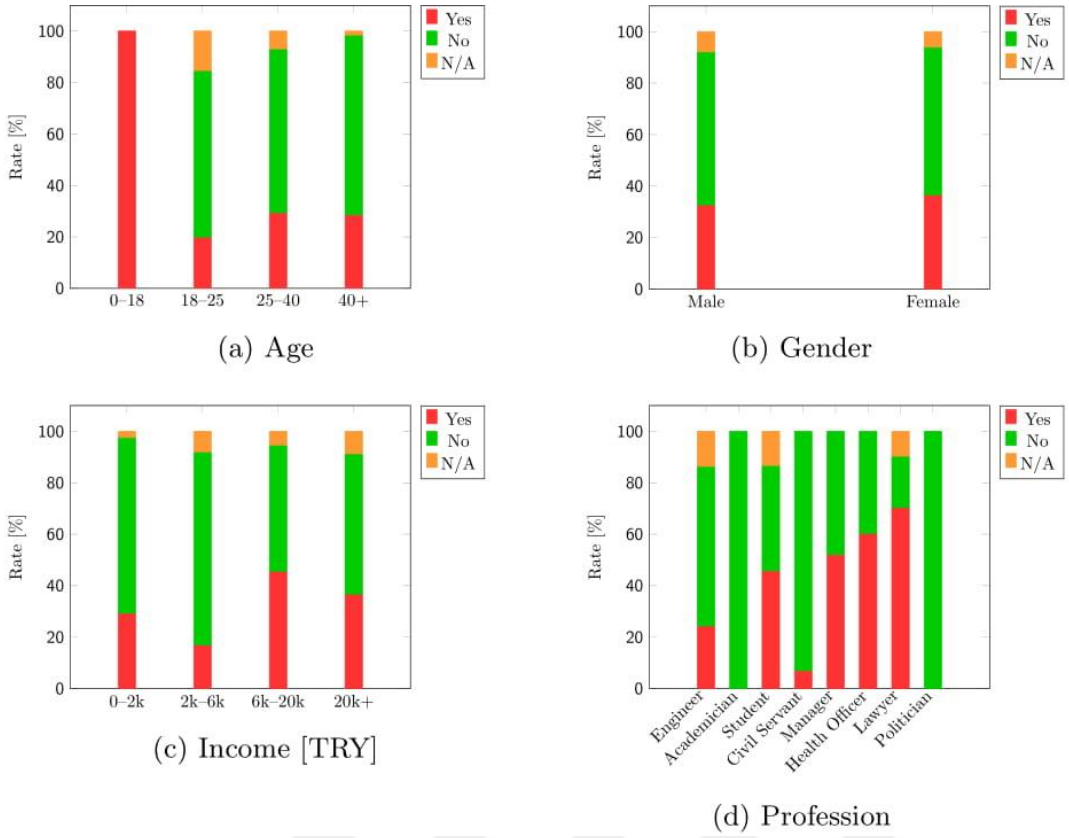


Figure 4.4: Gift card usage of participants (Bilbey and Sandıkkaya, 2020).

Figure 4.5 shows the demographic distribution of participants regarding Q3. People older than 25 are using discount cards more often than others. Men prefer to use discount cards more than women. People earning more than 20k tend to use discount cards more. Also, all politicians in the experiment are using discount cards.

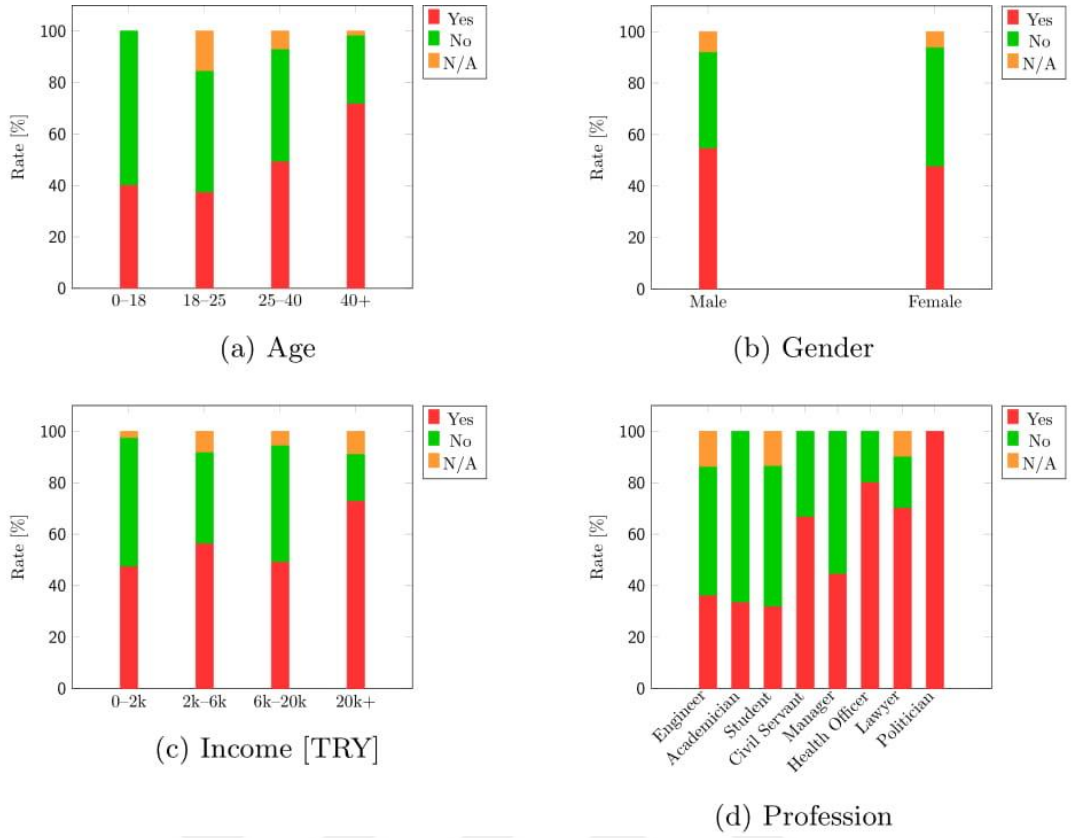


Figure 4.5: Discount card usage of participants (Bilbey and Sandıkkaya, 2020).

According to Figure 4.6, 0 between 18 ages shares their private information more than other groups. Also, women prefer to share more private data comparing men. People earning more than 6k are sharing private data to get benefits. Lawyers and managers are mostly sharing their private information with others more than other professions.

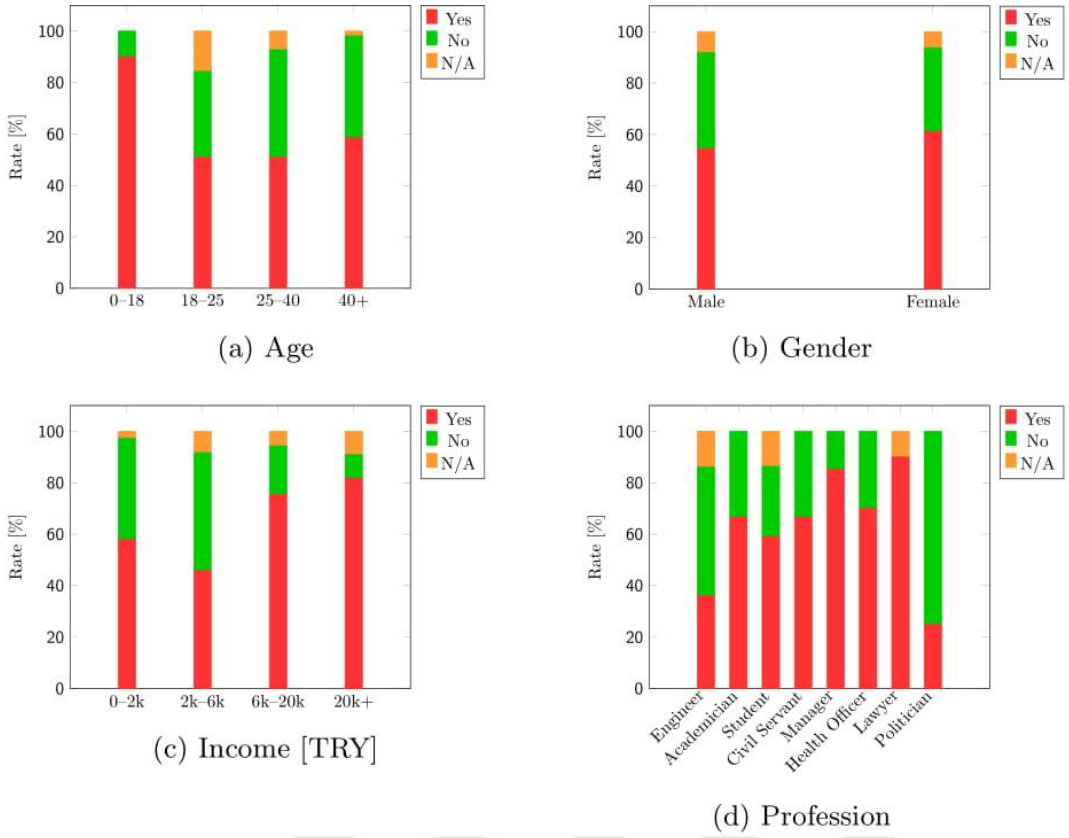


Figure 4.6: Participants open to share private information to get benefits (Bilbey and Sandıkkaya, 2020).

The total number of personal answers are calculated to show hypotheses are valid. The answers per group as follows:

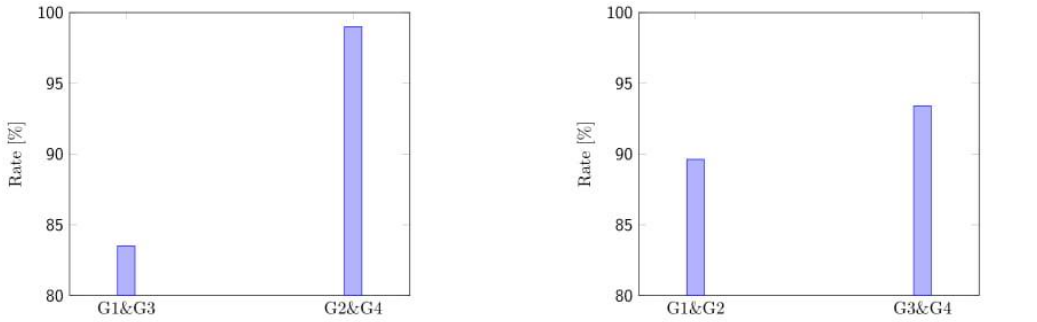
G1 168 questions answered considering the total number of 212

G2 212 questions answered considering the total number of 212

G3 156 questions answered considering the total number of 176

G4 184 questions answered considering the total number of 188

Looking at Figure 4.7.a, G2 and G4 have more total number of answers than G1 and G3. It is supporting the H1 hypothesis that forcing people to share more private data works. Also, the total number of answers in G3 and G4 are higher than G1 and G2 in Figure 4.7.b. It is expected to validate the hypothesis H2. Hence, the game motivated more people to share their private data.



(a) Effect of sheer enforcement (b) Effect of sheer gamification

Figure 4.7: Ratios of sharing private data according to motivators (Bilbey and Sandıkkaya, 2020).

All participants in G2 gave their private information, so it can be a case that they wanted to finish the game so much that they did not care about their private information.

To validate the last hypothesis H3 which is checking whether any participant changed the opinion and shared private information. It is found that 99 participants from 115 participants changed their mind so that they can continue playing. The total number is calculated by total participants who played the game in G2 and G4. Also, distribution of participants who changed their mind according to demographics can be seen on Figure 4.8. It shows 86% of participants are affected by a gamified environment. Another interesting result is that 100% of participants of G2 changed their mind to continue the game.

This experiment is made to show that people are careless about their private information. Also, they are more open to the idea of sharing if they can get any benefits. Another interesting result is that they are changing their minds to get rewards that gamification supplies.

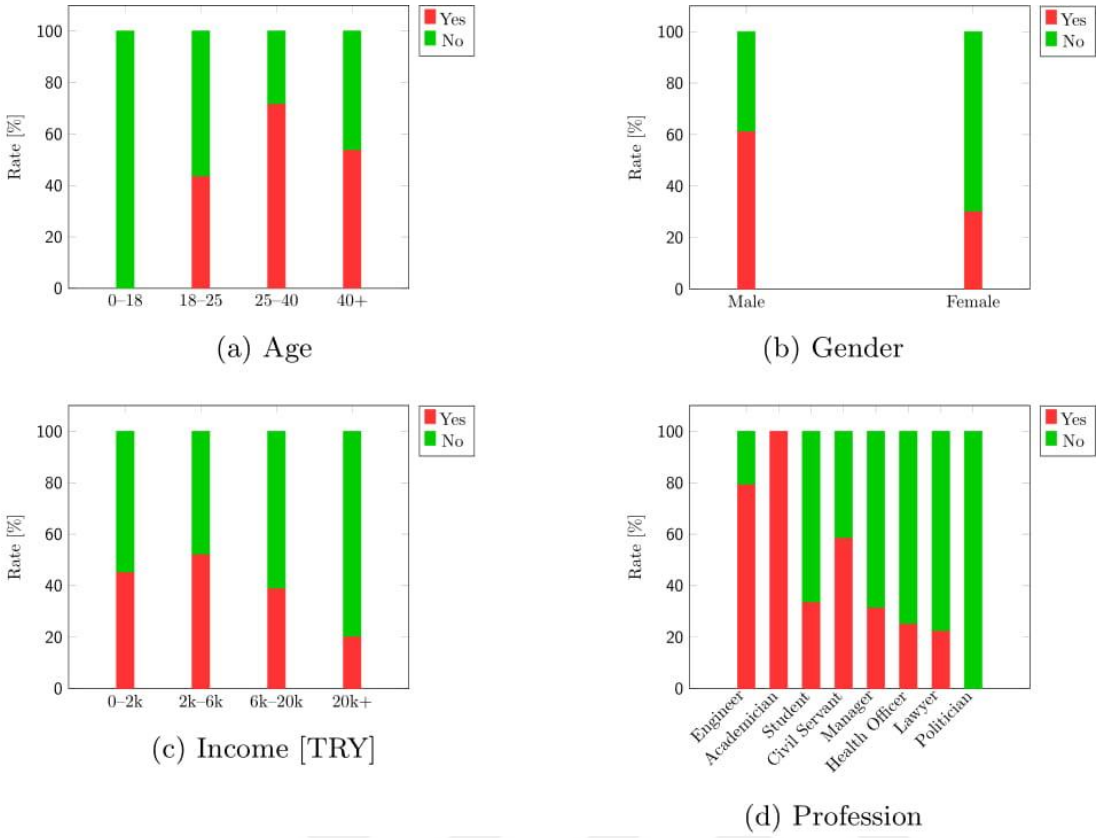


Figure 4.8: Distribution of participants who changed their minds.

5. DISCUSSION

The results are revealing that the number of participants from different demographic backgrounds is evenly distributed to groups. Hence, the differences in statistics can be eliminated. It can be said that participant bias is negligible for this experiment.

Another interesting finding is that most participants easily shared their demographic information. Moreover, they sometimes changed their mind to collect rewards from a gamified environment. It is an indicator that gamification can be used to manipulate people.

The findings about gamification effects on genders are like Conaway and Garay (2014). They found that women are affected more from gamified businesses, and looking at the results part, this study supports this fact.

Another demographic result of the survey is akin to the result of the study made by Brittner and Shipper (2014). 0-25 years participants are more open to gamified environments and affected by them. The interest rates are decreasing when participants get older.

Results are in the line of the study of Walz and Deterding (2015) regarding private data collection in HealthSeeker application. It is easier for people to collect private data using gamification. The collected data could be sold or used maliciously.

The results are showing the best results when a participant just played the game first, then saw the mandatory private questions. The participants are in this group, and they 100% shared their private information. This setup is used by lots of legal or illegal organizations to obtain private data. Kim and Werbach (2016) presented a similar result that gamification can be a manipulation tool.

To sum up, individuals sometimes do the actions they do not want to get a reward in the gamified environments. There should be regulatory forces to fight against harmful usage of gamification, as the detection of harmful gamification is harder than it seems for individuals.

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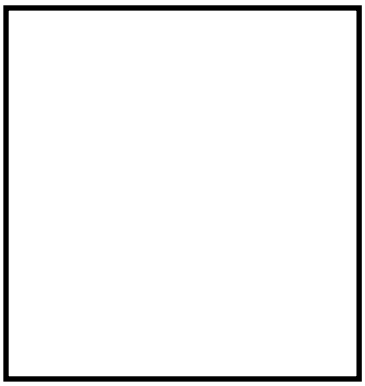

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