KADİR HAS UNIVERSITY
SCHOOL OF GRADUATE STUDIES
PROGRAM OF NEW MEDIA

A SYSTEM MODEL PROPOSAL IN WHICH HUMAN CREATIVITY MEETS WITH MACHINE LEARNING COPING WITH SMOKING CRAVINGS

DAMLA PARTANAZ

SUPERVISOR: ASSOC. PROF. LEVENT SOYSAL

MASTER'S THESIS

ISTANBUL, AUGUST, 2019

A SYSTEM MODEL PROPOSAL IN WHICH HUMAN CREATIVITY MEETS WITH MACHINE LEARNING COPING WITH SMOKING CRAVINGS

DAMLA PARTANAZ

SUPERVISOR: ASSOC. PROF. LEVENT SOYSAL

MASTER'S THESIS

Submitted to the School of Graduate Studies of Kadir Has University in partial fulfillment of the requirements for the degree of Master's in the Program of New Media.

ISTANBUL, AUGUST, 2019

I, DAMLA PARTANAZ, hereby declare that;

- this Master's Thesis is my own original work and that due references have been appropriately provided on all supporting literature and resources;
- this Master's Thesis contains no material that has been submitted or accepted for a degree or diploma in any other educational institution;
- I have followed "Kadir Has University Academic Ethics Principles" prepared in accordance with the "The Council of Higher Education's Ethical Conduct Principles"
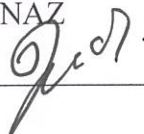
In addition, I understand that any false claim in respect of this work will result in disciplinary action in accordance with University regulations.

Furthermore, both printed and electronic copies of my work will be kept in Kadir Has Information Center under the following condition as indicated below

The full content of my thesis/project will be accessible only within the campus of Kadir Has University.

The full content of my thesis/project will not be accessible for 2 years. If no extension is required by the end of this period, the full content of my thesis will be automatically accessible from everywhere by all means.

DAMLA PARTANAZ

_____

23.08.2019

KADIR HAS UNIVERSITY
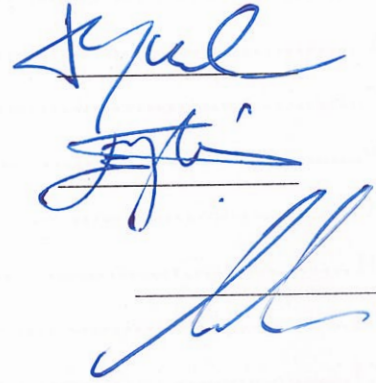
SCHOOL OF GRADUATE STUDIES

ACCEPTANCE AND APPROVAL

This work entitled **A SYSTEM MODEL PROPOSAL IN WHICH HUMAN CREATIVITY MEETS WITH MACHINE LEARNING COPING WITH SMOKING CRAVINGS** prepared by **DAMLA PARTANAZ** has been judged to be successful at the defense exam held on **23.08.2019** and accepted by our jury as **MASTER THESIS**.

APPROVED BY:

Assoc. Prof. Levent Soysal (Advisor)

Assoc. Prof. Eylem Yanardağoğlu

Assoc. Prof. Erkan Saka

I certify that the above signatures belong to the faculty members named above.

_____

(Title, Name and Surname)

Dean of School of Graduate Studies

DATE OF APPROVAL: (Day/Month/Year)

TABLE OF CONTENTS

A SYSTEM MODEL PROPOSAL IN WHICH HUMAN CREATIVITY MEETS WITH MACHINE LEARNING COPING WITH SMOKING CRAVINGS

ABSTRACT

PARTANAZ, DAMLA. *A SYSTEM MODEL PROPOSAL IN WHICH HUMAN CREATIVITY MEETS WITH MACHINE LEARNING COPING WITH SMOKING CRAVINGS*, MASTER'S THESIS, Istanbul, 2019.

Quitting smoking is hard, yet preventing relapse can be even harder. During those craving moments, urges to smoke may be the determining factor as to whether a smoking quitter will relapse or not. I researched the question "what could be done at craving moments in order to resist to smoke?" and spotted that the things that can be done/thought, at the craving moments instead of smoking, can vary from person to person and even from one craving moment to another craving moment. So I figured out that some people can come up with "instant creative solutions with some design thinking approach to these craving moments". Actually, people are already doing this even if some of them are doing this unconsciously and do not look at those acts as "solutions". And if they do, those solutions -real world information- are not preserved as computable data. Thereupon I pursued the question: "how can I computerize these experiences and enable the exchange of those solutions between smoking quitters in an optimum way?". Drawing inspiration from this question I designed a system model. The designed system will (1) take solutions from smoking quitters for each craving moment they encounter and pass without smoking, and (2) give the optimum solution from collected solutions to the ones who need a solution at their craving moment. These solutions are on the edge of the smoking quitters' imagination and creativity. And the given instant solution- the recommendation- will be (1) personalized and also (2) suitable with that craving moment's characteristic 'features'. These solutions can vary just as the answers to these questions (a) "where?", (b) "while doing what?", (c) "with whom?", (d) "which emotion state?", and (e)"when?". I researched two topics: smoking cravings, machine learning. Then to better understand the users, I conducted a qualitative exploratory approach and in-depth interviews. In the light of the analysis of these interviews, I designed the conceptual model of the system model and lastly for the system-user interface design and as a data collection solution I designed and developed a chatbot named "Drop-it-at-t0_bot" on Telegram.

Keywords: Smoking cravings, Human-Machine collaboration, machine learning, system design, chatbot, design thinking, computational thinking, data collection

A SYSTEM MODEL PROPOSAL IN WHICH HUMAN CREATIVITY MEETS WITH MACHINE LEARNING COPING WITH SMOKING CRAVINGS

ÖZET

PARTANAZ, DAMLA. *A SYSTEM MODEL PROPOSAL IN WHICH HUMAN CREATIVITY MEETS WITH MACHINE LEARNING COPING WITH SMOKING CRAVINGS*, MASTER TEZİ, İstanbul, 2019.

Sigarayı bırakmak zordur, ancak tekrar başlamayı önlemek daha da zor olabilir. Aşerme anları, sigara içme dürtüsü, sigarayı bırakmış bir kişinin sigaraya tekrar başlayıp başlamayacağı konusunda belirleyici olabilir. "Sigara içmemek için aşerme anlarında neler yapılabilir?" sorusunu araştırdım ve sigara içmek yerine aşerme anlarında yapılabilecek / düşünülebilecek şeylerin kişiden kişiye ve hatta bir aşerme anından bir aşerme anına farklı olabileceğini farkettim. Ve bazı insanların "bu aşerme anlarına tasarımsal düşünme yaklaşımıyla anlık yaratıcı çözümler" bulabileceklerini anladım. Aslında, bunu zaten yapıyorlar. Ancak bazıları bunu bilinçsizce yapıyor ve bu eylemlere "çözüm" olarak bakmıyorlar. Ayrıca öyle baksalar bile, bu çözümler hesaplanabilir takip edilebilen veriler değillerdir. Bunun üzerine şu soruyu sordum: "Sigarayı bırakmış kişiler arasında bu deneyimlerini/çözümlerini optimum şekilde nasıl sirküle edebilirim?". Sonra bir sistem modeli tasarladım. Tasarlanan sistem (1) karşılaştıkları ve sigara içmeden geçirdikleri her aşerme anı için kişilerin buldukları/uyguladıkları çözümleri alacak ve (2) toplanan çözümlerden aşerme anında çözüme ihtiyaç duyanlara en uygun çözüm sunacaktır. Bu çözümler sigarayı bırakanların hayal gücü ve yaratıcılığının sınırındadır. Ve verilen öneri (1) kişiselleştirilmiş ve ayrıca (2) kişinin içinde bulunduğu aşerme anının özelliklerine uygun olacaktır. Bunlar, (a) "nerede?", (b) "ne yaparken?", (c) "kiminle?", (d) "hangi duygu durumunu?" ve (e) "ne zaman?" sorularının cevapları olabilir. İki konuyu araştırdım: sigara aşermeleri ve makine öğrenmesi. Sonra kullanıcıları daha iyi anlamak için, nitel bir keşif yaklaşımı ve derinlemesine görüşmeler yaptım. Bu görüşmelerin analizleri ışığında, sistem modelinin kavramsal modelini ve hem veri toplama çözümü hem de kullanıcı-sistem arayüzü çözümü olarak bir chatbot tasarladım ve geliştirdim.

Anahtar Sözcükler: Sigara aşermesi, İnsan-Makine işbirliği, makine öğrenmesi, sistem tasarımı, chatbot, tasarım düşüncesi, hesaplamalı düşünme, veri toplama

ACKNOWLEDGEMENTS

To my parents

LIST OF FIGURES

1. INTRODUCTION

I designed a system model in which human creativity meets with machine learning to help cope with smoking cravings. I focused on smoking quitters and their challenges on not relapsing. Quitting smoking is hard, but keeping away from relapsing can be even more problematic for quitters. Those craving moments, smoking urges may be a determinant as to whether a smoking quitter will relapse or not. I researched the question "what can be done at craving moments in order to resist the urge to smoke?" and encountered -even there are same generic answers like breathing, drinking water etc. in most sources- that the things that can be done/thought, at the craving moments can vary from person to person and even from one craving moment to another craving moment. I figured out that some people can come up with "instant creative solutions with some design thinking approach to these craving moments". Actually, they are already doing this. But some of them are doing this unconsciously and do not look at those acts as "solutions". Also even if they do, they do not share these solutions instantly, so this behaviour is not traceable and is not preserved as knowledge for others to use. Thereupon I pursued the question: "how can Icomputerize these experiences and enable the exchange of those solutions between smoking quitters in an optimum way?". How would I achieve that? When a smokingquitter encounters a craving moment and pass that without smoking, I question what did they do at that moment and whatever their answer is I call thoseactions as "the solution of that craving moment for that person". So, the designed system will (1) take solutions from smoking quitters for each craving moment they encountered and passed without smoking, and (2) give the optimum solution from collected solutions to the ones who need a solution at their craving moment. The collected solution can be anything that lets them get through the craving moment without smoking eg. eating banana, doing a handstand, looking at the sky. These solutions are on the edge of the smoking quitters' imagination and creativity. And the given instant solution- the recommendation- will be (1) personalized and also (2) suitable with that craving moment's features. These can be altered such as the answers to these questions (a) "where?", (b) "while doing what?", (c) "with whom?", (d) "which emotion state?", and (e) "when?". So, regarding those craving moment's

1

defining features, the recommendations will be offered by the system will be different. For example, if a person is with their boss in a meeting then the recommendation will probably not be "doing push up", again if they are with their friends at a bar or sitting alone while feeling stress, the recommendation will be different. How would it achieve that? First of all, the solutions will be collected with their own craving moments' features. Again, before offering the recommendation the craving moments' features will be questioned. A recommendation system will be built with machine learning. The collected solutions will be the data to feed the ML model for training. Those craving moments' features will be the some of the features which will be determined by the system and the feature engineers. What about data collection, how would the system collect all those solutions? When a smoking quitter come up with a solution and successfully defeat the smoking urge with it, it is not detectable from outside. Those people do not leave any breadcrumbs or digital actions which could be traceable. So, the person itself should self-track these solutions and share with the system. But because system takes solutions along with the craving moments features and details such as where, with whom etc. this process should be easy. How could that be achieved? I came up with a chatbot idea. The users can easily share their solutions along with their craving moments' features more or less in a minute on a mobile messaging application called Telegram.

1.1 SIGNIFICANCE AND CONTRIBUTION

Amongst many features of this research and designed system model, here, I will list the three most important aspects.

Firstly, I have not found any existing application similar to the system model I have designed. There are some personalized approaches but they do not focus on craving moments' features and neither they collect solutions from their users nor give personalized recommendations - at the same time tailored to the needs of the craving moment -again to their users when they need, like the model I designed.

Secondly, this designed system model creates a platform to create and encourage "idea(solution) flow". Pentland highlights the importance of idea flow in his recent book about social physics and states that with the right idea flow, group members can make better decisions compared to when they make individual decisions (2014). This idea flow brings people new behaviors, even without the dangers or risks of experimenting with them beforehand (Kleinberg and Strogatz, 2009 as cited by Pentland, 2014).

Thirdly, this model combines human's creativity to overcome problems, with AI's strength in data processing, to cope with a social problem by helping individuals with the recommendations/solutions which are produced and shared by those very individuals. Basically, it can be a great example of a Human-human collaboration via human-machine collaboration.

1.2 FUTURE STUDIES

Even though I could try the first prototype with limited users, my next goal was to create for every undesired behavior (spending too much time watching films or on social media, drinking too much, biting fingernails, thinking obsessively about a person etc) an agent and to see whether those agents can feed each other. For example; whether a solution that was generated by a smoking quitter in order to resist the smoking urge could work as a recommendation for a heavy social media user whose aim is to resist social media craving.

1.3 CHAPTER OUTLINES

In chapter 2, I present my research on the topic of smoking cessation and relapsing. I looked for which approaches to the craving moments are appropriate in order to prevent relapsing and showed the potential efficiency of the designed system model's approach on this point. In chapter 3, I handled machine learning theme, mentioned recommendation system models and chatbots as well as their implementations. In chapter 4, (a) I first discuss about interviews I have conducted. Then (b) I explained the conceptual design of the system model and lastly

(c) I explained the chatbot which I came up with as a data collection method as well as user-system interface design and showed the user experience results of the prototype I have built. Lastly, in chapter 5, I presented a general summary of the model and added some perspectives on privacy matters. I also talked about the limitations I have encountered, future research in which I aim to elevate it to "undesired behavior models" and significance of the research with all its uniqueness.

2. SMOKING RELAPSING PROBLEM

In this chapter, firstly I will maintain the hardness of smoking cessation and preventing relapsing to highlight why I picked this topic and aimed to design a system model which is also open for any kind of existing methods in this subject. After that, I will share the related literature on this subject and support designed system model's way of handling the relapsing problem and approaching the craving moments. And lastly, I will share some of the mobile and web-based applications created for the purpose of quitting smoking.

At the point we have arrived today, it is no longer necessary to talk about the harmful effects of smoking. Cigarette smoking was once reflected as a good and healthy thing especially with advertisements (Bonnie RJ et al, 1994), but now its dangers are well known even among smokers and it is stated as the leading preventable cause of death (World Health Organization, 2019; U.S. Department of Health and Human Services, 2014; Samet, 2013). This research's aim is not about solely propagating quitting smoking though. Smoking considered as probably most problematic addiction (Baumeister R.F., 2017). It can even be considered harder to quit by comparison to other drugs such as heroin, because it is socially acceptable and accessible(X). In smoking cessation there are many treatment methods. Nicotine replacement therapy, pharmacotherapy, cognitive behavioral therapy, motivational interviewing can be listed as main methods of this subject. But even with those smoking cessation treatments relapse can be seen happening (Hays et al, 2001) or even after a prolonged abstinence (Hajek P. et al, 2013; Wetter DW et al, 2004). Therefore the designed system is intended for use by anyone with and without professional support. Because there is not any kind of distinction on this subject, the collected solutions could have been thought up by individuals on the spot or they can be methods or techniques from existing literature given by professionals. So, this model does not exclude any existing methods but also encourages people to come up with entirely new solutions at the instant of craving to smoke.

2.1 APPROACHING TO THE CRAVING MOMENT

Studies have shown that approaching the craving moment can be critical. If the smoking quitter's approach to these moments are negative, relapse can be seen within a month (Nosen and Woody, 2014). Therefore, I wanted to design a system where individuals would not have to suppress their craving and gamificate it instead of having a negative outlook. It is like lemon/lemonade analogy. Craving moment is considered like lemon. It is hard to resist, and yet it is unpleasant to encounter with it. But with adapting this system model's approach through these craving moments there will be a possibility to look at those moments as a chance to make delicious lemonade with them. They can look at the problem out of the box and come up with instant, creative solutions. Again, another study showed that suppressing these cravings can result in relapsing (Erskine, 2010). In contrast of this Rogojanski et al have conducted another study and showed mindfulness based approach's significance in their study investigated the effectiveness of a brief suppression compared to mindfulness-based strategy (2010). According to their findings, both of those approaches can achieve increased self-efficiency in coping with cravings but mindfulness approach brings additional benefits -such as a decrease in depressive symptoms, as well as a marginal reduction in the level of nicotine dependence (Rogojanski et al, 2010). The designed system model approach to the craving moment have some similarities with mindfulness approach. The designed system model- which I will explain in more in detail in Chapter 4- handles this relapsing problem by focusing only on a single craving moment at a time.

It does not matter how many urges the quitter will encounter; the system encourages users to come up with a solution only for that particular moment, or if they cannot find a way to cope with their craving they can ask for a recommendation again just for that particular moment. There will be only one craving moment for the system. So, the system does not care if a person have slipped before. There are evidence which can prove significance of this approach, showing that after slip ups, people can get upset and relapse().

2.2 EXISTING APPLICATIONS

Rughiniş et al in their article assert that smoking cessation applications offer three frames (2014). First frame is that applications coach users through the quitting process. Secondly, these applications provide a playful environment to its users and reward them. Thirdly, the applications build online support for its users among ex smokers (Rughiniş et al, 2014).

An application called "Smotivator". This application tries to encourage its users by showing them how much money they save by not smoking. The system model which is intended to be designed and developed will not function like Smotivator. While the motivation of saving money can be an effective method in the short term usage, it will not be as effective in the long term. Because the planned application is aimed at long term smoking cessation, this method will not be used.

A popular application called "QuitBuddy". This application helps the user with tips and distractions to overcome cravings; has a tracking system to chart their progress and shows the user facts they need to understand the impact smoking has on their health. The games which should distract its users can be ineffective after several months of using this application. The games do not evolve or no new games are added. Also games cannot be appropriate for every craving moment or situation, such as in a meeting, at a club or with a friend.

I have not found any existed application like the system model I have designed, as I have researched. Text based messaging programs (SMS) like mHealth (Ghorai et al, 2013) are used as smoking cessation applications. But, including mHealth, most of them are designed for intervention and there are not any examples which collect solutions from its users only to recommend them again to its users, like the model I have designed.

Text2Quit, can be given as an example of automated, personalized mobile health program that sends text messages and e-mails. The text messages sent by this program are about medication reminding, relapse, peer ex-smokers' testimonials and educational material which are sent before and after the quit day (Abroms et al, 2012).

3. MACHINE LEARNING

In this chapter, firstly I will maintain machine learning definition in order to differentiate it from programming. Then I will talk about the importance of data on this subject and focus on recommendation systems, since the designed model will use real-time recommendation system. After that, I will explain chatbots also known as AI assistants, conversational agents, and give some special example of usages in various fields.

Through 50 years of research and development in artificial intelligence, now we have advanced machine learning services (Goodfellow and Mcdaniel, 2018). The advancement in technology in accordance with Moore's law, and with increasing abundance of data, machine learning has soared.

In situations where relationships between observations are not programmable, then machine learning approach can be used (Alpaydin, 2016). To achieve this, first of all, data should be collected. To train the machine learning model, there needs to be huge amount of data available. Applying machine learning on smoking cravings, which is too complex and because there are plenty of factors to trigger cravings, it is not programmable beforehand effectively. But with plenty of data with its labels to feed the designed ML model, the recommendation system can work effectively as we can gain much insight about this topic as well.

3.1. RECOMMENDATION SYSTEM

Recommendations are part of the personalized information, to recommend the user items that fits their expectations (Nabil, Elbouhdidi, and Yassint). "Item" is the general term used that corresponds to what the system recommends to users (Ricci et al, 2011). So, in the designed

system model I propose, items will be the solutions. Recommendation systems can be collaborative filtered, content based or hybrid. In content based recommendation systems natural language processing should be processed. In collaborative filtered systems, users' past interactions matter.

3.2. CHATBOTS

When it is asked to Bill Gates to select top 10 inventions that will change the world for better, he listed "Smooth-talking AI assistants" along with "custom cancer vaccines", and "carbon dioxide catcher" (Heo, 2019). Chatbots became so popular, we can see many examples in various fields. We can ask for their assistance to just chat, to consult about a health issue, to order pizza etc. One of the better examples would be Woebot. It is a nice a conversational agent which people can interact via Facebook Messenger in order to deliver Cognitive Behavior Therapy to young adults with depression and anxiety (Fitzpatrick KK et al, 2017). This chatbot was developed by Stanford AI researchers and Andrew Ng, one of the pioneers of this field, who joined the board of directors of the company (Knight, 2017).

Botler, another chatbot example, which provides free legal advice to immigrants, launched first as a FAQ chatbot that can answer immigration-related questions and then relaunched as a chatbot that can assist users through the entire process of immigration application (Erlick, 2017).

3.3 ETHICAL DIMENSION

We can see many benefits of ML in our lives about health, security, self-care, etc. But to do all these goodness, the ML model should be fed with so many data. It is not a problem, because data growth exponentially increases in every year and we have a term to define the amount of data such as "Big Data" for several years. And the combination of these ML and big data works so well, so frequently and so careless, now we have another new term such as

"AI Ethics". We encountered so many scandals about this issue. Some people gain, collect so many private or common data without any permission. Users do not have a clue, what those data collectors are up to with their data. Cambridge Analytica can be given as an example on this subject. It is not the only example of a scandal but probably the most famous one. So, so many Institute about AI Ethics developed so many principals to prevent this kind of scandals, protect individuals and make the systems more fairly. Getting permission from the user to collect their data and declare the aim to collect their data to the users beforehand have to be addressed definitely. "But what will happen if some people's lives depend on the health systems to be developed with those data?" asks Cansu Canca to point out the grey areas of this topic. On the other hand, after Gdpr(General Data Protection Regulations), which is applied in Europe, some think that Europe will be slowed down in AI Innovation.

The data which the system model I have designed is needed cannot be mined. Some people can look up this model as ineffective but it has a great potential to be an example about ai ethics. First of all, the data system needs do not mine from elsewhere. The users share their solutions by their initiatives and meanwhile convert those solutions into 0s and 1s. Secondly, the system does not collect other related data which can be the features of the solutions people share with the system such as location. Contrarily, the system asks the user about the data which can be the features of those data, when they share a solution with the system by their initiative. Yes, to recommend the system should be fed with a big amount of data and it is not possible to make it happen beforehand but this proves the importance of its users- the individuals- and shows that this system can not be developed without them. People are positioned in a high manner in this model and can be said to easily fort his model that it is human-centered. So it does not collect people's data behind them and get insights without them. And of course the aim is clear and the people with the same aim can come together. So we can summarize it as "the people "develop and share" data(solutions) on their "own initiatives" with the system with the "same purpose" (coping cravings) together".

4. RESEARCH DESIGN

Now it is time to go to the core: designing the system design. In order to do that I have needed to know this problem and the related personas more in detail. That's why I carried out a qualitative exploratory design approach. I conducted 1:1 in-depth interview with the smokers who have not quit ever, the people who quit smoking, the smokers who quit smoking and relapsed again and also the people who have not smoked ever. In light of this interviews' analysis, I designed the conceptual model of the desired system model. Then I designed a chatbot as user-system interface design and developed its prototype. I conducted a pilot study with this prototype first and then with the users' feedback I revised that chatbot. Then I get contact with the possible users from the people who I have interviewed with. Those were the people who quit smoking recently and having cravings and the people who did not quit smoking but do not smoke at their every craving moment. I told them this chatbot's aim, and tell them that they can use it if they pass any of their craving moments without smoking. Lastly, I interviewed with those users and get their feedback about this user interface design.

4.1 IN-DEPTH INTERVIEWS

4.1.1 Reason of preference and Participants

Although I was looking for a system model for craving moments only, I decided that my first step in my methodology should not be limited to craving but should be more comprehensive and detailed. Thus, I could only see if there was a point I had jumped by focusing on the moment of craving. I wanted to make these interviews 1:1, there could be more interaction, I could see the points I could jump while preparing the questions and make corrections and additions. In the same way, to better empathize, to hear the stories of those people, to see the

details, the difficulties they experienced, to see the scope and diversity of the problem and lastly examine their perception of the craving moments.
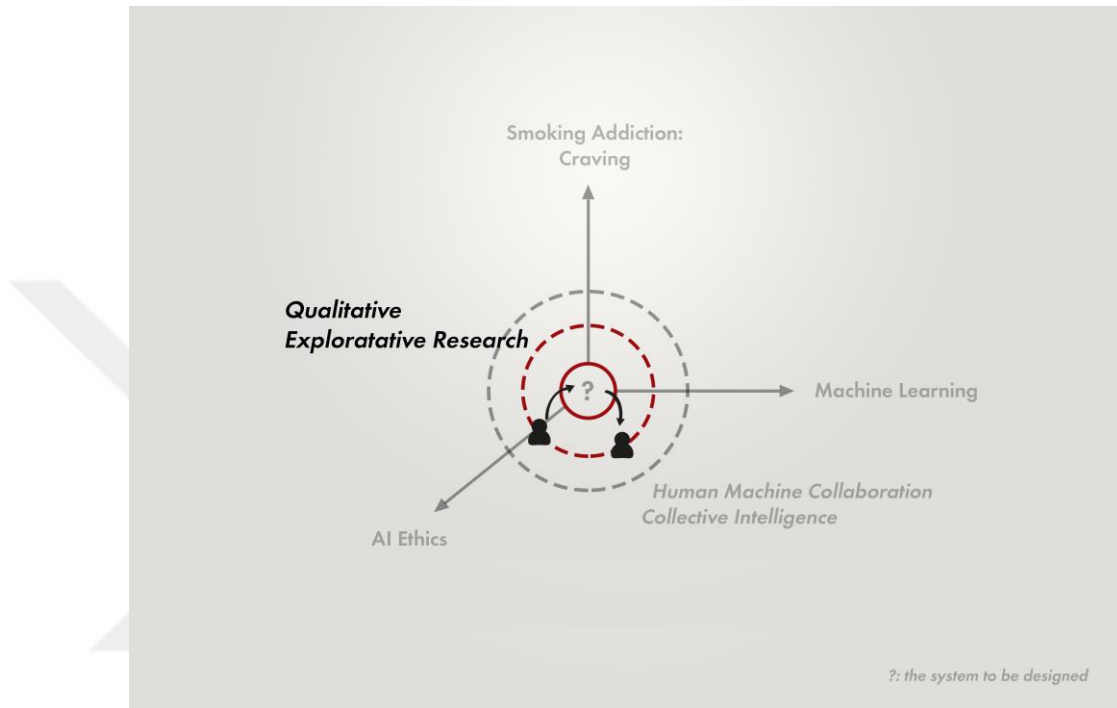
Figure 4.1

As I predicted earlier, during the interviews, I realized that the importance of in-depth interview and its contribution are very significant. Each person can give amazing answers to unexpected questions and can open new horizons. I also saw that it was a good decision to conduct in-depth interviews in order for the interviewees to understand the questions. They had difficulties answering some questions. Not caused by the way of asking questions but because they heard those questions and ask themselves for the first time. Although they had the answers, they were not aware of it. After some repetition of the same questions at different times, they were able to give the answers. But if these interviews were not conducted as in-depth, then answers could not be given to those questions. The questions I had to repeat in order for the interviewees to give answers properly were the questions about craving moments and their approach to these moments, as well as their mental models.

Seeing these questions unclear in these in-depth interview changed the way I would follow in the next step and I did not conduct any questionnaire online.

First of all, I planned to interview people who have quit smoking at least once. So the people who quit smoking as well as the people quit smoking then relapsed. All of the interviewees were university students and recent graduates, 19 to 28 years of age. Because of their mobile phone and social media usage habits, I thought this age range would be proper. The questions I have prepared include their relationship with smoking: their starting story to smoking, their smoking experiences, their craving moments, their cessation processes, their approach to the craving issue and what they can do to avoid smoking in the craving moments, and finally, after telling about my research project and its approach to craving, their thoughts on approaching cravings moments. After several interviews, I realized that I should conduct interviews also with the people who had never stopped smoking, and even people who had never started. But the way I have conducted the interviews with the smokers and nonsmokers were different. That is why they are given under different titles.

To find people who completely quit smoking (maybe relapsed again but currently a non-smoker) was difficult. I started conducting interviews with the people I knew at the university where I spent more than half of my day. And I asked every interviewer if they had any friends they knew who quit smoking. If they knew an ex-smoker, I wanted first to get permission from them to give me their contact numbers. Because there were few people who quit smoking at the University, every name was very important for me. Therefore, it is possible to say that I reached these people in the form of a snowball effect. Even then, there were few. That is why I also try to reach people outside of the University still in this age range (such as recent graduates from other Universities). Many of them would have relapsed again during the time passed in-between acquiring their contact information and conducting interviews. I was able to acquire their contact information because of their quitting decision till the time I try to conduct the interviews, they could have relapsed again.

I gave great attention to the interviews with the quitters. If they were recently quitters (less than a month) or even that a month has passed since they quit, but feel themselves fragile like if they feel urge to smoking when talking about smoking, then I

did not conduct the interviews even I got their contact numbers, because I take it very seriously, and do not want to tempt anybody to relapse. I did these interviews in a quiet indoor place. I recorded sound and took notes. I asked for additional questions (follow-ups) in the topics that I thought were necessary, and I also asked some questions several times at different times when I thought it was necessary.

I started with interviewing people I already knew. It was not difficult to find them because they had a large number of smokers. However, the highlights were highlighted as they did the interviews. I continued to interview by looking for more specific people in their light. Like those who went to the army. Besides, I asked the students who were not going to work in smoking places in school and were not engaged in a job and asked if we could make this brief interview. I took the interview immediately with the people who accepted the interview.

I conducted a shorter interview with the people who have not quit smoking. I used a small part of my other interview questions. It took 30 min. I did not do a voice recording. I took note of the important points in my notebook. In order to prevent any mistakes, I read each and every one of my notes and read them aloud. I had them sign the consent form immediately. If not, I'll tell you what the situation is. I couldn't use it. I did these interviews not in a quiet environment, but in open areas where participants could be comfortable and even smoke if they wanted.

I tried to pay particular attention to my approach to people who are currently smoking. I did not want to give them the impression that I was trying them to quit smoking. When I explained the purpose of the research, I emphasized that it was in order to help people who decided to quit smoking at their craving moments.

4.1.2. Content
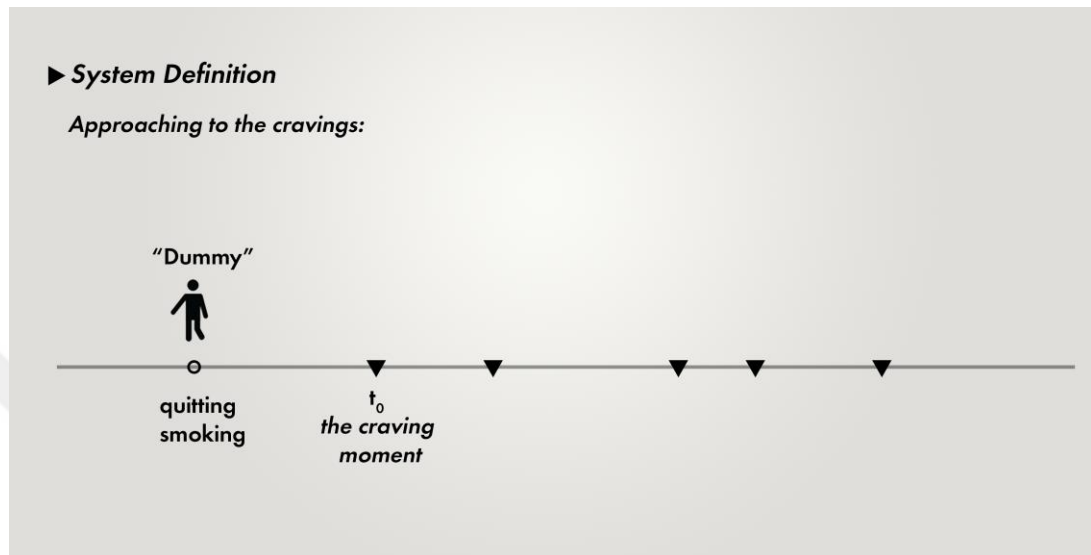
Figure 4.2

Before designing this system, I drew a timeline and put a cartoon character named "Dummy" as a smoking quitter (as a persona) on it. Then I marked critical steps: The first time Dummy smoked, as "the first cigarette": a cross, the time Dummy started smoking as "starting smoking" (Dummy defines this part as "addictively"): across, between the first cigarette and starting smoking: a line, then comes our starting point: the time Dummy quits smoking as " quitting smoking": a circle, between starting smoking and quitting smoking as "smoking experience": a line, then the first cigarette Dummy smoked as " first cigarette" (This could be happen): a cross, then starting smoking again as "relapse":a full circle (I have should dream the worst possible scenario), between quitting smoking and starting smoking again as "quitting experience": a line, then another quitting moment as "quitting smoking, the second": a cross, between starting smoking again(relapsing) and quitting smoking again as "smoking experience, the second": a line. This is the possibly most complex fractal's most tiniest part (quitting smoking-first cigarette-relapsing- quitting smoking again-the first cigarette-relapsing again)
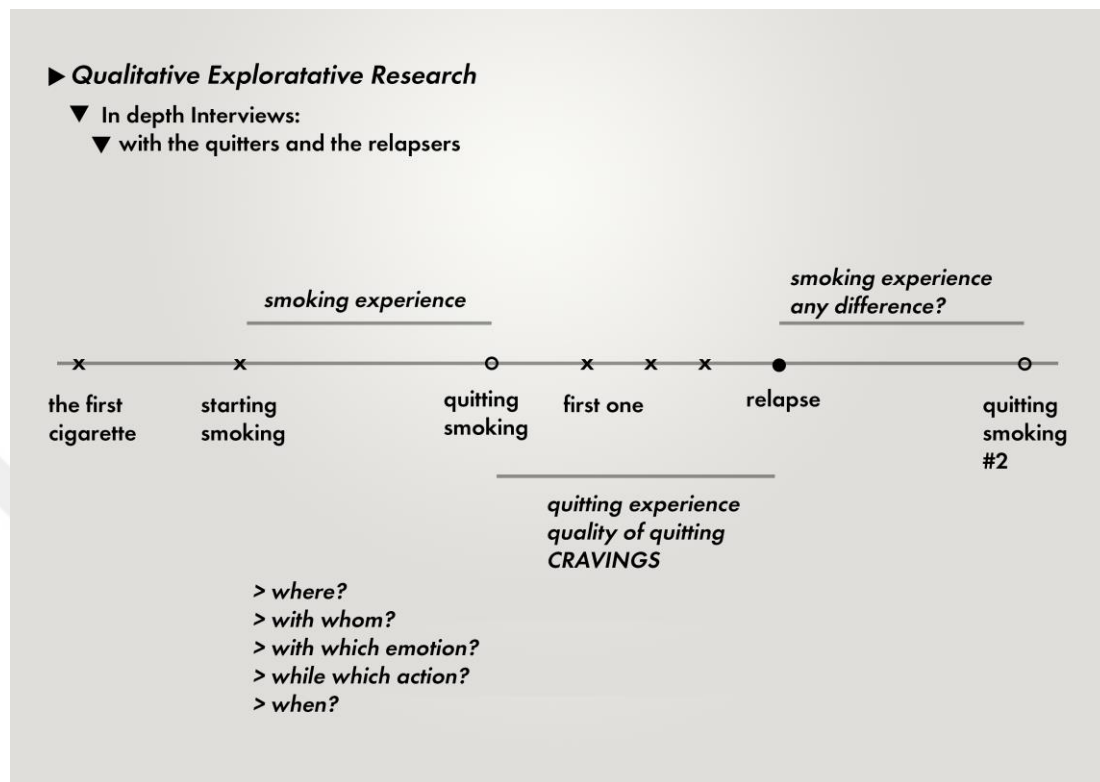
Figure 4.3

For the first cross "the first cigarette experience": I ask why and want him/her to explain that moment in details. When, during what age, and with whom? Did he/she know how to inhale a cigarette? Then the line: "between the first cigarette and starting smoking": I ask what? Did you smoke another? What happened? After that, the second but the deepest cross: "Starting smoking": I ask again: "why?" and want them to explain in detail. Then it comes to speaking the" smoking experience" part: I want them to explain where, when and with whom did they smoke? Which action did they smoke? With which emotion state did they smoke? And besides these, is there any other situation? After that comes the circle: "quitting smoking" - why and how did they quit and for what reason? Did they consult to a professional or a doctor? Did they take any drugs or take nicotine gums or patches by themselves? Afterward comes the line as "quitting experience" - did they change anything in their life? Was there anyone they do not meet, after quitting smoking? Or was there any place they do not go into after quitting smoking? And then comes the most crucial issue: cravings. Did they crave and how did they handle their cravings? What did they do, when they had the urge

to smoke? Thereafter I inquire: have they ever smoked in that period? If yes, then I ask why and try to learn kindly to describe that situation in more details. If they relapsed then again: why when and how? Was it right after that first cigarette or was it in the following days? If yes, then do they think that if they did not smoke that very first cigarette in their quitting smoking period, then could it be possible not to relapse? After relapsing questions, for "smoking experience," the second part comes the differentiation questions. These questions aim to understand whether there was any difference between this smoking experience and the first one. Do they smoke more or less? Do they smoke at the very same situations, or not? Lastly, if there is another quitting smoking moment then the fractal goes on. I asked these questions as I have explained in a timeline, in order to see their alterations, development or remaining the same -as well as to better understand their behavior models and their mental models.

After I have conducted several interviews with smoking quitters, I have realized that I should do exact same interviews with also the smokers who have not quit smoking ever. The beginning of the timeline is the same as the ex-smoker's timeline. It begins with "the first cigarette" as our first cross, then "starting smoking" the second mark, the period between the first cigarette and the starting smoking as the first line and the moment when I conduct that interview as the last cross as "now". Between "now" and the "starting smoking" is the part as a line as "smoking experience".
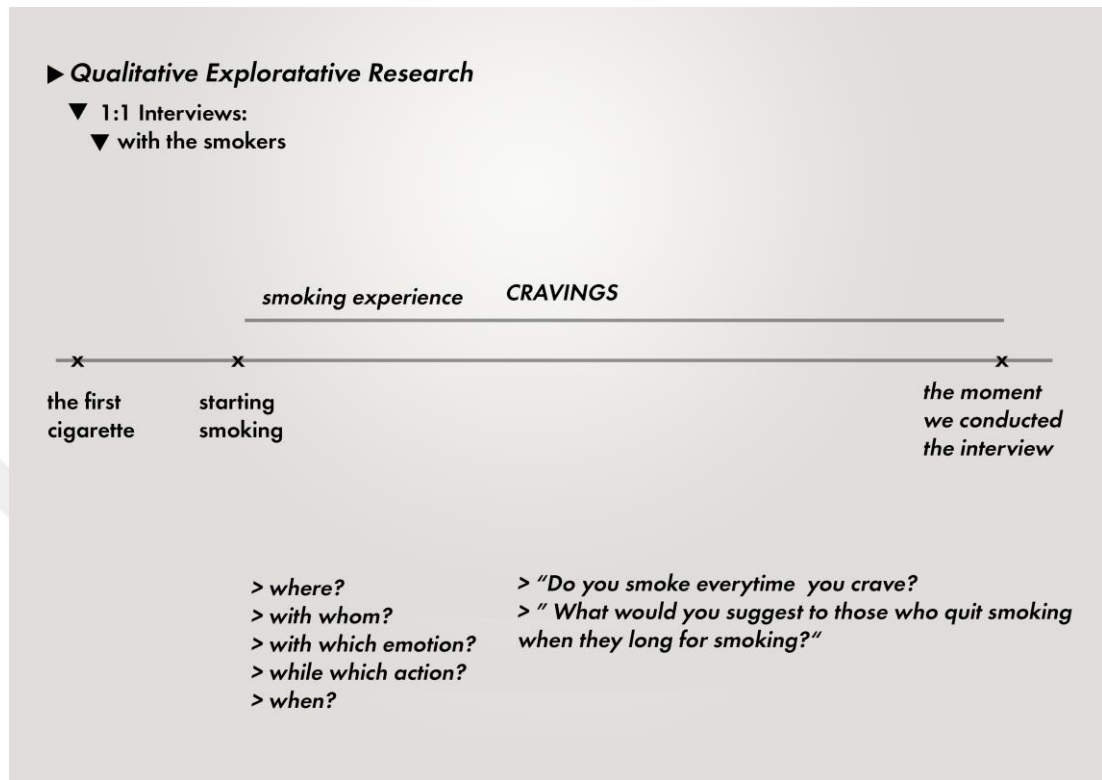
Figure 4.4

The beginning is the quite same: For the first cross "the first cigarette experience": Questions start with "why?" and then want him/her to explain that moment in more vivid details, such as when, at what age, and with whom? Did he/she know how to inhale a cigarette? Then the line: "Between the first cigarette and starting smoking": I ask whether smoking continued? That is followed by the second but the deepest cross: "Starting smoking": Again the first inquiry is "why?" and then I want them to explain in detail. Then it comes to speaking the "smoking experience" part: At this part, the time frame changes. I want them to explain to me where, with whom, when do they smoke? These are followed by more detailed questions where I try to learn what they were busy with as they smoked or in which kind of emotional state they were in. And besides these are there any situation else which triggers them to smoke? Then I ask some questions with additional words: "like to" where do they like to smoke? The most liked situation in which they like to smoke: where is it, with whom and which action is done with it? The difference between these and the second question frame reveals the most essential triggers. Because for some smokers there is no reason to smoke,

as I will mention this situation later on the analysis part. As long as they are not taking a shower or taking a nap, there is a possibility them to smoke. So, with this question, I can take the most critical situations in their smoking experience. For this part I ask them another question: Do they smoke, every time they crave, or are there any situations that they cannot smoke, or can but do not smoke? If this question is answered yes, then it is followed once again by questions of why and how? How they can stand to not smoking? Do they do anything for this? Do they have any solutions? Then comes imagination part: I want them to tell me some recommendations which can help the people who have decided to quit smoking at their craving moments. And I collect their thoughts. After they declared every thought, I give them one fact about cravings. I say them that these cravings come and go and only last for 3 -5 minutes. Then I ask them the same recommendation question and try to see if there are any difference between the recommendations they are coming up with.

4.1.3. Interview Findings

In this chapter I will explain the interview findings and evaluate the designed system model's attribution to the findings.

Quitting motivation is highly important. Many people have agreed that it all matters to the motivation of quitting smoking. If it appears then there is a big chance to relapsing.

When I asked this question: "What have you done when you did not smoke even if you have craved that moment?" Most of the people tend to say directly "nothing" or just "my willpower was enough". But as I move on to the other questions, they add so many things as their solutions. So we can say that individuals, even if they successfully come up with ideas to resist smoking urge, they are often not aware of their own solutions, the ideas they came up with, or just do unconsciously manage to not smoke.

One of the interviewees who has quit smoking with nicotine gum, and at the moment I conducted an interview with him, he was still using nicotine gum when he needs, replied a significant statement: " I do not need a cigarette, I need to relax," After quitting, he

encountered the most difficult cravings when he is stressed. By the time we interviewed, as he stated, he was taking nicotine gum, when he was stressed and had smoking cravings. So he was taking the nicotine gums to take control of his stress not the desire to smoke. Smoking is not a purpose for him anymore, it is just a tool. This distinction is highly important. Because it changes the approach user can take to deal with the problem. This shows us how people tend to position smoking in their life. If they can get awareness like in this example, they can take precautions. They can focus on their cravings -not on the smoking but on the main problem: handling the stress in this particular case. The system design meets this need. First of all the solutions, the recommendations will be given according to the person and their craving moment's features such as the emotional state. Secondly, there will be an agent for every undesired behavior models. That means for smoking an agent, for stress an agent, for getting angry an agent. These agents can communicate amongst themselves and can recommend the optimum solution regarding the person's needs at that craving moment.

Some of the young adults who have been quit smoking said that they were smoking in the yard of the university in which they are studying. After quitting smoking, going back to the yard of the same university has become a problem for them. This is not just a craving-related problem. They were talking about feeling empty because they are not smoking. They have a reason to be there: smoking. When I go there, I feel myself so "empty (mal)". This is a good example of the quality of quitting. Is it affecting smoking quitter's social life? If yes, then is she or he is happy with it, or is there a desire to change it back?

Some of the young adults who have been quitted for a long time ago (1-3years) have declared that they are not craving anymore and do not think that they will ever smoke again. Technically they do not need any help, so they do not or will not use any app for this reason. But I also interviewed with some ex-quitters that have not smoked for two years who then suddenly relapse. So we can say that there is always a chance of relapsing again. Quitting smoking is a lifelong experience people have to deal with it. If we go back to the interviewees which do not think of themselves ever smoke again, of course, their thoughts do matter. But we know that there can be some fragile moments during which they might suddenly want to smoke. At this possible scenario, this project's user-system interface design can be really

effective. Because to get interact with the system users do not need to download any application. They can just open the messaging application which they are currently using and find "dropitatt0_bot" from their contact list. For this they even do not have to add the bot earlier, they have to just know the chatbot's name and can interact with it instantly. After finding the bot they can tell the bot that they need help. After bot asks them the t0's predefined criteria, it gives them a recommendation. For this case, the recommendation the system finds will not be personalized for them, but at least it will be according to the answers they will give to the bot regarding their craving criteria.

One of the answers to the question, if they would start habitually smoking again if they hadn't smoked that one day, was very remarkable: "Cigarettes are so that even if you had stopped smoking 10 years ago - I've heard this from a lot of people - a moment comes in which they just smoke, and keep on doing so. Like people say "Geography is destiny." cigarettes are similar in the way that they do not stop following you. You have to have a lot of adamance, and as far as I know, I do not have it." This reflects people's conditioning on the difficulties of quitting smoking. With this system those conditionings which block the sight like blinkers can be dropped and new horizons can be risen. Because this system says "anything can be a solution!"

Some interviewees told that they all smoked their first cigarette after this period when they were with their friends or family members who were smokers at the time. Except for one interviewee who told that he was stressed as a reason, none of the other interviewees expressed a reason except "they just wanted to smoke one". And all of the interviewees, have been told sentences which reinforce the habit of smoking, such as "Why not smoke one if you want to?" or "It wouldn't even matter if you smoked a single one." by their smoker friends and relatives and they smoked. They were asked if they smoked after that day. They told that they smoked a few in the following days and most of them relapsed again. I have also conducted interviews with smokers who have not quit, ever. I asked them what recommendation they can give to the ones who decided and quit smoking, at their craving moments. Most of them tend to say that the quitters should not go to the places with alcohol.

After these replies I asked them the same question with a scenario. " For example here is a person, who decided quitting at his/her own and did it one year ago. Now he or she is at a place with his or her friends drinking alcohol and socialize. There he/she had a urge to smoking a cigarette. What do you recommend for her/him to do except smoking?" Beside the recommendations they have given, some of them tend to declare that they wont give to those who quitted smoking a cigarette, even I did not ask anything about this. And one of them has stated clearly that" I do not see any harm in smoking a cigarette for him or her. If he/she has not smoked for a year and want to smoke a cigarette that night, he/she should smoke. I would give him/her a one." At these craving moments people cannot deny on their circle. It is up to them. With this system there will be a chatbot who could be asked for a recommendation and also can make them feel "in a sort of a club" with its other users even if they do not know them. There are also some smoking quitters communities who meet regularly, but at some point people tend to go there to get socialize. They should bound up with the process instead.

Some responded to the question "What did you feel the first time you smoked after the abstinence / what was your emotional situation?" that they felt sorry and others responded that they were disappointed with themselves for failing to abstain after all the effort they made to stop smoking. But they all expressed that this emotional state changed over a period of time. For smoking quitters, smoking a cigarette can be depressing. But this system always focuses at the moment, not the past which they could have smoked one or two, or not the future in which there is a possibility of relapsing as a result of those cigarettes. There is always just one present moment - one craving moment that they can and might handle well.

4.2 CONCEPTUAL DESIGN OF SYSTEM MODEL

In this chapter I will explain the system model I have designed with the help of the persona "Dummy" on a graphical timeline step by step.

4.2.1 Step0: Definition of t0
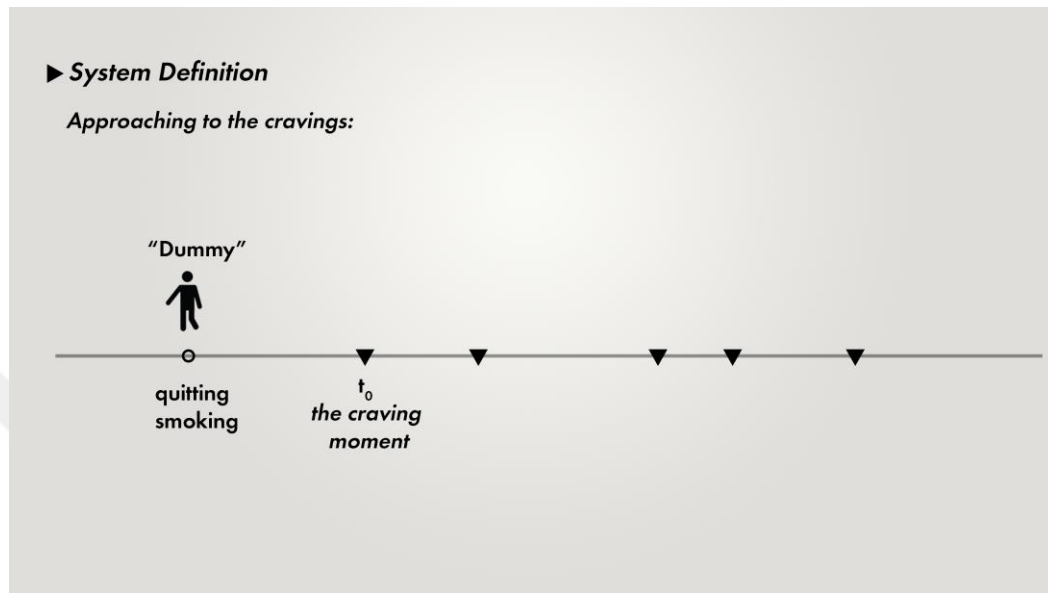
Figure 4.5

Let's visualize a timeline, lay down "smoking cessation" on it, and then take the highlighted moments -that making smoking cessation a problem. What does it mean? While our topic is to help people who have decided to quit smoking, then the moments will be shined on this timeline will be the craving moments. For this system design, I will recall this craving moments as t0. Now, let's try to visualize this moment to better understand the situation. Firstly, let's visualize a stickman who quit smoking named "Dummy". Then let's imagine a line of a timeline, under "Dummy" that will extend/stretch in a synchronized way with our time perception to the right. (right from the moment we understand this word)

Let our representative character go on with its life. Tick-tock, the timeline moves forward. Tick-tock, Dummy goes on with its life. And Bam(!) Dummy has craved, and feels the urge to smoke. Now let's put the main sign on this moment on our timeline. This moment's name is "t0". At this example, our imaginary character "Dummy" has resisted the craving and did not smoke. The life goes on, time passes on, tick-tock, and Bam(!) A craving moment again, this one's name is also t0. (It does not matter if it is the second t0, past is in the past, future

24

has not come yet, Dummy is craving now, and this is a problem.) What will Dummy do? At this example, Dummy did not smoke again. And let us assume this will go right this way. For the entirety of its life. Result: Dummy has not smoked. In other words, this problem is solved if the moments of t0 are handled one by one and these moments are passed through without smoking. That is exactly what I am going to build this project for. The goal is to not smoke at the moments of t0. So every t0 will be encountered instantly and individually. One by one. Let's do the definition of T0 again: the moment when a person craves(feels the urge to smoke) (not the past or the future) - exactly at that moment. For some, it may not be too many (some people I interviewed stated that they craved few), for others, they might be too many to question the decision to quit. But it does not matter. Because this t0s will be handled one by one, so the only thing to consider at the moment of a t0 will be the t0 moment. One moment, one problem.

4.2.2 Step 1: Confronting the t0

Let's continue with our representative character Dummy. Dummy is now at a t0 moment and it is craving. What will it do now? The project has a very clear action plan for this t0 moment. This begins with a question: At the moment of this t0 -craving moment- what can you do instead of X? (X= placeholder for the word that a person assigns to a smoking action) There are two options in front of Dummy: A. Find and implement a solution, B. Ask for a solution and implement it.

Now, before moving on to the next step, I want to clarify some sensitive points at the time of facing this t0. First of all, I will explain the importance of this t0 promptly. Then I will continue to explain what the "solution" is, and why these solutions can be unlimited, and why these solutions can be independent of cigarettes, and then I will continue with the answer to the question Dummy encountered with Step 2. This question is the invitation to the design thinking process. Because the possible answers are unlimited, people can approach this problem of the craving moment out of the box.
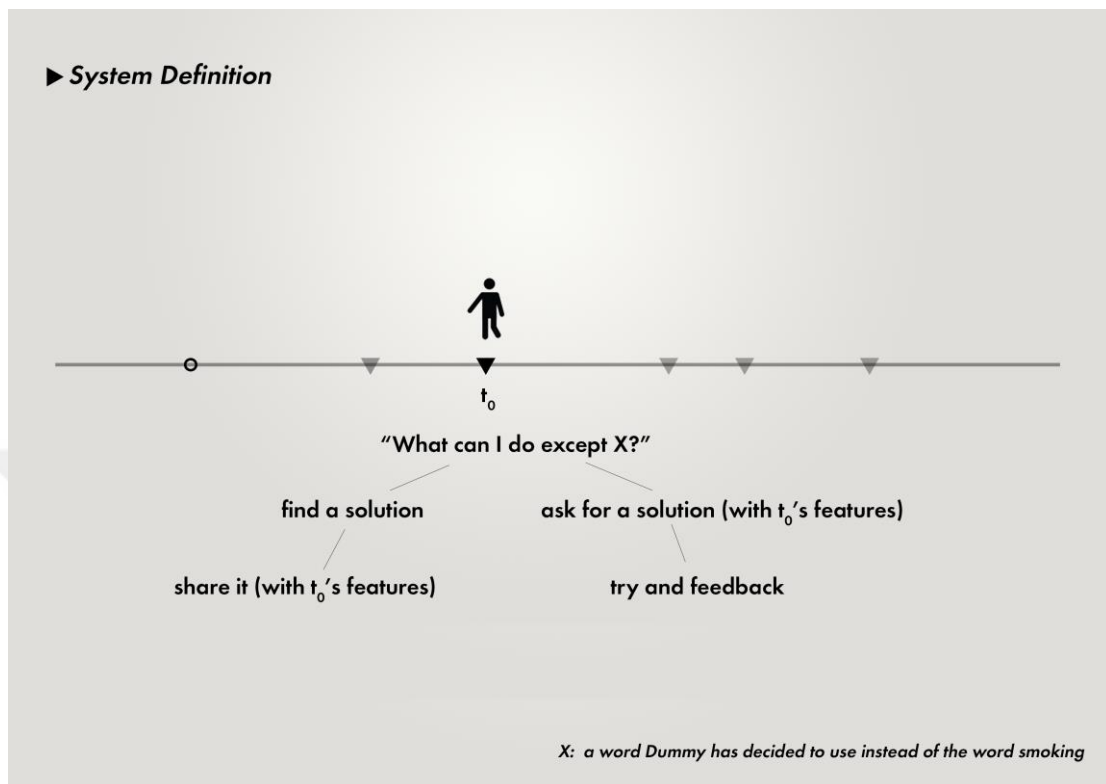
Figure 4.6

I want to clarify a point without getting any deeper: "Solutions." In these t0 moments, I call the actions taken instead of smoking - for this research - the solution. But I think I should explain the choice and meaning of this word here. One of the questions I prepared for the interview with the people who quitted smoking was, of course: "When you wanted to smoke, what were you doing instead of smoking at those craving moments, what was your solution?" My co-advisor, Assoc. Prof. Aslı Çarkoğlu, who have been working on smoking cessation, said to me that I should especially pay attention to my choice of words in my interviews. The perception of the word "solution" would be different in the people I would interview. They may or may not understand the need to give more scientific, more intellectual answers, or simply say, "I have no solution." (To avoid this, I have conducted the interviews 1:1, which I have mentioned this earlier) For this reason, first of all, I want to talk about the definition of this word and its boundary in this research. The solution that this research is looking for is not a proven, model of behavior which is stated already in the literature. It is beyond all existing patterns, it is at the edge of one's imagination. It's really ambitious. At these t0

moments, I call every possible action or thought that is taken instead of smoking as a "solution". There is a problem and we are trying to find a way to overcome it. It works or does not, but it is tried. It may not have been the right solution for that moment, but that does not mean it is the wrong solution. It is very valuable for this system that every solution is tried at the t0 moment. So what can be any kind of behavior rather than smoking and is it limited to the imagination? Here is another sensitive point.

The question that users ask themselves at their t0 craving moments is "what can I do instead of smoking?", not "what can I do when quitting smoking?" So the answer to this question-the solution - is independent of the list of things that should be done when quitting smoking. In the other words, the solution does not have to be on the most popular actions list when one quits smoking, such as drinking water, chewing gum, breathing. Solution here does not have to be one of them. They may also be in the solution set but as a subset. This set of solutions is in the size of the one's imagination that will be shaped in the light of the person's t0 moment (described in more detail in Step 2). What does this mean? If Dummy had five push-ups in the garden instead of smoking at its t0 craving moment, then "doing five push-ups" is the solution for Dummy at that t0 moment. This solution could be "eating carrots", "trying to use five rare words in a sentence in five minutes", "doing handstand", "meeting with a new person", "doing some qi gong moves", "trying to whistle melodically" or the most common solution: "chewing a gum". So I defend that the solutions can be independent from the theme of "quitting smoking.

4.2.3 Step 2: Decision Moment

Let's go through a little summary before we go to step 2. Dummy came to t0. It asked the question, "What can I do instead of X now?" (X means smoking) There are two options in front of Dummy: find a solution and share it with the system or ask for a solution to the system. Before we continue with the choice of Dummy, we will also need to mention the characteristics of t0, which is an important factor that will affect this choice.

The properties, characteristics and features of a particular t0 moment are the most important factors affecting process of finding solutions. Even though doing a handstand is a behavior that prevents Dummy from smoking, it may not be possible to do this during a business meeting. Even though "eating a carrot" is normally an effective solution for Dummy, it may not be the preferred choice for Dummy when it is at a party with friends. At this point, I took out five important criteria that should be considered at these t0 moments directly related to the solutions.

*Where? At the office, at the meeting, in the garden, at home, in the car, on a plane, etc
*With whom? With the boss, with a friend, with family, etc
*When? Morning, evening, yesterday, etc
*Which action? While drinking coffee, at the meeting, partying, etc
*Which emotion state? Sad, frustrated, happy, stressful, etc

As can be seen, the same answers can be given to different questions. ("at the meeting" answer can be given to the question "when?" and "where?" at the same time.) It is extremely important, not to skip the detail that will be the criteria for the solution. Ending up with the same answer for different questions is not important or of any consequence. What is important is not to skip an answer that might be the criterion, and that is why it is the most crucial part to ask the right questions. So far, I decided on these questions, according to the analysis of the interviews that I have conducted. These questions can be changed in further studies, as machine learning can be adapted.

Let's move on with our imaginary character Dummy, who has quit smoking. At t0 moment it asked itself immediately this question: "What can I do now instead of X?"
(X =smoking) Hmmm, hmmm and Eureka! Let me do this! And Dummy took action: I explain our imaginary character, Dummy's decision here: Dummy tried to make a hand gesture, the framing hand gesture, that it recently saw it in a film. To describe this gesture in words is quite difficult, but Dummy managed to do it in a couple of tries, and of course, with

this action, it passed t0 moment over! And now the expected surprise is the moment when this system will be fed. Our persona Dummy came up with a solution at its t0 moment it encountered with and it also captured this moment by taking a photo of this gesture.
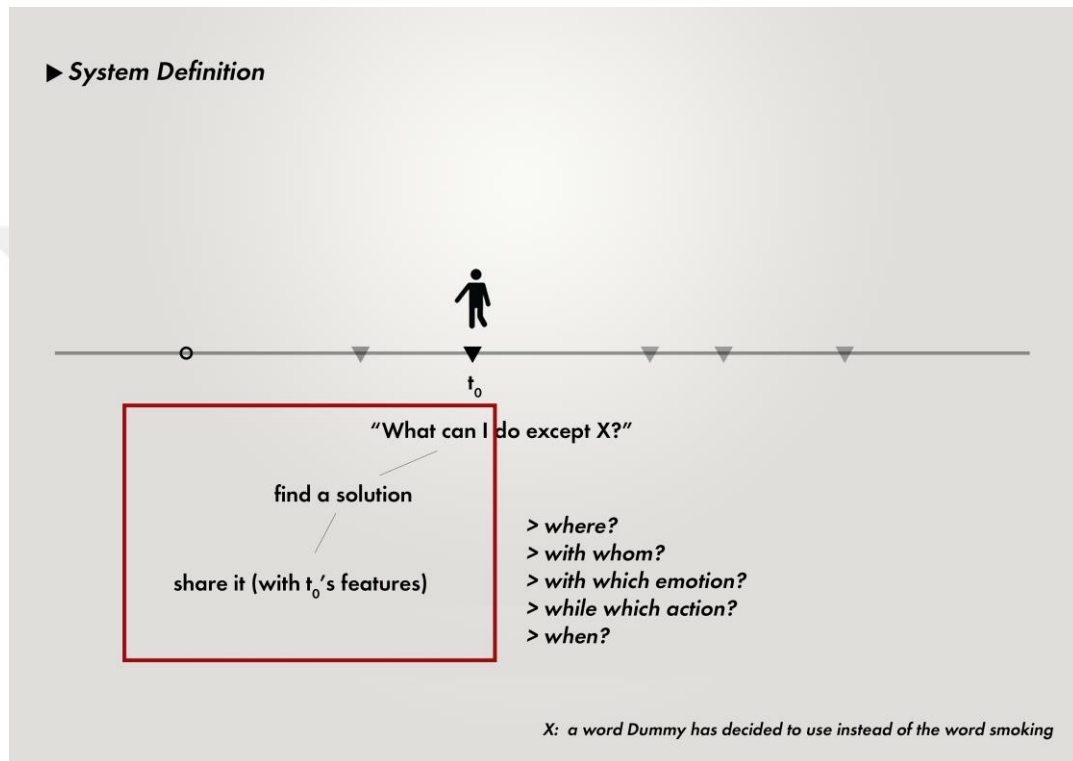
Figure 4.7

Now it is time to share it! Dummy shared this photo of its solution with the system. How? With a chatbot. This user-system interface design will be explained in details in the next chapter. For now, let's talk about what will happen to this share. What will happen to the solutions that users find and share with the system?

(1) Personal log: When Dummy gets to its personal page, it will be able to see all the solutions that it applied at all moments of t0 it encountered and successfully survived - the struggles that resulted in the victory on this journey. The data of the moments in which instead of simply putting one cigarette in its mouth and burn it, Dummy thought "What can I do? and came up with a solution.

(2) System database: The initial step of the human - machine collaboration process. It is the product of the intelligence and creativity that human beings can put in difficult situations, the action/inertia that he/she has provided to get over the moment of t0, that is, to collect the solution to be processed by the system. These solutions will be taken with the features of t0 of the solutions (Step 2: Decision moment: I have explained in the feature of sensitive point 1: t0), a user who cannot find another t0 instant solution to be processed in. So here comes the next title: Step 2: Decision moment: Selection 2.

Until now Dummy could have passed all the craving moments that it encountered without smoking. Now it craves again, so it is at a t0 moment. Dummy asked itself, "What can I do instead of smoking now?", but an idea did not appear! There is no solution in its mind, and there is a probability that it will try to rationalize the act of smoking. What will Dummy do? Dummy asks the system for help. The system asks a few important points about the t0 moment (details of the user-interface design will be declared in the next chapter). The system recommends the most suitable solution to the that t0 moment. Dummy looked at the suggestion, it thought, "OK, I will," it replied. And it did. Afterward, Dummy shared this solution, which system recommended to it in the first place, back with the system.

So far, we have seen the overall interaction between our representative user Dummy and the system step by step. To summarize all these steps at 5x speed: Dummy asked itself every time it craved a cigarette at every t0. "What can I do now instead of smoking?" Sometimes it found a solution and shared it with the system. Sometimes it did not come up with a proper solution, consulted the system and tried out the suggested solution by the system and it shared the result with the system again.

Now, let's think that there are a lot more Dummies. Not clones, they are all individuals. They all have a different experience with smoking: one has been drinking for years, the other has just started, some have quit a few times (!), some have relapsed, some have never tried to quit before. Their lives are different, some of them have a big part of their life spent in the

construction sites, or in the garden, or library, or some spend their time 10000 feet above. All the common features of all these people, the roof where they use for shelter: to quit smoking by their will and decision, and not to start again. It is important to say not to start again "as the definition of quitting is an important detail. Quitting smoking is not enough. For example, how long can a man who smokes stop smoking? One hour? One day? Twenty-one days? Six months? For example, what could be said for a person who tried to celebrate one-year abstinence from smoking by smoking. Or, can we say one hundred percent sure that a person has not smoked for five years, will definitely not start again? "But it is good with the coffee", "But I'm at the party, everyone is smoking", "But today is a different and special day.", "But I shouldn't be the only one who doesn't smoke now at this moment.", "But I'm going to be empty-handed in the yard like this?" In short, if one can continue not to smoke despite these "buts" and can do the same in the next "buts", only then maybe we can consider them as quit smoking.

So what do these people who share the same aim of quitting smoking and preventing relapse, do in order to achieve their aim? In every "but", that is, at every t0, they will ask this question: "What can I do now instead of smoking?" There are two options in front of them. They will try and share a solution or ask for a solution from the system, and try and share it again. All these people, all of these people will be gathering at a t0 moment. A great variety of t0 moment solutions. So when the user requests the solution from the system, how will the system find the most suitable solution for that person and the person who owns it from that database? With machine learning algorithms, recommendation system will ensure this happening. Through comparison of t0 moment's features and the features of Dummy's - which it is upon to Dummy's choice to share via filling up a form in the application- a solution which is personalized and "t0lized" will be shared.

4.3 USER-SYSTEM DESIGN INTERFACE: Dropitatt0_bot

As I have stated before, even though I have theoretically explained my system design as a whole, I will only focus on gathering "solutions" -the things the quitting smokers and even the smokers do except for smoking- for this master thesis. As I have seen also with the interviews, there is no one-solution-fits-all. And as I hypothesised, these solutions can differentiate also according to craving moment's criteria, which was explained in previous sections. These are "where, when, with whom, during which action?" and lastly "which emotion state?" So while users share their solutions with the system, the system should have gathered the craving moment's criteria before they find the solution as well. This would be an extra effort for the users. So this process should be designed as easily as possible for them. That's why I have decided to develop a chatbot as user-system interface. With this decision, they could have easily shared their solutions to the bot, and the bot would ask the t0 related questions. And they easily answer them right back to the bot at that moment through a messaging application which they have already using to get contact with their friends and acquaintances.
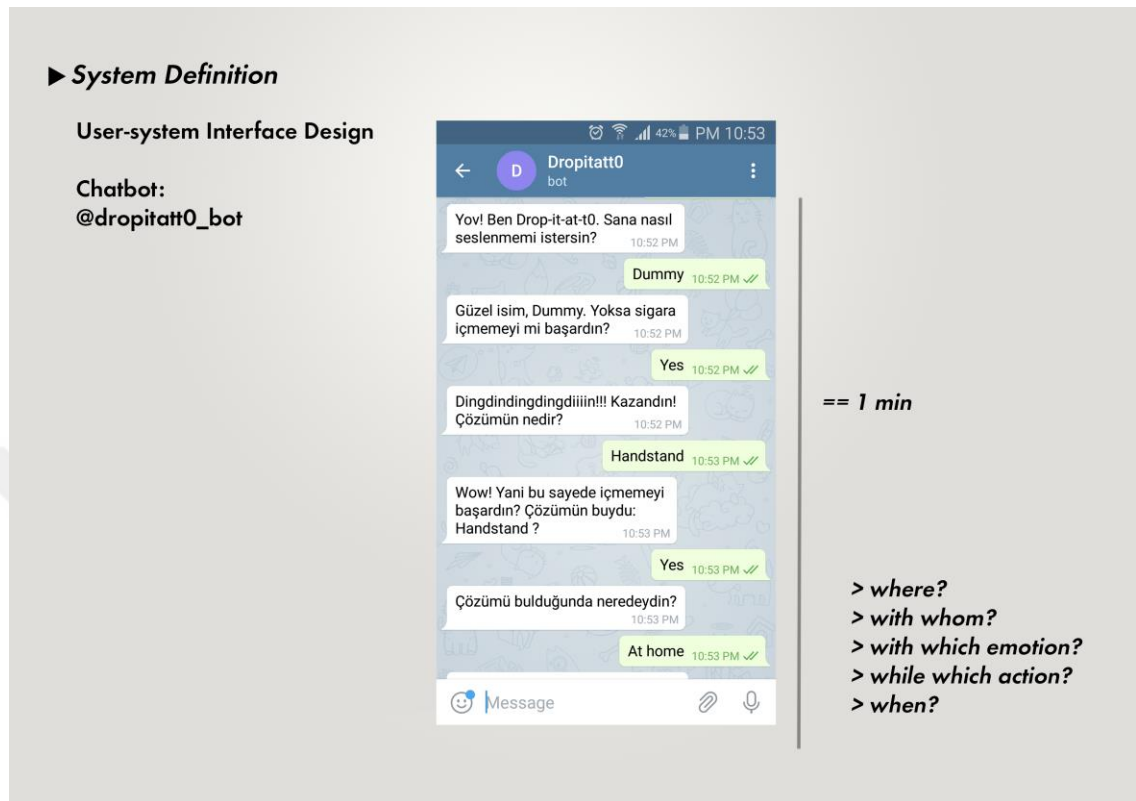
Figure 4.7

4.3.1. Background

I started by researching how to build a chatbot. There are several ways for this. Firstly, I could have developed it with python from scratch. This could be nice for independence and privacy of any data from third parties. The second option was to choose one of the big companies' platforms which users could use it for free for a limited time with interaction limitation. The third option was to go with paid platforms which I directly eliminated. While I was researching on this topic, I was also attending to IBM Watson's workshops. In every workshop, they have examined another topic. These workshops were free. Reason for this I cannot be sure, but there is a probability of making their publicity through these workshops. Because before starting these workshops, they explained every time their services. With these workshops and online tutorials which I have found through their website and also on Youtube which developed by them or some individuals. I thought using IBM Watson's

Conversational service would be easy to build a prototype. So firstly I signed up with a student account which you can use it for a year for free. With the tutorials, I have developed a prototype and deployed it with Telegram through Node-red. Telegram is a cloud-based messaging application, in which making a chatbot and releasing it is much easier. Node-RED is a programming tool for wiring together hardware devices, APIs and online services. But there was a problem; in that time, I have designed user and the bot's interaction slightly differently. I was thinking that sharing the solutions would be much easier and fun with a photo or a video for the users. When they could have passed their craving moments with their so-called-by-this system "solutions", they would just take a picture or record that moment and would send it to the bot. This was not so easy to make it happen. And meanwhile, I was working on another layer beside this. And I intermitted to work on the chatbot. After I decided to go back on working the chatbot, I have come across the bitter truth: My student account's free trial days were ended. To continue on my chatbot, I had to fill up the billing information. Without this process, you cannot see or copy the work you have done so far. At that point, I have decided to go free and look for another option. I have found Google's chatbot platform: Dialogflow. Its interface was similar to IBM's Watson, so I decided to give a try. First I had to make an account, which was the hardest step I encountered during this process even after developing and integrating it into a messaging platform. To make an account in Dialogflow, you should give your billing information- even if you consider using the free version only. It did not work with my bank card so I tried it with my friend's visa card. Then my account has been suspended, I had to upload some various documents several times and this process took my time. After they reinstated my account it was time to build: "drop-it-at-t0" the bot the user interface prototype for this project.

4.3.2. Content

Before explaining my flowchart, there are several terms that needs to be defined, in order to understand the mental model of this platform.

Intents:

Firstly, I built an agent. There were language options, which you can set it up in multiple languages. But for English there were some predefined training phrases or actions which will be mentioned later. At my first attempt, I built an agent with English and Turkish. But it gave me some errors in the Turkish version, which I would attempt to introduce to my interviewees for them to use. Because it was only a prototype I could have decided to go with the easiest solutions. So I built a new agent only in English but trained it in Turkish and the problem went away.

Then I think about possible scenarios and decided on the flowchart. With flowcharts -which I have designed with pen and paper on my own, only one intent was enough. In Dialogflow if a sequence has more than one step then you should make a follow-up intent. Or you can add different intents together with the right context. My steps were several and could be done with follow up intents. So I decided to go with the follow-up intents.

Welcome Intent: This intent comes with the agent by default. There were several training phrases already. But because I made it in Turkish, I trained it by adding greeting words and phrases in Turkish by myself, such as "merhaba, selam," (Hello, hey) I also tried to anticipate the possible users' age range and try to use youth language. That is why I also trained it within different languages and phrases as well, such as "yov, hola, slm" Hereby, they will not be misunderstood by the chatbot and did not fall back to the fallback intent. After user says a greeting word chatbot responds: "Merhaba! Ben Drop-it-at-t0. Sana nasıl seslenmemi istersin?"/ "Hello! I am Drop-it-at-t0. How would you want me to call you?"

"CozumVarMı" Intent/ "IsThereASolution" Intent: I connected the welcome intent with this intent by a context named "awaiting_name". So after welcome intent, after chatbot says "Hello! I am Drop-it-at-t0. How do you want me to call you?" agent goes to this "CozumVarMı" intent. In this intent I have to train the agent Turkish Names, it would not be effective. And I also wanted to set users free as picking a name for themselves. That is why I did not train the bot with names, I set it up as any words would be taken as a name. To

achieve this, I set a parameter named "name" and use "@sys.any" as an entity. So, the users did not have to type their real names. As a response, chatbot goes directly to the point and ask: "Güzel isim, $name. Yoksa sigara içmemeyi mi başardın?" ("Nice name, $name. Did you not smoke?") This is important because for

In this prototype as I have explained earlier, this bot only collects user's solutions. Its whole aim is this. And only criteria to this is whether the user could have passed their craving moment without smoking. So with this question, the chatbot will be sure that the user is a good candidate. If they are not, then won't ask related questions about their "solutions" (the things they did at their craving moment instead of smoking)

From that point on, the user can reply to this message as three ways: "Yes, I did not smoke.", "No, I smoked.", or something else.

"CozumVarMi - no" Intent/ "IsThereASolution-no" Intent: Users could be able to send message to the bot, just for trying. In that case, they can state that they do not have any solutions. So, if the answer is a "no" to the question whether they have a solution or not, then the agent goes to this intent and replies: "Ach! Şimdilik sana ne yazık ki yardım edemeyeceğim. Ama şimdiki tüm bu çalışmalar da bunun için. İnsanların yaratıcılığıyla yardımlarıyla kendilerinde işe yaramış çözümleriyle beslenip, o an ihtiyacı olan diğer insanlara en uygun çözümü önereceğim. Sen de belki tekrar düşünebilirsin, ne dersin? ^^" // " Ach! For now, I cannot help you, unfortunately. But all of this research is just for this purpose. I will feed up with the human's creativity, contribution, and the solutions which have already worked on them, and then I will recommend the best option when it is needed. Maybe you can consider it again, what say you?^^" Even though I have told every person this bot's only aim, designing this intent was appropriate. Some of them sent a message to this bot before they came up with a solution and because of their decision to be true, they came up with this response.

"CozumVarMi - yes" Intent/ "IsThereASolution-yes" Intent: It is a follow-up intent. This time I did not connect intents with context to be sure, it goes smooth. I trained this with some

phrases meaning "yes", such as: "Yos, yis, yes, sure, evet, kesinlikle, aynen" Drop-it-at-t0 responds: "Şahane haber! Çözümün nedir?"/ "Great news! What is your solution?".

"DummyninCozumu" Intent/ "Dummy'sSolution" Intent: This intent is the follow up of the"CozumVarMi - yes" Intent. This intent is the one where the user should give their solutions. So I should have this intent with possible solutions. After the pilot study, I understood that user should have given anything as they want, and I could not foresee them and train the bot earlier. So I set this intent like in the CozumVarMı Intent, and set it up as any words would be taken as a solution. To achieve this, I set a parameter named "D_cozum" ("D_solution") and use "@sys.any" as an entity. After user types anything as a solution, Drop-it-at-t0 responds: "Wow! Yani bu sayede içmemeyi başardın? Çözümün buydu: $D_cozum ?" ("Wow! So you managed not to smoke this way? This was your solution: $D_cozum ?") Because this is the most crucial part of this conversation, I needed to be sure to get the right message as a solution. That is why before going any further with the follow-up questions, I wanted to get confirmation first.

"t0Ozellikleri" Intent/ "t0Features" Intent: After user confirmed their solution as " Yes", the agent goes to this follow-up intent. As I have explained it earlier, this system is built upon the importance of the craving moment's characteristic features. So, the system takes into account its craving moment's features, and recommends a solution out of it. That's why there are 5 parameters for this intent. These are:"D_where", "D_withWhom", "D_action", "D_emotion", "D_when". Drop-it-at-t0 asks one by one the following up questions to get answers to these parameters. For "D_where" Drop-it-at-t0 asks "Çözümü bulduğunda neredeydin?" ("Where were you, when you came up with the solution?") For "D_withWhom" Drop-it-at-t0 asks "Çözümü bulduğunda kiminleydin?" ("With whom were you, when you came up with the solution?") For "D_action" Drop-it-at-t0 asks "Çözümü bulmadan hemen önce ne yapmaktaydın?" ("What were you doing, right before you came up with the solution?" For "D_emotion" Drop-it-at-t0 asks "Çözüm öncesi nasıl hissediyordun kendini?" ("How do you feel yourself, right before you came up with the solution?") And lastly for "D_when" Drop-it-at-t0 asks "Çözümü ne zaman buldun?"

("When did you come up with the solution?") I set these parameters with again "@sys.any" entity after I conducted a pilot study with this bot. So whatever user reply to these questions, one by one, chatbot takes them as an answer and ask the next question. After Drop-it-at-t0 asks all these questions and got the answers, responds: "Şahanesin! Hem çözüm buldun, hem de sabırla t0 anının detaylarını paylaştın. Bu çözümün ileride bir insana t0 anında yardımcı olabilir! Onun adına "Çok teşekkürler!" ^^" ("You are great! You have found a solution, and you have patiently shared the details of the t0 craving moment. This solution can help a person at her/his t0 moment in the future! On their behalf "Thank you very much!" ^^") And I set this intent as the end of the conversation.

4.3.3 Pilot Study of the chatbot "Drop-it-at-t0_bot"

Abroms LC et al, suggest some steps that a text messaging program should include, such as research to get insights from target audience and health behavior, designing the program, pretesting it and revising the program (2015). I followed exactly these steps which I will outline below with more details.

Before I got in contact with the possible users which I have interviewed, I conducted a pilot study. I ask three of my friends to use this bot. They could not complete the conversation, because bot could not understand some of the answers they have given. And go back to fallback intent. First I tried to train the bot with possible answers and then I understood that I should use "@any.sys" entity instead and get any feedback as a response. After this was revised, system worked smoothly.

After the pilot study, I got in contact with a couple of people who might be using the bot. The only condition to use this bot is being able to pass a smoking craving moment without smoking. So the possible users are the smoking quitters who have smoking cravings and the smokers who do not smoke every time they want. Even though there were two groups of people who might use it they were few.

Some of the solutions, Drop-it-at-t0_bot has collected:

► Chatbot:
@dropitatt0_bot

"D_cozum": "kedi sevmek",
 "name.original": "X",
 "D_emotion": "standart",
 "D_withWhom": "yalnız",
 "D_where": "ev",
 "D_when": "şimdi",
 "D_action.original": "oturuyordum",

"D_cozum": "kuruyemiş,
 "name.original": "Y",
 "D_when": "Dizi izlerken",
 "D_where": "Ev",
 "D_withWhom": "Yalnız",
 "D_action": "Dizi izliyordum",
 "D_emotion": "Sıradan, sakin"

"D_cozum": "Canım sigara istediğinde
gökyüzüne bakmayı tercih ediyorum bi
süredir",
 "name.original": "Z",
 "D_when": "Sabah kahvaltıdan sonra",
 "D_where": "Evimde",
 "D_withWhom": "Tektim",
 "D_action": "Kahvaltı yapmıştım",
 "D_emotion": "Bitkin"

"D_cozum": "Video izledim",
 "name.original": "ß",
 "D_when": "45 dk önce",
 "D_where": "İş yerinde",
 "D_withWhom": "Tek başıma",
 "D_action": "Çalışıyordum",
 "D_emotion": "Normal"

Figure 4.8

Then I interviewed every person who chatted with the chatbot to share her or his solution. One of them has declared that it could be nicer if the chatbot replies a little bit slower. ("It replies instantly right now. And I felt myself a little bit intense,") This very same issue was also mentioned at one of a conference about chatbots. To give the bot feeling of a human, developers set chatbots' response time with one to two second delays, in purpose.

All of the users have found the bot's language friendly and humorful. Language is an important issue: it is important to give a personality to the chatbot. As far as these feedbacks go, they show that Drop-it-at-t0's personality is suited to this young group. But it should be noted that there were few users.

All of them declared that they will not use the bot out of its purpose. One of them replied at this issue as "And if I want to, I knew that it won't understand me." I designed it at this aim.

For this prototype, its aim was only to get solutions from the users. And if the user tries to speak out of this purpose, I designed the chatbot to not understand the user's intent and it replies directly "Anlamadım. Konunun dışına mı çıktın?" ("I didn't understand. Did you get out of the context?") With these replies, the user will not have the motivation to speak out of the purpose and will concentrate on the aim only.

When I asked them were there any solutions you came up with that you did not share it with the bot, one of them replied that because every time he does the same thing as a solution he has shared his solution only one time. Actually, this was not the intention of this system model. Even when a person does the same thing every time craving comes and the solution works, it should be shared with the system. Because every solution is collected along with the details of its t0 craving moment's features. So even if it is the same solution, with the t0 moments' five features, the whole combination of data can differ. And at the same time, it is important for the user to be able to see his/her solutions as data in his/her phone, which would be like a logbook and can raise the awareness of the user about themselves and their own habits.

All of them has declared that they do not have any doubts or worries about their privacy when using the bot.

When these participants were asked if there was any significant difference between before and after hearting, this research and this bot, one of them pointed out the importance of the craving moments' longevity and declared that "The fact that cravings will last only for three minutes, has suited my cravings really well. I have said myself that it will go away and they really did." One of the interviewees looked upon the bot -even now it does not give any recommendations back to its users as the system model aims- as a whole. And told his craving moments with this new mental model which he engages after using the bot: "Now I ask myself at my craving moments, that "How can I handle this urge to smoke? Because I want to help other people who also crave. If I come up with a solution, I feel obligation to

share. This obligation gives me more energy to try and find a solution." He also detailed his craving moments as before and after.

"Before using this bot, I had two solutions: chewing nicotine gum and drinking water. Now I try to come up with new ideas."

5. CONCLUSION

This system has taken only craving moments as a focus. This is because the craving is the very last occurrence before the individual decides to smoke or not. So if a person who quits smoking, do not smoke on their craving moment then they will not begin to smoke again. Likewise, if a smoker can resist their craving moment and not smoke, it can be a good experience for them. I will look at this topic from the angles: approach and solution.

(1)The approach: After quitting smoking there will be so many cravings people can encounter. Quitting smoking can be looked difficult while looking at all possible cravings together. But this system suggests people focus only on one(1) craving, which is the one present at the moment. So the problem gets much tinier and easier to address when the entire aim is to handle only single craving moment which lasts only three minutes. After handling that craving moment, the next craving moment will be the one they need to focus on and handle. One of the interviewees associated this approach with that of the climbers'. He declared that many mountain climbers prioritizes one point which they are able to see physically from the point they are at, and when they reach that point, they set another point to reach, and another, till the highest point.

This approach, focusing only on one craving moment is also reminiscent of mindfulness meditation. In mindfulness meditation, one tries to focus on not the past nor the future, but only on that moment right there. There are also some experts who use mindfulness techniques to help with smoking cessation, like Judson, who stated he wants people to smoke mindfully; focusing only on smoking experience, taking that breathe, that smell, the taste at the mouth, being more aware of the whole experience in general, which actually aids in cessation.

(2) This system looks for instant solutions, which can be permanent, just to handle that craving moment. But some of the interviewees have declared that while quitting smoking they start a new hobby or a habit like dancing or going to the gym, or start a new healthy eating plan and execute it every day. One of them also replied that if he knows that he can do ATVs on a daily basis, then he would quit smoking instantly. He now plans to go to the gym daily to be able to quit smoking. These more permanent solutions and new behaviors would not be on the system though as these are more structured and permanent decisions to give up smoking instead of momentary methods to combat smoking urge right in that moment. People won't need creativity being able to decide on these. Another crucial point on this approach I encountered while doing interviews was one of the interviewees stating that after quitting smoking, she started to eat healthy food. After some period when she cannot maintain that new habit of eating healthy food, the smoking cravings came back and she relapsed. We cannot be sure if it is the reason behind her smoking cravings, but to feed the system with this data can be effective and useful to the point even the reporting user can be aware of this process and also the system can give more accurate and personalized recommendations. So there can be a feature on this system where users can share their permanent solutions, their new habits, daily - which can then also be tracked by the system.

The future application which is intended to be designed and developed will not only be able to contain the aforementioned techniques but also will be open to any techniques, ideas, solutions, in order to prevent smoking at their craving moments its users. So with this system model, the approach to the cravings can differ and many new solutions can rise. While doing that, it does not turn its back to any other techniques, methods researched and suggested by the professionals. It can be a hub, a medium for all of the approaches.

5.1 PRIVACY, DATA TRUSTWORTHINESS

When the data meets appropriate algorithms and processed with ML, then it becomes power. It can be used to detect cancer-risk abnormal moles, it can be used to detect epidemics before

they happen and also it can be used to make a profit by companies. All of these examples about the data they are collecting and processing should be discussed. Efficiency, trustworthiness, privacy, all of which has social implications. Even if a company's or a institutes' aim is to help people, while trying to do so, they can involuntarily overlook or misinterpret some essential points, such as personal data and health-related data.

There are also some people who do not only focus on the work but also take into consideration individuals and their rights to their personal data. Alex Sandy Pentland, one of the MIT Media Lab founders and a leading expert who has spearheaded creation of related Gdpr laws, suggests a model in which all three sides win: government, companies, and individuals (Edge.org,2019). At this model for privacy issues, individuals should store their data by themselves. This model was designed to prevent personal data intrusion, as well as for individuals to get paid. This model can be used for social good.

When we take a look at profit aimed companies, such as Facebook, Youtube and others, we all know their algorithms' aim is to keep users attention more and more on these platforms. In order to accomplish that, they show personalized contents, which that person would like and click and read or watch.

But for the system model which I try to conceptualize in this research, its aim is clear. For the smoking cravings agent, the aim is to help people who need a suggestion at the instant of their smoking craving moments. To achieve this, it collects solutions from people that already passed a craving moment which they encountered and managed not to smoke. Because the system believes in the potential of individuals, their creativity, their intelligence, their power on handling these difficult situations and coming up with a working solution for the moment. If a person successfully passes their cravings without smoking, then they are a professional for that particular craving moment with that craving moments distinct features and with his or her personality. So in this system there will be no monetary compensation - users need to believe themselves as that moment's solution finder and other individuals who can overcome their craving moments without smoking. One solution which a user shared can

be suggested to another user at a related moment by the system and can help him or her at their craving moment. With that suggestion maybe that person also passed the possibility to relapse. So, possible users should believe in this process. Of course, the only motivation to use this system is not to help others by sharing their solutions at their t0 craving moments, but users can also track their process- the quality of quitting. What do they do to not smoke? Did they gain any unwanted new behavior? Moreover, users can track their craving moments and be more conscious of them. Users themselves will be in time more aware of their own smoking habits and urges, understanding mostly where, when, with whom, in which situation, with which emotional state they are craving to smoke.

In conclusion, this system will be a hub for those individuals, the whole system will consist of them, if they are not part of it, then we cannot talk about any system. So if they want to become a user then they will produce data just for this very system. I am talking about users own, personalized solutions. Normally, people just pass their craving moments without logging them. There are people who write books, shooting videos after they quit, about this issue. There are lots of motivational videos from "influencers", youtubers, experts. But such information is not shared right at the moment of craving. So, after they share their solutions with the system, those solutions will become traceable data with the 0's and 1's. Which means there will not be any data collection without the data users produce and share for this system.

Even though users produce and share their data voluntarily and might not have any concerns on privacy, we definitely need to consider privacy and its related concepts more in detail. Because the data shared by individuals can contain so much insight, it is expected for some profit aimed companies, institutes or any kind of organization to be interested in gathering and processing such information, as these solutions and its craving moments features will give insight about craving moments- the fragile side of individuals. Since advertisers already use our cognitive biases to sell more, to have us consume more, it is natural for them to be interested in our craving moments.

For security and privacy, the whole structure should be revised. At this point "New Deal on Data" can be a guidebook(Greenwood, D., et al,2014). Pentland declares on this matter:

"People are OK about sharing data if they believe they'll benefit from it and it's not going to be shared further in ways they do not understand (Harvard Business Review,2019).

I said that it will be a hub for those individuals but it will also be a hub for any solutions which already exist in the literature, as the users can be the ones who are in contact with those professionals. Users could be their patients, they could read their book or could have watched their video. So this system does not eliminate any mainstream approaches, any suggestions could be applied at these craving moments as long as the user reports solutions success. It is inclusive for all research, all methodologies, suggestions from the professionals and academics in these areas, too. But this theme brings us the other possible rising question:" will there be any kind of solutions?" There can be trolls, and there can be users who want to use it out of its aim. So to gain trustworthiness, efficiency, the solutions should be investigated in "data preparation" stage. It is the step before data processing -before data meets with ML algorithms. So we can clearly define the situation like this: Everyone can share any kind of solution by themselves (it can be vaping, eating unhealthy snacks, etc.), but before data processing, all solutions should be controlled to some extent. If a person shares "smoking a cigarette" as a solution, it should be eliminated for sure. If there is a "vaping", or there is "eating snacks", or something with a label on it (advertisement possibility) these are the kind of situation that should be more clearly addressed. So I will maintain this theme also in further studies.

5.2 LIMITATION

My research question and its motivation standard were really high. Can we meet data with ML to overcome some social issues as we design a new transparent and ethical system from scratch? " Can we build a system model with which the individuals share their data voluntarily, knowing that the data they have shared will be processed in order to cope with their common social problem?" Can we build a win-win situation: the individuals who have the same problem and the society which is the sum of those individuals? For these questions,

I designed a system model as the core. It has three layers which should be addressed: Addiction - AI- Social implications. As for the bigger picture, some terms have to be defined such as H-M Collaboration, Swarm Intelligence, and Social Physics. Even, I designed the whole system as conceptually, I only focused on data collecting from users and did not execute the recommendation part. And came up with the idea of building a chatbot as a user interface to make the sharing and developing data process more easier for the users.

At this point, it was too hard to find the users. There were several reasons for this. 1. The condition to use this bot (this condition includes 3 more reasons: 1.1 the awareness of the craving moment 1.2. Awareness of the situation which is overcoming this craving moment without relapsing 1.3. 4. Their approach to these moments. 1.4 The lack of ex-smokers) 2. The motivation to use this bot 3. The medium which is integrated on. Because first of all the first condition to using this bot was overcome a craving moment without smoking.

The only condition to use this bot was overcoming the craving moment without smoking. First of all, as I explained this in results, people mostly do not have awareness of their cravings. And as I also mentioned this on results, people are also inclined to not see when they overcome their craving moments without smoking. Maybe if their cravings result with smoking they can recognize it and/or remember. But in the moments they have craved and did not smoke, they have not built any awareness. If one cannot recognize this situation then how can they share their solutions with the bot? They cannot. There are so many different approaches and thoughts that have been seen as the one truth under the umbrella of the things that can be done in order to quit smoking. Some people recite these from their memories without having really thought on it or they happen to believe it because they heard and were exposed to only such methods or approaches: such as drinking water, chewing gum, taking a breath… I do not say that these actions cannot be useful by the way. I criticize that some people believe that only these can be applied in order to pass craving moment. That is why even when they did something else -maybe unconsciously- to pass the craving, they do not recognize it or see them as a solution. Of course, this system is open to any kind of solutions so they can also share these with the system, but users cannot share what they are not aware

of. And the other reason under the condition is the lack of ex-smokers. There were really few people who quitted smoking around this age range, 19 to 28. When I started this project three years ago, I was asking every person I met whether they are an ex-smoker or not. And with their approval, I was collecting their contact information in order to access them when I prototype the chatbot. But after 2 years, after developing the prototype I have learned that most of the ex-smokers that I have noted down their contact numbers under the ex-smokers list have started smoking again. With this kind of severe limitation, I came up with the idea of gathering solutions from the smokers too. Because the bot was focusing only on one craving moment if that person who is a smoker and do not want to quit, but avoided smoking at a craving moment, then they could share their solutions at that moment with the bot as well. So my target group had grown quite. And also this could be more fertile in order to see the results of ex-smokers and smokers at their craving moments.

My second biggest limitation on this research was that I was only conducting half of the system model I have designed. I was trying to get solutions from the users but I was not giving any recommendations. Or the solutions they have shared do not process and shared with an optimum user at an optimum environmental stimulus. So the motivation the users in order to use this chatbot was low.

And the last limitation was the medium. There were several people who have this app (Telegram) on their cell phones already, while most of the others did not want to download this new app. One of them has reported that she could not download it even though she has tried ("Telegram did not send the activation code" she replied). Some of them showed their phone's storage limit as an excuse for not installing it. As I have also explained the reason I have chosen Telegram as a medium, in the methodology part, it was the optimal choice that I could have integrated with Dialogflow - the platform which I developed the chatbot. After I encounter with this medium limitation though, I have tried to integrate it in FB Messenger and Twitter. For FB messenger there are several steps to make in order to handle the integration. Having a developer account, having a contact form because of Gdpr. And then the waiting part begins in order the developer team examine and will decide. I have not got

any feedback yet. For the integration with Twitter, I have also got a Twitter and Twitter developer account and make my application though filling some questions they have asked. And I got a decline email in one hour. They could have made all interaction through a chatbot in a messaging app which they already have their phone and use it daily. That's why I will mention this situation also in Future Research, cause it can be developed in Whatsapp, which I have seen the most popular chatting app around the people I have contacted.

5.3 FUTURE RESEARCH AND SIGNIFICANCE OF RESEARCH

One of this research's system model's highlighted part is the approach to the cravings. So far, I only explored the remaining approaches, smokers' and ex-smokers' mental model to handling with craving moments. I wanted to know, can there be a change to handle the smoking cravings after knowing the fact that "craving moments come and go and remains only for three minutes." between the interviewees. For this reason, after I got every answer from them, I shared this fact with them and ask them nicely to think about their answers about cravings again, in the light of this knowledge. So, I did not try to manipulate any of them. With this system model, I think that people can handle this craving problem with design thinking and come up with creative ideas. They can change their approaches as well. They can see the cravings as "lemons", and the possible solution they can come up with as a "lemonade". So with their creativity, these problems they will encounter can become their expressive piece of art.

As I have also mentioned this earlier in the introduction and methodology part, there should be one agent for every "undesired behavior models". So these agents can feed each other. In other words, the solution from somebody with a smoking problem can help another person who plays online games uncontrollably in his quest to fight his own craving moments and desire to play.

The system architecture should be revised accordingly for privacy and security. The new deal on data" can be a guideline on this matter. Blockchain should be considered. And for a backup plan in which people are debating on general Artificial Intelligence topic, there may be a plan to plug off the whole system if it is needed.

Data scientists define sometimes deep-learning as a black box. A black box which gives the desired outcome, but they sometimes do not know how it does it. Smoking is one such topic, as this craving is very much complicated. It has so many layers that can be a trigger - physically, chemically, socially, mentally. This means that if we do not know the equation, we cannot program this. But we can feed an algorithm with training data which will be the solutions, and come up with some insights about cravings and the possible ways to deal with it. We should not know how it does it.

There are not any specific application which focuses only on cravings and gives personalized recommendations at these moments. This model though aims to collect the solutions from the people who have passed their craving moments doing those-will-be-shared-"solutions" with also that craving moment's features. When, which action, with whom, what emotion state, and where. It covers environmental stimuli, the person's in that moment's emotional state and that moment's uniqueness. This is the first approach to challenge the smoking cravings in such a way.

The future application which is intended to be designed and developed will not only be able to contain the aforementioned techniques but also will be open to any techniques, ideas, solutions, in order to prevent smoking at their craving, moments its users. So with this system model, the approach to the cravings can differ and many new solutions can rise. While doing that, it does not turn back to any other techniques, methods researched and suggested by the professionals. It can be a hub, a medium for all of the approaches.

REFERENCES

Abroms LC., Whittaker R., Free C., Mendel Van Alstyne J., Schindler-Ruwisch JM. (2015) 'Developing and Pretesting a Text Messaging Program for Health Behavior Change: Recommended Steps', JMIR Mhealth Uhealth, 3(4):e107

Alpaydin, E. 2016. *Machine Learning: The New AI*. Cambridge: The MIT Press.

American Heart Association News. (2018, October 17). Why it's so hard to quit smoking . www.heart.org. [online] Available at:https://www.heart.org/en/news/2018/10/17/ why-its-so-hard-to-quit-smoking [Accessed 17 May 2019]

Baumeister, R.F. (2017) 'Addiction, cigarette smoking, and voluntary control of action: Do Cigarette Smokers Lose Their Free Will?', Addictive behaviors reports, 5, 67–84.

Edge.org., 2019. REINVENTING SOCIETY IN THE WAKE OF BIG DATA | Edge.org. [online] Available at: https://www.edge.org/conversation/alex_sandy_pentland-reinventing-society-in-the-wake-of-big-data [Accessed 17 Aug 2019].

Erlick, N. (2017) 'AI pioneer will advise chatbot startup that provides free legal advice to immigrants', *The Verge*.

Erskine, J., Georgiou, G. and Kvavilashvili, L. (2010) 'I Suppress, Therefore I Smoke: Effects of Thought Suppression on Smoking Behavior', *Psychological Science*.

Fitzpatrick KK, Darcy A, Vierhile M. Delivering Cognitive Behavior Therapy to Young Adults with Symptoms of Depression and Anxiety Using a Fully Automated Conversational Agent (Woebot): A Randomized Controlled Trial

Ghorai K., Saha S., Bakshi A., Mahanti A. and Ray P. (2013) 'An mHealth Recommender for Smoking Cessation Using Case Based Reasoning', *46th Hawaii International Conference on System Sciences*, Wailea, Maui, HI, 2013, pp. 2695-2704.

Goodfellow, I., and Mcdaniel, P. (2018) 'Making Machine Learning Robust Against Adversariel Inputs', *Communications of the ACM*, 56.

Greenwood, D., Stopczynski, A., Sweatt, B., Hardjono, T., and Pentland, A. (2014) 'The New Deal on Data: A Framework for Institutional Controls'. In J. Lane, V. Stodden, S. Bender, & H. Nissenbaum (Eds.), Privacy, Big Data, and the Public Good: Frameworks for Engagement (pp. 192-210). Cambridge: Cambridge University Press.

Hajek P, Stead LF, West R, Jarvis M, Hartmann-Boyce J, Lancaster T. (2013) 'Relapse prevention interventions for smoking cessation', *Cochrane Database of Systematic Reviews*, Issue 8. Art. No.: CD003999.

Harvard Business Review. (2019) 'With Big Data Comes Big Responsibility' [online] Available at: https://hbr.org/2014/11/with-big-data-comes-big-responsibility [Accessed 17 Aug. 2019].

Hays JT, Hurt RD, Rigotti NA, Niaura R, Gonzales D, Durcan MJ, et al (2001) 'Sustained-Release Bupropion for Pharmacologic Relapse Prevention after Smoking Cessation: A Randomized, Controlled Trial', *Ann Intern Med.*; 135:423–433.

Heo, K. (2019) '10 Breakthrough Technologies 2019', *MIT Technology Review*.

Institute of Medicine (US) Committee on Preventing Nicotine Addiction in Children and Youths; Lynch BS, Bonnie RJ, editors. Growing up Tobacco Free: Preventing Nicotine Addiction in Children and Youths. Washington (DC): National Academies Press (US); 1994. 4, TOBACCO ADVERTISING AND PROMOTION. Available from: https://www.ncbi.nlm.nih.gov/books/NBK236761/

Knight, W. (2017) 'Andrew Ng Has a Chatbot That Can Help with Depression', *MIT Technology Review*.

Lorien C. A, Meenakshi Ahuja, Yvonne Kodl, Lalida Thaweethai, Justin Sims, Jonathan P. Winickoff & Richard A. Windsor (2012) 'Text2Quit: Results from a Pilot Test of a Personalized, Interactive Mobile Health Smoking Cessation Program', *Journal of Health Communication*, 17:sup1, 44-53

Nabil, S., Elbouhdidi, J., & Yassin, M. (n.d.). Recommendation system based on data analysis Application on tweets sentiment analysis.

Nosen, E., and Woody, S. (2014) 'Acceptance of cravings: How smoking cessation experiences affect craving beliefs'. *Behaviour Research and Therapy*, s. 71-81.

Pentland, A. 2014. *Social Physics: How Good Ideas Spread — the Lessons from a New Science*. New York: Penguin Books.

Ricci F., Rokach L., Shapira B. (2011) 'Introduction to Recommender Systems Handbook', *Recommender Systems Handbook*, Boston: Springer.

Rogojanski, J., Vettese, L. and Antony, M. (2010) Coping with Cigarette Cravings: Comparison of Suppression Versus Mindfulness-Based Strategies. Mindfulness, 2(1), pp.14-26.

Rughinis, C. (2014) 'Smoking Does Not Make You Happy. Unlearning Smoking Habits through Mobile Applications on Android OS'. [online] Academia.edu. Available at: http://www.academia.edu/6273796/_Smoking_Does_Not_Make_You_Happy_._Unle arning_Smoking_Habits_through_Mobile_Applications_on_Android_OS [Accessed 20 Jan. 2017].

Samet, J. (2013) 'Tobacco smoking. The leading cause of preventable disease worldwide', *Thoracic surgery clinics*. 23(2):103-12

U.S. Department of Health and Human Services. The Health Consequences of Smoking— 50 Years of Progress: A Report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014.

Wetter DW., Cofta-Gunn L., Fouladi RT., Cinciripini PM., Sui D., Gritz ER. (2019) 'Late relapse/sustained abstinence among former smokers: a longitudinal study' - PubMed - NCBI. [online] Ncbi.nlm.nih.gov. Available at: https://www.ncbi.nlm.nih.gov/pubmed/15539050 [Accessed 13 Aug. 2019].

WHO Report on the Global Tobacco Epidemic, (2019). Geneva: World Health Organization; 2019. Licence: CC BY-NC-SA 3.0 IGO.

CURRICULUM VITAE

Personal Information
Name Surname   : Damla Partanaz

Education and Training
Bachelor Degree   : Yıldız Techical University, Communication Design
Master Degree   : Kadir Has University, New Media
Other language(s)   : English, German

Work Experience
Workplace and
Date of Employment   : Arteg (2011-2016)

Contact Details
E-mail   : damlapartanaz@gmail.com