

Games4Health



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Abstract

This research focuses on how to engage people with the age between 20 and 30 to be physically active. To be healthy a person should move at least 30 minutes a day, five days a week. The people in the target group usually have a busy schedule and don't have the time to be physically active. They have other priorities like work and family. Gamification and quantified self are discussed to see which parts could be used to motivate this group. To motivate people, game elements could be used. Using quantified self could help them be aware of their behavior, at least if a proper context is given. Game elements could be used to accomplish this. Also, data visualization could give insights, if used correctly.

Introduction

This research will focus on how to get people to do physical activities in the Netherlands. People in the Netherlands have been moving less and less for the last couple of years. Only 59% percent of the adults meet the norm for enough physical activities. To understand this problem and develop a good solution for it, the research will answer the following question: 'What motivates people in their 20s to improve their amount of physical activity in a Dutch urban environment?'

The target group in this research will be people between the age of 20 and 30, living in a Dutch urban environment. The reason for this decision is because this group of people will have a transition in their daily routine during these years. For example, they will start working after finishing their studies, or they will start living together with their significant other. To get to know the daily routine of this target group, a small qualitative research was done with 7 participants.

One of the aims of this research is to know what kinds of projects are already available in the Dutch urban environment, especially in Amsterdam. The cities in the Netherlands have a lot of possibilities for people to use for physical activities. How can these possibilities be used to really get people to do it?

In order to answer the research question, a general understanding of what physical activities are exactly enough is provided. In addition to this, an analysis of motivation and behavior is given. It is important to know what kind of things motivates people, in order to change their behavior. The Self-Determination Theory is used to explain what kind of motivations people generally have. There is a divide between intrinsic motivations and extrinsic motivation. After this the principle of Gamification will be explained. Gamification will be used to make the product that is being developed more fun and engaging.

Furthermore, feedback has proven to be an important factor for people to keep on doing things. This is why Quantified Self is used to understand why people track certain things and what is beneficial doing this. Quantified Self is a movement that is all about self-tracking. The numbers that are collected are used to change behavior or to understand a particular problem. Also, for a lot of self-trackers, it is a way to learn more about themselves.

One problem with all this data is that users often don't know how to learn anything from this. This is why the visualization of the data is very important. To understand and learn from data, it is necessary to visualize it. People learn by vision, and people come up with new ideas and solutions through visualizing it.

The research will end with an exploration of how it is possible to combine Quantified Self, motivation theory and visualizations, in order to make a fun and engaging product that will help users be physically active.

Physical activity

Getting sufficient physical activity is benefiting for all kinds of different health related qualities of life. According to the website “30 minuten bewegen” (30 minutes of being active) being physically active benefits a person in several ways. It prevents overweight and diabetes and in some cases also cancer. By releasing good chemicals like endorphins in the body it helps to reduce stress, anxiety and depression. Being fit can prevent diseases and benefit the heart, bloodstream, lungs, muscles and joints. On top of that it can be good for a person’s social life, if he or she does physical activities with other people. Overall, being physically active will increase a feeling of wellbeing.

Because physical activity is necessary for one’s health, the Dutch government made a Dutch Norm for Healthy Physical activity (in Dutch NNGB). It defines that adults have to do a minimum of 30 minutes of moderate physical activity a day at least 5 days a week. The “Trendrapport bewegen en gezondheid” measures this as 5 - 8 MET (Metabolic Equivalent of Task), which means that the heart rate should go up a little, a person should breath quicker and the body should warm up. This compares to riding a bike or taking a brisk walk. Another norm is the Fitnorm, which states that a person should 20 minutes or more of intensive physical activities for at least 3 times a week. This is needed in order to keep the cardiovascular system healthy. The final norm is the Combinorm, in order to reach this norm one has to comply with at least one of the two norms above (Hendriksen and Hoogwerf).

Only 59% of adults meet the NNGB norm. For young people this is even worse, only 17% complies to it, although partly the reason for this is that their standard is higher. The Fitnorm is met by 20% of the adults. Together this comes down to about two-third of the adults meeting the Combinorm. Compared to adults in different age categories, 18-34 years old score the lowest on the NNGB norm, but the highest on the Fitnorm. Therefor we focus on this group of people in their 20’s, they need to do more moderate physical activities. However, during the summer more people meet the standards than in wintertime (Hendriksen and Hoogwerf).

Sedentary behavior can be a danger to the health of people. It can cause health risks even if someone does a lot of sports next to it. Many jobs for adults however require relatively inactive tasks, like working behind a computer, leading to sedentary behavior. The kind of job a person has can influence his or her abilities to meet the norms. Working in the administrative sector often means the most sedentary behavior while the services branch are usually the most active jobs. So a certain job can be the biggest source of sedentary behavior and the biggest source of physical activity (Tiessen-Raaphorst et al. 129-131).

A lot of people however do think that more physical activities would be good for them. A percentage of 56,4% of the people complying with the Combinorm and 76,2% of the people who don't comply with the Combinorm think they should be more active. About 10% of these people get support from the people around them to do this. This means that most people know they have to become more physically active, but they lack a trigger that makes them start doing it (Hildebrandt et al. 26).

The most common complaints against doing sports and exercise are, according to the Mulier Instituut, a lack of time, a lack of motivation or simply not like doing it, costs, physical complaints and bad weather. The Sportersmonitor of 2012 shows that especially people in the age of 24-44 state a lack of time because of work, education or family and sometimes also a lack of money as their main reason not to do sports. They want to do it, but they don't make doing sports a priority. They think that they don't have the opportunity and the capacity to do so. (Hendriksen and Hoogwerf 39). Sometimes it is also about a lack of knowledge and information about the ways of being physically active. If one doesn't know about, he or she will not be able to do it (30 minuten bewegen).

Research has shown that the level of urbanization a person lives in does not influence their amount of physical activities. No activities are done significantly more or less by urban people. This means that people living in a Dutch urban environment are not generally more or less physically active than people living in the less urban parts of the Netherlands (Dool et al. 2010 24). Other factors that can have an influence on the physical activeness of people are shown in the graph below. It states that for example the infrastructure of the neighborhood can be a determinant for the amount and the kind of activities done by its inhabitants.

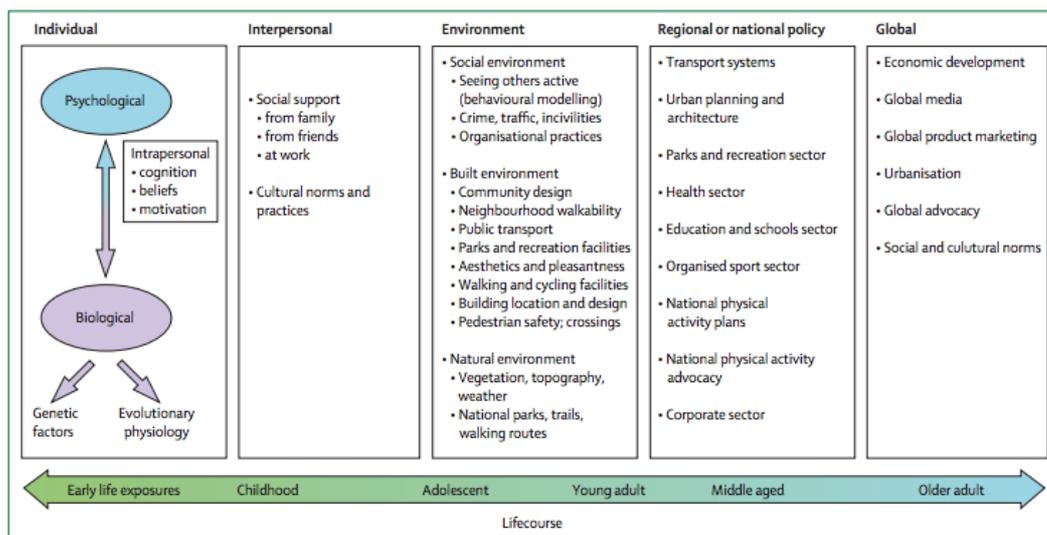


Figure 1: Adapted ecological model of the determinants of physical activity

(Bauman et al.)

Target group – daily routine

As said before, research has showed that people between 22 and 44 years old mainly state a lack of time because of work or family as the reason not to do more physical activities. Other research found out that people between 18 and 34 are the adults who do the least amount of moderate physical activities. In order to get to know more about the target group - people living in a Dutch urban environment between the age of twenty and thirty – a small diary was designed. We've asked 7 people to keep track of their daily activities during five days. We chose people we know ourselves, so we could make sure different kinds of people within our target group would be explored. This diary shows what people do during a week and what kind of similarities these people have in their daily routine. This way we are able to see when people have some time off, so we can use this to change their behavior.

How does it work?

In the diary the participants keep track of their daily routine by hour. This way it is clear what the participants have been doing. Below that the participants will have to fill in how they got to the different places, for example by bicycle or train. At the bottom they draw a smiley-face with their mood, so it is clear how they felt during their activities. Every day the participants have filled in the weather, what was the best part of the day and what their overall mood was. Summaries of the interviews can be found in the appendix.

Results

By looking at the filled in diaries we found out that most people in their 20s are indeed busy people. They have a certain regularity in their life, having specific times they need to be at work or at their study. These workdays make for a lot of sedentary behavior. Most of our participants didn't think much about taking active breaks. For some people lunch break was the only break they took during their work. In general all breaks were mostly taken with the idea of relaxation instead of the idea of giving their body some balance to all the sitting down. They just didn't seem to think about making their breaks more active. One of the challenges will be to get these people to take more active breaks, more often a day.

Most of the participants tried, if the distance allowed, to take their bike to go to their jobs. However, if the weather is bad, most of them will choose public transportation over biking. In most cases bad weather will also have a bad influence on their mood and on their active behavior.

Because of their busy life, for some participants it was hard to fit in sports into their schedule. Other reasons not to do sports were simply not liking it or not having enough motivation to keep up. When they did do sports, almost all of the participants stated getting a better stamina as the main reason for doing it. It was about feeling good about themselves and their performance. When they tracked themselves, it was mainly about tracking their performances and seeing what and whether they can improve. They liked to keep this information to themselves, so they didn't share it on social media.

Although friends can be motivators, most of the sports were done alone. Especially running was something they only did for themselves, by themselves. However, they seemed to prefer doing moderate physical activities with someone else. Most of them stated their friends as an influence in their mood, activities and trying new things. If friends introduced them to a new kind of experience and taught them the basics, for example using fitness machines at the gym, they were more likely to do it alone later.

The participants of our research all felt more or less healthy. They said that the food they ate was generally healthy and they mostly got enough physical activities.

Dutch urban environment - Amsterdam

Amsterdam is the biggest city in the Netherlands with just over 800.000 citizens (CBS). It is famous for a lot of things, but there's one thing that's really large in Amsterdam and the Netherlands. That thing is biking. Bikes are found everywhere in Amsterdam and are the main transportation method for the majority of the Dutch citizens. There are more bikes in Amsterdam than there are people, which is not just good for one's health but Amsterdam made their whole city about bikes. To make a long story short, in 1978 the citizens of Amsterdam (or Amsterdammers) demanded for more room for bikes and protested until the government finally gave in (Figure 1). This made room for more the now famous bicycle paths. There are a few factors that the municipality should consider, which are: a social environment where you see other people being active; a build environment, which optimizes the environment for being active; and a natural environment, where there is room for vegetation and walking trails (Bauman et al).



(Figure 1 – Bicycle protest)

Existing Facilities

There are an overwhelming amount of parks, gyms, sporting events and other sporting facilities in Amsterdam. One of the biggest sporting park, isn't even a park it's a forest the Amsterdamse Bos (Amsterdam Forest). The forest is just next to Amsterdam and is easily accessible by bike, car or public transport. It's also a hotspot for sporting events. It has possibilities for swimming, walking, biking, horseback riding and much more. There are a lot of parks all throughout the city where people are welcome to do physical activity. Not just parks, but there are also quite a few gyms in Amsterdam. Amsterdam is home to about 70 gyms (Duijvestijn and Lagendijk); from small to large, something for everyone. Between

2009 and 2013 the municipality of Amsterdam started focusing on getting the citizens more active. They did this with five main points: develop talent in young citizens, make adults get more active, getting sporting facilities to be socially active, making room for sport in Amsterdam and having a Olympic ambition (Amsterdam.nl).

This means that everybody, young and old, can do sports; from recreational to top athletes. That should mean that most of the citizens are fit, right? Unfortunately not, over 40% of the Dutch are overweight (CBS).

Possibilities

But there is always room for improvement and luckily Amsterdam has a lot of room for a major city. There are more schools that offer a physical activity curriculum and there were investments in facilities for adults (Selten et al). Those investments have helped. The people that do sports in Amsterdam for at least once a month has increased with 6% in 2013 and the municipality wants that to keep increasing (Selten et al). The municipality plans to continue the trend that was set in 2009 in the new plan of 2013-2016. They plan to stimulate physical activity by giving the people that don't do physical activity extra attention and have made four priorities: get more youth to do sports, focused on kids and youth from disadvantaged neighborhoods; more adults to do sports, concentrated on disadvantaged neighborhoods, people of 65 and over and the disabled; enable people to sport more by investing in enough and easy accessible sporting facilities; and finally top sport, because it inspires people and increases the view of the city (Amsterdam.nl).

Amsterdam is a big city with a lot of space. It isn't crowded like other capital cities and this means that there is a lot of space for people to do physical activity almost everywhere. This leads to a lot of people running. Running is quite popular in Amsterdam with over 25% of the inhabitants doing it (Selten et al). Not just running, but a lot of physical activity is to be found in Amsterdam. The Dutch are also quite big on new media. With over 60% of the Dutch having a smartphone and almost a third of own a tablet, it is just a matter of time that these worlds collide (Oosterveen). Not only running, but also the slower counterpart walking is something you see a lot in Amsterdam. Amsterdam has a great deal of walking paths to accommodate this.

But what about the people that don't do any physical activities, how can we convince them to do more physical activity? This is what the research will conclude. We will focus on the group that don't do physical activities, although there are lots of possibilities for them to do so.

Motivation and Game elements

Motivation, according to Edward Deci (Professor of Psychology and Gowen Professor in the Social Sciences at the University of Rochester), is the energy for action. It can also be translated into the desire to do things, it is a crucial element in setting and attaining goals. For psychologists, motivation can be divided in two groups: intrinsic and extrinsic. The first category is about the motivation that comes from our self-core, is the motivation to do things because they are part of something important and are not necessary based on the world around us. On the other hand, extrinsic motivations are driven, normally, by the world around us, for example: the desire to make money.

Everywhere people struggle with how to motivate others or find energy to do something. People are often moved by external factors such as reward systems, grades, evaluations or opinions about themselves. Yet just as frequently, people are motivated from within, by interests, curiosity, care or abiding values, and this, as is said before, is the intrinsic motivation. The interplay between the extrinsic forces and the intrinsic motives and needs of the human nature is called the Self-Determination Theory (SDT). This theory was initially developed by Edward L. Deci and Richard M. Ryan at the University of Rochester, and it represents the study of human motivation and personality. It's a formal theory that defines intrinsic and extrinsic sources of motivation in cognitive and social development and in individual differences. The two motivational groups can also be called controlled motivation and autonomous motivation. In the SDT they found out that when a person works with a controlled motivation, there's a lot of pressure involved and the result will create negative consequences on their performance and well being. Also people tend to take the shortest path to the desired outcome. In contrast, they explained that the autonomous motivation comes in two categories: interest/enjoyment and values/believes. If the person is interested in some activity and enjoys doing that, the motivation comes from the inside. At the same time, if you think that something is really important or valuable for you, you are also in the perfect position to engage into a new behavior.

During a TED Talk, analyst Dan Pink shows that science knows three things about motivating people. The first one is that the 20th century business way of giving rewards to make people produce more does work, but only in a surprisingly narrow band of circumstances. The second topic said that the *if you do this, then you can get that* rewards often destroy creativity, for example. And the third and last point was that the secret to high performance isn't rewards and punishments, but that unseen intrinsic feeling (or

motivation), that drives you to do things for your own sake, the drive to do things because it matters.

Extrinsic rewards crush intrinsic motivation, is what Gabe Zichermann and Christopher Cunningham showed in the book *Gamification by Design*. Instead of using money as a reward for an action, a long-term social status can be more effective. They also showed that too much competition can stop people from collaborating. It's important to take care of the simple things, like fun and a social aspect, because the social part can motivate people by giving them something to compare and an opportunity to see results.

A good and common example of motivating using fun is with games or, as this combination can be called, gamification. According to Sebastian Deterding from the Hamburg University, the guiding idea of this term is to use elements of game design in non-game contexts, products, and services to motivate desired behaviors. It involves using these concepts of games, as leaderboards, achievement badges, reward systems, and other elements to trigger our fascination with competition and winning. But gamification isn't about gaming per se, is about understanding the tools and motivators that are in games, then incorporating those components into a service/product to engage people. It's important to understand the motivation, find ways to draw on both those motivators and gaming concepts, and integrate the gaming elements into the heart of the activities.

Greg Siering, director from the Center for Innovative Teaching and Learning, said that gamification can be very useful encouraging engagement and providing motivation. He also gave a list of some game elements that might be good examples: clear goals and progress indicators, since is better to play a game where you know how far is the end and how long you will take to be there, for example if they use progress bars or a checklist of items ; level up or a new status as reward for success, if the game gets more difficult every level the player will keep challenging him- or herself; badges, while leveling up suggest progress on the game, badges can recognize more isolated achievements, it also works wonderfully with mastery learning; and leaderboards, that can be used in a lot of different ways, one example is to use it on forums of discussion, where you encourage competition to write the most engaging post, since to be on the top of the board, you need to accumulate more responses to your message.

In the book *Gamification by Design*, they showed that gamification works better if and when we can align intrinsic motivations and extrinsic rewards. It's better to accept players and their motivational states as they are and try to help them get to where they would like to go, as well as where you would like them to be. A factor that fits with this

helping and motivating aspect is combining the game mechanics with social interactions. Socializers account for the majority of players types and motivational states since is proved that if it's possible to share and compare your numbers with someone else, your performance is better. Below you can find some examples of what people like the most and which mechanic can be used.

Table 5-1. Example game mechanics.

Dice roll	Things people like	Example mechanic*	Example mechanic*	Example mechanic*
1	Pattern Recognition	Memory-game interactions: items are revealed, then hidden, then combined	Combine like items, as in object-matching games	Earn and burn: learn how to optimize virtual economies
2	Collecting	Collectible objects, such as stamps and badges	Scarcity and return: limited-availability items, time-based items	Trading mechanisms with others
3	Surprise and Unexpected Delight	Slot machines, variable reinforcement	Easter eggs, geocaching, hidden objects	Unexpected dynamism, such as Foursquare's unique and funny badges
4	Organizing and Creating Order	Time/job/throughput challenges, such as in <i>Diner Dash</i> or <i>Chocolatier</i>	Combining like items and/or creating symmetry	Organizing groups of people, like a team
5	Gifting	Easily transferrable virtual items	Gift reminders and recommendations	Karma points: only purpose is as a "gift"
6	Flirtation and Romance	Poking, smiling, flirting: lightweight, easy-to-ignore interactions	Hot or Not style: choose people from a list/group and express interest	Virtual items or lightweight "props," shout-outs
7	Recognition for Achievement	Badges, trophies	Contests, game shows, award shows	Kudos system for reinforcement, e.g., Nike Plus and Lance Armstrong
8	Leading Others	Team-based or cooperative challenges	Levels associated with leadership	Long-term, "great" challenges that require multiple players
9	Fame, Getting Attention	Leaderboards based on player feedback, scores, and promotion	Award shows, game shows, contests	Large or out-of-scale promotional opportunities, e.g., images on Flickr's home page
10	Being the Hero	"Rescue the maiden" challenges	Friends ask for help, you respond with help	MacGruber: things are going to blow up in 10...9...
11	Gaining Status	Badges, trophies—especially public ones	Scarce, limited-edition items that are public	Public, obvious scores and leaderboards
12	Nurturing, Growing	Tamagotchi style: feed this thing regularly or it will die	Points that expire in the absence of activity, growth	Pyramid scoring, with cumulative scores for teams and leaders

Quantified Self

The Quantified Self (QS) is a movement started by Gary Wolf and Kevin Kelly to connect people who are doing self-tracking and self-monitoring. The members of this movement believe that “collecting detailed data can help them make better choices about their health and behavior” (Singer). People combine wearable sensors and wearable devices, such as mobile phones, to track their daily life. As Wolf puts it: “Numbers are infiltrating the last redoubts of the personal. Sleep, exercise, sex, food, mood, location, alertness, productivity, even spiritual well-being are being tracked and measured, shared and displayed” (Wolf).

Of course, keeping track of behavior is something people have done for ages, for example by writing diaries or standing on a scale to measure their weight every morning. What is new is the possibility to use cheap and small sensors to do the tracking for you. Whereas people used to write everything down by themselves, it is now easy to track things just by wearing a small device.

According to Wolf, four developments are at the core of this new QS movement. First, electronic sensors have become smaller and more accurate. This makes it very easy for users to track their behavior, without putting a lot of effort in it. Second, the use of computer devices, such as mobile phones, has become very common. Phones are being used to see the data that has been tracked, anytime, anywhere and in a way that it is understandable to the user. Thirdly, the use of social media is widely accepted and people don't hold back sharing everything about their lives. Even if a social media user doesn't have anything special happening to post about, he will always have his numbers: “You might not always have something to say, but you always have a number to report” (Wolf). At first this self-tracking was adopted by geeks and techs, who were fascinated by numbers and explored their data by using different tools, like excel. But now, because of the developments described above, self-tracking has become more alluring to a bigger group of people.

The reason for most of the people to start self-tracking is to learn the answer for a particular question, like ‘how much hours do I work during office hours?’. People want to learn more about themselves (Wolf in Economist). It's not about discovering something about human beings, but about yourself. Although the tracking starts with a particular question, after answering this question, it is mostly used for discovering new things about the persons daily life. It's about finding what you were not looking for. It's about serendipity.

Of course, there are some things that should be taken into account before diving into the world of quantified self. Although QS seems to help a lot of people to solve their

personal problems and learn more about themselves, QS can demotivate people too. For example, someone who has just started running and uses an app to track what distance in what speed the user has done his work-out, could be easily demotivated by seeing the slow pace in which he has been running. This information will be confronting and no fun to share at social media and the runner will be ashamed of himself. The problem with tracking everything is that “A graph or a spreadsheet talks only in numbers, but there is a policeman inside all of our heads who is well equipped with punishing words” (Wolf). The numbers don’t tell you that you have been good, or bad, but you will feel bad about yourself anyway. One way to solve this is to make the numbers more human. Human feedback like ‘Way to go! Keep up the good work!’ will motivate people to keep on going, even if it is coming from a machine (Wolf).

Another limitation to quantified self is that some self-trackers will make connections between different numbers and that they will see this causality as the truth. For example, “One self-tracker learned that eating a lot of butter allowed him to solve arithmetic problems faster” (Economist). If you believe something to be true, it will be true to you. The tracking will function as the placebo effect; you will feel better because of changing something in your behavior you believe to be working.

The quantified self-movement shows that there are many possibilities using self-tracking. Already a wide range of apps and devices has been developed and brought to the market. But how can all these numbers be useful to a normal consumer? Still, a lot of apps and devices don’t work as accurate as you would want them to be, or the information presented is not useful or understandable. In what way could this data be presented so it will give feedback that is important to the user, and most importantly, easy to understand?

Data visualizations

“To understand something is called “seeing” it. We try to make our ideas “clear”, to bring them into “focus” to “arrange” our thoughts”(Card et al 1). This quote shows that people use visual metaphors to explain how they understand things. This is not a coincidence; to understand something better, we need to use external aids, like graphs, drawings et cetera. “The power of the unaided mind is highly overrated. Without external aids, memory, thought and reasoning are all constrained” (Norman 43). External aids have two main purposes. The first one is communicating an idea, the other one is to discover the idea itself. To discover an idea we need to use “vision to think” (Bertin in Card et al.). Because using

quantified self is all about discovering new things about oneself, the focus here will lie on the second purpose of external aids; to help discovering an idea or new insights.

The main goal of this part of the research is to get to know how the presentation of the data collected by using self-tracking tools could be designed in a way that is useful and understandable for the user, because one of the problems of quantified self-data is that this is often not the case. According to Hamming (1973) “the purpose of computation is insight, not numbers”. This is exactly what this research wants to accomplish. Likewise, the purpose of visualization is not about pictures, but is also about insight (Card et al 7). The numbers should be presented in a way that is useful. ‘Chartjunk’¹ should be avoided.

Visualization of numbers is done by using either data graphics or information visualizations. The main difference is that data graphics are static, contain relatively less data, and information visualizations are usually more interactive and use more sets of data. Another difference is that the goal of data graphics is to communicate a certain idea or teach something, while information visualizations’ goal to give the viewer the opportunity to explore the data and get new insights. Because the users of quantified self normally want to explore their own data to get new insight, the focus will lie on information visualization, rather than on data graphics.

Information visualizations give the user the opportunity to explore the data. In this way, the user will find new insights in the data and learn new things. “It is a way of using graphical tools to see things previously unseen: structures, relationships or data obscured by other data” (Shirky 2). Using this kind of visualizations will be perfect for people who do self-tracking; they will be able to find new things and use this to change their behavior. The data presented should not just show the results, but it should support the process of learning more about yourself.

Things that should be taken into account if one uses information visualizations are the limited size of computer screens, the unfamiliarity of the visualization and the skills user lack to create good visualizations (Shirky). The most important part for this project is the unfamiliarity of the visualization for the user. If a user already knows one kind of visualization, it will be easy to understand and interpret another visualization of this kind (Unwin). But, if the user is unfamiliar to the form of the visualization, the visualization will not feel intuitive and it might be more difficult to understand. “The resulting interfaces can often leave the user spending more time trying to understand the interface than the data

¹ Chartjunk is a term thought of by Edward Tufte. Chartjunk are the elements in a visual presentation that don’t convey any information (Shirky).

itself" (Shirky). This is very important to keep in mind, and create a visualization of the data that is not that difficult to understand and it doesn't take a long time to learn how it works.

A good visualization does not only contain the correct information, it should also be part of a larger whole (Unwin). The context, in which the visualization is created, will provide the relevance of the visualization. Without the context, the visualization does not have meaning. If the context is provided, the user will be able to compare the data in order to understand it better.

Existing products

The different products shown in the grid are all chosen because they all have the purpose to motivate people to be physically active. In order to understand the functions of these products this grid has been created.

	GPS	Auto.	Emotional feedback	Rewards	Goal Setting	Story-telling	Overview	No Cheating	Collaborating	Competing
Moves	✓	✓	✗	✗	✗	✗	✓	✓	✗	✗
Teemo	✗	✗	✓	✓	✓	✓	✓	✗	✓	✓
Argus	✓	~	✗	✗	✓	✗	✓	~	✗	✗
Temple	✗	✗	✓	✗	✓	✗	✓	✗	✗	✗
Human	✓	✓	✓	✗	✓	✗	✓	✓	✗	✗
Zombies, Run!	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗
FitBit	✗	✓	✓	✓	✓	✗	✓	✓	✗	✓

GPS GPS will track one's movements in the environment. This function is mostly used in apps for running or tracking all physical activities.

Automatic The product tracks the activities automatically.

Emotional Feedback This means that the product gives feedback in a human way to the user. An example is when the product talks to the user, like "way to go! Great job".

Rewards Rewards are given when the user has achieved something. For example this could be badges or new levels.

Goal setting The product gives the opportunity to set a goal, for example 7,000 steps a day.

Storytelling The product contains a story to make it more fun.

Overview	The product shows the user an overview of what he/she has been doing. This could be done in graphs or visualizations.
Cheating	It is easy to cheat the activities with this product.
Collaborating	The users can work together on a goal by collaborating.
Competing	The users can compete with each other.

All these products/apps have the goal to get the user fitter/healthier. Some work, some don't work at all. Below an analysis of what kind of elements work in what way, and what elements don't work at all.

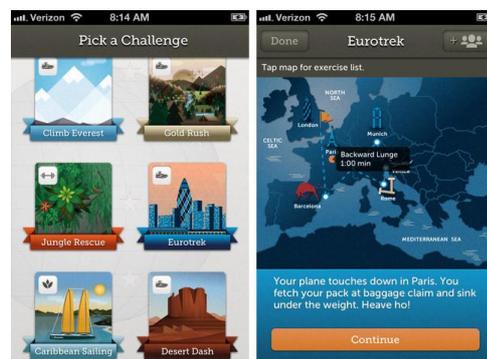


Moves

Moves is an automated app that tracks the user's daily behavior. The app gives the user the opportunity to see for how long and when they were walking, running, cycling, working, at home or in public transport. The app uses GPS and runs all day on the background of the phone, and tracks the user very accurate. At the end of the day the user will be able to see how much minutes he/she has done of every activity in an overview of circles. It is not possible to share this experience with friends or family, or to collaborate or compete with them. The app does not encourage the user to move more with push notifications or humanly feedback.

Teemo

Teemo is an app that focuses on small exercises for users to do in their spare time. Exercises will only take around 3 minutes of the user's time. In order to make the experience fun for the user, different challenges with their own story are provided. The user is able to collaborate and/or compete with friends. When a challenge is completed, the user will get a badge and the app will encourage the user to keep on going.



The app looks beautiful. One downside of this app is that it is not automatic and it does not track anything, which means the user can pretend to have done an exercise to learn more

about the story or be better than his/her friends. When the user is doing the actual exercise, there is no storytelling to make it more fun.



Argus

Argus tracks different aspects of daily life. It automatically tracks the user's walking, the distance and the calories burned. If the user wants Argus to track another activity than walking, he needs to 'record' it. Next to that, glasses of water and someone's food and calorie intake can be filled in. In addition it adds a tile with the weather of that day. The user can set goals and the app will cheer the user on if the goals are accomplished. Because the user has to manually adjust the kinds of activities, and these cannot be changed afterwards, there's a bigger chance that this gets forgotten or is not accurate.

Temple

With the app Temple, the user can track three categories: Fitness, Fluids and Fuel. Within these categories, you have different sizes of circles that represent the amount of the activity, drinks or food. When tapping the circle, the bar will fill a little bit more. When the goal (that has been set by the user himself) is reached, the user will get feedback and the bar will be in 100%. These circles can be modified by the user to his or her own wishes. For example, you can change the amount of minutes for a quick, light, moderate or intense fitness. The user has to do everything, the app is not tracking anything for the user. This makes it easy to cheat.



One-tap health & fitness tracker



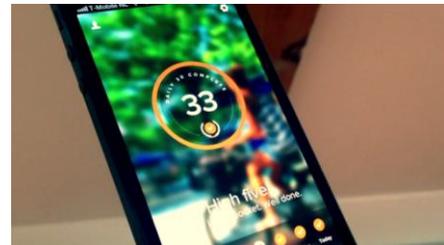
Zombies, Run!

Zombies, Run! is an app that uses storytelling to make its users go running. It's an immersive story with the users as the main character who needs to save the world but is sometimes also followed by zombies. GPS will track the speed of the user and this way the app can tell the user to run faster or that he didn't run fast enough. This way a human is talking to the user and also gives him rewards, which the user can see on the website afterwards. Next to that it gives an overview of the user's running statistics. The app

brings fun and engagement to running, but it will only work if the user is prepared and willing to run or walk.

Human

Human's goal is to motivate the user to do at least 30 minutes of physical activities each day. It tracks the user's daily behavior on the background of the phone.



In a circle the user can see how many minutes he/she already has done, and how many minutes the user should do to reach his/her goal of 30 minutes. After reaching this goal, a checkmark will appear at the bottom of the app at the specific day. There is always a week displayed, so if someone has missed the 30 minutes minimum once, this will follow him or her for the rest of the week. After reaching the 30 minutes, the next goal of 60 minutes will appear and the app will change color. One problem with this app is that people have the tendency to look at the average; if the user never meets the 30 minutes goal, he will try to do more, just to meet this goal, but if the user easily meets this goal every day, this will not be an incentive to do more, because he or she is already doing 'enough' physical activities (Plattel). An overview is provided, so the user can see how many minutes he has done in total, how many days he or she has reached his goal et cetera.



FitBit

FitBit is a small device that tracks steps. When the user taps the screen, the user is able to see his step count, distance walked, the time, the calories burned, and a smiley that will be happier when the user has walked a lot. The FitBit does not track any other activities, like cycling. The user has to carry

this device around in his pocket. The data collected from the device can be seen in the user's browser or on an app via a dashboard that shows all the different data in numbers or in graphs. At the dashboard the user can set his goals (for example 7,000 steps a day), see how he is doing and look at an overview of the week, month or year. If the user has met his goal, the dashboard will give human feedback ("Congratulations, you have reached your goal today"), and it is also possible to win step badges (starting at 10,000 steps). Users can add

other FitBit users and compete with them in a group. Because the FitBit works automatically, there is no way to cheat.

Conclusion

The different functions these products have, all work in a different way and are sometimes very effective in one app, while not effective in the other. One of the main things is that when the app is automatic, which means that the app does the work for the user; it is very hard to cheat. When the user has to add information himself, it is likely that he/she will not do this properly in order to feel better, or will forget what the information exactly was.

Only a few products use collaborating or competing, although the research of the target group pointed out that doing activities with friends and sharing this experience is a big motivator. As stated before, most people are in the category of the 'socializers'.

Quantifying data is a big thing in most of the products. The apps use graphs or overviews to show the users their progress. As written before, it is necessary for this quantified data to have some kind of context. This could be done by using graphs or a overview of the results. What kind of activity is needed? For example, the app 'Human' gives a concrete goal to the user, the 30 minutes goal, but other apps like Moves don't provide the information that a user will need to understand how much physical activity is needed to be healthy.

Also, storytelling is not a big thing in most of the apps, but the apps that use stories (Teemo and Zombies, run!) have made this the most important part of the app. In 'Zombies, Run!' the story is in a spoken voice, and in addition noises of zombies running behind the user are added to the story, which the user hears while he is running. Contrary, in Teemo a written challenge is used to tell the story, and the story is complimented with images.

There is a big difference in use when the product works automatically or manually. When automatically, the user won't have to put in a lot of effort to self-track. In contrast, when the product is manually, the user should add a lot and put a lot of effort in it. It could be tiring for the user to keep track of everything himself and this could work demotivating. On the other hand, when the app is totally working automatic, the level of engagement could decrease too; the user won't have to look at the product or open the app in order to let it work.

A lot of apps give the user some kind of human feedback; when a user has finished a task at Teemo, or has reached the 30 minutes goal of Human. This makes the person like the product, it doesn't feel like only confronting numbers are shown.

The combination of Quantified Self and Game Elements

It is proved that to change a behavior is important to, apart from motivate, show important information, with images and graphics instead of only numbers, and create something fun. Knowing that is possible to say that there's a lack of combination between this numbers (quantified self-data), motivation and game elements. The numbers of quantified self should be clearer to the user; it needs to have some kind of context, because the average user doesn't know how to make the right connections. One thing that is proved already is that people prefer graphics and visuals than text. This is the key component to value delivery in quantified self. It allows for pattern recognition and is a primary catalyst that will assuage an end user to alter their behavior. In short, visualizing the data in a compelling manner allows individuals to understand the impact of their decisions. A good example is to show this data like a map with how many blocks you should walk instead of giving just numbers, this will be more personal and easier to measure (Plattel). The mainstream consumer is never going to go out of her way to adopt all these newfangled sensors simply for the sake of raw data (Chang). It's important to use the game elements for this data, because it can make it more fun and useful for the consumers in general. A simple way to present this numbers combined with the motivational game elements can make a huge impact on how people play the "Game of Life"(Chang).

These numbers can also be used to give a type of feedback. If combined with comparison will show the user a frame of reference. This is the social aspect. If the user can see what your friends and family are doing, you can try to be better or they can be the reason why you want to do it, like for a healthier and longer life close to them. For Tim Chang, the managing director of Mayfield Fund, the first step is to understand root motivations (especially for younger users) and then use it to design engagement loops .

Nowadays it is possible to calculate and measure everything you do or like and all our talents and characteristics. Some time ago this kind of information was only possible with characters of a videogame, where you can look at the levels and skills. But now, we have the technology to bring the scoring, feedback and interactivity of games into our real-world lives, we just need to define our goals (Chang).

Gamification is not a new subject but it's getting bigger every day. The term is evolving into real-world qualifications and measurement where a gamified approach helps to increase uptake, keep users engaged and provide a competition platform for the users who simply enjoy pairing their numbers versus others or against their personal best. It's the

perfect companion for data visualization, because is a mechanism that when done properly, has huge impacts on the end user.



(source: topcoder)

Conclusion

People should move at least 30 minutes a day, for at least five days a week. This norm is only met by 59% of the adults in the Netherlands. Sedentary behavior is another problem; people sit too much during work and other activities. The question of this research was what will motivate people in their 20s to be physically active in an urban environment.

In order to answer this question the research focused partly on why people in our target group don't do physical activities. The main reasons were lack of time, lack of motivation, bad weather and that being physically active is no fun. The people in the age group of 20-30 also have other priorities, like work and family. It is not easy for them to fit in physical activities into their busy schedule. The challenge for this project is to make physical activities more fun and fitting in this busy schedule.

Motivation is an important factor to take into account. Intrinsic motivations will have the best outcome on the long term, and extrinsic motivations will make people reach their goal as fast as possible. One way to motivate people is to use game elements. Most of the players of a game are socializers; they want to collaborate with friends and compare results with them. From the results of the diaries this is also clear; learning a new way of physical activity from a friend will be a motivation to move more. Friends make things more fun too.

Leaderboards, progress indicators, badges, are all game elements and if used in non-game context they are part of something called Gamification. This concept, apart from being used to design games, can be used to motivate and engage people into a different behavior, since it involves also the tools and motivators of a game itself. It's important, while using Gamification, to understand what makes people do something, find ways to draw and integrate the right game elements into the heart of the activities. Gamification works better if and when we can align intrinsic motivation and extrinsic rewards. The most important part is to accept player's motivation as it is and try to help them get where they want to go.

Self-tracking data could be used if used correctly; this means for example that the data should have a context with which the user of the product could relate to. This could be showing a map of the activities, or giving the opportunity to compare the results with the results of people the user knows. Using game elements like leaderboards could help this accomplish. The data won't make sense to the user if it are only numbers; using data visualization could be a solution to this. Also, just numbers can be very confronting; the user should be challenged step by step to improve his behavior. In addition, human feedback could be added to make the user more attached to the product.

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Appendix 1 – Interviews diaries

Participant 1

27 years old

Entrepreneur/Project Manager at a company that helps young entrepreneurs

Excel and music

Dutch

Favorite place in Amsterdam: Home

Relationship: No

Smoker: No

Lives in house with 3 roommates

Participant 1 works generally 12 hours a day. He works in Utrecht and travels between Amsterdam and Utrecht during the week. He is a real work-a-holic. Even in his spare time, he is thinking about his work and does small tasks, like sending some emails. He says work gives him energy and he really loves his job.

The work he is doing is really a desk job. He doesn't get outside for the whole day. He works on his computer for more than 80% of the day. In between, he tries to walk around in the office, at least one time an hour. He doesn't get out to get fresh air, when he is tired of the work, he will start with something else, work-related.

Participant 1 tries to run twice a week. This does not always work; the week he tracked his behavior he was too busy to work-out. For Participant 1, running is a way to forget about work. After working out, he feels very tired but satisfied. When Participant 1 runs, he runs alone. This is a conscious choice, because he wants to free his mind. He uses the app 'Map my run'. He normally runs between 20 minutes and 40 minutes, depending on the amount of spare time. The data collected he only uses to improve his own running, he does not share his results with his friends or on facebook. He is not interested in quantifying himself, because he feels he already knows his daily routine pretty well. One thing he does do, is keep track of a bucket list, things he still wants to accomplish.

Participant 1 feels that he is a healthy person, he doesn't run to get fitter. He does not have a goal, it is just for freeing his mind. He thinks it would motivate him to do sports with friends, but he wants to do something that is flexible, he should be free to cancel if he does not have time. One thing he would like to do is boxing.

If the weather is good, this will influence his mood positively. For him, it does not really matter if it is raining all day, because he is inside. In his spare time, he usually tries to do some small things for work, like sending an email. If he just wants to chill, he will watch 'dumpert' video's. He doesn't read, and sometimes he watches a movie, but not very often.

Participant 2

21 years old

Student + works 3 times a week at a film company

Hobbies: being with friends, watching films, cooking

Dutch

Relationship: yes

Smoker: yes

Lives in Apartment with one roommate.

The week Participant 2 tracked, felt different than a normal week for her. She had some other things to do (ALV), it was raining a lot, and she went to the Amsterdam Dance Event. She acknowledges that this might be the case every week. (I know her and I think this is a regular week for her)

Participant 2 works three times a week (tue,thu,fri). This brings regularity to her life. Her day normally starts at 9:00. Participant 2 works behind a desk and doesn't take a lot of breaks, only at lunch time. At lunchtime she eats in the office, so she doesn't get out.

When Participant 2 is not working, she is studying. The weather influences Participant 2. When it is raining and she has a lot to do, she will feel less good, and if the weather is really good, she will feel happier. When it is raining, she is more likely to take the tram to work/UvA.

Participant 2 has just started to run in the park. She used a scheme that would help her run 10 kilometers. Normally she runs twice a week, but this week she ran just once. To track herself, she uses Nike +. With this she wants to improve herself, for example the distance and the speed in which she is running. She has some friends on her Nike + account, but it doesn't influence her running-behavior; she won't go for a run, because her friends can see she has not run that week. She is not very competitive, she only runs to get more stamina. She runs alone, because she wants to improve herself and wants to do this for herself. It was not a really big deal for her to start running, because she's done it before and the scheme motivated her to keep on going. She felt that she was improving, and that was motivating. She has set her goal on 10 kilometers. (Now she can run 8 km).

Another way for Participant 2 to track her daily routine, is to use the app 'Moves'. This app tracks her daily movements throughout the city. Normally she will check this app at night to see how much physical activities she did. If that day she did not move enough, she will try to do more physical activities the next day.

Participant 2 thinks she is a healthy person. Although she smokes and drinks pretty often, she eats healthy and moves enough. Since her boyfriend she started to eat less healthy, and she started to get a little bit more lazy. (For example, it is easier to stay home at

night now). In her spare time she likes to hang out with friends, she studies and likes to see her boyfriend. Sometimes she watches a movie on her own, or reads. According to Participant 2, her life is not that busy, but it's busier than the life of a regular student.

Participant 3

24 years old

Master Student and part-time content manager

playing guitar, xboxing

dutch

Relationship: yes

Smoker: no

Lives in an apartment, which he shares with his girlfriend. They have been living together for about one month.

Participant 3 just started to live together with his girlfriend. This has given his life more regularity than before. He feels that the past months he started a more healthy life. He has to write his thesis, and because of this he does not have a lot of time to hang out with friends and drink. His friends have started to live a busier life too.

Participant 3 works as a part-timer. When he goes to the office, he sits behind a desk all day. When his colleagues are having a smoke-break, he will join them for a small break. The office is 3 stairs high, so this is a small work-out.

Since Participant 3 has been living close to the park, he started running two or three times a week. Normally he runs at monday, wednesday and friday, to give his body some rest. Before living together, he used to go to the gym (fit4free). At that time, the gym was closer, so easier to do. Now the park is close. He wants to get better stamina, because you will feel better overall. He runs either in the morning or in the evening, because running is a good start or end of the day.

When Participant 3 is running, he does not carry anything with him. He thinks it is annoying. He does not bring his phone, because he does not want to be interrupted for example by whatsapp. So, he does not use any apps or tracking devices to keep track of his running. He does this by looking at the clock and the rounds he does in the park. To the park is 500 meter, and one round in the park is 2 km. He normally does 3 rounds, so he runs 7 km. This is how he keeps track.

He runs alone, but he went to fit4free with his friends. This was an incentive for him to work out. At first, he did not really like to go to the gym, because he was not sure how to use all the machines there. A friend introduced him to all the devices, and later he went

there by himself. After understanding everything better, and feeling sure about this, it was easier for him to go by himself.

If Participant 3 has to go somewhere, he usually will go by bike. When the weather is bad (raining) and he doesn't have to be there at a particular time, he will wait for the rain to stop. If he has to be somewhere on time, he is more likely to take the tram when it is raining.

In his spare time, Participant 3 likes to xbox and to play guitar. He is also learning how to program. To keep his mind of work, he will make a note in his phone with everything he has to do the next day, right before he goes to sleep.

Participant 4

21 years old

Student Education Assistant, part-time fitness instructor, part-time bartender

Soccer

Dutch

Has an open relationship

Social Smoker

Lives in a shared student building

Since his new study, Participant 4 says he's gotten more regularity in his life. He needs to go to school at specific moments, or to his work and therefore he has more somewhat more routine in his life. While seeing his own diary, he noticed that a bigger part of his life involved sleeping than he thought it would. Though even with knowing this, he doesn't want to change this.

He almost always goes by public transport. Because he is a student, it's free and he doesn't see the fun (he only wants to do things he thinks are fun) or the necessity to go by bike or by foot more often. He doesn't really mind being in the public environment, he usually just uses the outside to get from point A to point B. Bad weather keeps him inside, and although he likes good weather, it doesn't make him want to go outside to just be in the environment. The thing which influences him the most is his friends. They are the ones who influence his mood the most and they can make him go outside for a fun game of soccer.

Although he considers himself kind of a lazy person, he does think he is healthy, considering he does a lot of sports. Improving his performance and bringing it to the next level are his greatest challenges in doing sports. Because he think it is fun and and he has a regular training schedule with his soccer team, he finds it easy to keep up. He doesn't track any of his activities, but he says that he would like doing this. He just didn't know much about it and doesn't want to spend money on it.

Participant 5

22 years old

Intern at Dutch Label and weekends at Car rental company

Movies, series and sometimes video games

Dutch

Favorite place in Amsterdam: Nieuwmarkt

Relationship: Yes

Smoker: No

Lives alone in an apartment

Participant 5 started with his internship at Dutch Label last month and says that he has gotten really busy with that. He has little to no time to do any physical activity, as he works until late and also works in the weekend. He has a long term relation with his girlfriend in Florida, which also takes up some time.

He used to do workouts with Insanity, which is a training programme where you get as fit as possible in 60 days. However he stopped after 21 days thanks to his heavy workload. He goes to work by bus if it's cold and if it's warmer he will go by bike, which takes about half an hour. At work he plays table tennis, which he likes to do with his co-workers. After work he is too tired to work out and will just lay on the couch, talk to his girlfriend, watch movies and go to bed.

Although he wants to do more physical activity, he says it's because a lack of relaxation and sleep. He goes to bed at midnight and has to get up at 7:30. Before his internship he used to sleep about ten hours, instead of the seven and a half hours he gets right now. Although he does not really see himself as a really healthy person, he does buy healthy food and eat a lot of protein. He would like to do more sports, but just cannot find the right timeframe to do it.

Participant 6

22 years old

Works at a creative company every day from 9-5

Dutch

Favorite place in A'dam: home

Relationship: Yes

Smoker: Yes

Lives alone in an apartment

Having to work every day of the week, from 9h to 5h, sometimes more, makes Participant 6's daily life busy. When he have free time after work he normally spend at home, it can be alone or with his girlfriend, playing videogames, watching TV or just chilling at the couch. For Participant 6 this relaxing time is really important.

Walking is how Participant 6 goes to work, but sometimes he use the bike too (he didn't use it this week because it was broken). He never use the public transportation to go there because is too close to where he lives and too handy if he wants to. So even if it's raining, he goes walking.

Having a nice night of sleep is also priceless for Participant 6 and when it happen, he always start the day in a good mood. The weather doesn't influence his mood in most of the occasions, but if he need to go out and do a lot of things away from home, he said that is annoying. Also about mood, one thing that makes his day better is to be able to have fun playing videogames.

Some days in some weeks Participant 6 do physical activities during his free time. The activity that he do is some home exercises, like push-ups. Normally it takes 30 minutes. He said that he didn't like that much, but he do to be a bit in shape and to stay active.

Participant 6 thinks that he doesn't have motivation and time enough to do more activities, like going to a gym, but he still worries about doing something. When the subject is alimentation, he said that it's ok too, he also try to stay healthy.

Participant 7

26 years old

Educator/Manager

Dancing

Dutch

Has a relationship

Smokes sometimes

Shares a (3th floor) apartment with her partner

Because of the distance between her work and her home, Participant 7 only bikes to the station in her own city and travels by public transport the rest of the journey. She finds it unfortunate that she is more or less obligated to travel this way. She wants to bike more, to get more physical activities, but she doesn't have a reason to do it, she won't do it just for fun, only functionally. She thinks everything she needs to go to are too close.

She likes to be in nature, the city doesn't invite her to get active. This makes that she wants to take a walk in a forest but not in the city.

She dances a lot, pretty intensively, twice or three times a week. She mainly does this because she thinks this is fun. Though because this makes her do moderate physical activities, she doesn't need to do other sports next to it anymore. She has tried some sports before, but because the main goal of most other sports is just being physically active instead of fun, she couldn't really engage and keep up with it.

Sitting behind a desk doesn't improve her mood, she likes some action, to make things and do stuff, and she misses these things when she has to sit behind a desk all day. Another mood influencer are the people around her. Being in good company is more important than the things she does. Weather is only an influence when the weather is really bad. Not getting enough daylight is really bad for her mood though. During winter she really needs to go outside and take walks every now and then.

She thinks she has good and healthy habits, eating healthy and dancing and therefore she doesn't think a lot about her health. When she notices that she does feel less healthy, she starts to adapt her habits.