

Final report

Tovertafel Compass: tackling alcohol addiction with happy moments

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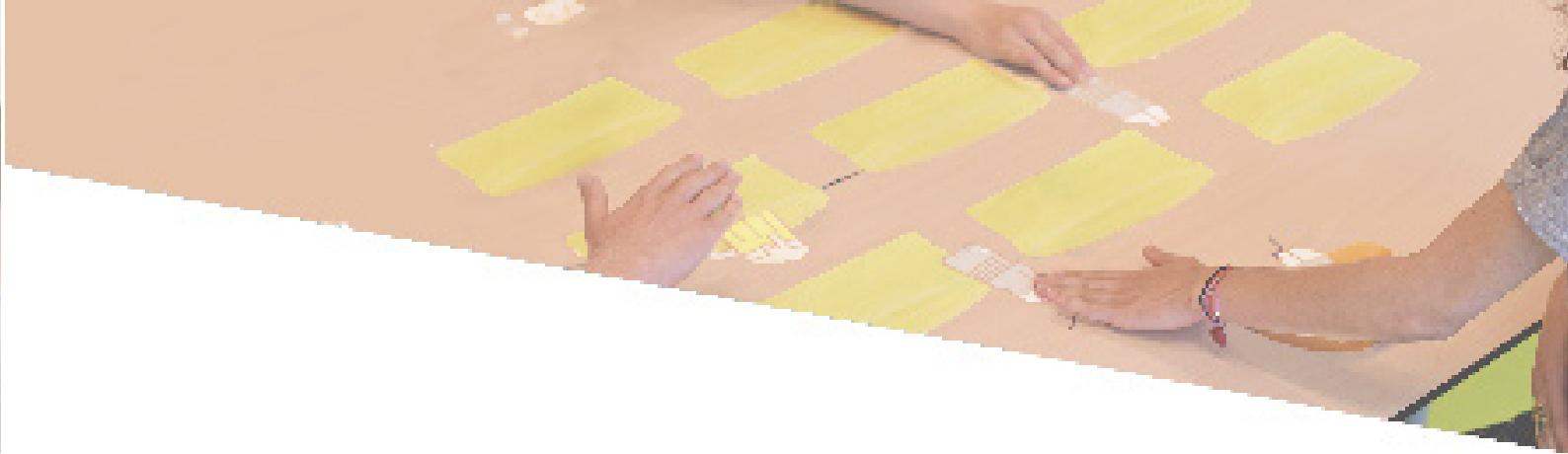


Table of contents

Executive summary	5
Objective	6
The Team	7
The Tesla Team	
The Supervisors	
External Coolaborators	
Research	9
Stages of the project	10
Global analysis	
Feasibility Analysis	11
Research and market analysis of five promising audiences for the Tovertafel	13
Elderly	
Refugees	
Acquired Brain	
Anxiety disorders	14
Substance use disorder	15
In-depth analysis	17
In-depth analysis in substance use disorder audiences for the Tovertafel	18
Prevalence and societal impact substance use disorder	
Symptoms and treatment of substance use disorder	



Co-design: The new Tovertafel Compass	21
Co-design Process	22
Stakeholder map	23
Who is the customer?	24
Substance abuse clinics and types of treatment	
Addiction therapy and the Tovertafel	25
Customerpersona map	26
Who is the substance abuse patient?	27
Patient Journey	
Patient persona map	29
Value proposition canvas for the patient	31
Whack-a-drink!: game prototype	33
Game characteristics	34
Creative process	
Prototype Whack-a-drink!	36
Whack-a-drink! prototype description	37
Game goals of Whack-a-drink!	40
Strategy plan & Advice	43
Steps to design the new Tovertafel	44
Risks & mitigation	45
Future questions for Whack-a-drink! development	
Alternative games	41
Cocktail shaker game	
Lane racer game	42



Research & funding of the Tovertafel Compass	46
Research collaboration Tovertafel Compass	
Funding categories and strategy for Tovertafel Compass	47
Funding opportunities for smaller grants:	
The APCA grant	
The Creative Industry Knowledge Innovation Mapping	
Funding opportunities for bigger grants:	48
Open Technology Program from NWO	
Advice	49
Acknowledgements	50
Appendix	51
References	56
,	



Executive summary

Active Cues is known for their Tovertafel, which creates happy moments in healthcare. Active Cues wants a new audience for the Tovertafel, for which they enlisted us. Based on market and scientific research, we advise Active Cues to invest in the development of a new "Tovertafel Compass" for people with an alcohol addiction. Alcohol addiction has two main causes, **(1) weakened conscious processes**, especially in decision making and **(2) overdeveloped unconscious impulses** in response to alcohol. Current therapy is aimed at training the conscious control system via cognitive behavioral therapy, but largely ignores the overdeveloped impulses. This therapy is still far from perfect, as 60% of patients relapses within a year. However, there is compelling evidence that incorporating an innovative therapy called **CBM** (Cognitive Bias Modification) as a complementary treatment could help **reduce relapse rates by targeting the overdeveloped unconscious processes** found in alcohol addiction. Current scientific research by the University of Amsterdam using CBM shows that **CBM therapy decreases relapse rate by 15%**. However, in its current form, the treatment is very repetitive, causing high dropout rates. The new Tovertafel Compass could integrate CBM in a fun and engaging game, which complements current group therapy. On a yearly basis, the reduction in relapse rate would decrease national health care expenses by 180 million euros and will create **45.000 happy moments a day**.

In this project, we examined 50 candidate audiences. We then performed co-design steps by talking to patients, psychologists and customers in substance abuse clinics. Based on this, we created persona maps and a patient journey. Lastly, to make our recommendations more concrete and practical, we developed a **value proposition canvas** and a **game prototype**. The goal of these is to link therapy elements to the needs of patient, caretaker and customer in a visual way. After the current project, further steps still have to be performed. These steps include further co-design and **validation through a pilot**. We recommend carrying out this step in collaboration with CBM therapy researchers at the University of Amsterdam, which ensures the effectiveness of the therapy and opens up many funding opportunities, minimizing the required financial investment by Active Cues. In total, this pilot stage will take around 1,5 years. After this pilot, the product could be developed further by adding more games and could slowly be introduced to the market.

We envision that as the Tovertafel Compass is soft-launched in addiction care, Active Cues will be known for the solid research-based and innovative background of their products. Also, a new market in health care without any direct competition can be explored and Active Cues will **lead the way** for innovative healthcare technologies integrating therapy with fun and motivating games.



Objective

Active Cues is interested in the future potential of the Tovertafel, and which new target audience could benefit from their product. In this project, we have explored the following question: **For whom is the new Tovertafel?** The goal of this project is to find the new target audience for the Tovertafel in a research-based approach, and to provide tangible tools to introduce the Tovertafel to this new audience. These tangible tools include a strategy plan to enter the specific market and first steps into a co-design approach for the new Tovertafel, including a game prototype.



Box 1: Active Cues' Tovertafel

The Tovertafel consists of a projector box which presents a light display on a flat surface, and of an infra-red sensor which detects movement, making the light projections interactive. Currently, Active Cues has three different Tovertafels on the market; the Tovertafel Original for people in late stages dementia, the Tovertafel UP for people with intellectual disabilities and the Tovertafel Unique, which was created for children suffering from autism. All Tovertafels are designed to activate their users in three ways: they stimulate physical activity, trigger social interaction, and engage their users cognitively. Crucially, the Tovertafels are developed in close collaboration between designers and users, a procedure known as "co-design". Another central part of Active Cues' philosophy is that they are evidence-driven and incorporate a lot of scientific research on the efficacy of their products.

The Team

The Tesla Team



Despina Kortesidou

Despina is a master student in molecular neuroscience and the creative mind of the team. Despina is an imaginative free-thinker, who generates out of the box ideas and explores problems in unconventional ways. For the project, Despina focused on connecting the technical aspects of the Tovertafel and the research of the team in a creative way. She was also in charge of the lay-out.



Ron Dekker

Ron is a master student in cognitive neuroscience and the analytical mind of the group. He took all the wild ideas that the team came up with and developed these in a sober way. Strategic and accurate, Ron made sure that ideas were observed from all angles, so objective decisions could be made. Furthermore, Ron focused on proofreading the written deliverables of the group.



Janneke de Vries

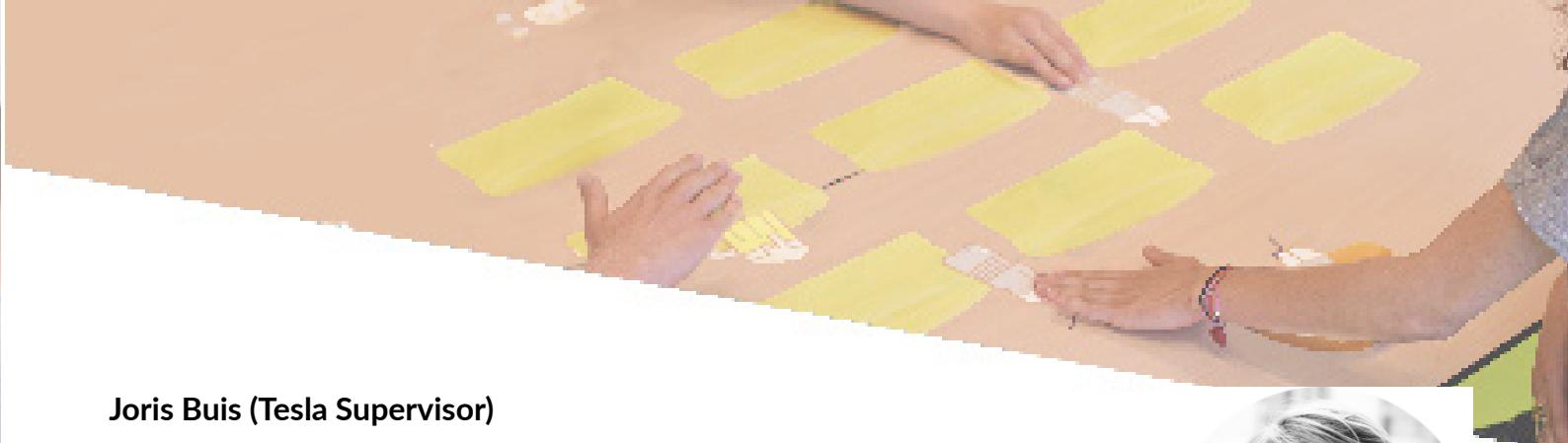
Janneke is a master student in psychopathology and the planner of the team. Janneke focused on turning the team's ideas into tangible actions. Practical and efficient, Janneke was responsible for organizing the work that had to be done across the course of the project. In addition, Janneke focused on network building and professional contact in this project.

The Supervisors

Ger Post (Internal Supervisor)

Our academic supervisor for this project was Ger Post. Ger studied Journalism at the University of Technology of Utrecht and Brain and Cognitive Sciences at the University of Amsterdam. Ger combines these skills by writing about science for a broader audience. Recently, Ger has started working as a lecturer at the Institute for Interdisciplinary Studies of the University of Amsterdam. He is an expert on interdisciplinary research, and thus had valuable insights for the current project, which is of a transdisciplinary nature. In particular, Ger ensured that our academic background was sufficiently applied in this project.





Joris Buis (Tesla Supervisor)

Joris is one of the two program coordinators and founders of Tesla. His main role in our project was as an advisor. In addition, he formed the intermediate element between us and Active Cues; he made sure that we met our learning goals, while also delivering valuable information to our client.



Judith de Groot (External supervisor)

Our contact person at Active Cues was Judith de Groot. She has been working as a user experience designer for the last two years. In this project, Judith had the crucial role of communicating what Active Cues wanted to get out of our collaboration and which information was most valuable to them.



External Collaborators

Dr. Marilise Boffo (Postdoc researcher in Wiers' group at University of Amsterdam)

Marilise Boffo is doing research on gamification of CBM elements in a computer game in the research group of Professor Wiers. She is very enthusiastic about the implementation of CBM elements in the Tovertafel and a possible collaboration combining her research with Active Cues' Tovertafel.



Professor Reinout Wiers (Professor Developmental Psychopathology in Addiction, University of Amsterdam)

Professor Wiers' academic interest is focused around implicit cognitive processes in addiction. With his team, he formulated the theory and framework for the therapy cognitive bias modification (CBM), a very promising therapy within addiction care. Currently, he works with his team on gamification of this therapy for computer games. In this project, he gave advice on implementation of CBM elements in the Tovertafel Compass and linked us to other substance abuse researchers.



Ronald Mooijer (IXA Business developer)

Ronald Mooijer is a business developer who connects science to business by facilitating knowledge transfer. He has advised us during the project and can provide grant and funding support. He knows a lot about funding opportunities, specifically for collaborations between businesses and research.



Research



Summary:

- In the research phase, we analyzed 50 audiences on different market and scientific components.
- Based on high ratings for these components and objective weighing methods, we chose the most promising new audience for the Tovertafel: Substance use disorder.



Stages of the project

This project consisted of three distinct phases, which correspond to the chapters in this report. These stages are outlined in Figure 1.

- **Research:**
 - **Global analysis:** We rated 50 audiences and choose 5 potential audiences for the Tovertafel. The global analysis represents our initial research for the Tovertafel's audience.
 - **Feasibility analysis:** We rated 5 audience and chose the single most promising target audience for the Tovertafel. This was done in a similar manner as the global analysis, with less breadth and more depth.
- **In-depth analysis:** We conducted a more in-depth scientific analysis pertaining to the final audience of our research.
- **Co-design:** The goal of this phase is to involve different stakeholders, ultimately leading to a game prototype and strategic advice



Figure 1. Approach of the Tesla Tovertafel project. The approach of this project consists of a research phase after which we selected the most promising target audience for the Tovertafel, an in-depth analysis, and finally a co-design phase. These form the chapters of this report.

Global analysis

From 50 to 5 audiences

An initial list of potential target audiences for the new Tovertafel was created based on brainstorming about the intuitive presence of characteristics which could be targeted by the Tovertafel, consultation with experts and categorization of diseases in the Diagnostic and Statistical Manual of mental disorders 5th ed. (DSM-V; American Psychiatric Association, 2013). The resulting list of disabilities is composed of 3 main clusters: Physical symptoms, cognitive symptoms and other special needs (Figure S1). We rated the 50 audiences on 6 components and chose the 5 most promising target audiences. These topics were rated in a plus-minus fashion. Whenever a component of a potential target audience was rated double minus, this audience was discarded from the potential audience list and excluded from further analysis. A table is provided with the components and the criteria when a plus or a minus was assigned to a group (Table S2). The following topics were considered in the global analysis:

- Prevalence
- Expenses per patient
- Competitors
- Number of buyers
- Audience feasibility
- International feasibility



The results of our global analysis show that elderly, refugees, substance use disorder, acquired brain trauma and anxiety disorders are the most promising audiences among the 50 initial ones (Table S1). We rated all audiences using a 5-point system. Possible outcomes were ++ (very positive), + (positive), +- (neutral), - (negative), and -- (very negative). You can see how each of the top 5 audiences scored in the table below (Table 1), and you can find the explanation of each rating in the Appendix (Table S1). When an audience scored a double minus for any component, the audience was eliminated and excluded from further analysis. Using this method, the first 37 audiences were discarded from the analysis based on insufficient prevalence, low expenses per patient and potential effectiveness of the Tovertafel. The last 13 audiences were scored with the system of pluses and minuses, in which we selected the top 5 audiences (Table 1).

	Prevalence	Expenses per patient	International feasibility	Number of Buyers	Competitors	Audience feasibility
Substance use disorder	+-	+	+-	+	+-	++
Exposure Therapy	-	+	+	+	+-	++
Acquired Brain Injury	-	++	+-	+	+-	++
Refugees	+-	++	++	+/-	++	++
Elderly	++	+-	++	++	-	++

Table 1: The rating system of the 6 factors which were used in the global analysis. We used a gradient from ++ to -- to rate the information we gathered in our research. Only the top 5 audiences are displayed here.

Feasibility Analysis

From 5 audiences to 1 audience

We analyzed and rated on a 1 to 10 scale the five most promising target audiences for the new Tovertafel on different components. For the sake of objectivity, we tested the robustness of the outcome with a sensitivity analysis (box 2). Based on this, we chose the most promising audience for the new Tovertafel.

The 6 components on which we rated the 5 audiences are:

- Number of buyers: number of organisations specialised in treating each audience.
- Cashflow: stability of income stream available for the Tovertafel within relevant organizations
- Competition: number of direct and indirect competitors in the same field.
- Willingness to innovate: willingness of the organisations to invest e-health and IT related tools and applications
- International feasibility: a first analysis of a) the prevalence of the audience in each of the following countries and b) the political agenda of treating/helping this audience in each of the following countries; Denmark, Germany, Belgium and United Kingdom (countries that already sell the Tovertafel Original).
- Expected effectiveness: a) the benefit of Tovertafel usage for each audience & b) the added value of Tovertafel usage over the current treatment/situation.



All components were weighted. These weights represent beliefs about the importance of a component. For example, the effectiveness of the product for this audience was deemed to be 3 times as important as the international feasibility. The base weights were as follows:

effectiveness: 3

number of buyers: 2.5

cashflow: 2

competition: 2

willingness for innovation: 1

international feasibility: 1

These weights were determined based on averaging over the informed guesses of each group member. Since this introduces a certain amount of subjectivity to the outcome, we ran a sensitivity analysis (box 2). Results of the sensitivity analysis show that substance abuse wins over 90% of the time, even if beliefs about weight assignment are drastically changed. This shows that, based on the six analyzed components, substance abuse is the most promising audience and still would be if priorities were changed. The following sections will elucidate the scientific and market arguments for the choice for substance use disorder as new target audience for the Tovertafel.



Box 2: Sensitivity analysis

Different people hold different beliefs. While science can solve many problems, it is virtually impossible to unequivocally prove for example whether the number of buyers is a more important component than the strength of the competition. For this type of problem, a sensitivity analysis can be used, to test whether the same conclusion would be reached if one held different beliefs. Only our sensitivity analysis did not compare 2 different beliefs, but was automated to simulate 10.000 sets of beliefs, rendering the result much more objective.

On a technical level, the sensitivity analysis was performed by changing the weights stochastically across different iterations, and determining which audience had the highest score under the new weights. The weights were changed at every iteration to their base value plus a random value between -2 and +2 (random uniform; independently drawn for each weight), with the limitation that weights could not go below zero. In total, 10.000 such iterations were performed. Despite these vast differences in beliefs, substance abuse wins 91.26% of the time, while elderly wins the other 8.73% of the time. Thus, substance abuse remains the most promising audience.



Research and market analysis of five promising audiences for the Tovertafel

Elderly

Our scientific research analysis revealed that elderly are not involved enough in physical activity. (Matthus-Vliegen *et al.*, 2012). This contributes to an increased risk of developing depression, diabetes type 2, coronary heart diseases, osteoporosis or weakened muscles (Matthus-Vliegen *et al.*, 2012). However, elaborate scientific research underlines that physical activity can decrease these disease-like psychological and physical symptoms with elderly (Zamboni *et al.*, 2005; Laurin *et al.*, 2001). The Tovertafel for elderly could be a promising product by increasing physical activity, bringing elderly together and engaging them cognitively. These findings show that elderly are a promising target audience for the Tovertafel, however, the new Tovertafel would be similar to the existing Tovertafel Original. Our market analysis for introducing the new Tovertafel in elderly homes reveals that the market size is by far the largest compared to other audiences (2383 elderly homes). The budget of elderly homes is paid by the inhabitants itself, they can obtain several packages which offer them certain privileges in terms of care or daily activities. Considering these findings, it would be difficult to place a Tovertafel in a general room, because of the different nature of the packages of each inhabitant. In addition, recognizing the potential of this market, competition from other products offering happy moments and daily activities is very high (Figure 2).

Refugees

While refugees have many special needs, an expert in the field of refugee shelters (Machiel Keestra, ASPIRE initiative Amsterdam) identified the following needs of refugees as most important: (1) familiarization with the Dutch culture and system and (2) integration with Dutch citizens. The Tovertafel could play a role in these needs by connecting refugees from different countries and backgrounds with Dutch citizens. Furthermore, the Tovertafel could familiarize the refugees with the Dutch culture. However, there is little scientific research on the subject of gamification of cultural integration. While playing together with Dutch citizens to promote integration would be helpful, making this happen would be difficult, given the strict entry policy in refugee shelters (AZCs). Our market analysis for introducing a Tovertafel in refugee shelters reveals a very unstable potential market for the Tovertafel. There are not a lot of refugee shelters in the Netherlands (51) and they have a minimal budget for daily activities. Instead, charity organizations sometimes finance workshops or other activities, thereby providing happy moments to the refugees. However, the income stream of these charity organizations is unreliable, as it is heavily reliant on individual donations. Dependence on charity money streams also renders this audience very sensitive to public opinion and political developments, making this option risky and challenging, especially on an international scale. Given this unstable cashflow and unstable market, the refugees would not be a viable option for the Tovertafel (Figure 2).

Acquired Brain

Acquired brain injury (ABI) is an umbrella term that includes traumatic brain injuries (TBI), such as sudden trauma causing a concussion, and non-traumatic brain injuries, caused by, e.g., stroke or brain tumors (Savage *et al.*, 1989). The severity of the injury is the determinant for the extent and



asperity of the symptoms. Symptoms fall into four big categories; cognitive, executive functioning, communication and social problems (Savage *et al.*, 1989). These emerging symptoms can be combatted with cognitive rehabilitation therapy (CRT) (Bret & Laasch, 1989). The goal of CRT is to help an individual with a brain injury to enhance his or her ability to move through daily life by recovering or compensating for damaged cognitive functions (Bret & Laasch, 1989). Hereby, the new Tovertafel could make the CRT more engaging and more fun compared to regular CRT. However, not a lot of research was performed to test the efficacy and gamification of CRT interventions. Our market analysis shows that different components including competition, cashflow and willingness to innovate are relatively comparable in organizations treating people suffering from substance abuse, anxiety disorders or ABI. The budget for therapy in these organizations is provided by insurance companies and the treatments are completely covered in the standard insurance package, providing a very stable income stream. In addition, there is not a lot of competition in the market of therapy-based innovative technological products in healthcare. Lastly, many organizations state they are willing to innovate concerning eHealth applications, apps, internet platforms and other related technological products. All the abovementioned facilities state they are only interested in implementing innovative technologies which have been previously tested on their efficacy. This validation process of testing the efficacy of therapy-based technological products is time-consuming and costly, however, there are great benefits to entering such markets, considering there is enough budget and nearly no competition.

Anxiety disorders

Anxious responses can be developed following experiencing a traumatic event or can be gradually developed without a clear trigger. People who have experienced a traumatic event can develop disturbing thoughts or dreams which remind them to the stressor or develop a compulsion related to this stressor (Chorpita & Barlow, 1998). In terms of obsessions, fears may be related to contamination, doubts, orderliness, religion, morality, aggression, or sexuality. When it comes to compulsions, the most common are cleaning/washing, checking, ordering/symmetry, and accumulating (Laforest *et al.*, 2016). The anxious responses to a certain trigger can be targeted by exposure therapy with response prevention in order to reduce the associated behavior with the fear trigger (Hoffman, 2008). Exposure therapy typically involves the patient repeatedly confronting the feared stimulus in a graded manner, either in imagination or in vivo (Hoffman, 2008). Emotional processing is an essential component of exposure therapy, involving activation of emotional networks with information about the feared stimulus, including its meaning (Gerardi *et al.*, 2010). Hereby, research studies show that connecting mindfulness stress-reduction strategies to exposure therapy resulted in a decline of stress levels in patients suffering from anxiety disorders (Brake *et al.*, 2016). Therefore, designing a Tovertafel combining exposure therapy with a safe environment containing stress reducing components in the Tovertafel, would be a very promising therapeutic intervention for people suffering from anxiety disorders. Currently, there is very little research performed to the gamification of exposure therapy. However, there is a strong IT innovation competitor in the combination of exposure therapy with a virtual reality environment (Powel & Emmelkamp, 2008). Taken together, combination of exposure therapy with stress reductive components in the Tovertafel could be a promising addition to regular exposure therapy. Our market analysis reveals a stable income stream, high willingness to innovate, no direct competition and high international feasibility for anxiety disorders as audience for the Tovertafel (Figure 2).



	Effectiveness	Number of Buyers	Cash flow	Competition	Willingness for innovation	International feasibility	Weighted average
Substance Abuse	+ Can increase motivation + Builds on research (CBM) - Gamification Needs validation	+ 178 clinics and institutes	+ Stable cashflow from insurance companies	+ No direct competition	+ Clinics prioritize innovation (Jellinek) + A lot of research on CBM	+ Treatment for substance abuse available in all countries - In DK and UK, mental health care is not centralized	8.0
Exposure Therapy	+ Increase motivation for exposure therapy + Reduce stress during treatment	+ 98 GGZ institutions + 26 small organizations	+ Stable cashflow in GGZ institutions	+ No direct competitors - Virtual reality-based competitors	+ High willingness to innovate and collaborate with researchers	+ Many mental health institutions in DK, GER, UK - In DK and UK, institutions are not centralized	6.9
Acquired Brain Injury	+ Can address cognitive & social problems + Social contact attenuates emotional deficits	- 24 specialized clinics - Academic hospitals (10% care)	+ Several sources of cashflow, e.g. insurance companies & charities	+ no direct competition	+ High willingness for innovation & e-health solutions	+ Treatment for ABI available in all countries - In DK and UK, mental health care is not centralized	6.8
Refugees	+ Bring together refugees & non-refugees + Nostalgia + Fun introduction to Dutch culture & language	+ 51 AZCs, 550 refugees per AZC	- COAs have no budget for this - Charity income stream is unreliable	+ No direct competitors + 'Competitors' might be willing to support a Tovertafel initiative	- Almost no collaboration with researchers, IT firms, etc.	+ All other stage 2 countries have higher asylum acceptance rates than NL - Political discord (esp. Denmark)	6.6
Elderly	+ Increase social interaction, physical activity and cognitive functions	+ 2383 elderly homes + Positive market trend: More elderly	+ Stable cash flow	- 15 indirect competitors - Several direct competitors: Qwiek play, Onwijs belevenstafel	+ Willing to innovate	+ Many elderly homes in DK, GER, UK and BE + DK: high budget for elderly care	7.2

Legend

7+
 4 to 7
 1 to 4

Figure 2: Feasibility analysis results on 6 components of 5 promising target audiences for the new Tovertafel. The 6 market and audience components were graded and compared between 5 potential target audiences for the new Tovertafel on a scale of 1 to 10. The final scores reveal that substance abuse is the most promising target audience for the new Tovertafel.

Substance use disorder

Substance abuse is brought about by weak conscious processes on decision making and strong unconscious processes to the substance (Wiers *et al.*, 2011). Current therapy mainly focuses on training the conscious control system via cognitive behavioral therapy, whereby still 60% of these individuals relapses within one year (Wiers *et al.*, 2011). Cognitive bias modification therapy (CBM; Box 3) is designed to decrease strong unconscious processes in patients with substance use disorder to complement current treatment. CBM is often applied in computers; patients change their automatic process for alcohol by pushing alcohol away, rather than pulling them towards themselves (Fleming *et al.*, 2016). However, prior methods have used joysticks and external monitors. Although CBM seems to be a promising new technique, the repetitive nature of the training tasks often fail to trigger the user's motivation and make them boring (Wiers *et al.*, 2011). Tovertafel could help make this treatment more engaging and embodied. In addition, the social setting that the Tovertafel furnishes can help in creating new associations and norms in a group setting, which could be more effective than individual treatment. Our market analysis reveals a stable income stream, high willingness to innovate, no direct competition and high international feasibility for substance abuse as audience for the Tovertafel. Taken together, the promising combination of scientific literature and previous attempts of gamification of the therapy in order to induce motivation with the user, resulted in a good evaluation of the Tovertafel for individuals suffering from substance abuse (Figure 2).

In -depth analysis



Summary:

- Substance use disorder causes many problems in society, as the prevalence is high and has many costs in health care.
- Current therapy for addiction needs improvement as the yearly relapse rates of addicted patients who received therapy are 60%.
- In substance abuse clinics, the Tovertafel can complement current group therapy with the innovative CBM therapy and social elements triggered by the Tovertafel games.

In-depth analysis in substance use disorder

Having determined that we want to go forward with substance abuse, the goal of this analysis is to get a clear picture on what substance use disorder entails from a scientific perspective, and what the status quo in substance abuse research is. To this end, we compiled scientific literature and consulted researchers at the University of Amsterdam.

Prevalence and societal impact substance use disorder

The term “substance addiction” is an umbrella for substance abuse and dependence disorders, and compulsive seeking of a substance despite its adverse consequences. Regarding the alcohol consumption, 800.000 people in the Netherlands are addicted to alcohol (Jellinek, 2016). Alcohol addiction is diagnosed when at least 5 criteria are met on 11 components in the DSM-V edition. As for the hard drugs among the Dutch population, 1.6% had used cocaine, 2.8% ecstasy, 1.3% amphetamines and 0.1% heroin in the last year in 2015 (Trimbos Instituut, 2015). Apart from its high prevalence, substance use disorder also has a high mortality rate, causing 127.000 deaths in 2013 in Netherlands (GBD 2013). Lastly, research of KPMG indicated that alcohol addiction costs every year 3,2 billion euros in the Netherlands alone (KPMG, 2011). These numbers underscore the necessity of improving therapy for substance abuse disorder. However, high relapse rates show that current therapy appears to be not sufficient to treat substance abuse, so new innovative treatment is needed to cure substance abuse (Wiers *et al.*, 2011).

Symptoms and treatment of substance use disorder

The main struggle of individuals affected by substance use disorder is that although they have knowledge of the consequences of their addiction, they continue the self-destructive behaviors (Wiers & Stacy, 2006). One line of research aimed at understanding this paradox investigates how automatic processes contribute to addiction behavior (Stacy & Wiers, 2010; Wiers *et al.*, 2011). In this framework, substance use disorder is conceptualized as an imbalance between strong associative, automatic processes to drug-stimuli and weak controlled conscious processes. Consequently, effective therapy should aim to (1) reverse overdeveloped automatic reactions in response to drug-related cues and (2) train and reinforce the cognitive control system (Boendermaker, Prins & Wiers, 2015). However, current addiction treatment focuses only on reinforcing the cognitive control system, and does not target automatic impulses. Cognitive



Box 3: The brain and substance use disorder

The underlying mechanism of substance use disorder relates to the addictive nature of the substances. Almost all addictive drugs target the brain's reward system by flooding the neuronal circuit with dopamine; a neurotransmitter that is produced in brain regions that regulate emotion, cognition, motivation, feelings of pleasure, and movement (Herz, 1992). The overstimulation of the reward system produces the euphoric effects that make addicted patients inclined to repeat the addictive behavior, which creates a tunnel-vision for obtaining the substance and neglecting other essential daily activities (Koob, 1992). Therefore, drug abuse becomes problematic to the user when he/she becomes dependent on it or experiences significant interference in their daily lives due to overuse.



intervention targeting the automatic impulses in reaction to the substance, generally by using computer tasks (see Box 4).



Box 4: Cognitive bias modification (CBM) therapy

Cognitive bias modification is a therapy for substance use disorder, which targets overdeveloped automatic impulses in response to drug-associated cues. This therapy can adapt many cognitive biases towards a drug-stimulus. These biases include attentional bias, approach bias or memory bias (Box 7). The Tovertafel has an important interaction component, which is an added benefit for computer approach bias therapy. Therefore, we focus in this report on approach bias training. In approach bias training, participants have a joystick and see a computer monitor. They are instructed to push away pictures of alcoholic drinks with joystick, causing the picture to zoom out and become smaller. If the displayed image is something non-alcoholic, such as a soft drink, they have to pull the picture toward themselves, causing the image to zoom in. The goal of approach bias training is to modulate the bias to the action tendency to approach the substance (Wiers *et al.*, 2011). The therapeutic merits of CBM therapy are well-established and replicated several times (Fadardi & Cox, 2009; Schoenmakers *et al.*, 2010). For example, 1-year relapse rates are decreased from 59% without CBM to 46% with CBM therapy (Wiers *et al.* 2011). Unfortunately, CBM therapy is very repetitive and not engaging, resulting in motivational issues leading to high dropout rates, especially in adolescents (Boendermaker *et al.*, 2015). Therefore, a major challenge in contemporary CBM research is on how to make therapy more fun and engaging through gamification (Boendermaker, Prins & Wiers, 2015; Box 5).



Box 5: Increasing motivation for CBM therapy by persuasive game design

Therapy can be made more fun and engaging by creating a game integrating elements of the therapy. For this, one can use the framework of persuasive game design (PGD). The essence of persuasive game design is that one creates a game world, which evokes behavioral change in the real world (Visch *et al.*, 2013). A major benefit is the increased motivational value, since in the game world, the user is generally more easily motivated to learn new skills compared to the real world (Visch *et al.*, 2013). In addition, the game environment can often provide a safe setting in which the user cannot truly fail (Apter 2007; Oinas-Kukkonen, 2012). To elucidate, in both the game and the real world the user is driven by similar motivational needs: autonomy, social relatedness and competence (Ryan & Deci, 2000). The motivational aspects and the feeling of safety of the game world can help, motivate, or persuade users to behave in ways they experience as difficult in the real world (Visch *et al.*, 2013). These benefits reveal a role for the Tovertafel in integrating elements of CBM therapy to make the treatment more fun and engaging.

Co-design: The new Tovertafel

Tovertafel Compass: for people with substance use disorder



Summary:

- Substance use disorder patients are treated in 178 specialized substance abuse clinics in the Netherlands.
- Substance abuse patients often have low self-esteem and are afraid to fail. Social interaction and sharing experiences with peers often helps in combating the addiction.
- Current treatment focuses on increasing conscious decision making in risky situations, which is called cognitive behavioral therapy. This therapy is offered both individually and in group sessions.
- The Tovertafel Compass could offer innovative CBM impulse therapy in a fun way, reducing relapse rates and potentially increasing therapy acceptance and facilitating social interaction.

Co-design Process

After extensive literature analysis and consulting with experts, we proceeded with the penultimate stage of our project, which is centered on co-design. The goal of co-design is to involve the target audience in this early stage is to make our recommendations more concrete and applicable for marketing employees and game developers, and to make sure our conclusions are built on a precise understanding of the target audience's needs. Therefore, co-design offers valuable insights on the product understanding from the users' perspective. The co-design procedure consists of three stages; the exploration, the design and the implementation stage. In our project, we focused on the exploration stage.

The exploration stage involves the use of various tools, including the stakeholder map, persona mapping, patient journey and the value proposition canvas to visually present the previously obtained research findings (Figure 3). In addition, we investigated different types of therapy and the organizational structure of different substance abuse clinics in the Netherlands. For this, we looked at the structure of 60 clinics in 6 different organizations (Brijder verslavingszorg, Jellinek Kliniek, Vincere GGZ, Trubendorffer, Castle Craig and Triora verslavingszorg). Based on this information, we aim to determine how the Tovertafel could fit into the current treatment process.

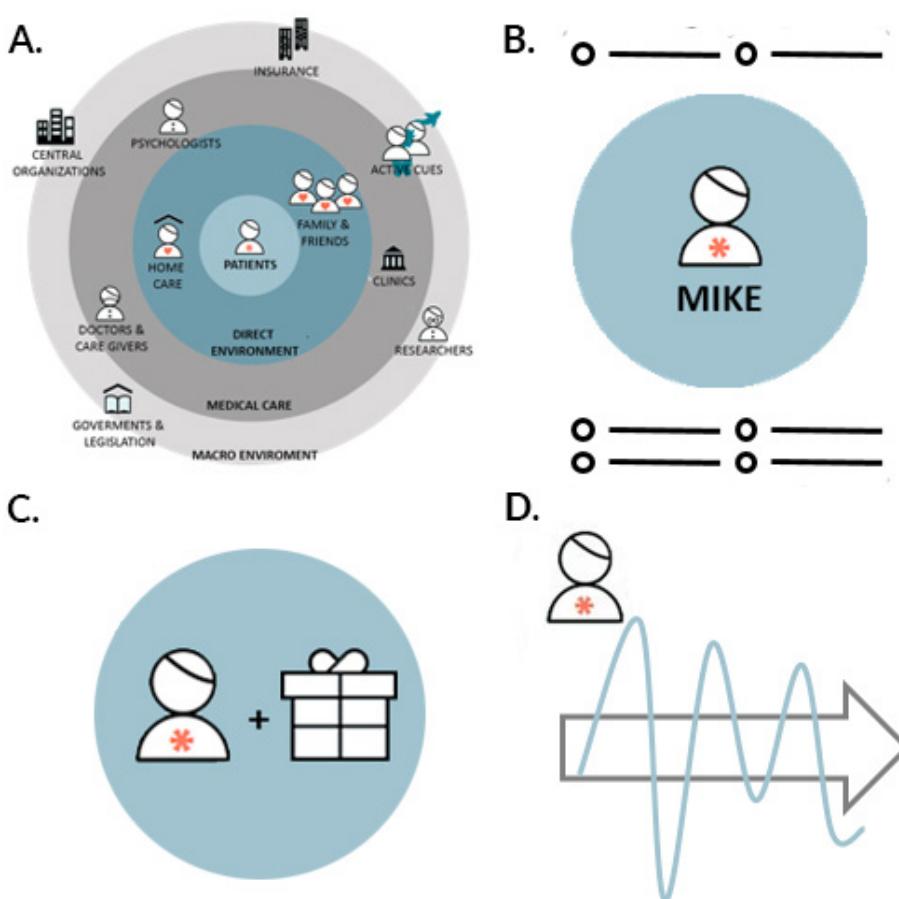


Figure 3: The co-design tools that were used to chart customer and patient needs. A: The stakeholder map presents an overview of the individuals or groups that are affiliated with the substance abuse audience. B: The Persona maps represent a visual summary of all the interviews we conducted with customers and patients. C: The value proposition canvas is a tool to visualize the fit between the functions of the tovertafel on one hand, and the pains and gains of the customers and patients on the other. D: The patient's journey shows the patient's treatment trajectory from the moment they seek help until their release from treatment. It also shows the different types of therapy programme that are offered.



Stakeholder map

The stakeholder map is a tool to display the many stakeholders that are involved in treating substance abuse (Figure 4). The direct environment of the patient includes the people that take personal care of the patient. Moving to the outer circles of the figure, stakeholders are involved in the medical care or in the macro environment. The customers are the substance use care organizations, which would host the group therapy sessions for the addicted patients. After approaching professionals that work in several clinics, it became apparent that although the big decision are taken by those in management positions. However, the psychologists are the employees of the addiction care clinics that interact with the patients and have a lot of knowledge on what kind of therapies work, and what the possibilities for growth and innovation are in the current therapy plan. Accordingly, psychologists are often in contact with the management, to inform them about new therapy methods. For this reason, in the remainder of this section, we will refer to the psychologists as our “customers”. In the next sections, we will clarify the needs of the customer and the patient.

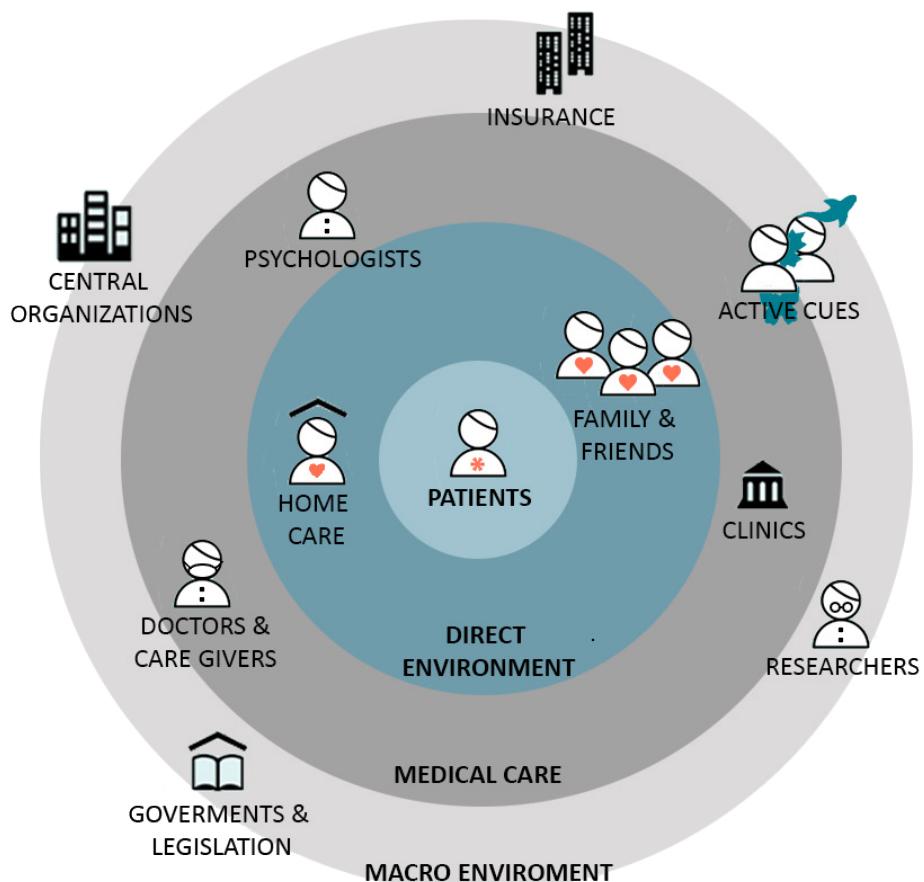


Figure 4: Stakeholder map. This figure represents all the important stakeholder involved with substance abuse patients.



Who is the customer?

Substance abuse clinics and types of treatment

When an addicted patient is facing challenges in his life, he can decide for himself to seek help, or his environment can persuade him to. Professional help for addicted patients is offered in substance abuse clinics. Currently, the Netherlands counts 178 substance abuse clinics, offering treatment for every type of addiction. It should be mentioned that there are also other, more informal treatment facilities, such as Alcoholics Anonymous and church-led initiatives. However, we will not go into detail about these alternatives here. The type of treatment is often adjusted to the needs of the patient by a psychologist; either ambulatory therapy (box 7) or clinical therapy (box 8). Factors which influence the choice of a therapy trajectory include the diagnosis of comorbidities (co-occurrence with other pathologies), the severity and length of addiction, the number of previous relapses and remaining responsibilities, such as jobs or childcare. All treatment options are based on cognitive-behavioral therapy (box 6) and clinics offer both individual and group sessions.

However, the differences between therapies include the number of sessions per week, and the location of the therapy; in a clinic near your own home (ambulant therapy) or within a clinic where the patient also stays overnight (clinical therapy; box 8).



Box 6 - Cognitive behavioral therapy

Presently, cognitive behavioral therapy is the golden standard for substance abuse treatment. Cognitive behavioral therapy reinforces the conscious processes to change the automatic reactions to drug-stimuli in stressful situations (Ouimette *et al.*, 1997). Cognitive behavioral therapy aims to change unhelpful patterns in thoughts, behavior and emotional regulation in order to change personal coping strategies in response to a certain situation (Navajits *et al.*, 1996). Hereby, an assumption in cognitive behavioral therapy is that substance abuse is a learned, but adaptable behavioral pattern (Bijendorf *et al.*, 1990). For example, many addictions were developed following a stressfull period or an unstable youth, which creates coping strategies in response to stressfull situations or distorted beliefs about themselves such as a low self-esteem. By giving insights in these strategies and beliefs, drug use behavior can be changed. Eventually, by identifying and changing conscious processes in response to the drug, the drug use can be decreased.

Addiction therapy and the Tovertafel

For the use of the Tovertafel with CBM therapy elements, we envision the use of the Tovertafel Compass during a group session. In such a group session, usually 6-12 addicted patients are present together with a psychologist. Thereby, the difficulty of the psychologist is that he has to pay attention to both leading the group session as observing the patient. By complementing the current therapy with the Tovertafel Compass, the psychologist would have more time to observe the patients as they are focused on the game. This requires the Tovertafel to be self-explanatory, so the psychologist can focus more on the individual patients.



Box 7 - Ambulant therapy

Most of the substance abuse clinics offer mainly ambulant care, providing first order substance abuse therapy care. This therapy lasts between 3-9 months and includes one or two evenings a week to develop a personal treatment plan using cognitive behavioral therapy protocols (Ambulant therapy 1). Ambulant therapy 1 often does not contain group sessions, as the severity of the addiction of the patients involved in this therapy is not high. For more severely addicted patients with previous relapses, there is day therapy which includes 3-4 full days at the clinic for 6 weeks (Ambulant therapy 2). This therapy includes life-style and emotional training in group sessions of 6-12 people and individual cognitive behavioral therapy. In order to maintain a normal day activity for the patient, the patient could also follow a ambulant therapy 2 track in the evening. The set-up of the evening ambulant 2 therapy is similar to the day therapy. The patient should be present every evening and the full weekend in the clinic. A visual representation of the contact moments of the organization and patients involved in ambulant therapy is shown in figure 7.

Addiction therapy and the Tovertafel

For the use of the Tovertafel with innovative CBM impulse therapy elements, we envision the use of the Tovertafel Compass during a group session. In such a group session, usually 6-12 addicted patients are present together with a psychologist. Thereby, the difficulty of the psychologist is that he has to pay attention to both leading the group session as observing the patient. By complementing the current therapy with the Tovertafel Compass, the psychologist would have more time to observe the patients as they are focused on the game. This requires the Tovertafel to be self-explanatory, so the psychologist can focus more on the individual patients.



Box 8 - Clinical therapy

Most substance abuse organizations have one or two clinics which offer clinical therapy. This is an intensive treatment plan for 7 weeks, including a first week of full abstinence, and then a therapy program of 6 weeks. This 6 week program includes emotional and spiritual therapy in groups, cognitive behavioral therapy for individuals and often walking or sporting activities. The location often consist of around 40 single person rooms, with internet, boxspring and individual bathroom. Furthermore, there is often a room for sports, 2 living rooms and a dining room where 3 meals a day are eaten.



Customer persona map

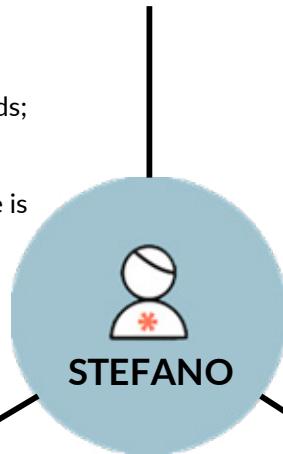
The goal of this persona map is to chart the personal difficulties of the customer and thereby making sure that game developers take the needs of the customer into account in the development of a new game. We visualized the gathered information from interviews with psychologists, in a personalized and coherent way in these persona maps. The persona map in this section is based on the difficulties of the therapist in substance abuse clinics.

Personal:

- His dad is Italian.
- Married (happily) for 10 years with 2 kids; 1 boy and 1 girl.
- Wife is a nurse, they met at a clinic (she is very nice).
- Likes helping people.
- Very polite, sometimes snaps around family and friends.

Needs & values:

- Likes: outdoor rock climbing and drinking beers with his buddy Mo(hammed).
- Dislikes: people who tell him what to do and egocentric people.
- Needs: concrete/direct impact in his job, helping people not to relapse.
- Needs some flexibility in his schedule to pick up his kids from their sports clubs.



Technical:

- 40 years old, Psychologist in Jellinek Amsterdam
- Not addicted himself, but his father had alcohol problems
- Volunteer at Sanquin Bloedvoorziening

Figure 5 Therapist Persona map. The persona (note: all personas in this document draw inspiration from various sources, and do not represent real persons) of therapist Stefano represents a psychologist in a substance abuse clinic. The persona map is divided into a personal section, a technical section and the needs and values.

Value proposition canvas for the customer

The goal of this persona map is to chart the personal difficulties of the customer and thereby making sure that game developers take the needs of the customer into account in the development of a new game. We visualized the gathered information from interviews with psychologists, in a personalized and coherent way in these persona maps. The persona map in this section is based on the difficulties of the therapist in substance abuse clinics.

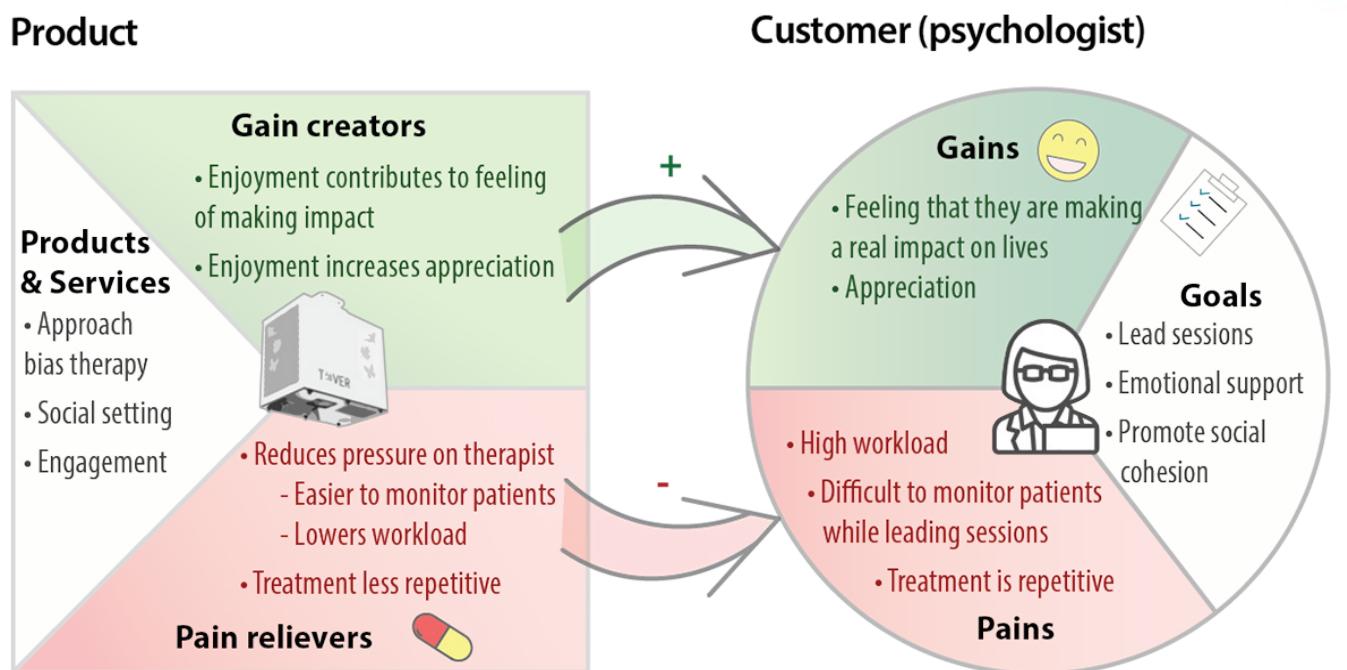
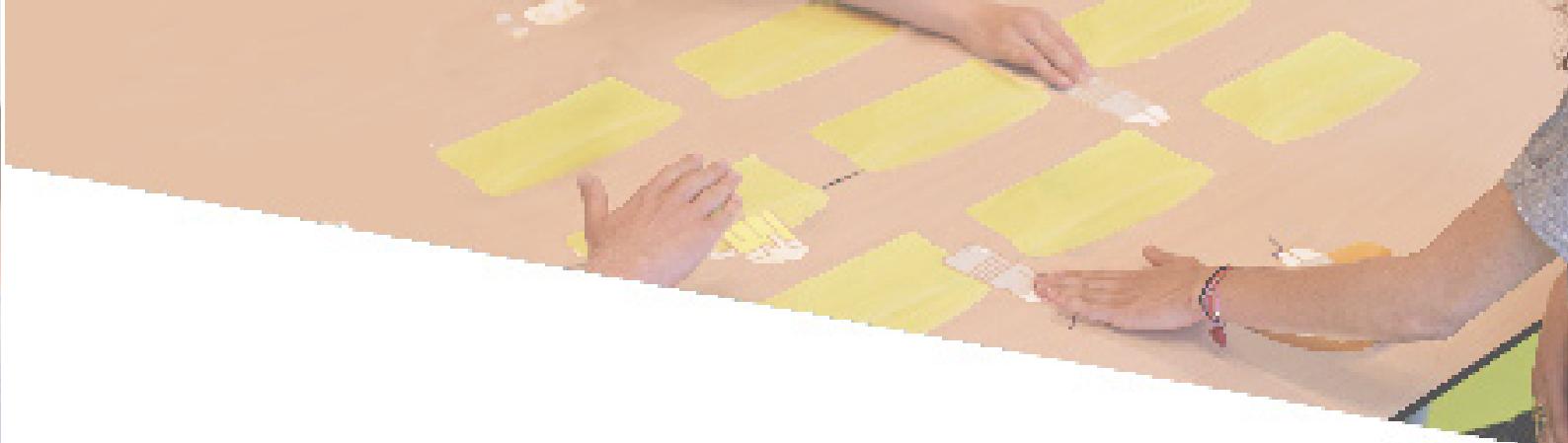


Figure 6: Value proposition canvas for the customers (psychologists working in substance use clinics).
 The value proposition canvas consists of two parts; the customer profile (on the right), and the product profile (on the left). The customer profile describes the goals the customer targets to achieve, the frustrations which annoy them (pains), and the positive outcomes that the customers hope to achieve (gains). Through the goals, pains and gains of the customer profile, we visualise what the product profile has to address. With the product profile we list the services of Tovertafel on which the value proposition canvas builds on. These services reduce or minimize the customers' pains (pain relievers), and maximize their gains (gain creators). The product map makes explicit how the value proposition releases pains (red arrow) and increases the gains of the customers (green arrow). This visualization can be used to determine the customer fit of the product.

Who is the substance abuse patient?

Patient Journey

The goal of the patient journey is to inform game developers and the sales team about the clinical trajectory of the patient to envision where patients and customers would use the new Tovertafel. With this information, they can ensure they can design their marketing plan or game design plan in a way it would perfectly fit this specific environment. Thereby, a patient journey formulates the different contact moments and the decision moments of the psychologist with the patient in order to choose the right therapy. The patient journey of an addicted patient consists of a check-in phase, assessment phase, treatment phase and an outcome phase (Figure 7). When a patient has decided to seek help for his/her addiction, he makes an appointment with a substance abuse clinic close to home. Then, he will check-in for the first meeting in which the psychologist together with the patient decides on treatment trajectory and treatment content. Based on the severity and length of the addiction, comorbidities and previous number of



relapses, the psychologist chooses between three types of therapy: Ambulant therapy 1, ambulant therapy 2 (see box 7) or clinical therapy (box 8). After therapy, the patient is either clean or is still addicted. The psychologist and the patient will evaluate the treatment trajectory and make a plan for future after-care.

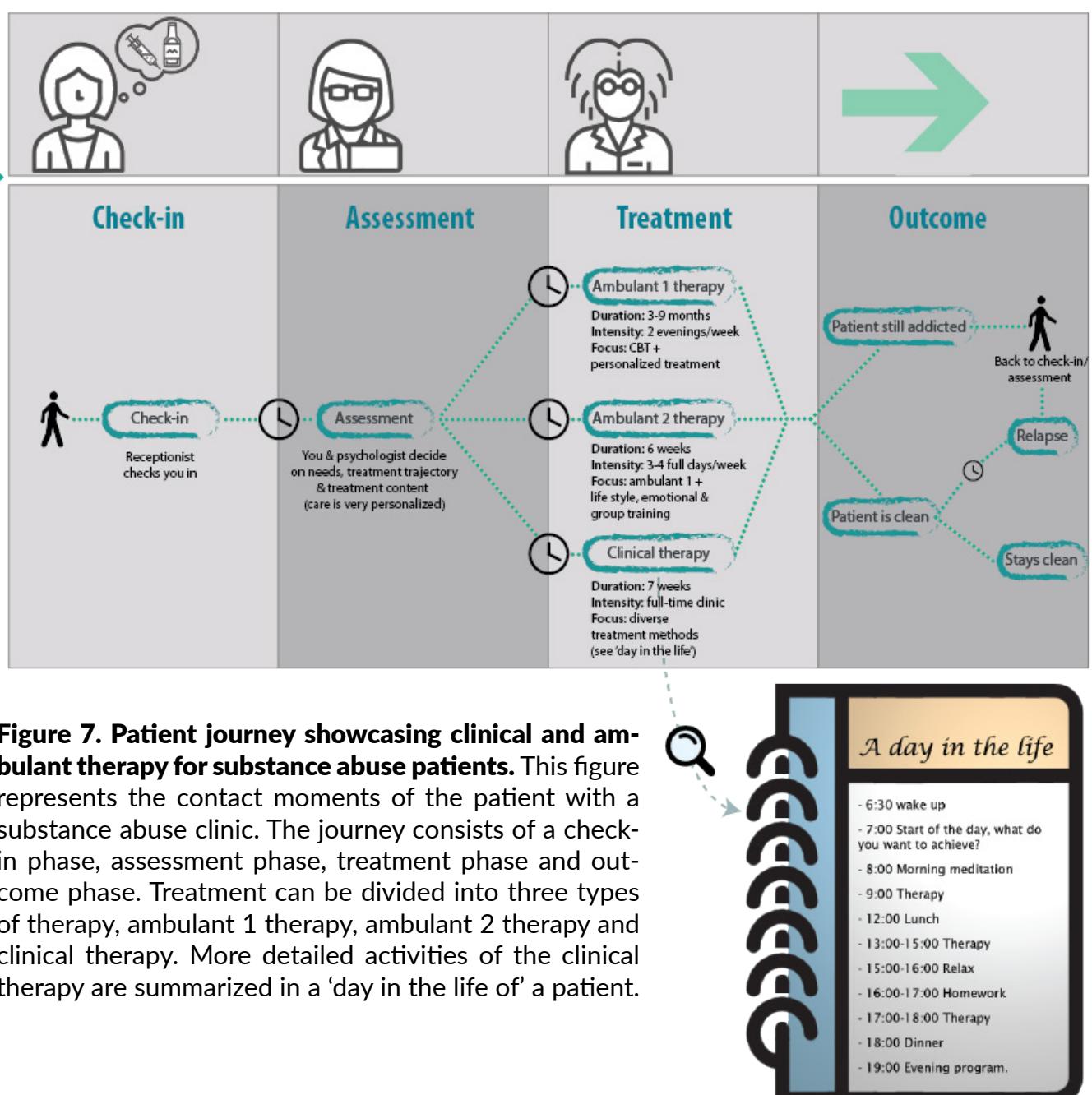


Figure 7. Patient journey showcasing clinical and ambulant therapy for substance abuse patients. This figure represents the contact moments of the patient with a substance abuse clinic. The journey consists of a check-in phase, assessment phase, treatment phase and outcome phase. Treatment can be divided into three types of therapy, ambulant 1 therapy, ambulant 2 therapy and clinical therapy. More detailed activities of the clinical therapy are summarized in a 'day in the life of' a patient.



Patient persona map

Similar to the customer persona, the goal of this persona map is to chart the personal difficulties of the patients and thereby making sure that game developers take the needs of the patient into account in the development of a new game. Substance abuse has a highly heterogeneous profile: every patient is different. Realizing this, current treatment is already highly personalized. To chart these differences in personal difficulties, we visualized the gathered information from interviews with patients, in a personalized and coherent way in persona maps. The three persona maps correspond to the three different types of therapy in the substance abuse clinics; Marit is involved in ambulant therapy 1, Joris is involved in ambulant therapy 2 and Mike is involved in clinical therapy. In this way, the differences in addiction history and the choice of therapy are represented.

Personal:

- No kids, lives with husband in den Haag.
- Started drinking to calm herself after a stressful situation.
- Drinking started as one glass of wine per night, which turned into 3, 4, 5...
- Has a book club evening every week with friends.
- She is still very active in society and has difficulty facing her addiction.

Needs & values:

- Marit has a strong child wish. But after years of trying, it ended in a miscarriage.
- Marit doesn't want her friends to know about her addiction, as she is ashamed about it.
- She has never considered addiction care before, but her husband persuaded her to see a psychologist.

Technical:

- 34 years old, high-school chemistry teacher
- Addicted to alcohol: 1,5 years
- Started drinking after a stressful miscarriage
- Comorbidity: ADHD

Figure 6 Persona Map - ambulant 1 patient. The persona of Marit represents a patient with the criteria for an ambulant 1 therapy. The persona is divided into personal information, technical information and her needs and values.



Personal:

- Married, with 2 kids in puberty.
- Raised in strict catholic environment, where you keep your problems to yourself.
- Demanding & stressful job (70 hrs/ week), travels often.
- Tried to tackle addiction alone, doesn't want to go to AA

Needs & values:

- Sees himself as a very intelligent and independent man.
- He is stubborn, but sensitive to the love of his wife.
- After her suggestion, he is looking for addiction care which you can follow in the evening hours, aside to your normal 40 hour / week schedule.

JORIS

Technical:

- 44 years old, international IT manager at Unilever
- Addicted to alcohol: 4 years
- Started drinking to keep up with his stressful job

Figure 7 Persona Map - ambulant 2 patient. The persona of Joris represents a substance use disorder patient with the personal and technical background for ambulant 2 therapy. The persona map is divided into a personal section, a technical section and his needs and values.

Personal:

- Divorced with 1 son (under the custody of his ex-wife).
- Abused by father & neglected by mother.
- On welfare
- Has received therapy before, but relapses every time.
- Low self esteem
- Likes nightlife

Needs & values:

- Likes: clarity, doesn't like confusion.
- If something is not fun, he won't do it.
- Wants to get rid of his addiction, as he is sick of relapsing
- Wants to solve emotional problems that drive his addiction.

MIKE

Technical:

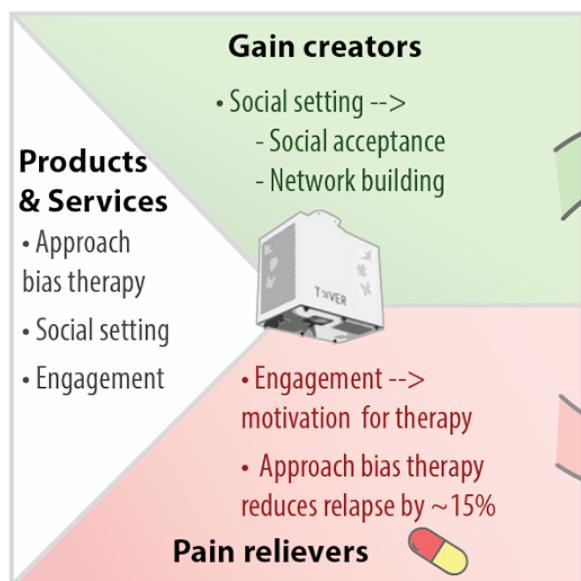
- 30 years old, plumber
- Studied psychobiology but dropped out
 - Addicted to alcohol: 8 years
- Started drinking with wild party behavior
- Comorbidity: mild paranoia

Figure 8 Persona map - clinical patient. The persona of Mike represents a substance use disorder patient with the personal and technical background for clinical therapy. The persona map is divided into a personal section, a technical section and his needs and values.



As before, the goal of the value proposition canvas is to find the match between the value of the Tovertafel and the difficulties of the specific audience. It consists of the pains, gains and goals of the patient. It then juxtaposes this to what the Tovertafel brings to the table. As such, it is an indication of the “patient fit” of the Tovertafel Compass.

Product



Patient

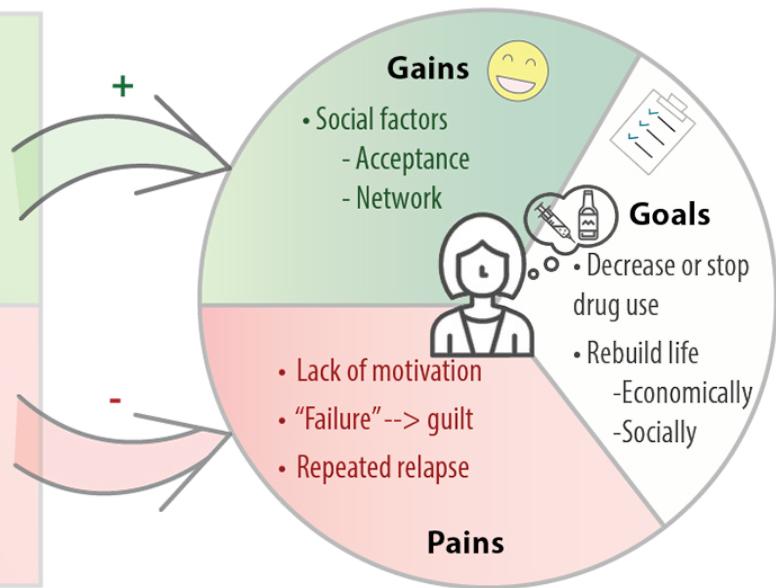


Figure 9: Value proposition canvas for the patient. The value proposition canvas consists of two parts; the patient profile (on the right), and the product profile (on the left). The patient profile describes the goals the patient targets to achieve, the frustrations which annoy them (pains), and the positive outcomes that the patients hope to achieve (gains). Through the goals, pains and gains of the patient profile we visualise what the product profile has to address. With the product profile we list the services of Tovertafel on which the value proposition canvas builds on. These services reduce or minimize the patients' pains (pain relievers), and maximize their gains (gain creators). The product map makes explicit how the value proposition releases pains (red arrow) and increases the gains of the patients (green arrow). This visualization can be used to determine the patient fit of the product

Whack-a-drink!: the game prototype fo the new Tovertafel Compass



Summary:

- Whack-a-drink! is a prototype for a Tovertafel Compass game: it shows what such a game could look like.
- The new Whack-a-drink! game targets the following needs of the patient: Increased social interaction, create a cooperative and reward-based game to increase a low-self esteem, is cognitively and physically challenging by a rule-based game and decreases strong automatic impulses to the substances via elements of CBM impulse therapy.



With the gathered information in co-design and the in-depth analysis, we were able to identify the needs and difficulties of the different stakeholders for the new Tovertafel Compass. In order to generate a prototype game from this information, we first define some essential game characteristics, which should be present in every game.

Game characteristics

The game characteristics were derived from the following needs of the patients:

- Incorporate CBM therapy elements to ensure therapeutic merit. Patients with substance use disorder have different levels of cognitive or physical challenges. The game should be accessible to every level.
- Realistic images of substances would enhance the transfer of obtained skills in the Tovertafel world to the real world.
- Current research shows that CBM therapy requires many trials. The game should remain engaging, which is achieved with a level progression system in which players have a clear goals and levels become increasingly challenging.
- Substance use patients are normally very focused on their own goal in life. However, they tremendously benefit from sharing experiences with peers of their therapy process.
- Cooperation in a game opens and stimulates a conversation about their own experiences and builds a social network.
- Substance use patients usually have a very low self-esteem. The game is mainly focused on reward and group achievements and not on personal failure, which would be beneficial for personal mood and group feeling.

Creative process

The next step is to go from these game characteristics to a real game. The development of this game took place in several steps.

- 1. Ideation:** To gather initial concepts, we organized a brainstorm session with students from the Tesla program. First, we clarified the characteristics of the game, in order to generate many creative ideas for a potential game for the Tovertafel Compass.
- 2. Development:** From these initial concepts, we selected those we deemed most promising for further development. These concepts were then developed into concrete games.
- 3. Prototyping:** From these concrete games, we chose for the Whack-a-drink! game, which we thought was the most promising. Then, we created a prototype using paper cut-outs. Using these, we played through a level of the game and made a stop-motion video of the game, which will be presented at the final presentation at Active Cues (17 July 2017) and is available from the authors upon request.



Figure 10. Game Characteristics Whack-a-drink! A. The game includes CBM elements. The Whack-a-drink! game includes a gamified version of the approach bias of the CBM intervention (see box 9). Creating an engaging version of CBM was a priority from the beginning of our brainstorming regarding games, considering the intrinsically boring nature of the classical CBM. **B. The game is for all cognitive and physical levels.** Heavy alcohol abuse over a long period of time can cause brain deficits that persist well after the patients achieves sobriety (White, 2003). These deficits, include learning and memory impairments, as well as impairments in movement and coordination (Wong *et al.*, 2003). **C. The game has realistic imagery.** The more convincing the imagery is, the closer to a real-life encounter with an alcoholic beverage the gamified CBM resembles. **D. The game consists of multiple levels.** Due to the repetitive nature of the the classic CBM intervention, the tasks are not engaging for longer times. With the addition of multiple levels of escalating difficulty we aim to make the game fun even for many trials. **E. The game encourages co-operative play.** When brainstorming for our game we aimed to design a game that encouraged cooperation, and not competition between the players, to nurture the safe environment, that they build during other treatment activities, e.g. group therapy, and create a shared responsibility. **F. The game focuses on rewards.** Although there are point reductions for mistakes, this never leads to 'failure', as players can only increase in levels. Within a level, you can go back to 0 points, but never fail.



Box 9: Tovertafel and Cognitive bias therapy: Approach bias vs other cognitive biases

In order to train the unconscious thinking patterns, one can either focus on training the attention bias, the memory bias or the approach bias towards alcohol-related stimuli. Alcohol addicts have a strong focus on all alcohol-related stimuli, which is called attention bias. You can identify attention biases by the following task. Two stimuli are presented briefly on a computer monitor simultaneously, of which one stimulus is neutral (a water bottle), whereas the other stimulus is an alcoholic stimulus (a beer bottle). Then, the stimuli disappears and a probe (e.g., the letter 'E' or 'F') appears in the prior location of one of the words. The participant's task is to identify the probe quickly and accurately by pressing a corresponding button (Beard, Sawyer and Hoffman, 2012). In order to modify this attention bias, the probes can replace more often the neutral stimuli, thereby steering the attention towards neutral or positive stimuli and away from the alcohol-related cues (Beard, Sawyer and Hoffman, 2012). Furthermore, alcohol addicts also have a memory bias for the automatic activation of alcohol-related associations (Wiers, Van Woerden, Smulders, & De Jong, 2002). Lastly, alcohol addicts have an automatic action tendency to approach alcohol. To implement the bias modification training into the Tovertafel, the Tovertafel would have the most added benefit when incorporating the approach bias training. The Tovertafel is a 2D game, where you can interact with light projections. This interaction component of the Tovertafel, can be an added value for the approach bias training compared to computer approach bias training. This interaction component, is less present in the attention bias training or memory bias training. However, in the future, Tovertafel could aim to address all biases in different games to optimize the effect of the CBM training on relapse rate of the addicted patients. For the first game for the Tovertafel Compass, we focused on the approach bias training, as we felt this therapy would benefit most from the Tovertafel format.

Prototype Whack-a-drink!

Our game is inspired by the successful Whack-a-mole arcade game, where the player has to hit mechanical moles with a mallet as they pop up from their holes. For our game, we combined the basic concept Whack-a-mole, with addressing the approach bias towards alcohol-related stimuli. This could elevate the quality of life of the substance use patients and form an innovative addition to the existing therapy.

For the prototype of the first game, we recommend focusing on the 'approach bias' part of CBM therapy (see box 9 for an overview of CBM therapies). Concretely, this means the game should involve movements to approach non-alcohol related stimuli, while at the same time pushing away or moving away from alcohol-related stimuli. In the following procedure, the game is explained (see Figure 5 for a visual explanation). This game matches the needs of the patient and the customer in current addiction care. We present the first Tovertafel Compass prototype game: Whack-a-drink!



Whack-a-drink! prototype description

The players gather around the table and they switch on the Tovertafel Compass and choose to play the Whack-a-drink! game. The game starts and 9 pipelines appear on the middle of the table. The Tovertafel prompts how many players are playing and the corresponding number of baskets appear around the table. Next to the baskets there is a scorekeeper.

The game also asks if this is the first time playing for all the players. If the players choose "yes", a short presentation of the game elements appears. The Whack-a-drink! game has 5 main elements, that have interactions with each other and with the players. The elements consist of the alcoholic and non-alcoholic beverages, the pipelines, the baskets and the score counter. Every element has a trigger independent from the players'

hand movement behavior, and a dependent one that responds to the players' actions (reaction) (See table 2). Out of the pipes can pop up either alcoholic or non-alcoholic beverages. The goal of the players is to hit alcoholic beverages that fall back in the pipeline, and to collect non-alcoholic beverages by wiggling them out of the pipeline and dragging them into their baskets.

“ You can have a thousand questions about a game, but if you see an example, most of those are immediately answered.

Rajiv Krijnen - Active Cues



Table 2 Game elements Wack-a-drink! The game Whack-a-drink! consists of different game elements, an alcoholic drink, a non-alcoholic beverage, a pipeline and a basket. These elements are involved in different activities upon activation by a certain trigger, which induces a certain reaction of the user followed by a reaction of the specific element.

	Trigger	User's reaction	Element's reaction
Alcohol bottle 	Alcoholic drink appears with a sound through the pipeline.	User's hand moves towards the alcohol bottle and hits it.	Alcoholic drink makes a sound and slides back through the pipeline.
Non-alcoholic beverage 	Non-alcoholic beverage appears with a sound through the pipeline.	User's hand moves towards the non-alcoholic beverage, wiggles the beverage and pulls it towards the user's own basket.	Non-alcoholic beverage reacts on the user's movement through a sound and ends up in the basket.
Pipeline 	Pipeline reacts on the appearance of either an alcoholic bottle or a non-alcoholic beverage entering the pipeline with a sound.	User reacts to the beverage.	
Basket 	The basket reacts to a non-alcoholic beverage by giving a positive sound and shaking of the basket itself.		
Score counter: gaining a point		A player pulls a non-alcoholic beverage to a basket.	All players gain one point which adds to the existing point number in the Score counter.
Score counter: losing a point		The player does one of the 3 mistakes.	All players lose one point which is subtracted from their existing point number in the Score counter.



The first game levels are very easy with only one alcoholic or non-alcoholic beverage appearing at a time through one pipeline. When an alcoholic beverage appears through the pipeline, a player has to hit it. The beer will then be pushed back into the pipeline and disappears from the table (see figure 11, 1-3). When a non-alcoholic appears through the pipeline, the player has to wiggle it out of the pipe and drag it in the basket in front of him/her (see figure 11, 4-6). Since the Tovertafel still can't distinguish between players, the collected non-alcoholic beverage will give every player one point. Every player can see the common score next to his/her basket. The players don't get any points for the alcoholic beverages they hit, as that action is training their approach association towards substance-related cues.

There are some mistakes that the Whack-a-drink! is programmed to register, for which all players lose one point. These are: a) the players hit the non-alcoholic beverages instead of wiggling them out of the pipelines (see figure 11, picture 7), b) the players wiggle the alcoholic drink out of the pipeline (see figure 11, picture 8), and c) the players, they all lose one point. The loss of one point for all players, is a result of the incapability of Tovertafel to register individual players, and a motivation for a shared responsibility among the players. As the difficulty of the levels rises, multiple non-alcoholic or alcoholic beverages appear, alone or as a combination.

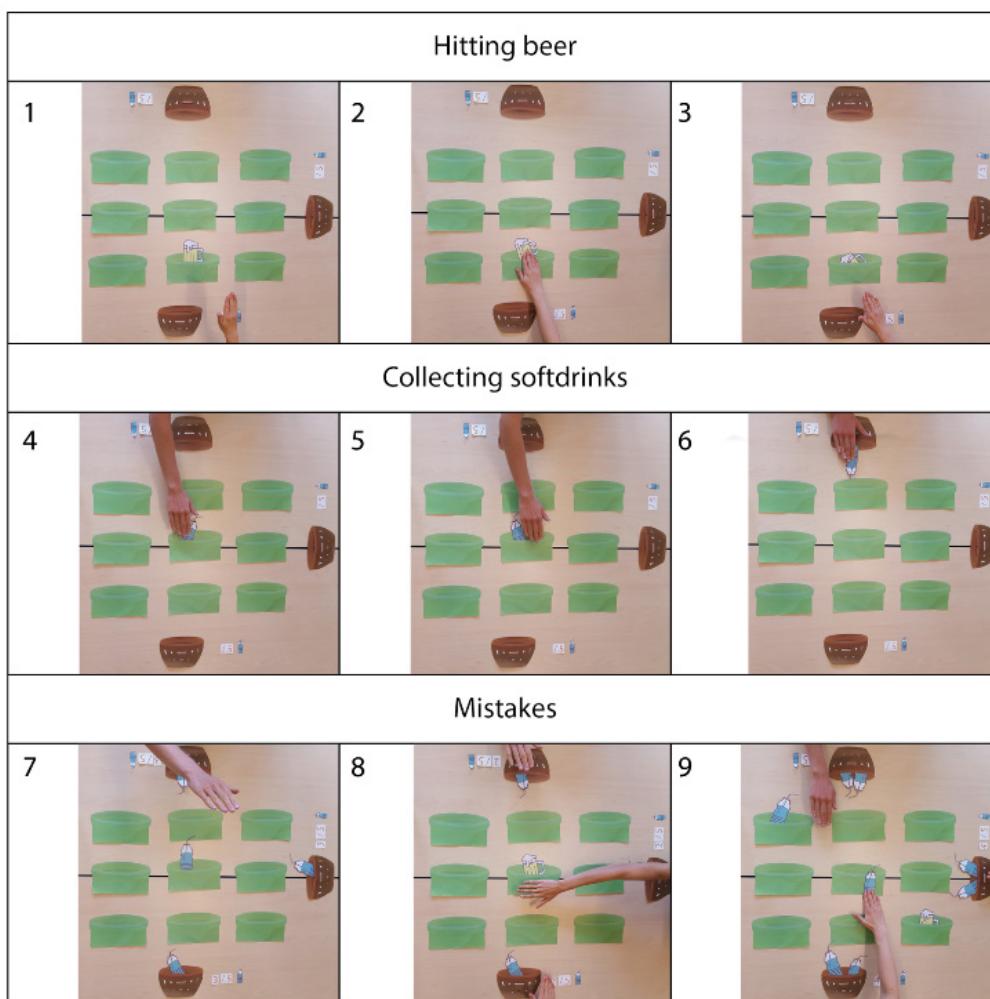


Figure 11 Whack-a-drink! The goal of Whack-a-drink! is to gain 5 points as a group, to proceed to the next level. You gain points by wiggling water bottles out of the pipes and getting them in your basket (4-6). This will increase the group points with 1 point. An alcoholic drink should be hit briefly (1-3). Lastly, as a group you can lose points. This is by hitting a water bottle (7), wiggling the alcoholic drink out (8) or ignoring either a water bottle or an alcoholic drink (9).



Game goals of Whack-a-drink!

The whack-a-drink! game matches the following components and game goals.



Social (cooperative) - 4/5

Players work toward a common goal, creating shared responsibility and room for group discussion.



Physical - 5/5

The game stimulates active involvement from every player. Time pressures and scaling difficulty ensure persistent physical activity.



Cognitive - 4/5

The game stimulates engagement by furnishing concrete goals in the form of level progression. In addition, there is a multitude of concurrent relevant game elements and the difficulty is scalable.



CBM elements - 5/5

Current treatment revolves around moving a joystick and receiving visual feedback on-screen depending on the direction of movement. By comparison, the proposed game is more intuitive and direct, involving hand motions directly toward the stimuli.



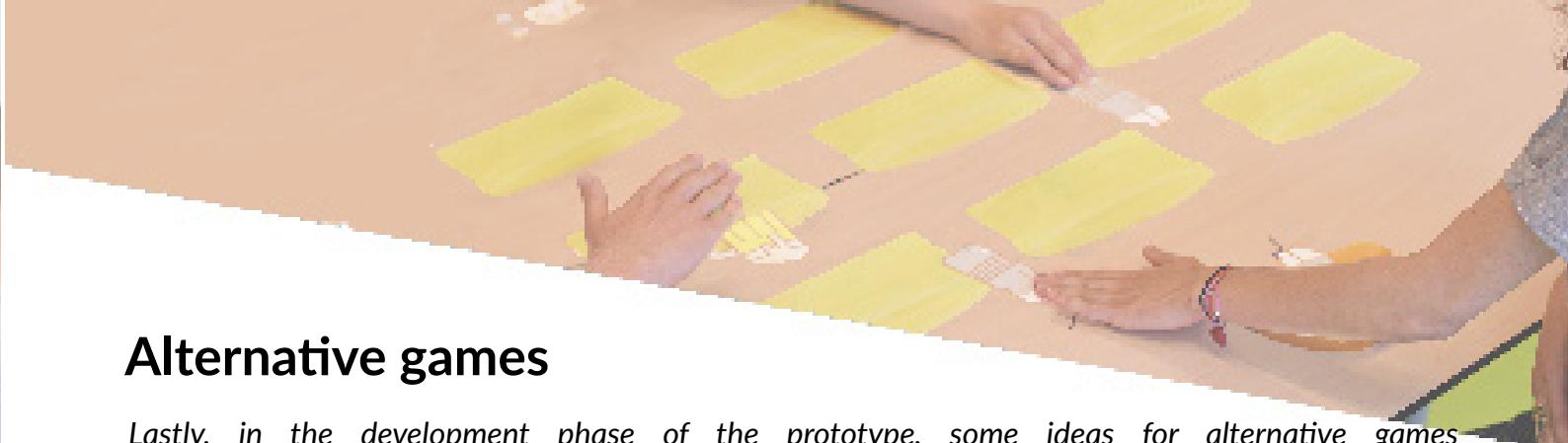
Technical feasibility - 5/5

The proposed game overcomes 2 technical limitations of the Tovertafel. Concretely, Tovertafel currently has no player recognition, and its games have to make sense from all angles.

Future questions for Whack-a-drink! development

When designing the Whack-a-drink! game suitable for the Tovertafel Compass, a few questions arose. The following questions can be addressed in the process of further development:

- The suggested scaffolding mechanisms are very general: when the level goes up, the speed and frequency go up. It would be interesting to consider a scaffolding mechanism that's more specific for the audience and game. For example, difficulty could be increased by using stimuli that are more difficult to distinguish. For example, a water bottle is more similar to a vodka bottle than a beer bottle is to a bottle of coke.
- Are gamified CBM elements, regarding the approach associations for alcohol cues, still effective?
- Do the patients find the game fun and engaging, even for many trials?
- How do patients with mild cognitive disabilities due to substance use, react to the game?
- Which unforeseen dynamics emerge when playtesting this with real patients?



Alternative games

Lastly, in the development phase of the prototype, some ideas for alternative games arose. However, due to different reasons we decided to continue with the development of the Whack-a-drink! game. Two alternative games are explained in the section below.

Cocktail shaker game

In this game, every player has a cocktail shaker, which can be moved left and right using hand movements. Objects are shot around the table, for example in a manner akin to the Bubbles game for Tovertafel Original. These objects can be harmless, such as fruits, which should be collected. They can also be alcohol bottles, which should be avoided at all costs. An alternative version of this game does not make use of the cocktail shakers, but instead has you collect/avoid objects with your hands.



Social (cooperative) - 2/5

We believe this is the biggest downside of this game in its current form. The gameplay is individualistic, leaving little room for co-operation.



Physical - 5/5

The game encourages continuous involvement from every player.



Cognitive - 3/5

The game stimulates persistent activity, due to the constant stream of objects approaching the player. Other than this, gameplay is fairly linear.



CBM elements - 4/5

The game deviates from mainstream approach bias training by moving away from, rather than pushing away alcohol.



Technical feasibility - 3/5

The proposed game faces several challenges with technical feasibility. Specifically, the Tovertafel's touch detection isn't the most accurate. This could cause issues where players unintentionally miss 'good' objects or catch alcohol, causing frustration. In addition, situations can occur where no optimal behavior exists, for example when a player has to move 'through' an alcohol bottle in order to reach the 'good' objects.

This game could be expanded in several ways. For example, a level progression system can be added to improve engagement. In addition, a streak system with multiplying rewards for 'streaks' of catching all fruit and avoiding all beer could be interesting.



Lane racer game

In this game, players are racing on an oval road with 5 lanes. In order to prevent players from having to run around the table, movement is visualized by the road moving, rather than the cars. Players each have their own car. They are unable to move forward or backward, but can change lanes, by moving their hand to the corresponding lane. By doing so, they can pick up desirable objects. To the racers' detriment, however, the road is littered with alcohol bottles, which they should avoid by changing lanes.



Social (cooperative) - 3/5

Much like the cocktail shaker game, we believe a lack of co-operation is the biggest downside of this game. There is one opportunity for co-operation in this game, which lies in communication. For example, warnings can be given for dangerous parts.



Physical - 5/5

The game encourages continuous active involvement from every player, since if they stop engaging with the game, their car will inevitably crash into alcohol bottles and miss all pick-ups.



Cognitive - 4/5

The game stimulates persistent activity, due to the constant stream of objects approaching the player. Other than this, gameplay is fairly linear.



CBM elements - 4/5

The game deviates from mainstream approach bias training by moving away from, rather than pushing away alcohol



Technical feasibility - 5/5

We foresee no issues with technical feasibility for this game.

Some considerations for this game include to add a level progression system, to increase engagement, but also to provide players with a sense of collective responsibility. In addition, one could think about adding powerups, for example giving the player a 'shield', allowing them to touch an alcohol bottle without adverse effects once, or picking up missed collectibles at a greater range (however, care should be taken that these powerups do not make the player indifferent towards avoiding alcohol bottles or collecting other objects, lest these powerups undermine the effectiveness of incorporated CBM components. For example, this would render a time-based immunity to alcohol bottles a less apt choice for this game).

Strategy plan & Advice



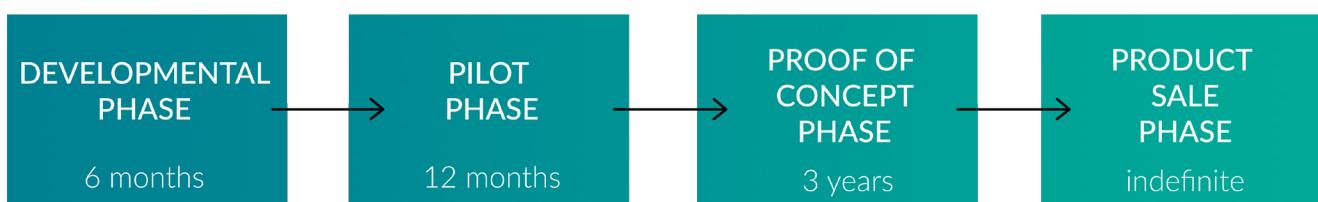
Summary:

- To implement the Tovertafel Compass in the market of substance abuse clinics, we designed a strategy advice with future steps for Active Cues.
- The planning includes a 4,5 process which consists of a development phase (0,5 year), pilot phase (1 year) and a proof of concept phase (3 years).
- To finance these phases, external parties should be considered to fund research to gamification of innovative CBM therapy into the Tovertafel.
- A collaboration should be established between substance abuse clinics, game development research groups, CBM therapy researchers and business developer. For this, we are currently involved with IXA a budget advice company, Brijder verslavingszorg and Trubendorffer verslavingszorg, professor Game Development at the Hogeschool van Amsterdam and addiction researchers at the University of Amsterdam. These parties are enthusiastic about a collaboration to develop the new Tovertafel Compass.



Steps to design the new Tovertafel

In order to develop the new Tovertafel Compass, some key activities need to be performed. These key activities are subdivided in several phases of different duration; The developmental phase, the Pilot phase, the Proof of Concept phase and the Product Sale phase. Each phase is characterized by several activities, and these activities are financed by different income streams. Financial income streams include amongst others funding from different grants, which we will elucidate further in the report. Furthermore, different activities are assigned as responsibilities of different functions within Active Cues. The responsibilities in practice might deviate from the activities formulated in this report, however, in order make this advice as concrete as possible, we have assigned different activities to different assets in the company Active Cues, as reported in table. Lastly in the appendix, a financial overview is provided with the financial cost structure and income streams of the new Tovertafel. The activities of different phases can be distinguished:



Phase 1: Developmental phase: 0,5 year.

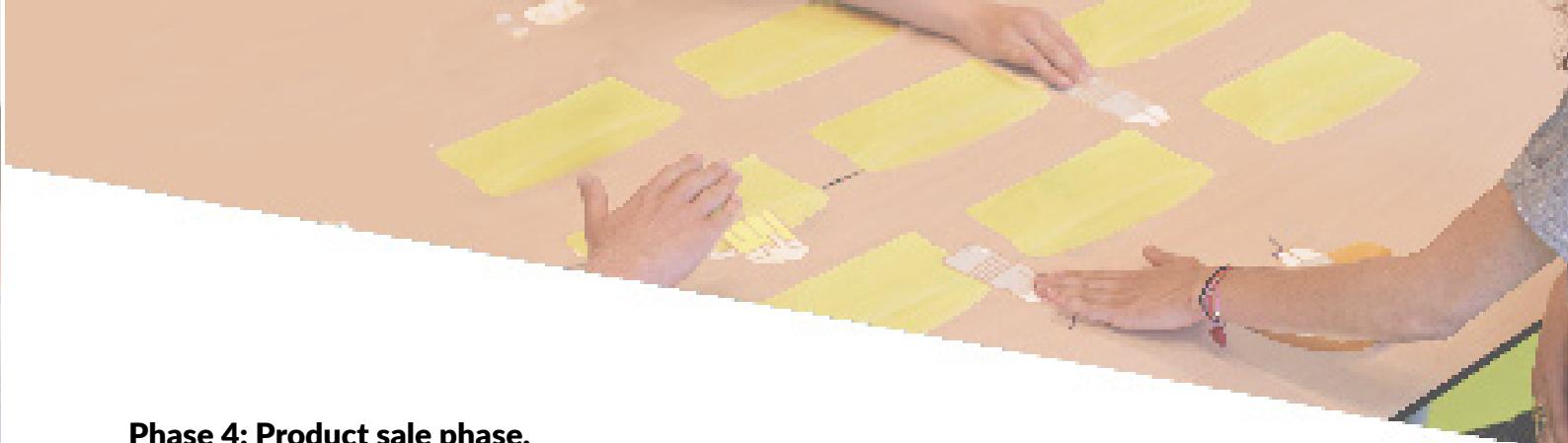
- Co-design steps into finalizing the pilot version of the Tovertafel Compass. The response of the patients and psychologists can be take this into account for the further design of the Tovertafel.
- Development of the pilot version of the Tovertafel Compass.
- Acquisition of new clients. In this phase, contacts with new potential clients need to be established. These contacts can be used to establish a location for a pilot study.
- Application for funding for the pilot phase of the Tovertafel Compass from smaller funds such as the APCA grant.

Phase 2: Pilot phase: 1 year

- A pilot study can be performed in one of the established contacts at a substance abuse clinic.
- Incorporate feedback of a pilot phase into an improved version of the Tovertafel Compass.
- Apply for funding for the Proof of Concept phase by contacting larger funds such as the NWO open technology program.

Phase 3: Proof of Concept phase: 3 years.

- Research on the efficacy of the new Tovertafel can be conducted. Some parameters which can be measured to reveal the effectiveness of the Tovertafel include; parameters to measure direct effect of the Tovertafel, such as moments of contact between substance abuse patients as parameter for social interaction. In addition, parameters can be measured that assess the long-term effect of the Tovertafel, such as measuring self-esteem via surveys after a Tovertafel session or one-year relapse rate after Tovertafel therapy.



Phase 4: Product sale phase.

- Establish positive contacts with insurance companies, to persuade them to finance the Tovertafel Compass for all substance abuse clinics.

Table 3. Future time planning and responsibilities. The future development and marketing of the Tovertafel Compass need some key activities to be performed. These key activities are divided into three phases: The developmental phase, the pilot phase and the proof of concept phase. The different activities within each phase are assigned to crucial assets within the company Active Cues or key researchers at the University of Amsterdam.

Tasks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	54
Acquisition new clients, apply for funding Recommended chief: <i>Claudia de Wijdt</i>																			
Game Design Recommended chief: <i>Rajiv Krijnen</i>																			
Co-design Recommended chief: <i>Judith de Groot</i>																			
Research Communication Recommended chief: <i>Janna Klein Breteler</i>																			
Research Recommended chief: <i>Marijse Boffo</i>																			
Developmental phase																			
Pilot phase																			
Proof of Concept phase																			
Responsibility																			

Risks & mitigation

The prospects for the sale of the Tovertafel Compass are promising, however, one should be aware of some potential risks in the process from development to sale for the Tovertafel Compass. To clarify some concerns, we listed some potential risks and mitigation for those risks.

- **Tovertafel Compass not effective in pilot study.** Activities of the first developmental phase include further co-design steps into a pilot version of the Tovertafel Compass. A risk in this phase includes that the Tovertafel Compass is not effective in this pilot study. Because previous scientific research revealed the efficacy of the CBM therapy, we expect that the underlying cause of this problem would be in the gamification of the CBM therapy. In order to transfer a therapy into a game, co-design steps such as observing and scoring the addicted patients playing with the Tovertafel, should be executed thoroughly. Knowledge on the exact motivation and incentives of the patients to play with the game, is crucial to make the Tovertafel Compass successful. When the results of the pilot study are contradictory, both the research and the design of the pilot version of the Tovertafel Compass should be revised, which is time consuming and costly. To summarize, to tackle this situation, the implementation of the CBM therapy into a game for the Tovertafel should be performed very thoroughly to match all the needs of both patient and customer. Current research on the efficacy of CBM is very promising, so the expected results of the Pilot phase of the Tovertafel Compass are positive.



promising, so the expected results of the Pilot phase of the Tovertafel Compass are positive.

- **Active Cues does not obtain a grant.** You applied for a smaller or larger grant, to fund either the pilot research or the proof of concept research, but the fund was not assigned to Active Cues. For the development of the Tovertafel Compass, we made a financial overview to calculate income and cost streams. This overview shows that funding is not necessary to fund the research, but this will ask for a larger initial investment of Active Cues. However, the expected revenue will pay back for all these costs.
- **Tovertafel Compass is not effective as treatment.** Following positive pilot phase results, the results of the Proof of Concept phase are less positive. Expert business developer Ronald Mooijer indicated that the success of the research does not specifically determine the success of the product in the market. The market itself is a better predictor of the potential success of the Tovertafel Compass. According to our earlier criteria, we determine this market as a highly potential successful market.
- **Not enough product sale.** Another hurdle to take in order to sell the Tovertafel on a larger scale, is to persuade insurance companies of the efficacy of the Tovertafel Compass. The Proof of Concept phase indicated the efficacy of the Tovertafel with positive results, but the insurance companies having doubts about the familiarity of the organizations with this new innovation. In order to tackle this potential risk, Active Cues might increase the publicity by donating some Tovertafel Compass products to larger organizations to raise more awareness. In addition, the Tovertafel Compass can be financed in some organizations by crowd-funding. When more awareness about the benefits of the Tovertafel Compass is created, the insurance companies will be more willing to provide funding for the Tovertafel in substance abuse clinics.

Research & funding of the Tovertafel Compass

The goal of the Tovertafel Compass is to increase current quality of treatment and decrease the relapse frequency of people suffering from substance abuse, through the gamification of CBM elements together with social elements. In order to implement the Tovertafel in current substance abuse therapy, the medical experts require validation clinical studies on the efficacy of the gamification of CBM.

Research collaboration Tovertafel

During our analysis, we came across various grants that provide the financial facility for the conduct of validation studies (also called “proof of concept” studies) as a collaboration between academic knowledge institutions and private parties. We recommend the establishment of such



a collaboration between Active Cues and a research group specialized in addiction research. In order to achieve this, we established contact with professor dr. Reinout Wiers in developmental psychopathology of addiction. Postdoctoral researcher dr. Marilisa Boffo does research in his lab with CBM serious games interventions for people suffering from alcohol addiction. Taken together, we propose a partnership between Active Cues and a researcher from Wiers' group to provide research support for the Tovertafel Compass.

Funding categories and strategy for Tovertafel Compass

Below, we categorized the eligible funding programs in two categories: a) smaller grants that can help kickstart the pilot phase, and b) the bigger grants that could serve as a long-term goal for funding the Proof of Concept phase. Our suggestion for Active Cues is to focus on the smaller grants initially, as they would accelerate the setting up of the validation procedure. Following, we advice to focus on some bigger grants, to provide more extensive financial support for proof of concept of the Tovertafel Compass.

Funding opportunities for smaller grants:

The APCA grant

The APCA grant, is provided by the Innovation Exchange Amsterdam (IXA) office. IXA's APCA grant funds projects in the intersection of science and business, which need further development before they are feasible to be introduced in the new market.

- The grant offers the amount of ≤ €45000, of which 50% is a loan and 50% needs to be matched (in cash or in kind) by Active Cues.
- An important term is that at least 75% of the offered money should be spent at one of the affiliated with IXA knowledge institutes in Amsterdam. In order to meet this criterion, we are in contact with Ronald Mooijer from IXA, and Ben Schouten (HvA, University of Nijmegen) to set up a collaboration with IXA, Active Cues and the research group of Reinout Wiers, professor developmental psychopathology of addiction at the University of Amsterdam.
- You can find the complete procedure for applying for APCA here: <http://www.ixa.nl/en-for-scientists/services/financing-instruments/academic-proof-of-concept-fund-amsterdam.html>

The Creative Industry Knowledge Innovation Mapping NWO

The Creative Industry Knowledge Innovation Mapping (KIEM) fund from NWO. The KIEM programme encourages and facilitates partnerships between academic institutes and private companies in the domain of the Creative industries.



- The grant offers the amount of ≤ €15000.
- Senior researchers as Professor Reinout Wiers can apply for funding via KIEM on behalf of Active Cues.
- Applications must meet the eligibility requirements that apply to the KIEM call for pro-

Funding opportunities for bigger grants:

Open Technology Program from NWO

The Open Technology Program from NWO. The Open Technology Programme focuses on scientific and technical research and is characterised by an absence of disciplinary boundaries. Limitations of this grant include:

- The budget of this grant includes 750.000 euros, or 1 million when > 250.000 spent in equipment.
- If total project costs exceed 500k euro, co-funding by users is compulsory. Co-funding can consist of financial and/or in-kind contributions.
- Maximum project duration: 6 years.



Advice

The scientific and market research in the current project indicated the most promising audience for the new Tovertafel; the new Tovertafel Compass for people suffering from substance use disorder. The games for the Tovertafel Compass are based upon crucial innovative CBM therapy elements, together with social elements stimulating social interaction, social reward and cognitive challenge. In order to design these games and implement them in the addiction care market, several steps need to be performed for the project to take off, both from the side of Active Cues and the researchers specialised in addiction research.

Our advice for Active Cues is to establish a collaboration with a research group experienced in pathology of addiction. We propose the group of prof. Dr. Reinout Wiers, who developed the CBM intervention. He and his post-doc dr. Marilisa Boffo have deep understanding and research experience with the gamification of CBM, and can help Active Cues developers and designers with having the CBM facts rights when brainstorming new games. They could also benefit from this collaboration by validating the effectiveness of this implementation of CBM therapy, which would be an important step forward in their research, where engagement is currently the stumbling block. In addition to this collaboration with researchers, Active Cues can set up a collaboration with addiction care clinics, to perform more co-design steps. These clinics can be used in a later stage to set-up a pilot study. After interest in collaborations is established from these sides, Active Cues can start the application for research grants together with Ronald Mooijer from the University of Amsterdam Technology Transfer Office.

We envision that as the Tovertafel Compass is soft-launched in addiction care, Active Cues will be known for the solid research-based and innovative background of their products. Also, a new market in health care without any direct competition can be explored and Active Cues will lead the way for innovative healthcare technologies integrating therapy with fun and motivating games.



Acknowledgements

This project couldn't be completed without the tremendous help and support of the people that inspired, envisioned and prompted its trajectory.

Obviously we wouldn't be here if it wasn't for Joris Buis and Bertus Tulleners that initiated the Tesla minor, this exemplary model of education, and an inspiration of how it should shape in the future. We would like also to thank Active Cues for enlisting us with this amazing project, it was a true rollercoaster full of happy moments. From Active Cues, we would like to personally thank: Judith de Groot (our incredible supervisor, who prompted us to think more visually), Rajiv Krijnen (who shaped the framework of our game prototype), Koen Logchies and Sjoerd Wennekes who enlightened us with their business and marketing insights, and of course Hester le Riche (the found of Active Cues for making everything happen).

Moving on, an enormous thank you to Ger Post our scientific supervisor who guarded the scientific integrity of our research this past 5 months. And of course all the people that believe in our project and guided us offering enormous amounts of knowledge and guidance. First and foremost dr. Marilisa Boffo and prof. Reinout Wiers, who helped us tremendously with the gamification of the CBM therapy and Ronald Mooijer, who saw potential in the intersection of science and innovation within our project.

Last but not least, we would like to thank our inspiring group of fellow Tesla students. Without their wit, candor and advice this project would be half as enjoyable and rewarding. Personally we would like to thank Marit Keemink, our photographer for the photoshoot of the Whack-a-drink play testing and Jip Zonneveld for happily playing the role of the "patient" in the photoshoot.

Thank you all so much!
Despina, Janneke and Ron

Appendix

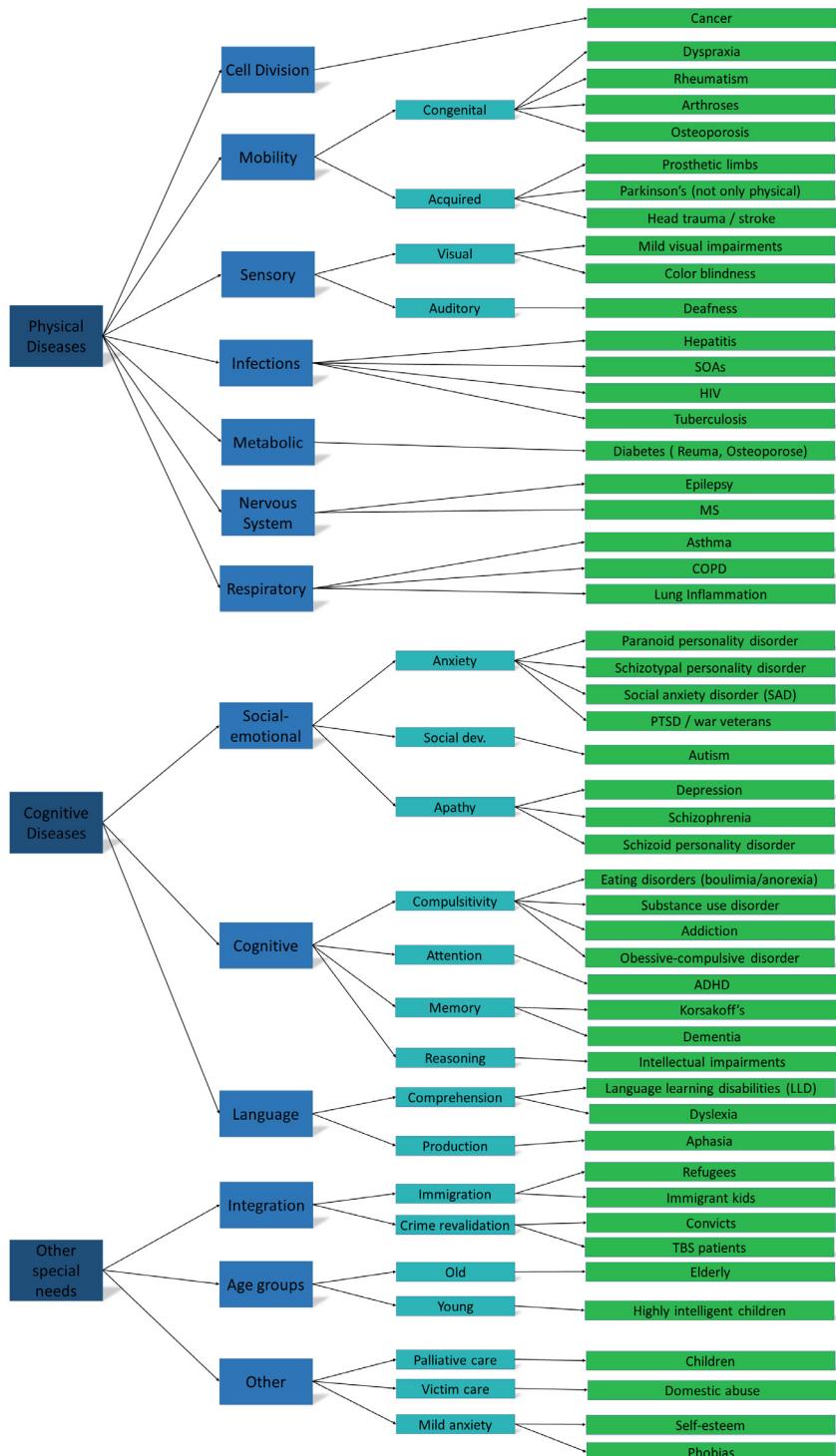


Figure S1. The initial list of potential audiences for the Tovertafel with special needs. The special needs are separated in three main groups; physical diseases, cognitive diseases, and other special needs (dark blue). From these branch out several subcategories (semi-dark blue and turquoise). The initial audiences (green), will be analysed upon our five criteria: the prevalence, the expenses per patient, the tovertafel feasibility analysis, the number of people suffering in our European countries and the competitors.



Supplementary Table S2: The rating system of the 6 factors which were used in the global analysis. We used a gradient of double pluses and double minuses; ++ (very positive for our analysis), + (positive), +- (neutral), - (negative), and -- (very negative for our analysis), to rate the information we gathered during our research.

	++	+	+-	-	--
Prevalence	> 4% of the Dutch population	2-4% of the Dutch pop.	1-2% of the Dutch pop.	0.5-1.0% of the Dutch pop.	< 0.5% of the Dutch pop.
Expenses per patient	€ > 15.000	€ 10.000-15.000	€ 5000-10.000	€ 1000-5000	€ 0-1000
International Prevalence (UK/BEL/GER/DEN)	Average > 4% across all countries	Average 2-4% across all countries	Average 1-2% across all countries	Average 0.5-1.0% across all countries	Average < 0.5% across all countries
Number of Buyers	> 500 institutions/clinics	250 - 500 institutions/clinics	100 - 250 institutions/clinic	50-100 institutions/clinics	< 50 institutions/clinics
Competitors	few direct competitors	many indirect competitors	few indirect & direct competitors	few direct competitors	many direct competitors
Effectiveness	qualitative mix of information based on: interviews, experts advice and suitability of Tovertafel use for each audience				

Supplementary Table S3: Comparison table of the 50 audiences of global analysis. These topics were rated in a plus-minus fashion. The audiences that received at least one very negative rating (--) were eliminated from the analysis. An asterisks (*) denotes lacking information. Subsequently, we chose the most promising 5 audiences out of this list (**bold**).

Target audience	1. Prevalence	2. Expenses	3. International Prevalence (UK/BEL/GER/DEN)	4. Number of Buyers	5. Competitors	6. Effectiveness
Rheumatism	++	--				--
Osteoporosis	++	--				--
Pneumonia	-	--				--
Domestic abuse	+-	--				--
Phobias	++	--				--
Prosthetic limbs	--	+-				--
Parkinson	--	+				--
Deafness	--	*				--
Hepatitis	-	*				--
Tuberculosis	--	+-				--
MS	--	*				--
Korsakoff	--	*				--
Aphasia	--	*				--
Immigrant kids	--	++				--
Convicts	--	++				--

The table continues on the next page.



Convicts	--	++				--
TBS patients	--	++				--
Highly intelligent kids	--	*				--
Schizophrenia	-	+				--
ADHD	+	--				--
Mild visual impairments	+-	+				--
Dyspraxia	++	*				--
Epilepsy	-	-				--
Paranoid personality disorder	+-	+				--
Schizotypal personality disorder	-	+				--
Color blindness	++	*				--
Cancer/ palliative care (kids?)	--	++	-	+/-	-	++
Acquired Brain Injury	-	++	+	+	+-	++
Diabetes	++	-	++	-	+-	-
Asthma / COPD	++	-	++	-	-	-
PTSD	+-	*	+	+	+	++
Depression	++	-	++	++	+	-
Eating Disorders	-	*	+	-	+	++
Substance use disorder	+-	+	+	+	+-	++
Exposure Therapy	-	+	+	+	+-	++
Dyslexia / LLD	++	*	++	-	-	-
Refugees	+-	++	++	+/-	++	++
Elderly	++	+-	++	++	-	++



Supplementary Table S4. Financial overview cost and income streams research, development and sale process of the Tovertafel Compass. The production and sale process of Tovertafel Compass is divided into 4 phases: The developmental phase, the pilot phase, the proof of concept phase and the product sale phase. Different income and cost streams determine the expected profit Active Cues will make.

Phases of development	Income stream	Revenue	Cost stream	Costs
Phase 1: Developmental phase			Development pilot version	10.000
			Acquisition clients	
Phase 2: Pilot phase	APCA fund	22.500	Hardware	427.500
			Additional game development	5.000
Phase 3: Proof of Concept phase	NWO open technology program	500.000	Research	200.000
Phase 4: Product sale	Sale product	2.278.400		
Total		2.282.400		637.505

Supplementary Table S5. Expert list with take-away points.

Expert	Contact information	Function	Take-away points
Reinout Wiers	R.W.H.J.Wiers@uva.nl	Professor Addictive Behavior University of Amsterdam	Professor Wiers gave us information about cognitive bias modification research
Marilisa Boffo	m.boffo@uva.nl	Postdoc researcher Wiers Lab University of Amsterdam	Marilisa offered us information on components of cognitive bias modification and its gamification.

The table continues on the next page.



Mehrdad Aslami	mehrdad.aslani@jellinek.nl	Psychologist in Jellinek Institute	Mister Aslami talked about the components of cognitive-behavioral therapy in Jellinek
Petra van de Wolk	petra@trubendorffer.nl	Psychologist at Trubendorffer Institute	Petra revealed different types of therapy for the patient journey.
Mario de Zeeuw	info@ucreate.nl	Managing director at Panton	Mario outlined several tools used for co-design.
Markus Oei	Anonymous	KNO-arts at Flevoziekenhuis	Acceptation is often more important than functionality of health-care innovations. Thinking is too often from techniques to needs, rather than from needs to solutions
Ronald Mooijer	r.mooijer@ixa.nl	Business Developer at IXA	Ronald introduced us to several funds which could finance the research trajectory we envision for the Tovertafel Compass.
Edmee Joosen	E.Joosse@Brijder.nl	Coördinator Brijder Vrijplaats Addictioncare	Edmee was really positive about our current idea for the Tovertafel Compass, and she envision such a game in group therapies of addicted patients. She will arrange a meeting for us with the management board of the Brijder Web verslavingszorg.
Koen Logchies	koen@activecues.com	Market Specialist Active Cues	Koen taught us some key insights and different tools we can use to do market research: 4 P's of marketing, DESTEP tool and SWOT analysis.
Sjoerd de Groot	sjoerd@activecues.com	International Business Active Cues	Sjoerd taught us the current 5-step analysis model, Active Cues uses to analyze the market in other western european countries.
Rajiv Krijnen	rajiv@activecues.com	Game Developer Active Cues	The game developer at Active Cues Rajiv introduced us in the world of game design and enlightened us with some tips and feedback on ideas for the Tovertafel.
Albert	Anonymous	Sex-addict	Albert has been involved in the SLAA (sex and love addicts) and has been 7 weeks in clinical care in South-Africa. He gave us insights in therapies he followed there, and their benefits and downsides.
Gunter	Anonymous	Heroine-addict	Gunter told us that the NA, narcotics anonymous, together with social interaction helped him to get rid of his addiction.
Ricus Dullaert	dullaert.ricus@gmail.com	Drug-pastor Amsterdam light district	Ricus told us that addicts are usually focused on their own goal and not busy with other people. However, he thought that therapy with experts with a similar past in drug addiction would really improve current care.
Ben Schouten		Game Developer Hogeschool van Amsterdam	We have a clear grasp on the mechanics of Whack-a-mole!, but it's important to clarify the emergent dynamics by playtesting with real patients



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