Requirements Engineering Case Report Easyflux

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Introduction

1.1 Our Project

Easyflux is a smart webbased light tool that prevents work pressure and ensures that a "no" is better accepted by the work environment. With the easyflux, the environment sees when people are busy or approachable on the workfloor. This way of working makes people more productive and they experience less work stress. The company is looking for an enthusiastic group of students to help them with:

1. Validate Easy Flux and learn how well it will work for different types of users in different settings.
2. Propose new features and make clear what the expected impact is.
3. Learn how Easy Flux can keep adding value to its users throughout the cycle from first orientation, first free use, to sustained use.

1.2 Motivation

The topic of work pressure is an incredibly prevalent topic in our modern day, especially considering the heavily demanding and competitive work environments in fast-growing companies. This sort of pressure can lead to long-lasting negative effects on an employee's mental and physical health.

We want to work with 4U Solutions BV to understand the ways and means to reduce work pressure in a professional environment, but we are also curious about how we can translate the process into other settings (for example the work pressure students face as well). Furthermore, as students who have experience managing academics and office jobs sometimes at the same time, we will be able to provide a valuable perspective to validate Easyflux.

As Requirements Engineers, in order to investigate our case, we researched multiple models that we could use in order to evaluate our problem and achieve the goals of the client. In this document, we only include the case findings.

Chapter 2

Case Findings

2.1 Case Validation

Within this section, we use requirements validation techniques in order to validate Easyflux. Typically, validation techniques in Requirements Engineering involve creating and designing a software based on the requirements elicited based on the customer's needs and goals. However, for our project, the product has already been created and designed, so we will validate Easyflux using RE validation techniques with the perspective that it was the product was already designed using the Requirements obtained through interviews.

2.1.1 Review of Existing Research

Colour Psychology
Colour as perceived by human beings can be described in scientific terms as being the result of the interaction of light with matter, atoms and molecules [1]. Colour is "defined as the subjective appearance of light as detected by the eye" [1]. Colour results from the interaction between the spectral sensitivity of the light receptors in the eye and the distribution of light energy vs wavelength. Light waves of different lengths reflect off physical, inanimate, and alive objects to create the seven hues of the spectrum. Simple vibrational frequency is all that separates light from colour. [2] In day-to-day life, colour is omnipresent and unavoidable, and influences our view of reality in ways that do not need much introduction.

Research shows that colours can influence a person's emotional and psychological states. [3][4] "In clothing, interiors, landscape, and even natural light, a color can change our mood from sad to happy, from confusion to intelligence, from fear to confidence." [2]
The effects of electromagnetic radiation from light on human mood and behaviour are referred to as the psychological properties of colours. This reaction is universal, psychophysical, and less influenced by culture, age, or gender than is commonly believed. The primary colours of psychology are red, blue, yellow, and green. They are related to the body, the mind, the emotions, and the crucial harmony between these three, in that order. [2]

Colours have a significant impact on your employees' productivity in addition to how they feel. For years, clever business owners have used colour psychology to accomplish a variety of goals, from evoking good emotions in customers to stimulating team members' creativity. Colours can be utilised to one's advantage to accomplish corporate goals with the help of an excellent office design consultancy. [5]
As the interest in colour psychology in the context of Easyflux mainly lies in the mood-affecting abilities of red and green, we will focus on the two tones in the following paragraphs.

Red light Red is the colour with the strongest and most fundamental properties due to its longer wavelength. In an environment, it attracts attention first because it gives the impression that it is closer than it actually is. It is energising, vibrant, and warm. Blood pressure, respiration, and heart rate all increase when the subject is exposed to red light. The nervous system, especially the sympathetic branch of the autonomic nervous system, gets stimulated by red light.[4] It might be interpreted as forceful and demanding at the same time. People are affected by the red-coloured spaces in terms of courage, strength, warmth, energy, fundamental survival, "fight or flight" instinct stimulation, masculinity, and excitement.

Red's negative effects include defiance, anger, visual impact, and strain. [2] On a mental level, the colour is associated with fire or blood, while direct associations include "danger" and "Christmas". Objective impressions of the colour lead to passion and excitement, whereas subjective impressions may trigger rage or fierce feelings in a person. [6]
In an office space, red can increase employee productivity, provide the impression that time is flying fast, and be beneficial in organisations that are high-energy and creative. [5]

Green light Colour experts believe that green is emotionally soothing. It imparts a sense of renewal, harmony, and balance. It stands for peace, environmental awareness and love for all people. Cool blues, greens, and neutral earth tones are calming to people since they are reminiscent of nature. Many plants and other forms of green are used by skilled designers in hotel lobbies, workplaces, and restaurants because green has the ability to aid individuals in acclimating to unfamiliar situations. Despite being the colour of equilibrium, it may also be boring, discouraging, and too bland when utilised incorrectly. [2] An example of a common direct association (for the catholic population) would be St. Patrick's Day. Objective impressions brought by the green colour are refreshing and peaceful, while subjective impressions may include disease or guilt. [6]
In terms of using green in the business world, green also stands for prosperity and money because it is the colour of dollars; financial institutions like to use darker variations of the colour. Green is calming to customers, making it a suitable choice for businesses that make people uneasy. Lighter tones of green have a relaxing influence on the mind and body, while brighter shades, like other colours, can be stimulating. [5]
The shading choice for Easyflux can be scientifically correlated with the psychological working benefits brought by the two (principal) colours. During work periods, the device flashes a red colour, boosting productivity, and enhancing attention and concentration for the individual, while offering explicit signals to others that the person working should not be disturbed (yet). When the user completes a Pomodoro work period, Easyflux will indicate a break time by flashing shades of green, which cool the person's mind and promote calmness and temporary relaxation. This benefits "recharging batteries" for the upcoming working block. Simultaneously, the green colour invites the user's peers to approach them, be it with recreational or work-related intentions.

Micro-breaks activities

The recovery process during off-work hours has received most of the attention in recovery literature. Momentary recovery at work has received relatively little research. There isn't enough data to inform businesses and workers about particular micro-break activities. Repairing the negative effects of workplace stressors like workload demands is a goal of recovery. One study looked at four types of micro-break activities—relaxation, nutrition intake, social, and cognitive—as potential mechanisms for workplace recovery. [7] For ten consecutive workdays, 86 office workers from South Korea were studied. It demonstrated the negative effects of work demands at the end of the workday could be addressed by relaxation and social activities. Beverage and snack nutrition did not significantly moderate the effect. Only caffeinated beverages, however, were found to lessen the negative effects of work demands. According to the study, while taking micro-breaks is important, the activity during the break matters more. [7]

The length of the micro-breaks was not the focus of the study, though. which mostly applies to our situation.

Intention-Behaviour Gap

People do not always do the thing they intend to do. How big is the intention-behaviour gap and what can influence it? What kind of problems people face that prevent them from reaching their goals? [8]

Goal intentions are self-instructions to achieve desired outcomes (for example, "I finish this project by the end of the week"), whereas behavioral intentions are self-instructions to take specific action to achieve this outcome (e.g, "I will work productively using Easyflux").
Despite the fact that most behavior is habitual or involves automatic responses to situational cues, forming intentions can be critical in achieving long-term goals. [8] Numerous studies have found that intentions predict behavior. They argue that forming an intention to change is critical if people want to begin new behaviors or change those that are no longer desired. However, intention does not indicate the extent to which behavior will change. Experiments show that a medium-to-large-sized change in

intentions led to only a small-to-medium-sized change in the behaviour. [8]
Promotion, autonomy, and learning goals, as well as specific goals like getting a grade, are said to be more likely to be achieved than general goals like 'do your best.' The goals we set are frequently overly optimistic (planning fallacy), which reduces their likelihood of success. There is also the 'hot-cold empathy gap,' which is a cognitive bias in which people underestimate the influences of visceral drives (e.g., hunger) on their behaviors (e.g, commiting to diet). [9] Setting optimistic goals, on the other hand, can help in dealing with obstacles and lead to better overall performance. What is not surprising is that easier-to-perform behaviors are more likely to be maintained. Someone who works in a more organized manner may find it more natural to continue using the Easyflux device than someone who works in a less organized manner. Not only does the direction and intensity of intention matter, but so do features such as accessibility (as measured by response latencies to intention questions), certainty (e.g., "I'm convinced that my intention will not change"), and temporal stability (correlation between measures of intention taken at two different times). ,,Several lines of research indicate that intention stability is a better indicator of the strength of the respective intention than accessibility or certainty". [8]

There are three stages of goal pursuit in which we can highlight the main issues we face in terms of self-regulation challenges.
The first is just getting started, and it is a failure to get started. It is associated with forgetting to act, second thoughts, and procrastination. Then there is a failure to follow through on a goal pursuit. Failure to monitor goal progression, 'bad' habits, unwanted influences, and a lack of willpower can all be sub-problems here. At the very end, we may fail to bring our goal pursuit to a successful conclusion due to falling short of the desired outcome.
To address these issues, we must remember to act, monitor goal progress, and conserve capability for future goal pursuit. There are several tools available to help with self-regulation issues. "If-then plans" is one of them. If-then planning involves identifying opportunities and challenges. If (opportunity/difficulty) arises, I will (respond in this manner)! [8] There are also interventions available to track progress. It entails comparing current progress to the standard specified in the intention. When the focus of monitoring (performance of goal-directed behavior or outcomes) matched the desired outcome (a change in behavior or a change in outcomes), and progress was physically recorded or made public, interventions had a greater effect. [8] Finally, insights from habit research are proving useful in identifying strategies that could aid in goal maintenance - pursuit (for example, repeating behavior in stable contexts, piggybacking new behavior(s) onto existing behavior(s)). [8]

In the context of the Easyflux, we can see that the process of sticking to the intention is highly personal, motivated by a variety of factors. People may encounter the same issues mentioned in the text during the process. If they are not used to using the device, they may simply forget to use it, or they may procrastinate and put it off until later. They may struggle to find motivation to continue the cycle after using it for a while. When people are made aware of potential obstacles and given tools to deal with them, the outcome should be better. The EasyFWD software provides a summary of the progress made. As stated in the text, once progress is physically recorded, the greater the effects.

Reward mechanism
Habit is a learned automatic response to a contextual cues. [10] Habit formation is supported by repeating behaviour in a stable context (the same place, time, etc.), it is a change in behaviour that is automatically prompted by contextual cues, rather than conscious input or motivation. A study shows that the time required to form a habit is from 18 to 254 days, indicating considerable differences between individuals. [11]
However, it is said that there exist variables that can help accelerate habit formation process. One of them is reward factor, which may play different roles in the habit formation process.

The reward system is a group of structures that are activated by some rewarding stimuli (good food, verbal praise). Once the brain is exposed to a rewarding stimulus, it responds by releasing the neurotransmitter dopamine. [12] When the VTA (Venternal Tegmental Area) releases dopamine it goes to a lot of different parts of the brain. The circuit is called a mesolimbic pathway. All these parts have dopamine receptors so when they uptake with the dopamine the result is a feeling of happiness which is the reward we get. Hippocampus, that is responsible for formation of memories, wants to remember everything about this environment so the experience can be repeated. [13]

Within social and health psychology, it is claimed that if the habit is associated with a reward, there is increase in the intention intention, and thus these behaviors are performed more frequently. [11] However, the animal learning and neuroscience literature states that, with the same number of repetitions, awareded behaviour may become habitual more quickly than an unrewarded one. [11] One example could be, that if working effectively is rewarding for a person, they can form a habit quicker. But there is more to it, being motivated to act because the process is enjoyable is more likely to lead to stronger intentions and sustain changes in behavior, rather than being motivated to act to achieve a desired outcome. [11] For instance, a person who enjoys using Easyflux will do it more often and develop the habit more quickly than a person who doesn't particularly enjoy the process but finds the result satisfying.

Open Space Study
From our model's and interviews conducted with the owner, we understand that the Easyflux will be primarily used and targeted for Open-Plan or Open Space office settings. When working in such an Office environment, it is important to understand people's behaviour in such a work environment in order to really evaluate and validate the effectiveness of the product.

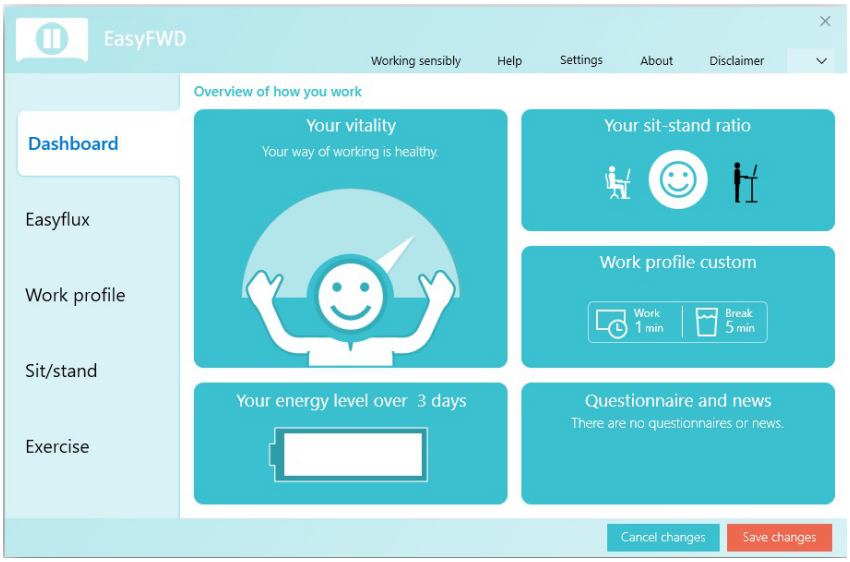
In order to investigate the current state of Open-Office research, we looked into papers that show the current effects of Open-Offices. We read a paper that compares the psychological and work Outcomes in Open-Plan and Cellular Office designs. In the paper the authors explain that from "all studies measuring stress, satisfaction with work environment, job satisfaction, noise, distractions/disturbances, privacy, as well as acoustic, light, sound, and air quality showed negative results for open-plan work environments as compared to single occupant private enclosed offices" [14]. Similarly, a paper looking at the impact of noise and privacy stated that "distraction by noise and loss of privacy were identified as the major causes of workspace dissatisfaction in open-plan office layouts" [15]. The consensus from Open-Space office research is that this type of office layout comes with employee dissatisfaction because of various reasons. Our interest is specifically within the increase in work stress, noise and other distractions.

An important factor to consider when it comes to the Open-Office environment is the ease of interrupting colleagues that are working. This has obviously increased due and is a discussion based on the previously discussed research [14]. We looked a study that investigated the face-to-face interruption in office environments. "Not many concerns were noted about choosing an appropriate moment for an interruption on the interrupter side. It appears to be a relationship between the perceived availability level and the task performed by the assistant. Conversations seemed most socially inappropriate to disturb." [16]. Another investigation in Hungary related to the interruptions in the work environment of IT professionals also discuss the channels of communication. In their investigation, they calculate that 20.4% of interruptions that lead to obstructions with their tasks/work were caused by personal inquiries (so directly interrupting at the desk) [17]. This was the highest percentage in which a communication channel had disturbed a professional's work flow according to their results.

From Open-Space and interruption research, it has clear evidence that the Easyflux has the potential to positively impact a work environment. Where if the Easyflux device is respected in the office then red will clearly indicate to colleague that you are working and focused, potentially forcing them to keep the noise level down in an Open-Office environment. If people learn to respect this visual cues and make the colour system into a habit, the Easyflux has the potential to help improve these factors. Furthermore, in regard to the value it can add to interruptions is similar. If colleagues learn to respect that fact that the colour red means you are occupied, then it is also a clear indication to them to not just wait around till you get free, but to come back later when you are available. However, it is important to note that this is only a possibility/hypothesis and that concrete testing/investigation would really be needed to validate the effectiveness of Easyflux to help reduce work stress, noise, and interruptions. We attempt to do this and discuss the results in section 2.1.3.

2.1.2 UI/UX Review

We have asked two fellow UI/UX designers working in a professional field for the feedback of a EasyFWD software. Below there are some notes they made:



There is a double navigation; the one on the left side is great, but perhaps something from the top one, such as help and settings, could be added to the one on the left as well. The fact that the navigation is in two places is a little disturbing. Are certain phrases, such as "disclaimer" and "about," important enough to be at the top of the page? Perhaps they could be placed under the arrow?

There is a smiley face next to the sit-stand ratio, so the user can infer that this is a good result, but the user should not be forced to think (there is a book about it called "Don't Make Me Think"). Perhaps a short message/word under the emoticon could also indicate how someone is doing (for example, on different screens, the emoticons are signed with "excellent," "average," and the smiley. It is not overwhelming, and the message is more clear).

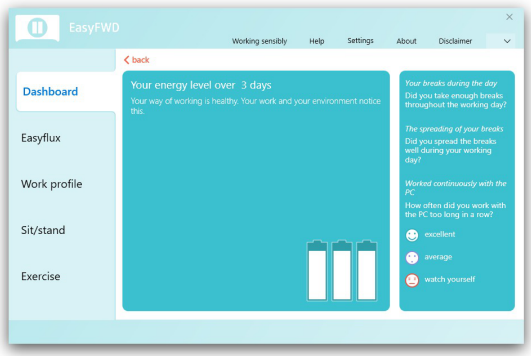
The graphic with the standing figure in the sit-stand ratio is black. This is the only place where this occurs. Is it an inconsistency or is it supposed to depict something?

If there are no settings in the dashboard, the save/cancel changes buttons are not used. When leaving a tab after editing, the user could be prompted to save the changes before proceeding (if the user does not click to save them earlier).

The order of the icons can be changed here: first, settings, then close icon, and aligned to one size. The labels and their corresponding values, such as ,,easyflux connected" , could be placed vertically one above the other to make it easier to read, and the labels themselves could be in a slightly smaller font.

The dropdown here could be placed under "select your exercise" and some different text could be in the input so that the text on the label is not repeated.

To make it easier to read, the text on the right side can be in the form of points (a list) and in a smaller font.



The timer overlaps some settings.

General points:
The proportions are good, as if someone did it on the net, so that it doesn't go apart - that's a plus.
The typography is something to consider. This font is quite thin, and it gets a little lost, especially with top menu items.
There is also a lot of space between the top menu items and the top of the page, but not so much between the bottom edge of this menu bar. The use of empty spaces and the manipulation of light can produce significant results.
If it's needed for some visually impaired people, for example, the contrast between this background and the white text could be an issue. Google Lighthouse tool can be used to check the accessibility of websites.
Here are some current UI trends that can be used to add more "depth" to the design: `https://uxdesign.cc/2022-ui-design-trends-guide-22ddc386557b`

2.1.3 Test case generation

Requirements should be testable [18]. In the validation process, by creating tests for the requirements, we can often reveal requirements problems. When designing a test, it might turn out that the test seems too difficult or impossible to create. This usually means that the requirements will be very difficult to implement and should be reconsidered [18]. Generally in requirements validation, developing tests from the user requirements before any code is written is an integral part of extreme programming. However, in our case, the code is written, and the product is created. Therefore, we will create tests with the EasyFlux itself as a means to validate the product using tests and validate the requirements of the product.

To conduct our test, we initially tried to get volunteers, especially working professionals. However, that was too difficult because we were barely able to get meetings with them, let alone ask them to test the EasyFlux for a couple of days. Furthermore, due to the price of the damaging the product, we decided internal testing was the best course of action. Therefore, when designing the tests we created these criteria based on the main requirements we have elicited that can possibly be evaluated in the short term:

- Does it change the behaviour of a Student?
- Did the device reduce work pressure, which should ideally assist with burnout?
- Did the device help reduce physical fatigue with longer breaks?
- Do others follow the indications of the EasyFlux?
- Is the product valuable to a student (market available in academics)?

These are the tests we conducted and the evaluations for each test:

1. **Test 1**
   Description: EasyFlux at home office/room setting. The user will use the easy Flux for 3 days for the duration they work at home (averaged around 4 hours a day).

   Observations and Evaluation:

   - Does it change the behaviour of a Student?
     It was way too little time to tell. There is some difficulty following through with it after the first day because it starts becoming a nuisance. The student kept ignoring the break. This is especially prevalent when programming. In programming, you can't force yourself to take a break midway, especially if you are on a train of thought. Of course for the EasyFlux you do not have to take the break immediately after 25 mins, but if you have an idea and if you haven't written it down it causes many problems, and you can forget in the 5-minute breaks. So forcefully taking a break as a programmer will be an issue in particular.
   - Did the device reduce work pressure, which should ideally assist with burnout? Yes, it did show early signs of reducing work pressure in the sense, when the student did take more breaks in between long hours of working they felt more at ease, able to re-strategize and be more realistic wiwth their own expectation of what they can complete on that day instead of being stressed the entire time that they are falling behind.
   - Did the device help reduce physical fatigue with longer breaks? Yes for sure. When they followed the rules, they felt less physical fatigue after a long day of sitting down.
   - Do others follow the indications of the EasyFlux?
     Not applicable.
   - Is the product valuable to a student (market available in academics)?
     Something that the tester noticed about using the EasyFlux that it assisted with focus. When working on red it kept reminding them they should be working and not be distracted/procrastinate. So it provides a reminder. Based on the other evaluation points and the observation, it is still a bit early to see if it will work for individual students, especially for programmers. With less complicated tasks, the EasyFlux proved useful and show early indication of meeting the requirements, however with programmers the aspect of changing the behaviour will be more difficult.

2. **Test 2**
   Description: EasyFlux in a living room setting. The user works in the living room for 3 days for the duration that they work (averaged around 3-4 hours a day). This test is also to test the ability

of people in the household to follow the colours.

Observations and Evaluation:

- Does it change the behaviour of a Student?
  In this sense, it is a similar response to the student in a home office/room. Better indication of a habit because this was a new study environment for the student, therefore it was easier to try to learn a new habit.
- Did the device reduce work pressure, which should ideally assist with burnout?
  Same response as Test 1. Nothing new observed.
- Did the device help reduce physical fatigue with longer breaks?
  Yes, and the fact there was more space to move around and take a break helped. Also, the fact that there is room to stretch made the student less inclined to sit in their chair.
- Do others follow the indications of the EasyFlux?
  This was a huge factor to consider. When the roommates were first told about the rules, they did not follow them at all. They were told only to disturb the student when they EasyFlux was green and to come back later. After the third time this was explained, but also aggressively emphasized not to disturb them on red the roommates started following the rules. So it took a couple of tries to get the point across, but the short period afterwards the rules were followed. However, such aggressive emphasis would be inappropriate in an office setting, so it is difficult to say that individuals will follow the rules of the EasyFlux that quickly.
- Is the product valuable to a student (market available in academics)?
  The observation was that the product seemed to be more useful in a setting that was surrounded by other people, or people that could disturb the student, compared to at a desk in a private room. Furthermore, it was also dependent on the task, because easier tasks that just required lots of time heavily benefitted from the EasyFlux mainly cause of reduced fatigue and more breaks to relax the brain and take a coffee break.

3. **Test 3**
   Description: EasyFlux in a university setting where students all study together in the UvA. The user works in a private room 4 with their colleagues days for the duration that they work (averaged around 2-3 hours a day outside lecture hours).

   Observations and Evaluation:

   - Does it change the behaviour of a Student?
     In this case, the student was more inclined to follow the instructions and times of the EasyFlux because others followed the same rules, so the group held one another accountable for taking breaks roughly at similar time. In this case, it was much easier to make it a habit as a group.
   - Did the device reduce work pressure, which should ideally assist with burnout?
     Using the device in a group reduced work pressure, but also increased the break times due to distracting each other in a group and taking longer breaks.It just ended up increasing the stress about work once the group stopped working with each other and went home. However, it did help with the habit overall once reached home.
   - Did the device help reduce physical fatigue with longer breaks?
     Yes, same results as tests 1 and 2.
   - Do others follow the indications of the EasyFlux?
     Yes, working in a group with students who are also in a setting to get work done made following the rules simple, and we even ended up assisting each other. Holding each other accountable and not disturbing each other unless it was green. However, as discussed we held each other less accountable for longer breaks as we talked to each other during this time.
   - Is the product valuable to a student (market available in academics)?
     There is a strong indication of its value in a group setting, at least to learn the habit. Once the habit is learned, it would be more beneficial at home or at an office where long hours are spent together. This would definitely make no sense in a lecture, but private studying would be the most useful, only if the habit can be learned and also if the tasks the student is working on does not require a lot of concentration and very consistent thinking (like difficult programming tasks).

2.1.4 Prototyping

In Requirements Engineering validation techniques, prototyping consists of presenting the system to the end-user or customer, in order to give them the opportunity to experiment with the current model and determine whether it meets their need and expectations or not. Typically, this kind of methodology is employed to gather user requirement feedback. [18]

The creation of a prototype is an iterative process that mainly relies on input from the system's users. The user will be seated next to the analyst, giving him the requirements so that he may input them immediately into the system and come back to the user with the results. Together, the two can resolve any issues with the prototype's current design and add any necessary features to make it more robust. Prototyping cannot be used as a stand-alone technique of requirement collection since it depends on user engagement. [19]

Prototyping is recommended by requirements engineering as a strategy for elicitation, testing, and validating the applicability of a product. Based on the stage it was created for, a prototype will generate either product-level requirements, which are used to highlight the need for required functionality, or design-level requirements, which show a comprehensive solution for solving a certain problem. [20] Due to the user's high level of involvement throughout, prototyping is an extremely successful way for defining requirements. [19]

One of the potential downfalls of prototyping is that the user may be inclined to pay too much attention to details in the process, instead of focusing on what the prototype is expected to achieve. [19]

As, in practice, a prototype for EasyFlux has been developed by the stakeholder and offered to us for testing, we have decided to perform prototyping as part of Radu's workflow during a regular (home) office day. By doing so, we try to make an assessment of the applicability of the product to one of the authors' working environment and habits. Radu is a genuine potential customer for *4U Solutions BV*, as he is working part-time as a software engineer from home, in a more traditional business-hours determined schedule fashion.

As soon as the experiments started, when trying to incorporate the EasyFlux device paired with the EasyFWD software into his workflow, Radu ran into some logistical issues regarding the Operating System supported by the latter-mentioned part of the system. As a software engineer, part of the tool suite required to fulfil Radu's work is best (or sometimes exclusively) supported on Linux. This can be easily extrapolated to a very considerable chunk of purely software-development-oriented companies and not only, where work is exclusively done on Linux or macOS, which EasyFWD does not currently support. While this invalidates the product entirely for ***some*** categories of clients, the principal targeted customers (i.e. governmental institutions or banks) do primarily use Windows, development departments excluded. [21]

The micro-breaks together with the work bursts proved to be an interesting technique for productivity. Radu saw some real potential for the effectiveness of the method to improve his working schedule, however, since he was testing the technique for the first time a lot of conscious effort to follow the time intervals had to be put in. Supposedly, this problem goes away once a habit is formed. Figure 2.1 shows the EasyFlux device during a working block, where the red-to-white LED ratio indicates how far into the 25-minute interval the user is. Figure 2.2 shows how the device looks like during a break period.

One idea that surfaced when testing the device this way was the potential integration of the device into the physical keyboard itself. This eliminates the need for an extra piece of hardware that takes up space on the desk, needs to be connected and charged, can be forgotten or lost and so on. All the sensors would fit into a keyboard, which is guaranteed to be a tool already used by any potential customer for the company. The illuminating functionality could seamlessly be incorporated into a keyboard, and in fact, a lot of them already do, as the pictures exemplify.

In terms of how the functionality to signal others when the working person is approachable and when not scaled up, there were some difficulties in recommending it for remote workers. Since in Radu's case, communication with work peers is done through transmission channels like Slack or email, it is virtually impossible to make it clear to others when the status in "red" and when it is "green". This issue could

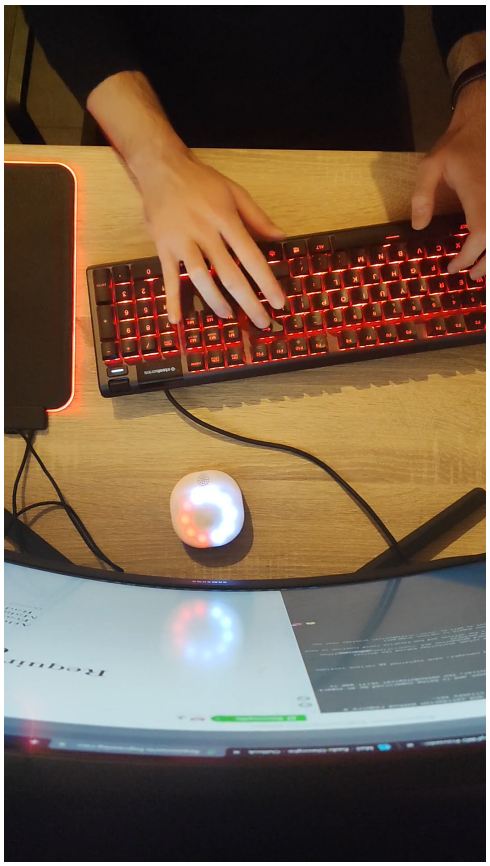


Figure 2.1: The EasyFlux device in the middle of a work block

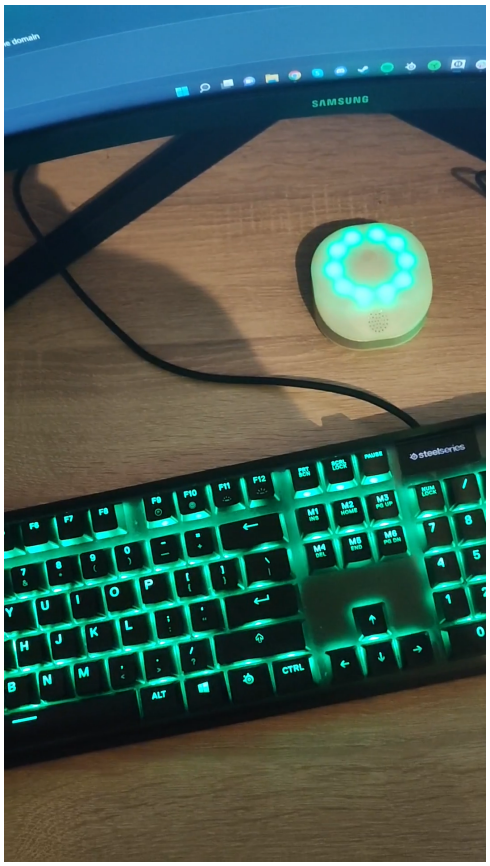


Figure 2.2: The EasyFlux device at the beginning of the 5-minute break

be addressed with an integration with such applications, where the user is able to set a "status", which could be controlled by the EasyFWD software, for example.

Then comes the issue of messages with high urgency, which need to be responded to without any sort of delay. In a tech company where high reliability and availability of its services are critical for the business, there are times when unexpected issues arise, which need immediate attention and taking a 5-minute break can have devastating consequences.

Lastly, the company working policy has to accept the use of such a device. Technically, in Radu's case, the company adopts a series of breaks for everyone throughout the day, but they are not as frequent and short as the Pomodoro method suggests.

In conclusion, this experiment showed us that EasyFlux can be successfully utilised by a developer working remotely, but only under the right circumstances. It appears that the ideal scenario would be a person who creates their own schedule and needs a tool to maintain a healthy working schedule and/or avoid procrastination, and who has a low need to communicate with peers.

2.1.5 Requirements Reviews

We wanted to review the requirements, but in our case we did not see the purpose of bringing the stakeholders together and going through a requirements document since we did not have access to a stakeholder; the client could not offer any of his partner to interview. Therefore, we took a different approach to traditional requirements reviews. In order to review the Requirements based off the product, we had an interview with a psychology student and a psychology expert (Assistant Professor in the field of Social Psychology) in order to discuss the product and ask questions that will help us review and validate the product from the perspectives of young researcher and an expert.

Interview with the psychology student
We interviewed the psychology student to learn about aspects (psychological research and contact to psychology experts) that can help us validate the requirements. Furthermore, while interviewing our client, he gave us some questions to ask the psychology student. Based on the conversation, we gathered the following information:

- The student was familiar with the Pomodoro technique. The reason why she didn't stick to it, was that she would get distracted waiting these 25minutes.
- Due to distractions, the student prefers to divide the work by context rather than by time.
- Our brains remain focused for about 40 minutes.
- The intention-behavior gap is one of the reasons why people don't follow through on their promises.
- Piggybacking new behaviors onto existing behaviors is one way to learn new behaviors.
- It takes about 21 to 30 days to form a new habit.
- The reward mechanism is connected to dopamine release, so our brain seeks motivation to receive more rewards. It can also make us proud of our accomplishments.
- The psychology of color is important. Red draws attention because it is associated with alertness. Green is associated with happiness. Blue is associated with productivity (main colour of the software).
- A person must be psychologically prepared to introduce new things into their life. They must also have a genuine desire to change their behavior.
- If people are around other users of the device, they may be more motivated to use it. Similar to going to the library to study, your motivation will increase if you see other people there also

studying.

Product Review with the psychology expert
In order to understand and validate the psychological aspects that are required by the product to be successful in various markets, we met with a psychology expert (dr. Eftychia Stamkou) to address possible concerns and limitations of the product. We started off by demonstrating the product, explaining what it does and how it works. We informed them about the intended effect of the product as a means to reduce works stress and the intended target audience. After this introduction, we created a set of questions/discussion points to get their expert opinion on the product. These are the questions and a summary of the responses we obtained from our expert:

- Have you heard about the Pomodoro technique?
  The professor has actually never heard of pomodoro, but she did seem to be familiar with this idea of timed work and then a set break in intervals.
- After hearing about the product, what do you think are the main concerns to make using EasyFlux a habit for a person?
  After hearing about the product, the immediate concern with the professor was about the colours used for the EasyFlux (similar reaction from the psychology student). Red tends to be a colour associated with negative connotation, stress and also stopping (like in a traffic light). Whereas green, like she pointed out, is associated with "go" in a traffic light. These perceptions already cause a conflict with it becoming a habit because the colours can effect a user's emotions and the colours they associate those emotions with. Another issue with the product is the issue to avoid procrastination. How can the device counteract procrastination during the "red" periods of the EasyFlux? It will be difficult to make a productive habit if the user just procrastinates during the 25-minute work period.
- What could be the other potential reasons for it not being successful from a psychological perspective?
  Different people have different patterns. The cycle of 25 minutes work and 5 minutes break may not fit other people's patterns, and an even be detrimental to their productivity or stress. The lack of customizability in the device can cause conflicts depending on the person.
- From your professional experience, do you think your colleagues or other people you work with will listen to the signals or interrupt you anyway? Would you expect it to be the same in an Open-Space office? How about at home with children?
  Yes, it could work, and the colleague could follow instructions. However, the issues lie with the fact that the EasyFlux acts as a sort of physical barrier between you and your colleagues, which can damage an organic relationship. The idea of red is to send a person away. This seems to be even more of a barrier when it comes to high to low interactions. There is an extra barrier if you want to communicate with your higher ups, even though there is already the mental barrier based on the power dynamics, this just adds the difficulty to that. With children, the physical barrier is not needed if the parent is already good at setting boundaries with their children. It is an additional tool but in her opinion has no purpose if your children already know when parents are working, they don't want to be disturbed, etc.
- How important is the culture of the company in introducing such a tool? It would not work in a company that is self-driven and creative. For example, creative fields that are research oriented like at the University will not work. However, for jobs that are scheduled and regimented, it can work. The main issue with creative work is the set time to take breaks, it will be too difficult to predict. Whereas with scheduled and regimented office jobs, where there is repetition and a rhythm to follow where there is a flow in that sense it has the potential to work. However, this would be in a scenario where the world is pretty manual, repetitive and maybe even "boring". The idea of the reward system can also be questionable in the sense that, the work should be rewarding on its own, so why is the product required to show rewards?
- In your opinion, do you think EasyFlux could help with work pressure? They think it really depends on the job. Like for her work pressure, it would be reducing the number of projects she takes on, or better time management overall. But EasyFlux does not really help with time management, instead it divides her time. So overall, she doesn't know, and it really depends on the job. For example, she said for other people it could possibly work fine. Repetitive jobs like the ones at Albert Hein is an example she used. However, that is also difficult, especially since they can't take a 5-minute break in the middle of a cashier shift. She suggested that asking the same question to

someone who has a repetitive job would provide useful insight on the other side.

Bibliography

[1] "Light and colour," in *Colour and the Optical Properties of Materials*. John Wiley Sons, Ltd, 2010, ch. 1, pp. 1–48, ISBN: 9780470974773. DOI: https://doi.org/10.1002/9780470974773.ch1. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1002/9780470974773.ch1. [Online]. Available: https://onlinelibrary.wiley.com/doi/abs/10.1002/9780470974773.ch1.

[2] S. Kurt and K. K. Osueke, "The effects of color on the moods of college students," *SAGE Open*, vol. 4, no. 1, p. 2 158 244 014 525 423, 2014. DOI: 10.1177/2158244014525423. eprint: https://doi.org/10.1177/2158244014525423. [Online]. Available: https://doi.org/10.1177/2158244014525423.

[3] A. R. Hussain, "Colour psychology in art: How colour impacts mood," *Art and Design Review*, vol. 09, no. 04, pp. 301–308, 2021. DOI: 10.4236/adr.2021.94025.

[4] A. J. Elliot, "Color and psychological functioning: A review of theoretical and empirical work," *Frontiers in Psychology*, vol. 6, 2015. DOI: 10.3389/fpsyg.2015.00368.

[5] *The psychology of colours in the workplace*. [Online]. Available: https://interactivespace.net/colour-psychology-in-workplace/.

[6] K. V. Meola, "The psychology of color," *Hohonu - A Journal of Academic Writing*, vol. 3, 2005.

[7] S. Kim, Y. Park, and Q. Niu, *Micro-break activities at work to recover from daily work demands*, May 2016. [Online]. Available: https://onlinelibrary.wiley.com/doi/full/10.1002/job.2109.

[8] P. Sheeran and T. L. Webb, "The intention-behavior gap," *Social and Personality Psychology Compass*, vol. 10, no. 9, pp. 503–518, 2016. DOI: 10.1111/spc3.12265.

[9] *Hot-cold empathy gap*, Jan. 2022. [Online]. Available: https://en.wikipedia.org/wiki/Hot-cold_empathy_gap.

[10] G. Judah, B. Gardner, M. G. Kenward, B. DeStavola, and R. Aunger, *Exploratory study of the impact of perceived reward on habit formation - bmc psychology*, Dec. 2018. [Online]. Available: https://bmcpsychology.biomedcentral.com/articles/10.1186/s40359-018-0270-z#citeas.

[11] P. Lally, C. H. M. van Jaarsveld, H. W. W. Potts, and J. Wardle, *How are habits formed: Modelling habit formation in the real world*, Jul. 2009. [Online]. Available: https://onlinelibrary.wiley.com/doi/full/10.1002/ejsp.674.

[12] *Know your brain: Reward system*. [Online]. Available: https://neuroscientificallychallenged.com/posts/know-your-brain-reward-system.

[13] *Reward pathway in the brain (video)*. [Online]. Available: https://www.khanacademy.org/test-prep/mcat/processing-the-environment/drug-dependence/v/reward-pathway-in-the-brain.

[14] O. James, P. Delfabbro, and D. L. King, "A comparison of psychological and work outcomes in open-plan and cellular office designs: A systematic review," *SAGE Open*, vol. 11, no. 1, p. 2 158 244 020 988 869, 2021. DOI: 10.1177/2158244020988869. [Online]. Available: https://doi.org/10.1177/2158244020988869.

[15] J. Kim and R. de Dear, "Workspace satisfaction: The privacy-communication trade-off in open-plan offices," *Journal of Environmental Psychology*, vol. 36, pp. 18–26, 2013, ISSN: 0272-4944. DOI: https://doi.org/10.1016/j.jenvp.2013.06.007. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0272494413000340.

[16] A. M. Szóstek and P. Markopoulos, "Factors defining face-to-face interruptions in the office environment," in *CHI '06 Extended Abstracts on Human Factors in Computing Systems*, ser. CHI EA '06, Montréal, Québec, Canada: Association for Computing Machinery, 2006, pp. 1379–1384, ISBN: 1595932984. DOI: 10.1145/1125451.1125706. [Online]. Available: https://doi.org/10.1145/1125451.1125706.

[17] F. Pataki-Bittó, "Interruptions at work from the point of view of it professionals," *Periodica Polytechnica Social and Management Sciences*, vol. 26, no. 2, pp. 121–129, 2018. DOI: 10.3311/PPso.11857. [Online]. Available: https://pp.bme.hu/so/article/view/11857.

[18] I. Sommerville, *Software engineering*. Addison-Wesley, 2011.

[19] M. Eid, Nov. 2015. [Online]. Available: https://www.umsl.edu/~sauterv/analysis/F2015/Requirement%20Gathering%20Methods.html.htm#:~:text=Prototyping%20is%20another%20form%20a,show%20the%20user%20the%20outcome..

[20] Lang, Franz and Mjöberg, Alexander, *Prototyping as a Requirements Engineering Technique*, eng, Student Paper, 2020.

[21] [Online]. Available: https://www.quora.com/Why-do-most-banks-cling-to-Microsoft-Windows-as-their-sole-permitted-operating-system.