

Design for pleasant awakening:
Evaluation of factors contributing to a productive and pleasant start of the day

By Varvara Timchenko
18016448

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Abstract

The process of sleep transitions (falling asleep and awakening) determines our perception of the consecutive morning experience. Factors contributing towards a productive and pleasant start of the day were evaluated in order to build context for the design of an innovative alarm clock. Two types of factors were considered- internal (physiology, psychology) and external (environment/ alarm clock market). Research confirmed that our sleep pattern preferences (chronotypes) are determined by genes, not discipline. Nevertheless, people still feel the guilt of not having productive mornings, which align with society's expectations. Market research showed that there is a lack of innovative and affordable alarm clocks in the market, which would ensure a pleasant and effective awakening.

Keywords: Alarm clocks, Chronotypes, Morning routine

Introduction

Research relevance

Sleep is an inevitable part of people's lives often surrounded by individual habits that define our mood, productivity and overall well-being for the rest of the day. The sleeping patterns are often difficult to control, but what can be influenced is the process of falling asleep and awakening. In the complexity of modern days, overwhelmed by the constant flow of information, the importance of these sleep transitions is overlooked.

A common assumption that the discomfort of waking up cannot be avoided (especially in early mornings) has been widespread, however, research shows that there is still room for innovation in this area of life. In order for this innovation to take place, a detailed context overview must be built, as a way to objectively assess different factors contributing to an effective and pleasant awakening. The research will then yield insights, which can be used to design a future alarm clock concept.

Problem statement

Many people struggle to wake up in the morning, often succumbing to bad habits such as snoozing their alarm clocks and overwhelming themselves with social media first thing in the morning. Alarm clocks (in whatever form they come in) are the first product interaction we have every morning, which gives it the power to set the overall tone to the rest of the day. There is a need for an effective alarm clock, which would ensure a pleasant start of the day for people. In order for it to be successful, it needs to utilize contextual factors contributing to a productive and pleasant start of the day.

Aims and objectives

The goal of this research paper is to evaluate the aforementioned contextual factors. These factors are then used to build a solid understanding of the domain the designed product will appear in, including its contradictions and complexities. The product domain is then used to formulate product requirements- related to feasibility, desirability and viability. Those components are crucial to successful design and implementation of the concept.

Research scope and structure

The main question this research is aiming to answer is:

What factors contribute to a productive and pleasant start of the day?

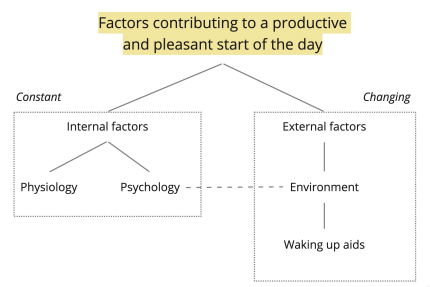


Figure 1: Factor research structure

The number of those potential factors is vast, and cannot be truly comprehended in a single research paper. Thus the main focus of this research is to classify and evaluate key factors, which can be split into two major categories- internal and external. Internal factors include two large groups of physiological and psychological influences. External factors consist of environmental influences, but for the purpose of this research, only alarm clock products will be considered ("waking up aids"). Figure 1 summarises the basic factor classification.

With this in mind, the following topics will be addressed, along with their relevant sub-questions:

1. Physiology behind awakening
 - What kind of physiological processes do people go through as they wake up and how do they influence the awakening?
2. Psychology of morning routines
 - What can be considered a productive and pleasant start of the day and which psychological factors contribute to this perception?
3. Environment- alarm clocks
 - What kind of effect do alarm clocks have on the start of the day and what kind of awakening products are currently in the market?

The first two factors (physiology and psychology) are relatively constant, since they are grounded in our nature as human beings. Therefore, they can be objectively chosen and evaluated. Environment, on the other hand, is constantly changing and therefore requires a level of subjectivity to decipher (which alarm clocks were chosen to be analysed is biased). There is some connection between psychology and the environment, which will also be assessed. The paper uses an adapted MAYA principle approach (Most Abstract Yet Acceptable) to make sure that the context of mornings is well covered, while also keeping it relevant to the alarm clock design project.

Background

Client and mission statement

NeXtime is a Dutch brand specialising in clocks. It's a family-owned company with 50 years of experience in designing and manufacturing clocks. They produce and sell more than 500,000 clocks every year together with their Hong Kong office and partners. Every year around 40 new models are introduced (NeXtime, n.d.). For the 2022 collection, the company has an ambition to introduce a new alarm clock, which has to be both innovative and desirable for the customers. Currently the company has to deal with a common expectation from its customers that alarm clocks have to be cheap, which is difficult to achieve as most alarm clocks are complex in terms of manufacturing and require more resources than a normal wall mount clock. The purpose of this research is to understand the potential value that the alarm clock can give to the customer, making it beneficial for both the buyer and the business.

The company's core statement: "We believe that clocks are more than just a time keeping device if it's made with the right combination of style, quality and value. We design, create and sell clocks with a great passion." (NeXtime, n.d.) reflects their drive for continuous innovation and creativity in an otherwise traditional market. They are open to new ideas, as long as they truly serve the wishes of their customers. Therefore, this research is kindly supported by their extensive insight and experience in the clock market.

Methodology

Methods overview

In order to ensure validity of the conclusions, different methods are used to gather data. Secondary and primary research is conducted to verify every insight reached, through an approach called triangulation. As mentioned before, the research has three sections: physiology, psychology and environment. For each of these sections a variety of methods were applied to reach meaningful conclusions. Figure 2 shows a summary of the research methodology.

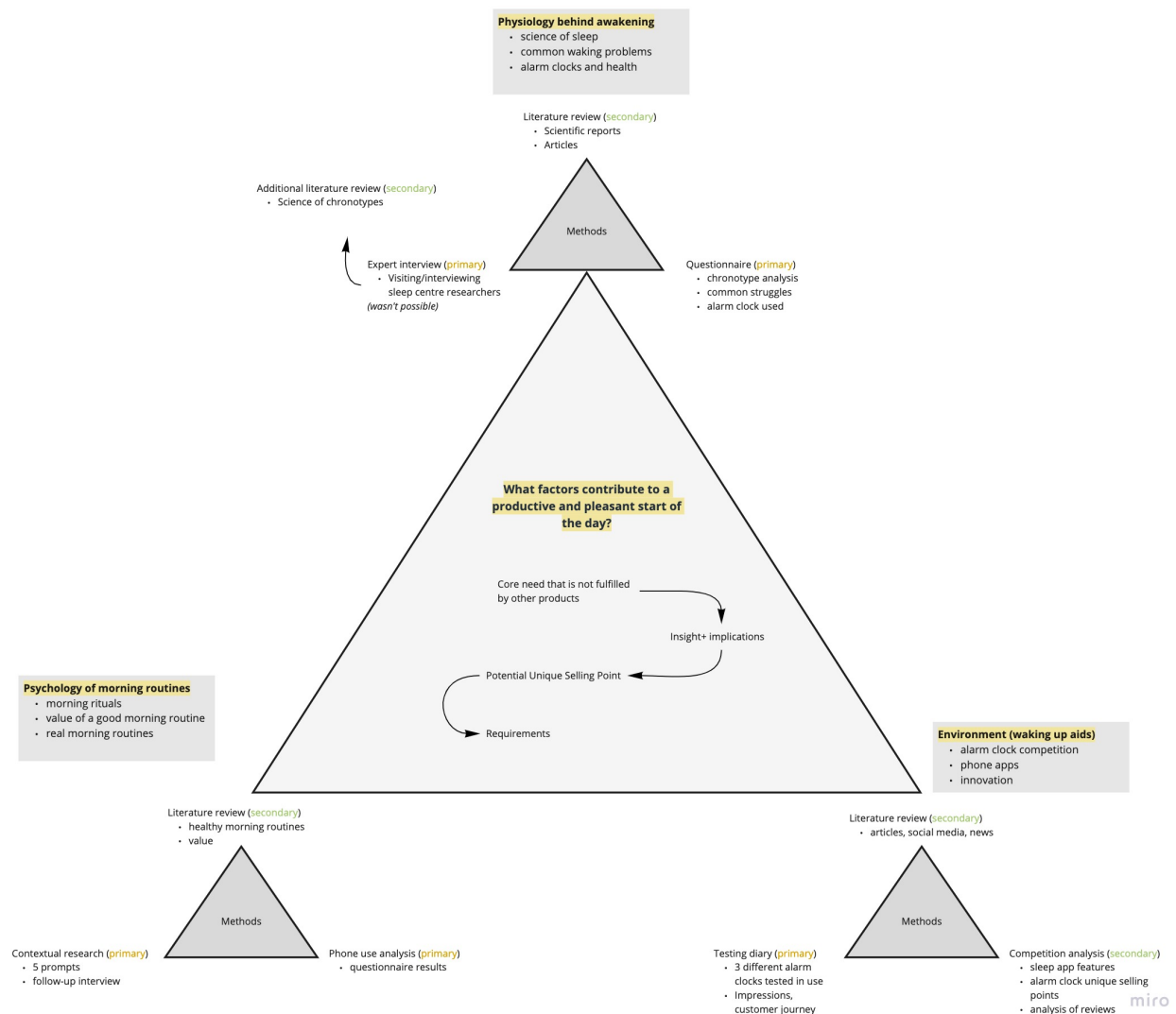


Figure 2: Factor research structure

Majority of methods used are standard for academic research, such as literature review, desktop research and user questionnaires. These methods provide a solid framework for the main body of knowledge. On the other hand, non-traditional “design” methods are used to provide nuance to the research, which makes it more human centred and applicable for further concept design.

Some initially planned research methods (expert interview at sleeping centres and user observations) had to be abandoned due to the COVID-19 pandemic and project time limitations. However, those methods were substituted by additional in-depth literature review as well as online interviews with potential users. For better readability, a glossary section was added for the clarification of key terms.

Literature review & Desktop research

Secondary research (literature review and desktop research) was used as a method to gather core data for the research paper. Every context factor category (physiology, psychology and market research) has been first established through scientific articles, research reports, books and blogs. Literature review was particularly crucial in understanding of physiological factors related to awakening. Desktop research was more important for alarm clock competition analysis, which required the most up-to-date information. This method served as the basis for further questions, which were then answered by primary research. Literature review also served as a substitution to expert interviews at sleeping centres, which wasn't possible due to COVID-19.

Questionnaire

The goal of the questionnaire was to gather quantitative data from potential product users. This included their age, sleeping habits, alarm clocks used and morning routines that made them happy. Secondary to that, the participants were asked to suggest potential design features they would be interested in having in an alarm clock.

The questionnaire was made in Google Forms and consisted of 4 sections- "about", "weekday vs weekend", "morning routines" and "suggestions". Most questions were multiple choice, except from "suggestions" and some questions in the "morning routines" section. This was done to minimise the time taken to complete the questionnaire, which would encourage more people to participate. The questionnaire was shared on LinkedIn and various student groups, which slightly biased it towards younger people. In total, 77 responses were gathered (1 of which was a duplicate, leaving 76 data sets for this research). The responses were uploaded into excel and computed into graphs for further analysis.

Contextual research & interviews

Contextual research was done as an adapted version of diary studies, where participants had to answer five prompts to deconstruct their typical night and morning routine, as well as their environment. Participants were encouraged to be as creative as possible using sketches and annotations to express their thoughts. There was also no time pressure to complete the prompts, which allowed for more reflection and less stress. The following prompts were used:

1. Assignment 1: Introduce yourself- fill-in form
Name, age, gender, occupation, country of residence, history of sleeping disorders, regular work schedule, number of people in the accommodation, quick sketch of themselves.
2. Assignment 2: Bedtime routine- timeline
Make a timeline of the hours leading up to our sleep. List the activities and place them on the Y column according how they make you feel (the higher the better). Make sketches or describe exact emotions you go through.
3. Assignment 3: Morning routine- timeline
Similar to the bedtime routine timeline, break down your morning routine, along with emotions that you go through, the ups, downs and potential frustrations.
4. Assignment 4: Your surroundings- morning route and night stand sketches
In one rectangle sketch out your accommodation and the approximate route you are taking every morning. On the right, sketch out what your night stand looks like (if you don't have one, sketch out your bed surroundings).
5. Assignment 5: Social map- circle diagram of social layers
Identify people you keep in contact with during your morning routine. Place them on different levels away from the core (which is you). Illustrate your relationships and the emotions you can encounter when sharing your routine with them.

In total, 8 responses were collected from people of different age groups (13-49). After the prompts 2 of those participants were interviewed for further elaboration on their feelings and frustrations. The interview had a free format without strict questions, which allowed for an open conversation. This method produced data for psychology and environment sub-questions.

Secondary observations

Due to privacy concerns of observing people's awakening patterns, YouTube series "How couples sleep" by Cut was used to note down any common behaviours. The videos consist of couples giving interviews about how they sleep, along with a recording of them falling asleep and waking up. To make that possible, the Cut team installed filming equipment on the ceiling above their beds. In total, 5 couples from diverse backgrounds were interviewed.

1. Genie and Ralph (elderly couple, married for 40 years)
2. Jason and Stella (married couple with a child, Stella is 7 months pregnant at the time of the recording)
3. Kris and Karlos (married couple with a dog)
4. Brit and Nina (married couple with a child)
5. Serena and Zach (young couple dating for a year)

This research exclusively focuses on the experience of people who do not sleep alone, however this is relevant to this topic since 61% of Americans share their bed with a significant other (Murphy, 2006).

Alarm clock market analysis & product testing

In order to understand external factors influencing people's morning routines, different alarm clocks were considered, as well as the overall market. This is relevant for the research question, since the majority of awakenings are assisted by different forms of alarm clocks and understanding their feature set (as well as limitations) can be useful to see how the market responds to different user needs. Secondary research was done to identify the most popular alarm clocks, as well as their reviews. Since many people are using their phones as an alarm clock, phone apps are also included in this research. Each app/product is analysed in terms of strengths and weaknesses, as a way to find out their unique selling point and limitations. Afterwards, a graph overview is made to place those products on the price and innovation axis.

Three clocks were also tested first-hand, in order to truly experience it's offered functionality. The observations and thoughts were noted down in a diary format. This primary research rendered a number of additional considerations for the future alarm clock concept.

Results

Literature review- physiology behind awakening

The analysis of awakening cannot take place without the consideration of sleep itself. It is a crucial process within our body, since it allows our brains to process the information gathered during the day. There are two basic types of sleep- REM (rapid eye movement) and non-REM. The overall process can be separated into 4 stages, that occur several times over on a typical night (NIH, n.d.):

1. Stage 1 (non-REM)- changeover from wakefulness to sleep. This stage lasts several minutes and during that time all body processes slow down and the muscles relax.
2. Stage 2 (non-REM)- period of light sleep before the body enters deeper sleep. The body temperature lowers and eye movements stop. Brain wave activity slows down as well, with occasional spikes of electrical activity.
3. Stage 3 (non-REM)- the deepest stage of sleep, which is necessary for feeling refreshed in the morning. Heartbeat, breathing and temperature is at its lowest, it is difficult to wake up from this stage of sleep.
4. Stage 4 (REM)- this stage takes place for the first time 90 minutes after entering sleep. Eyes start moving rapidly from side to side behind closed eyelids. Most dreams occur during REM stage of sleep, while the muscles are paralysed to prevent the body from acting out the dreams.

According to the National Institute of Neurological Disorders and Stroke, different parts of our brain become more active at different stages of our sleep. The hypothalamus is responsible for awakening, as it controls centers affecting sleep and arousal. It receives information about light exposure directly from the eyes and controls the behavioural rhythm. This information is then relayed throughout the nervous system via the brain stem.

The cycles of sleepiness and wakefulness are controlled by a biological clock called circadian rhythms. Circadian rhythms are physical, mental and behavioural changes that follow a 24-hour cycle (NIH, n.d.). According to extensive research by chronobiologist Till Roenneberg, 24-hour day structure provide us with the only context in which we can actually predict the future. The predictive power within temporal structures is an advantage that drove the evolution of biological clocks (2012, pp. 20-21). Ability to predict time of the day must have huge advantages for survival, so that internal clocks probably arose very early in evolutionary history.

However, our body does not only rely on its internal biological time to control the sleep-wake cycle. The temporal patterns are also organised by two other clocks: a social clock and a solar clock (Roenneberg, 2003). These external Zeitgebers force our bodies to oscillate relative to the day cycle on Earth. Figure 3 (retrieved from Ike & George, 2014) summarises this complex relationship. The timing of sleep is shown as a two-process model, which combines the oscillation of the day clock and the sleep pressure of our own internal clock (process S on the graph). The oscillating process is created by many physiological oscillations which are dictated by an external stimulus- Zeitgebers.

The internal clocks are not the same among people. Roenneberg states that individuals possess different timing types, or chronotypes. In many cultures people are grouped as “early birds” or “late birds”. However, chronotypes almost never fall strictly into two simple categories. Roenneberg and his team has developed a “Munich ChronType Questionnaire (MCTQ)”, which estimates chronotype based on the midpoint between sleep onset and offset on work-free days, corrected for “oversleep” due to the sleep debt that individuals accumulate over the workweek. Midpoint of sleep is the best way to define a person's chronotype, since it takes into account a person's sleep timing and sleep duration.

MCTQ allows the investigation of sleep behaviour in different populations worldwide. Figure 3 (Roenneberg, 2012) shows the distribution of midsleep in Central Europe (from answers of approximately 100,000 participants). The results show a normal distribution with a slightly higher number of late types than early types. Therefore, separating people into “larks” and “owls” is not productive, since these opposites simply label the extreme types at both ends of distributions, which are extremely rare. Research on smaller mammals also shows that chronotype is an inherited trait, not a learned behaviour.

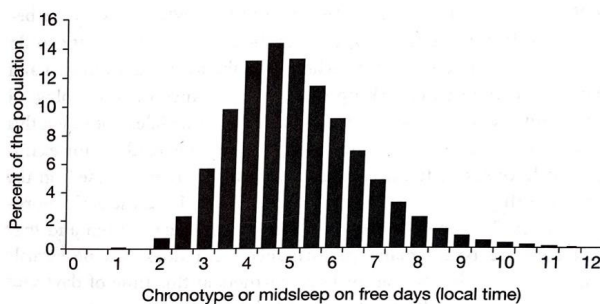


Figure 4: The distribution of midsleep in Central Europe

Roenneberg's team concludes that it isn't how much sleep people get that matters, it's how much wake up times differ from internal clocks. Work times are too early for 60% of the population and 85% of the population is forced to use an alarm clock to get up in time for work (Roenneberg, 2012).

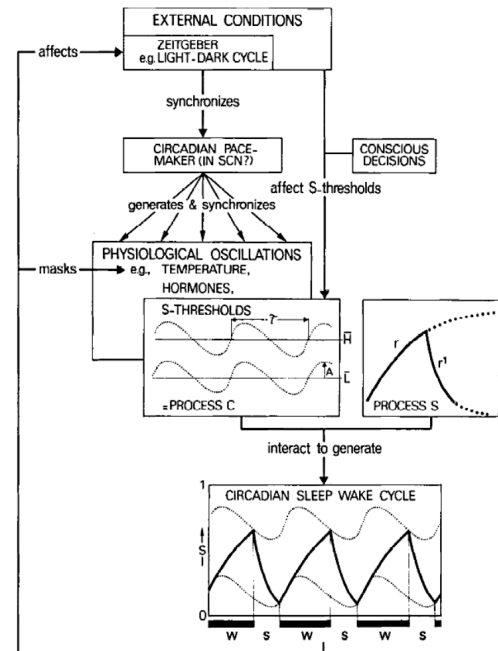


Figure 3: Formation of sleep wake cycle

Figure 4 shows sleep preferences on free days and therefore represents internal clocks. However, in a society we experience social pressures to wake up at certain times. Late chronotypes often suffer from social jet lag- chronic difference between mid sleep on workday and free days (Roenneberg, 2012). Analysis of 65,000 adults showed that 2/3 of them suffered from social jet lag, experiencing at least one-hour disparity between how long they slept on workdays and free days (Kalb, 2013).

Literature review- psychology of morning routines

The moral backbone of practically every culture declares early risers as good and late risers as bad people- “the early bird gets the worm” (Roenneberg, 2012). The “larks” are considered to be more successful and productive members of the society, while owls are considered lazy. There is also a religious connotation for waking up earlier- the morning hours are considered spiritual time, when “one’s closeness to God could be demonstrated by waking up at the scheduled time to pray” (Bryce, 2018). This creates a certain pressure on people to wake up earlier, although some are naturally later chronotypes.

The pressure to be productive is often hindered by phone use. Surveys showed that anywhere between 46% and 61% of people check their phones either before they get out of bed or within five minutes of waking up (Peters, 2019). On one hand, a 2007 study published in the Journal of Neural Transmission identified exposure to blue light as improving cognitive performance. A strong melatonin suppression can help people to fight off “sleep inertia”. On another hand, checking the phone first thing in the morning has negative psychological effects. “When we wake up in the morning and turn our phone over to see a list of notifications”, writes Tristan Harris, Google’s former Design Ethicist, “it frames the experience of ‘waking up in the morning’ around a menu of ‘all the things I’ve missed since yesterday’ (Garfield, 2016).

According to Google Trends, the frequency of search term “Morning Routine” has sharply increased since 2004. It is most searched in developed countries such as the US, Australia and Canada. It is also related to searches for “morning yoga” and “morning workout”. Morning routine is also a popular format for lifestyle YouTubers, generating millions of views. In recent years there’s also been a surge of self-help books, which relate productivity and morning routines. One of these books is 5AM club by Robin Sharma, which is described as a “revolutionary morning routine that helped his clients maximise their productivity, activate their best health and bulletproof their serenity in this age of overwhelming complexity” (Sharma, 2020).

Numerous online articles also tackle the topic of morning routines. Science of People journal gives 10 “research backed steps” to have a perfect morning routine. These steps include “setting intention”, “creating a “NOT to do list” and “stop snoozing”. The last suggestion is particularly interesting, since many people struggle to change this habit. “Board-certified sleep medicine physician W. Christopher Winter says that every time you wake up, hit snooze and then roll back over, you enter a brand-new sleep cycle. And the extra sleep you do get from snoozing is light and fragmented, which could actually leave you feeling more tired” (Edwards, 2021). Part of the article is also dedicated to the morning routines of famous people (Figure 5). It shows that most of these people (with a few notable exceptions) were “larks” who spent their mornings doing creative work. Another interesting source of morning habits is a personal blog “The Morning Effect” by Craig Kulyk where he breaks down 127 potential morning routines that tackle different aspects of life (see appendix 1 for the summary).

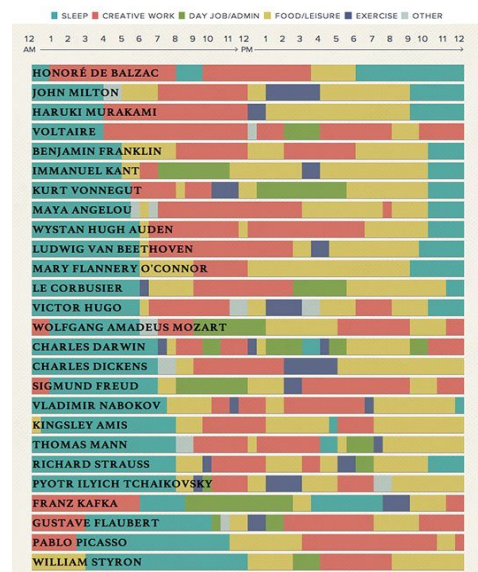


Figure 5: Morning routines of famous people

However, these methods often ignore the science of chronotypes and biological inclinations people have towards the preferred waking time. “I am often asked whether we cannot get used to given working hours merely through discipline and by confining our sleep habits to certain times”, writes Roenneberg, “the assumption inherent in this question is that the human body clock can synchronise to social cues. The phase of an individual’s body clock in relation to a zeitgeber is a biological phenomenon and not a matter of discipline.” This mismatch between social pressures and biology of late chronotypes, can cause stress and a sense of disappointment for not fitting into the preferred archetype of productivity.

Literature review- alarm clocks and health

YouGov reports states that out of 586 participants surveyed, 68.2% use a form of alarm for waking, of these 23% use an alarm clock, 14.9% a clock radio, and 26.3% an alarm on a cell phone (McFarlane et.al., 2020). However, numerous studies show that forced-awakenings have certain disadvantages, for example some alarm clocks create a stressful arousal that is high enough to raise glucose concentration in patients with type 1 Diabetes (Ike & George, 2014). Self-awakening, on the other hand, is proved to reduce the effects of sleep inertia- a transient period after sleep, characterised by impaired performance, confusion, and sleepiness. Research done by Ike and George also showed that humans are actually able to wake up without an external stimulus with good accuracy. 62% of the participants were able to wake up with an accuracy of the target time $\pm$ 30 minutes. Other studies also show that 55% self-awakens at home on a regular basis. However, it's important to consider that the portion of people practicing self-awakening is increasing the higher the age group, which correlates to the general trend of people becoming earlier chronotypes with age. Also due to social pressures of going to work and school, the precision of self-awakening is not sufficient enough.

However, for centuries people relied on the Sun to tell the time and wake up on time. Bryce in his article on LiveScience also correlates past generation's ability to wake up naturally with the low soundproofing of the houses- noises of the outside world (birds chirping, animals moving) were able to wake people up. For an agricultural society, noises of nature are crucial cues for awakening. Church bells were also used as a communal alarm clock for bigger settlements. In a post Industrial Revolution society, where our circadian rhythms are disturbed with artificial light in the evening, it becomes increasingly difficult to rely solely on natural Zeitgebers.

Despite these developments, people still strive for a more natural awakening, without compromising on precision of standard alarm clocks. The alarm clock market responds to this need with a number of light emitting alarm clocks, which claim to promote calmer awakening. One of these artificial dawn alarms is Philips Wake-up Light, which was studied by students from the Department of Chronobiology at the University of Groningen, along with a student of Medical Design Engineering. Their results show that a 30 minute artificial dawn signal before the alarm sounded led to lower subjective ratings of sleep inertia and to improvement of general well-being. However, "no significant shifts in DLMO (dim light melatonin onset) were observed" (Gimnez and others, 2010). The artificial dawn signal, although not capable of having circadian effects, is hypothesized to have an effect on physiological processes at waking up by activating the body.



Figure 6: Sensorial bed alarm clock (Reverse alarm clock)



Figure 7: Haptic peripheral alarm clock

Some academic design experimentation was also done to explore the possibilities of alarm clocks. Ozenc and others designed a "reverse alarm clock" (part of the concept is shown on figure 6), which focuses on improving interaction aesthetics and social pleasure related to using the product. Their alarm clock facilitates quality time between children and their parents, hence helping parents in achieving their ideal image of parenthood. Springer's alarm clock focused on the design of a haptic peripheral clock (Figure 7), which aims to reduce the level of attention necessary to check time at night. Their approach is based on Calm Technology theory of Weiser and Brown, who argue that "computers should be designed to stay out of the way, to keep users serene and in control" (Springer, 2012). By minimising the interruption of sleep, the quality of awakening increases.

Research by McFarlane et al. analysed waking sounds to counteract sleep inertia. Their primary analysis showed a significant relationship between the melodicity of participant waking sound and a measure of perceived sleep inertia. The more melodic the sound is, the easier it is for people to wake up and be productive.

User research- Questionnaire

1. About

The first section of the questionnaire was aiming to gather some basic information of the respondents and identify potential biases towards certain groups. Appendix 2 contains graphic representation of the data. In summary, the following picture emerged:

- **Age:** 68% of the respondents are aged 20-25 years old. The second largest age group is 15-20 years old (13% of the respondents). 25-70 years old make up 14% of the participants.
- **Gender:** 61.3% of the respondents are female and 37.3% are male. 1.3% of the respondents identified as “other”.
- **Country of residence:** 57% of the respondents live in the Netherlands. 19% in Czech Republic, 9% in Germany and 7% in the UK. Some individual responses include residents of Turkey, Russia, Portugal and Catalonia.
- **Current occupation:** 53% of the respondents are currently studying in university. Additionally, 17% combine their university studies with part or full-time work. 20% of the respondents are engaged with full time work, 2% are in school and 1% are unemployed.
- **Regular work schedule:** 65% have a regular work schedule, while 35% do not.
- **Number of workdays:** Out of respondents with a regular work schedule 67% have a 5 day work schedule, 6% work 2 days, 2% work 3 days, 12% work 4 days, 8% work 6 days and 6% work 7 days.

As a result, the most “average” respondent of the questionnaire is a 20-25 year old female, living in the Netherlands and currently attending university. She has a 5 day working schedule, with 2 days off.

2. Workdays vs Weekends

This section was dedicated towards figuring out sleep patterns and differences between workday and weekend sleeping/awakening times. Part of this section is also related to the use of wake up aids (different forms of alarm clock). It is also important to consider that the wake up routines of people could be affected by COVID-19, so a question to clarify this was also included. Appendix 2 includes in-depth graphs.

- For 73% of the respondents, the awakening time has changed since the beginning of the pandemic.
- 93% of the respondents use their phone as an alarm clock, while 4.2% use a light emitting alarm and 2.8% use a radio or a traditional analogue alarm clock to wake up.
- 93.3% of the participants use an alarm to wake up on workdays.
- Only 17.3% of the respondents set an alarm clock on the weekend, while 50.7% do it sometimes. 32% do not set a weekend alarm at all.
- 52% do not nap during the day, 38.7% do it sometimes and 9.3% do it regularly.

How many times do you snooze your alarm clock before you get up?

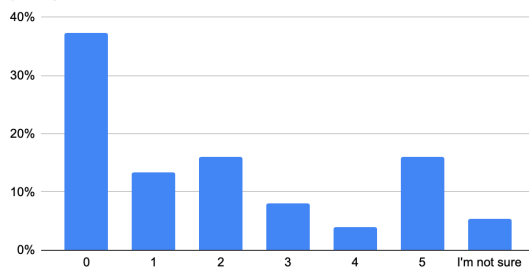


Figure 8: How many times people snooze their alarm

How long does it usually take you to fall asleep?

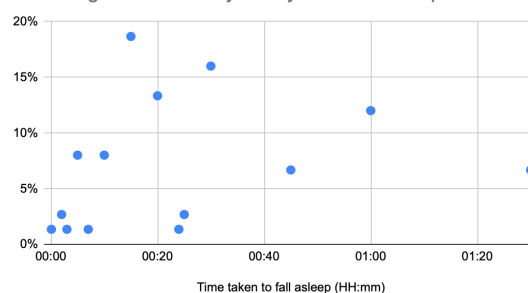


Figure 9: Time taken to fall asleep

- The results also show that some people need time to enter and exit their sleeping stages. Figure 8 summarises the number of times people snooze their alarm clocks before getting up. The majority (67%) snooze their alarm at least once. At the end of the questionnaire people were offered to express anything they couldn't do within the format of multiple choice question and some participants mentioned that they actually snooze more than 5 times (which wasn't an option given). Figure 9 shows the time taken to fall asleep among the participants.

This section of the questionnaire was built upon the framework of Munich Chronotype Questionnaire (Roenneberg, 2015), which uses basic variables (filled in by the participants) to determine their sleep patterns. The following data was requested:

- Time of going to bed (workdays & weekends) = sleep preparation time
- Time of waking up (workdays & weekends) = sleep end
- Time taken to fall asleep = sleep latency
- Time taken to get up from bed/ wake up = sleep inertia

These formulas were then used to compute the following data sets:

- Sleep onset (workday & weekend) = sleep preparation time + sleep latency
- Sleep duration (workday & weekend) = sleep end - sleep onset = sleep duration
- Average sleep duration = (sleep duration workday + sleep duration weekend)/2
- Mid sleep (workday & weekend) = (sleep onset + sleep duration)/2
- Mid sleep (average) = (mid sleep workday + mid sleep weekend)/2
- Relative social jetlag mid sleep weekend - mid sleep workday

Mid sleep difference on weekend and workday

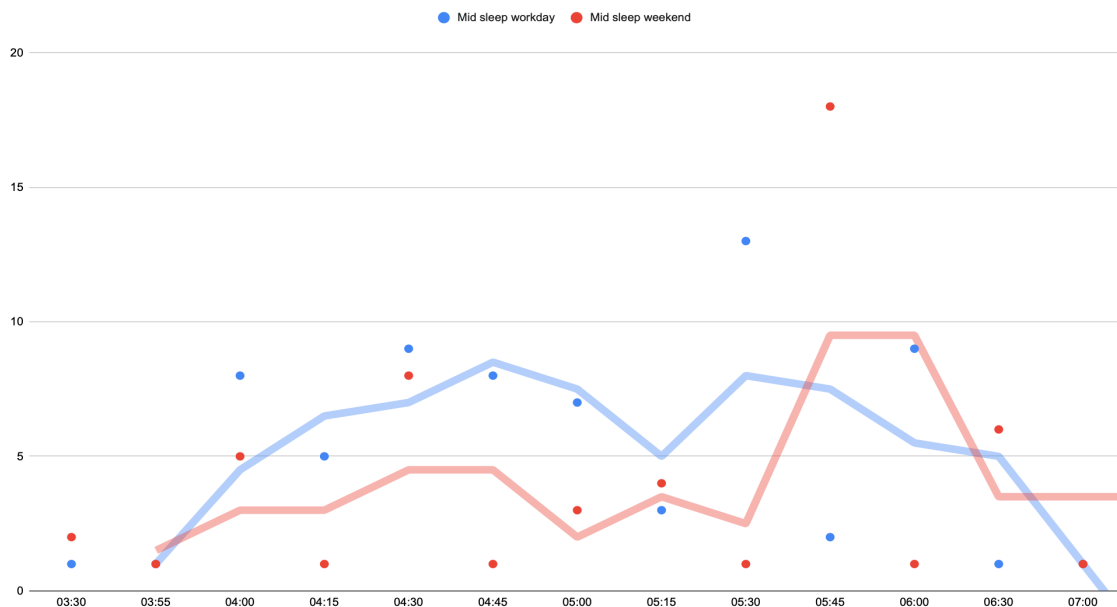


Figure 10: Mid sleep difference on weekend and workday

- Figure 10 shows the relative shift of mid sleep from workday to the weekend. The more the graph is shifted to the left, the more “lark-like” people are. Shift to the right represents more “owl-like people”. The lines show the overall trendline among the participants mid sleep, while separate dots are the averages relative to the percentage of respondents.
- Sleep duration also changes at different parts of the week. Sleep duration on a workday is 8 hours for 27% of the participants (see Appendix 2), with the distribution from 5 hours (1%) and 10 hours (also 1%). On the weekend there is a shift towards longer sleep, with the most common duration of 9 hours (21%), closely followed by 8 hours (19%). The average sleep duration on a workday is 7.82 hours, while on the weekend it is 8.47 hours.
- Almost every participant of the questionnaire experiences some form of social jet lag (with an exception of 4 participants). For 11/76 people the social jet lag accumulated over a span of 1 week is just 30 minutes. However, for the majority of people (52%) the social jet lag is over an hour, with 1 participant reporting a 3.5 hour delay from preferred waking up time and a socially acceptable one during the working week.

3. Morning routines

This section asked the participants to reflect on their habits, feelings and how they handle their start of the day. Some questions were open-ended in order to minimise the bias, but the responses were later on simplified for easier grouping and visualisation.

- Approximately half of the respondents (50.7%) said that they do not consider themselves “morning persons”. 21.3% were unsure and 28% identified with that label.
- Figure 11 shows a summary of frequency of common morning routines. The participants were asked to rate how often they do typical morning activities- “every day”, “only on the weekdays”, “only on the weekend”, “sometimes”, “never” or “never, but want to start”. The majority of respondents do the following activities on a daily basis- shower, make bed, make breakfast, brew coffee and check social media.

What kind of routine do you go through in the morning?

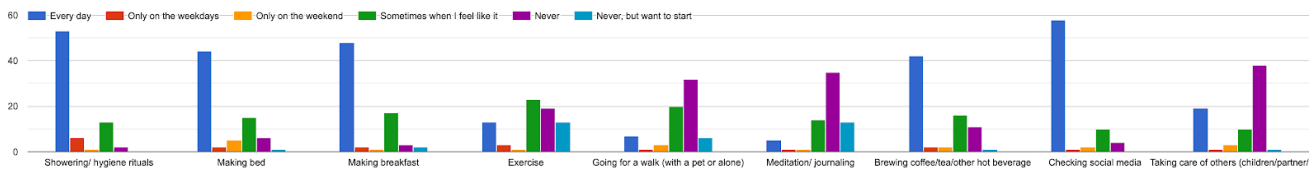


Figure 11: Morning activities frequency

- For 40.9% of the participants the best part of their morning routine is related to breakfast or coffee. The second most anticipated activity is hygiene rituals (24.2%). The other 34.9% enjoy other activities such as working out.
- The worst part of the morning routine for 34.8% is getting out of bed or the awakening itself- 31.8%. Some participants mention the annoyance of alarm clocks and difficulty getting up during winter months.
- Some people report that they struggle to wake up, so they use different methods to force themselves out of bed. The most popular method (38% use it) is to set multiple alarms, while some participants also put their alarms out of reach (4%). 40% of the respondents have no trouble getting up and sometimes even wake up before the alarm.



Figure 12: People's feelings on a typical workday morning

- People were also asked to describe their feelings on a typical workday morning. Out of 76 responses a word cloud was built, where the size of the words correspond to their frequency. Top words are “tired”, “grumpy”, “refreshed” and “motivated”. However, some people said “not motivated” which is represented as two separate words in the cloud. Overall, most people experience negative feelings as soon as they wake up, but feel a bit better after walking around/showering/having coffee.
- 77% of the respondents check their phones as soon as they wake up (still in bed). 11% check it after they brush their teeth, while the other 12% check it after or during breakfast.

4. Alarm clock suggestions

The last section of the questionnaire asked people to suggest features that would convince them to switch over from phones to separate alarm clocks. The questions were open ended, but the feature suggestions were tagged and summarised as the following:

- Easy set-up, potentially with a touch screen - 12 respondents
- Not easy to snooze
- Switch off on weekends
- Clear identification that the alarm is set
- Monitoring sleeping process/ waking up at the lightest sleep phase
- Voice assistant
- Appealing form - 20 respondents
- Different ringtones/ customisable- 7 respondents
- Ability to set multiple alarms
- Light-induced awakening- 9 respondents
- Weather summary- 4 respondents
- Phone charging- 4 respondents

Other unique suggestions include customisable feed, adjustable snooze difficulty, ability to store earrings safely, durability and motivational voice assistant as an alarm.

User research- contextual research

This method was very open ended, so to summarise results general timelines were sketched out (with each line representing the answers of one respondent). Appendix 3 includes the scans of filled in prompts.. None of the participants have a history of sleeping disorders and have a relatively regular work schedule.

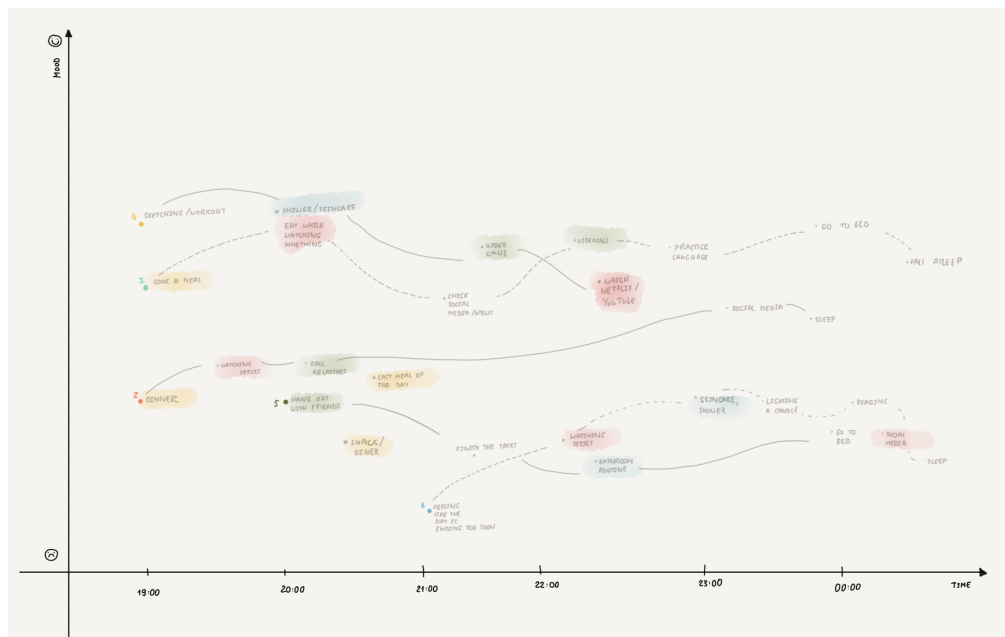


Figure 13: Summarised bedtime routines

- Figure 14 shows a summary of bedtime routines. Yellow highlights show activities, which are related to eating dinner, reds show entertainment (watch series, YouTube), blue are hygiene rituals and green activities are social.
- Social activities in the evening are highly rated in terms of “mood”, with hygiene being relatively low.
- Bedtime routines are less rigid than the morning routines, with less activities listed. The follow up interviews clarified this trend- people didn’t feel as pressured in the evening by work/school, so they were able to stretch out/shorten the duration of each activity according to how they felt on a particular day.

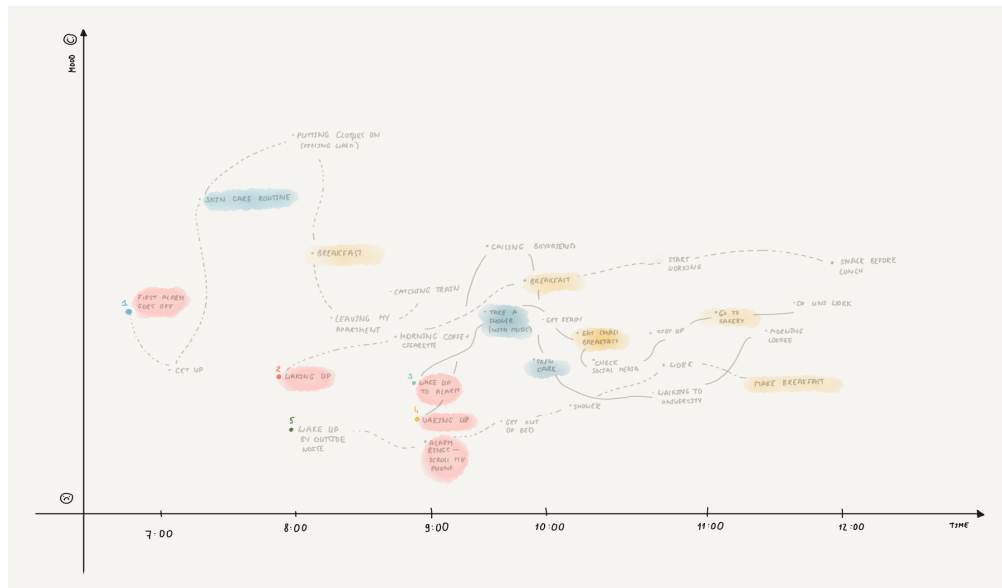


Figure 14: Summarised morning routines

- Figure 14 shows a summary of morning routines. Red highlights show the point of waking up, yellow highlights are breakfast activities and blue is hygiene. The point of waking up/getting out of bed is the lowest point of every morning routine described.
- There are more mood fluctuations and more activities in a morning routine. Overall people found this part of the research easier to fill in, since generally morning routines are well timed. Interviews confirmed that social pressures of being late to work/school ensured that people were efficient in their tasks.

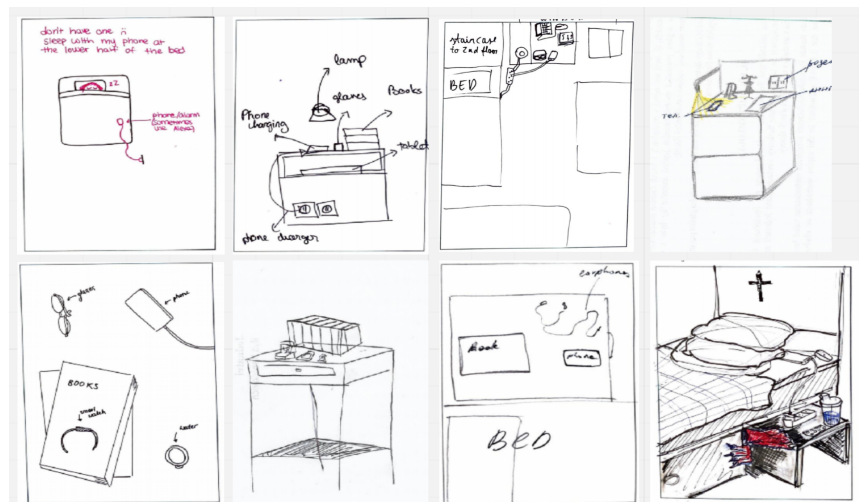


Figure 15: Nightstand sketches

- The participants were also asked to sketch out their nightstands (Figure 15). The results show that everyone had their phones in the near vicinity. Other common night stand items are books, jewellery boxes, water, headphones, glasses, lamps and phone charges. 1 respondent didn't have a nightstand at all.
- People found the "morning route" prompt easy to complete, since their movement in the morning is very habitual. Some even described it as "auto pilot".
- The social map asked respondents to identify people they keep in contact with during their morning routine. Most people had only 2-3 close contacts and for the most part didn't rate those interactions highly. During the interview one person mentioned that she doesn't like socializing early in the morning. For most people morning is reserved for themselves, when they gather their thoughts and prepare for the day.

User research- secondary observations

The observations and the follow-up interviews mostly focused on the sleep itself, but they revealed conflicts that a couple might have if one partner is a lark and one is an owl. Every couple used phones while in bed (both in the evening and in the morning). Appendix 4 shows some screenshots from the videos, which clearly show sleeping arrangements, as well as the environment. Most of the couples had only one nightstand, where common items such as books and phones were placed. $\frac{3}{5}$ couples practiced self-awakening and did not require any additional alarm to wake up at a consistent time.

1. Genie and Ralph

- Extreme larks, going to bed at 19:30-20:00, waking up at 3:30
- Ralph wears a C-PAP machine, which assists his breathing at night. It takes up half of his nightstand.
- The couple uses their phones in bed, sometimes wake up and check it.
- Explain their early wake up time as a “habit”, don't use the alarm clock to wake up. Once they are awake, they seem happy and content.
- Genie has loads of clutter on her nightstand (papers, TV remote, phone, lamp, water)

2. Jason and Stella

- Get in bed by 20:30, but turn off lights at 22:00 (and then stay on their phones for another hour)
- Share bed with a child, as a way to bond. Stella says “I’m so tired in the evening, I want non verbal intimacy, just being next to somebody”
- Only one nightstand at Stella’s side with books, a lamp and water
- Wake up without an alarm, but seem a bit tired

3. Kris and Karlos

- Time of going to bed depends on the weather (normally it’s 21:30, but in winter it can be 18:00-19:00)
- In the morning they instantly check their phones. In the follow-up interview, they say that they read articles about what happened when they were sleeping. Then they drink tea and get up, once they are out of the bed, they seem happy.

4. Brit and Nina

- “In and out of bed from 21:00 onwards”, but only go to sleep at 22:30-23:00
- Interrupted sleep because of the baby
- Brit is a morning person, who wakes up naturally anywhere from 4:00 till 7:00
- Morning routine is based around their child, the goal is to get him to daycare. Taking care of oneself comes second, they first make sure that the child is ready.
- Describe their bed as a “sanctuary”- private, personal, intimate, special and memorable.

5. Serena and Zach

- Average time in bed is 7 hours (go to sleep around 00:00-1:00, wake up at 8:00-9:00). Describe their sleep as “college schedule of sleeping”
- Go on their phones as soon as they wake up
- Only one nightstand on Zach’s side, which looks empty, except for one lamp
- Serena wakes up earlier and gets impatient. Zach wants to sleep in, but “never gets a chance to”. A conflict of an “owl” and “lark” couple.

Morning environment- alarm clock competition analysis

1. Alarm clocks

Top selling alarm clocks were analysed based on the reviews found on Amazon.com (March 2021).

Product	Information	Strengths	Weaknesses	Unique
 Echo Dot (4th gen)	- 59,99 Euro - Includes a smart voice assistant (Alexa) - Smart home features - Alexa Guard - LED display shows time - Speaker - 4.8/5 (38592 ratings)	- Easy to set up - High quality build with fabric over the LED screen - Alarm can be snoozed anywhere (no dedicated button)	- No volume bass - Voice assistant limitations (very limited commands) - Privacy concerns	The product combines a number of other gadgets (speaker, timer, alarm clock, clock and radio into one compact device). It also integrates with other products and services.
 Philips Smart Sleep	- 52,99 Euro - Simulate dawn with light intensity 200 lux - The sound gradually increases in volume to complete the wake up experience - 4.3/5 (5104 ratings)	- Unlike other light clocks, Philips alarm clocks are clinically tested - Can be used as reading light	- Aggressive sound design - Has no backup battery, so if the power flickers, all settings will be lost (including the alarm time) - Bright red numbers	Relatively cheap light alarm clock, with adjustable light settings.
 Philips Somneo	- 175 Euro - Smart features: midnight lamp, FM radio, phone charging dock, power backup, smart snooze, Ambi track sensor - 4.4/5 (1271 ratings)	- Many features - Includes sensors for room temperature, humidity, etc. - Allows for evening cool down, imitating sunset - Phone connectivity	- It's quite large on the nightstand - Works best in completely dark rooms - The app is not well optimised - Donut design results in lower overall brightness	A high end purchase, which has a strong marketing narrative. Tunes well with the trend of meditation, mindfulness and healthcare.
 Buffbee Alarm clock	- 16,45 Euro - Made especially for heavy sleepers- features include a loud buzzer, bed shaker and flashing light - 0-100% dimmer - 4.6/5 (564 ratings)	- Impossible to sleep through - Wake up methods can be adjusted to whatever works best for you - Vibrations are strong	- Non intuitive settings, difficult to set up - The button to turn off the alarm is difficult to reach - Only 9 min snooze option	The alarm clock combines a number of waking techniques (tactile, sound and light), which ensures awakening.

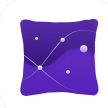
 Teddi sleep trainer	- 19 Euro - Children sleep trainer clock - Sleep/play/wake/nap modes - Creates a soft room glow with different colour lights - Training with sleeping expressions - 4.8/5 (1598 ratings)	- Alarm settings are placed at the bottom of the clock, so children can't accidentally change them - White noise can be set during the night - A friendly face make the alarm clock more likable, creates attachment	- Colour changes are too subtle for toddlers to recognise - Limited options for nap durations	The alarm clock strikes a perfect balance between core users (children) and core buyers (parents). It is cute and likeable, while also being functional and easy to set up.
 Clocky Alarm clock	- 40 Euro - Durable clock that runs away - Perfect gift for heavy sleepers - "He is cool, fun, annoying, unique and a bit crazy." - 4.1/5 (3229 ratings)	- Easy to set up - Clocky moves in an unpredictable manner, meaning that sometimes it can hide, which wakes up the user	- Low built quality for the price - Batteries don't last long - The wheels are too small in diameter, which makes clocky take more impact upon falling	This alarm clock has a very simple story behind it, but because of its fun design people buy it as a present.
 SmartRo SC91	- 32 Euro - Time and temperature projection - Indoor/outdoor thermometer gauge & humidity monitor - 4.1/5 (3229 ratings)	- Easy to set up - Projection angle can be changed (180 degree rotation) - Multifunctional - Projection is bright enough to see in different light conditions	- No automatic time setting - Each colour represents different function on the screen, making it easier to find information quickly	At an affordable price this clock combines many functions. It provides a lot of privacy, as all the data is measured locally and is not stored in the cloud.

2. Phone apps

Top 5 sleeping apps on App Store (IOS) were analysed to see the type of value they can provide to the user.

Customer reviews are also considered.

App	Information	Value	Customer reviews
 Sleep cycle- Sleep tracker Sleep Cycle AB	- Analyses sleep patterns and detects snoring, sleep talking, coughing and other sounds. - Designed to gently wake you up while you're in your lightest sleep phase.	The app combines two key features- sleep analysis and gentle awakening. It satisfies people's curiosity about their health and allows them to quantify and track sleep quality.	- 4.7/5 - 285.3k ratings - Complaints about overall accuracy, the app is mostly for entertainment.
 Sleep++ by Cross Forward Consulting, LLC	- Uses Apple Watch to automatically track sleep. - Manual mode allows for precise control over the start/end time of each night recorded.	Apple Watch integration allows for more precise sleep measurements. The limitation is that you need to wear your watch at all times, which can be inconvenient and less comfortable. The app also gives you "sleep duration scores", gamifying the whole experience.	- 4.2/5 - 5.1k ratings - Awake time is not always accurately tracked.

 Sleepzy- Sleep Cycle Tracker ThrivePort, LLC	- Includes an unwind feature to relax before sleep (relaxing sounds, dream radio, AI-generated music and hypnotic visuals). - Helpful insights show personal sleep advice and allow you to explore worldwide sleep statistics.	Unlike other apps, Sleepzy not only tracks the sleep, but also compares it to global statistics, which makes people feel more safe among “averages”. In-app unwind mode guides people into sleep.	- 4.3/5 - 19.3k ratings - Accuracy issues, problems with Apple Watch connections.
 Pillow Automatic Sleep Tracker Neybox Digital Ltd.	- Records important audio events such as snoring, sleep apnea, and sleep talking. - Sleep profile, regularly updated sleep tips and trends.	Similar to Apple Watch rings, Pillow app tracks time asleep and overall sleep quality in a gamified manner. Sleep profile and recommendations are built upon scientific research.	- 4.3/5 - 57.4k ratings - Battery drainage, accuracy issues.
 Loud Alarm Clock- Alarmy Delight Room Co., Ltd.	- With the various fun missions and loud random ringtone sounds, you can wake up easily. - Missions include taking pictures, solving maths problems, scanning barcodes, shaking your phone or test memory.	The app engages cognitive abilities to wake up the user, instead of relying on sound. There is no easy “snooze” or “turn off” button, the tasks have to be completed no matter what. This can raise frustrations, but it achieves its goal.	- 4.8/5 - 142.6k ratings - No major complaints, people like how persistent the alarm is and there is no way to turn it off easily.

3. Graph overview

Analysed alarm clocks, among with other popular alarms, were compared on a price/innovation matrix (Figure 16). The level of innovation was determined by the number of functions it offers, as well as it’s relative “uniqueness” on the market.



Figure 16: Innovation/Price market analysis

According to the analysis, there is a large gap between innovative and affordable products.

Morning environment- Product testing

As part of primary testing 3 alarm clocks were analysed- Technoline Projection Alarm Clock, Sensor Wake and Starck Alarm Clock. All of these have different intended target groups and offer a range of approaches from the most innovative clock (Sensor Wake) to a more traditional approach (Starck alarm clock). All notes were written in a form of a diary, over a span of 2-3 days (see Appendix 5). Figure 17 shows the pictures of the clocks tested.



Figure 17: Alarm clocks tested

Below are the summary of experiences:

1. Technoline Projection Alarm clock (12/03/2021- 14/03/2021)
 - Overall, the product has interesting features and it's really easy to get used to projection on the ceiling. When I had to return the alarm a week later, I was sad to see it go.
 - The design of the alarm is quite intrusive. It's bulky, plasticity and demands attention. It was a real eye sore on my nightstand, but the projection was too convenient to let go.
 - Features I actually used: projected time, indoor weather
 - Useless features: multiple weather channels, "radio control", actual alarm
 - In the end, this alarm clock was more of a bed time clock, than an alarm. It was annoying to wake up to and I found myself setting "backup" alarms on my phone, just in case.
2. Sensor Wake (18/03- 21/03/2021)
 - The product is very creative, especially with its marketing story: "wake up motivated & in a better mood".
 - However, it still has a very "startup" feel. Some design decisions are questionable at best and the main aroma function does not work.
 - Currently the alarm clock is sold for 120 Euros, which is way too much for the functionality and aesthetic it offers.
 - What I liked: overall story/intention, packaging design, intuitive and simple settings.
 - What I disliked: smell function not working, replaceable cartridges (eco friendly?), bulky design, small screen, quiet alarm sound.
 - For the current price tag I would not purchase this product. It is easy to give away, since I did not form attachment to it.
3. Starck Alarm Clock (22/03/2021- 24/03/2021)
 - Big marketing, not much real value ("understanding the universe precisely").
 - The design is a product of its time (early 2000s).
 - What I liked: back panel materia, solid plastic frame, large time numbers.
 - What I disliked: awful radio sound, overwhelming information, pretentiousness
 - When I set up the date, it suggested year 2003. Back at the time when the information was less accessible, this product can be seen as prestigious, but now it feels outdated.

Discussion

The methods used as part of this research have generated data, which is sufficient for answering the sub questions posed in the beginning of the report. It can also be used to create future design requirements, for the product which encourages a productive and pleasant start of the day- an innovative alarm clock. However, the methods themselves and the way they were carried out can bias conclusions or create only general understanding of an otherwise broad topic. Therefore, when using the data certain limitations need to be stated, which might also give future researchers an idea on how to generate even better results.

1. Number of participants

The research was done in a span of 8 weeks, which meant that less participants could get involved. Less participants results in lower representation of different groups, so the data gathered is biased towards students aged 20-25 years old. Additional involvement of different groups (middle aged, elderly, people with sleep disorders, shift workers) can potentially diversify the response pool.

2. Lack of in-person observations

Due to the COVID-19 pandemic it became no longer possible to safely meet people and carry out in-depth observations. Therefore, a typical “fly-on-the-wall” methodology had to be replaced with secondary observations via YouTube. The limitation of this method is that the video is pre edited and its authors made the decisions on what they would like to focus on. In future research, in-person observations should be carried out to note down the process people go through while waking up (especially “night owls” who rely on multiple alarms to wake them up).

3. Better definition of “productive and pleasant start of the day”

For the purpose of design research, contextual parameters of a “good” morning routine were defined as “productive and pleasant start of the day”. Some people might have a different understanding of those terms, which can lead to different expectations from the results of this research. Since the purpose of this research is to describe precisely the process of morning routines and how they can be improved via product design, exact semantics were not considered. Future researchers should take that into account.

4. In-depth market analysis of sleeping tools

Since the research was implicitly analysing devices for awakening, other popular morning routine products were overlooked. This can include voice assistants, radios, coffee machines or lamps on the nightstand. It’s impossible to consider all the artifacts aimed to make the start of the day more pleasant, however, some diversity could provide further insight into the environmental sub section.

5. Sleeping habits in different counties

The majority of the participants of this research come from Northern Europe, which is known for its distinct seasonal changes. Many questionnaire respondents stated that their morning routine changes significantly depending on the season. Those who suffer with Seasonal Affective Disorder experience extreme tiredness in winter mornings. However, the research does not consider people who live in warmer regions and do not experience a significant daylight change throughout the year. Studying those people can also generate some data on cultural differences in morning routines.

Despite these limitations, the research has significant strengths. In particular its interdisciplinary approach, human centred research methodology and triangulation of data. Most of the findings confirmed initial assumptions around the topic- people find it difficult to get out of the bed in the morning, some people are naturally “larks” while others are “owls” and that people feel immense pressure to appear productive in the eyes of their peers. However, some data was quite surprising, for instance, the fact that chronotypes are genetic and cannot be changed through sheer discipline. Acknowledgement of this simple biological fact could make people more accepting of themselves and feel less frustration in the morning. The main body of knowledge defined in literature review was very accurate to the data found in the questionnaire and the need for a better alarm clock was reinforced through market research.

Conclusion

Sub questions

The goal of the research was to identify and evaluate contextual factors contributing to a productive and pleasant start of the day. Those factors were split up into Internal (physiology and psychology) and External (environment- waking up aid). Through a variety of primary and secondary methods those factors were assessed, and evaluation was concluded.

Physiology behind awakening

- What kind of physiological processes do people go through as they wake up and how do they influence the awakening?

Literature review showed that people's waking up patterns depend on their circadian rhythm, which is a genetic internal clock that determines timing of sleep and wake. Person's chronotype (relative early and relative late) is genetic, however, it is also affected by external Zeitgebers, such as light and social pressures. Light is the first physiological trigger to start the process of awakening, as hypothalamus inside our brain receives information about light exposure directly from the eyes. Self-awakening relies on a combination of light exposure at sunrise and individual internal clock. Studies show that self-awakening can reduce the effects of sleep inertia- a transient period after sleep, characterised by impaired performance, confusion and sleepiness. Arguably, self-awakening is the key factor to a pleasant start of the day.

However, due to social pressures of going to work and school at a specific time, precision of self-awakening (which is usually +/- 30 minutes) is not enough. Although forced awakenings put our bodies in a state of "shock" every morning, 93.3% of the questionnaire respondents use an alarm clock to wake up on workdays. Participants state that getting out of bed and the awakening itself is their least favourite part of the morning (67%), some mention the feeling of tiredness and confusion upon awakening (clear signs of sleep inertia).

Although some blame can be put on the waking aids themselves, analysis of people's chronotypes showed a consistent social jet lag between their natural sleep timing and the timing forced upon them through social pressures. 54% of the respondents have a social jet lag of over an hour, with 1 participant reporting a 3.5 hour delay from preferred waking up time and socially acceptable one. Although the sleep duration of the majority of participants is acceptable (average sleep duration on a workday is 7.82 hours), they still report tiredness in the morning. Therefore, a productive and pleasant start of the day is not always determined by the number of hours slept the night before, but on how much wake up times differ from internal clocks. An ideal recipe for a pleasant start of the day (from a physiological standpoint) is to wake up to light according to our internal clock at the lightest stage of sleep (non-REM). Of course, it should be noted that more long term factors such as overall health, diet and activity outdoors are also factors that can determine how you feel in the morning.

Psychology of morning routines

- What can be considered a productive and pleasant start of the day and which psychological factors contribute to this perception?

In our culture a lot of pressure is put on the level of "productivity" of our morning, as it is considered a stepping stone which defines the level of productivity for the rest of the day. Those who naturally wake up early and commit themselves to a strict routine (working out/ reading/ having a healthy breakfast/ meditating) are perceived as disciplined and successful members of society, while those who wake up late, skip breakfast and rush to work/school as lazy and disorganised. This polarity between productive lark and lazy owl archetype puts pressure on people who are naturally late chronotypes to wake up early and then feel disappointed when they fail to do so.

From a young age we are encouraged to have productive mornings, but usually this advice is given from older people, who are more naturally inclined to wake up early. During interviews following up contextual research some people mentioned that when they wake up later, even on weekends, they instantly feel guilt despite sleeping well. Therefore, it can be concluded that psychological pressures are actually counterproductive in encouraging people to have a productive and pleasant start of the day.

Another factor which affects our psychological perception of the morning routine is phone use. 77% of the questionnaire respondents check their phones as soon as they wake up (still in bed). Secondary observations also showed that people use their phones when falling asleep and waking up. On the mood/time prompt (contextual research) some people marked phone use as a relatively low activity in terms of mood it causes. Literature review explains this phenomenon with the fact that checking notifications in the morning frames the experience of waking up around checking on the things missed, instead of anticipating the day ahead. Social media can also overwhelm people with negative news, which can spoil the mood for the day. It is clear that lack of phone use can have a strong influence on how pleasant and productive the start of the day is.

Environment- alarm clocks

- What kind of effect do alarm clocks have on the start of the day and what kind of awakening products are currently in the market?

Most of the people today use their phone as a waking aid. According to the questionnaire, 93% of the respondents use their phone as an alarm clock, while literature review states that only 26.3% use alarm on a cell phone. This discrepancy can be accounted for by the fact that the study found uses a bigger age pool of the respondents compared to the questionnaire conducted as part of this research paper. 14% of the respondents state that they are not willing to make a switch to a separate alarm clock, since they do not see any value in it.

App developments allow phone users to increase functionality of their standard alarm. This includes sleep analysis, smart awakening (when the alarm rings at the lightest stage of sleep) and difficult snooze options for heavy sleepers. Although reviews show that the accuracy of those apps can be relatively low, users are usually satisfied with the feature set those apps offer. Most of the time those apps are moderately priced or even free for download, which makes them far more accessible than separate alarm clocks. Key benefits of using phone alarm clocks is the ability to set multiple alarms at the same time, cheap price, sleep analysis and customisable snoozing experience. Waking up on time can be a big achievement for some late chronotypes, so the fact that the phone helps you to achieve this goal, makes it an external factor that contributes to a productive and relatively pleasant (if done right) start of the day.

However, the alarm clock market has a variety of products that offer various features to different groups of users. The most popular alarms can be separated into smart voice assistants, light emitting calm alarms, extreme alarms for heavy sleepers, alarms for children and traditional alarm clocks. All of these provide specific value to their users, either aesthetic or functionality. Once plotted on an innovation/price axis it is clear that highly innovative products are always priced highly, while traditional alarms are cheap. It is difficult to find a compromise between those characteristics, where innovation becomes affordable. Product testing showed that most of the alarm clocks currently offered on the market are difficult to set up and not necessarily trustworthy. Most of the time they end up being mere nightstand clock, instead of an alarm.

Last section of the questionnaire was dedicated to alarm clock feature suggestions. Some suggestions were replicating the feature set of a phone alarm clock, however the following features were the most frequently mentioned: easy set-up, difficult to snooze, clear identification that the alarm is set, appealing form, customisable ringtones, night induced awakening, weather and phone charging. Other unique suggestions include customisable feed, adjustable snooze difficulty, ability to store earrings safely, durability and motivational voice assistant as an alarm. Market research shows that there is no alarm which would satisfy all the needs described above, meaning that some innovation is necessary, to make the awakening process more effective and pleasant.

When analysing the environment around awakening it is also useful to consider nightstands, which usually contain important artifacts that people use when waking up and falling asleep. Part of contextual research asked participants to sketch out their nightstands (if they had one). The results show that everyone had their phones in the near vicinity. Other common night stand items are books, jewellery boxes, water, headphones, glasses, lamps and phone charges. Secondary observations showed that many couples who share a bed have only one nightstand, which they share. To make the start of the day more pleasant, all the tools necessary should be placed nearby, so when designing an alarm clock its placement should be considered.

Main question

The answer to the main question is a combination of answers to the sub questions. As a conclusion a detailed description of the morning routine is given below:

- What factors contribute to a productive and pleasant start of the day?

Social pressures of today's world dictate a big part of our life- awakening and morning routines. Although sleep tendencies are part of our physiology, we are often forced to ignore our biological cues in order to fit into certain expectations. Night owls are forced to wake up early during the work week, while larks are forced to fall asleep later during the weekend. This mismatch between our internal clocks and social expectations can create real health problems as well as psychological discomfort. Despite the importance of mornings many people define it as a tiring and unhappy experience, which only gets tolerable after a cup of coffee or breakfast. Many factors should be considered to make the start of the day genuinely productive and pleasant.

Some factors are long term. This includes listening to your body more and tuning into your internal clock whenever possible, living a healthy lifestyle and becoming more accepting of your sleeping patterns. The morning routine can be improved to make it more mindful and less stressful, but every day is different and when one fails to reach a certain standard, they should not put themselves under further pressure to do better. A true key to a productive and pleasant morning is surrender to your body cues, while becoming more mindful of your patterns without too much judgement.

Immediate factors are more relevant for product design. People are proven to wake up easier when they are exposed to intense light and are woken up at the lightest stage of sleep (non-REM). When designing for pleasant awakening those factors should be considered. However, it is crucial to encourage calmness of awakening through the form design, not just a feature set. There is a lot of potential viability within the market of alarm clocks, since current products are either outdated or too expensive for people to consider. Introducing a thoughtful and calming new product into people's morning routines can contribute to overall productivity and happiness of the experience.

Project application

The purpose of this research was to gain insight into the potential direction of alarm clock design. The key insight learned which differed from the initial assumption is the fact that sleep pattern tendencies are genetic and cannot be changed through discipline. The alarm clocks should accept that and instead offer a calm and intuitive user experience, which can be adapted to specific needs of people. Currently there is a lot of stigma against using separate alarm clocks, since traditionally those were difficult to set up, loud and unpleasant to wake up to. The challenge of this project is to change that. Finally, the form of the alarm should be appealing and create a sense of serenity, while being a nice addition to any home interior. Not everyone has a nightstand at the level of the bed, so a solution for that should be considered.

Some product requirements resulting from this research are:

- The product should relieve stressful morning awakening.
- The product should reduce the effects of sleep inertia in the morning.
- The product sound system should make natural, non-intrusive sounds.
- The product should be effective, but not too annoying for people to stop using it.
- The product should stimulate more than one sense to wake up the user.
- The product should imitate natural light patterns to signal the wake up time.
- The product is especially suited for people who struggle to wake up in the morning.
- The product should be melodical to reduce the effects of sleep inertia.
- The product should have multiple snooze time options.
- The product have different modes for the weekday and weekend awakening patterns.
- The product should communicate how long the user can stay in bed.
- The product should create a sense of serenity and control by only taking the user's attention when necessary.
- The product actively promotes the value of not using the phone first thing in the morning.

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Glossary

Chronotype= a person's natural inclination with regard to the times of day when they prefer to sleep or when they are most alert or energetic.

Circadian rhythms= physical, mental and behavioural changes within an organism that follow a 24-hour cycle.

Internal clock= circadian rhythm synced to the 24-hour cycle.

"Larks" (within the context of this paper)= people who are naturally early chronotypes- go to sleep earlier and wake up earlier. This can be seen in a relatively earlier point of mid sleep compared to the average.

"Owls" (within the context of this paper)= people who are naturally late chronotypes- go to sleep later and wake up later. This can be seen in a relatively later point of mid sleep compared to the average.

Sleep inertia= a transient period after sleep, characterised by impaired performance, confusion, and sleepiness.

Social clock= set of societal pressures for performing certain activities such as sleep, waking and working.

Social jet lag= chronic difference between mid-sleep on workday and free days.

Solar clock= external cues correlating to the movement of the Earth around the Sun.

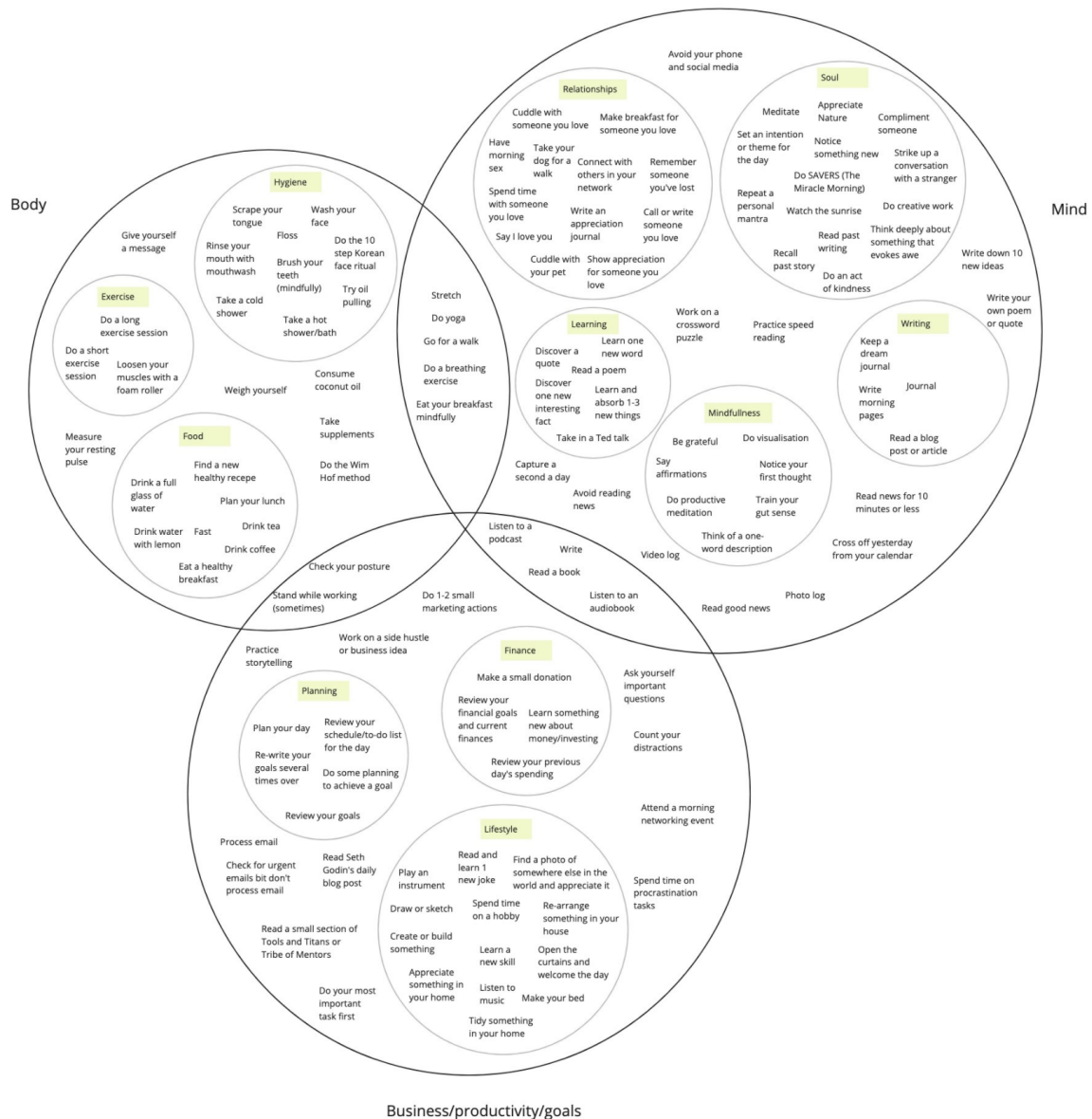
Zeitgebers= a rhythmically occurring natural phenomenon which acts as a cue in the regulation of the body's circadian rhythms.

Appendix

1. Morning Rituals by Kulyk, 2019 (summarised as a Venn Diagram)

127 Morning Rituals- summary

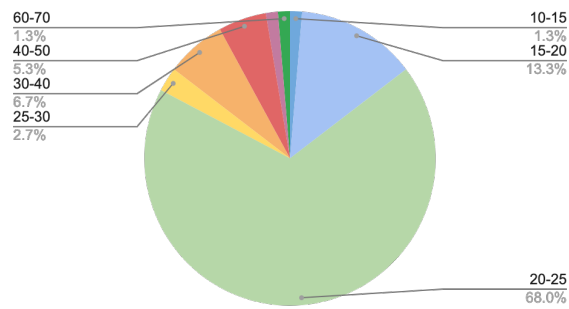
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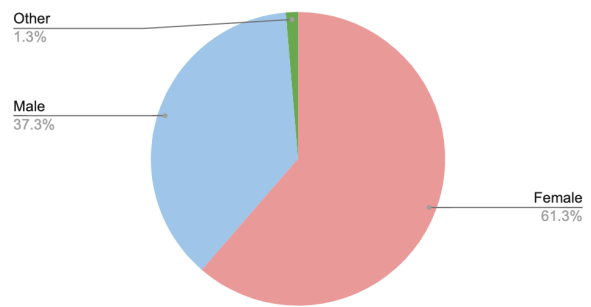
miro

2. Questionnaire data

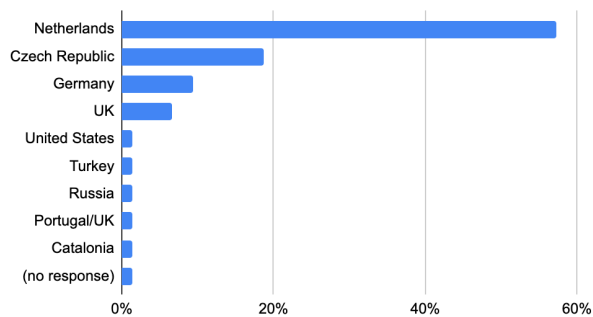
Age of participants



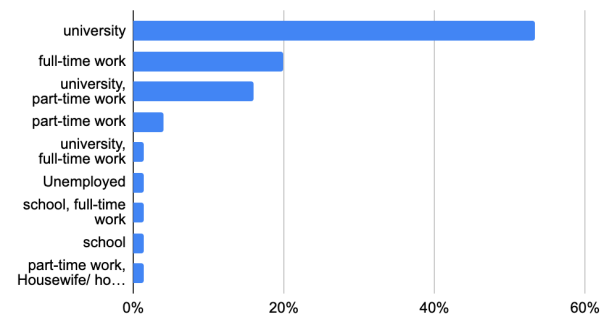
Gender of participants



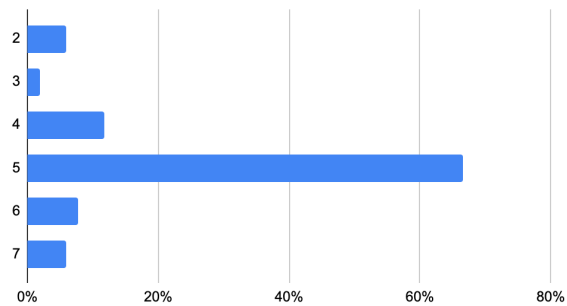
Country of residence



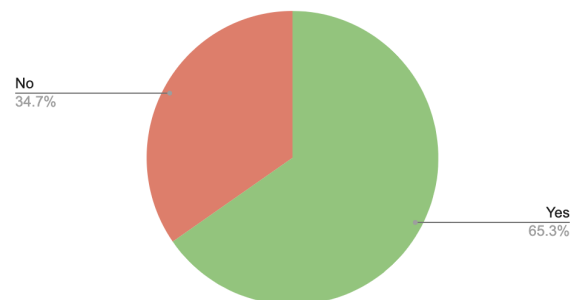
Current occupation



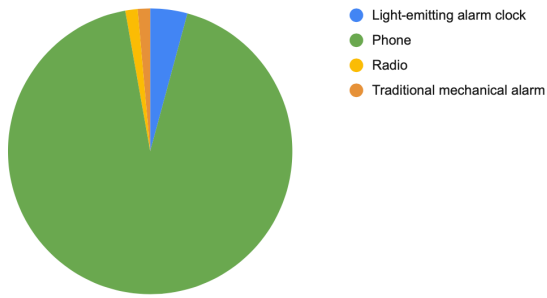
How many days a week do you work?



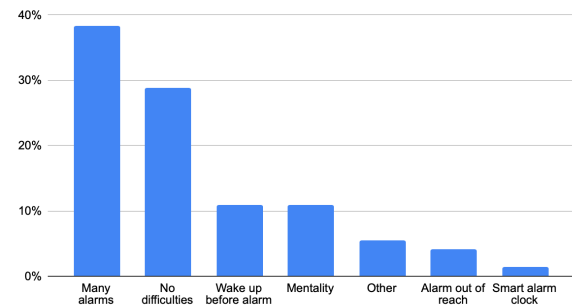
Do you have a regular work schedule?



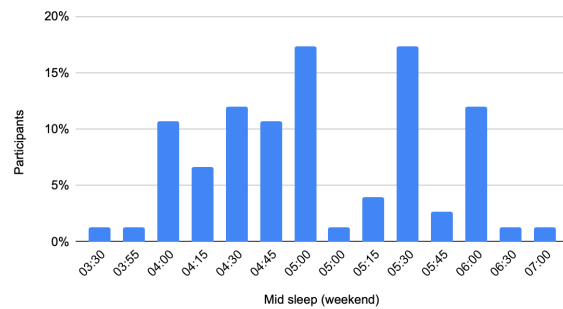
Alarm clock used



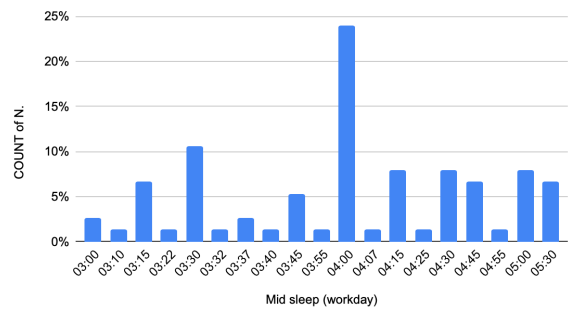
How do you force yourself out of bed?



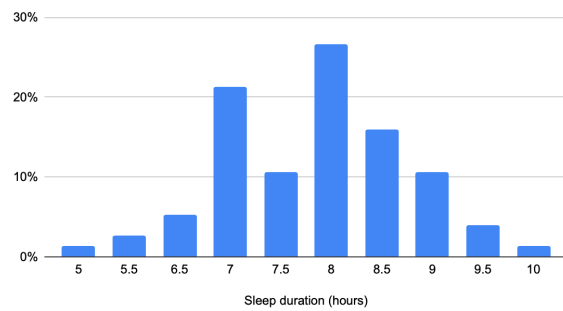
Mid sleep (weekend)



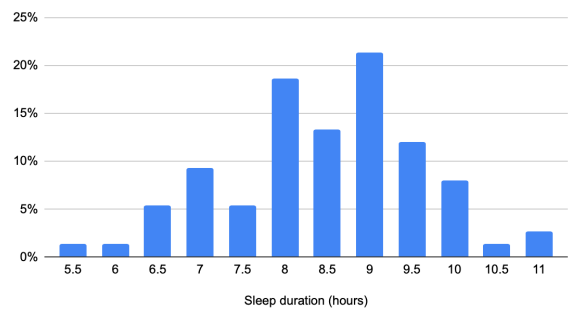
Mid sleep (workday)



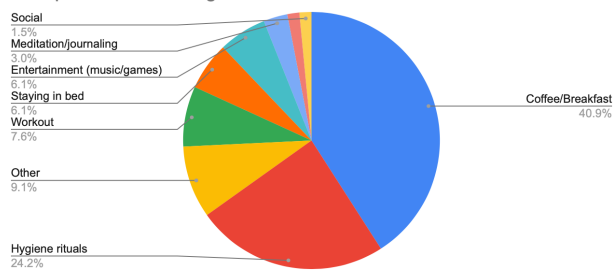
Sleep duration on a workday



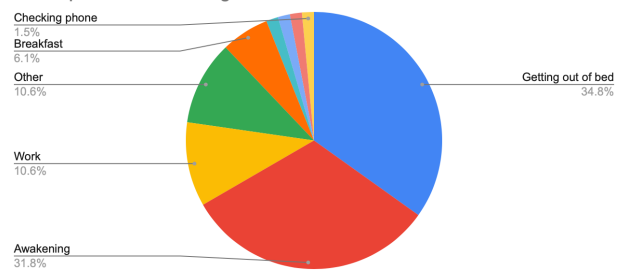
Sleep duration on a weekend



Best part of the morning routine



Worst part of the morning routine



3. Contextual research

Contextual research: Introduction prompt

Diary Studies | prompts to understand morning routines

This booklet contains five research prompts which will be used to explore and document your typical night and morning routine. Feel free to be as creative as possible. There are no right or wrong answers.

Assignment 1: Introduce yourself

Name: [redacted]

Age: 20

Gender: Male ☐ Female ☒ Other ☐

Occupation: university student

Country of residence: Netherlands, Germany

Do you have a history of sleeping disorders?
Yes ☐ No ☒

Do you have a regular work schedule?
Yes ☐ No ☒

With how many people do you share your accommodation?
0 - just me

Make a quick sketch of yourself



1.

Diary Studies | prompts to understand morning routines

This booklet contains five research prompts which will be used to explore and document your typical night and morning routine. Feel free to be as creative as possible. There are no right or wrong answers.

Assignment 1: Introduce yourself

Name: [redacted]

Age: 15

Gender: Male ☐ Female ☒ Other ☐

Occupation: student

Country of residence: Czechia, Czechia

Do you have a history of sleeping disorders?
Yes ☐ No ☒

Do you have a regular work schedule?
Yes ☒ No ☐

With how many people do you share your accommodation?
5

Make a quick sketch of yourself



1.

Diary Studies | prompts to understand morning routines

This booklet contains five research prompts which will be used to explore and document your typical night and morning routine. Feel free to be as creative as possible. There are no right or wrong answers.

Assignment 1: Introduce yourself

Name: [redacted]

Age: 21

Gender: Male ☐ Female ☒ Other ☐

Occupation: Student

Country of residence: Netherlands (Angry Joe's)

Do you have a history of sleeping disorders?
Yes ☐ No ☒

Do you have a regular work schedule?
Yes ☒ No ☐

With how many people do you share your accommodation?
0 - I live alone

Make a quick sketch of yourself



1.

Diary Studies | prompts to understand morning routines

This booklet contains five research prompts which will be used to explore and document your typical night and morning routine. Feel free to be as creative as possible. There are no right or wrong answers.

Assignment 1: Introduce yourself

Name: [redacted]

Age: 49

Gender: Male ☐ Female ☒ Other ☐

Occupation: entrepreneur

Country of residence: Vietnam

Do you have a history of sleeping disorders?
Yes ☐ No ☒

Do you have a regular work schedule?
Yes ☒ No ☐

With how many people do you share your accommodation?
3

Make a quick sketch of yourself



1.

Diary Studies | prompts to understand morning routines

This booklet contains five research prompts which will be used to explore and document your typical night and morning routine. Feel free to be as creative as possible. There are no right or wrong answers.

Assignment 1: Introduce yourself

Name: [redacted]

Age: 33

Gender: Male ☐ Female ☒ Other ☐

Occupation: Student

Country of residence: Netherlands (Germany)

Do you have a history of sleeping disorders?
Yes ☐ No ☒

Do you have a regular work schedule?
Yes ☐ No ☒ sometimes when I'm too stressed I have trouble falling asleep

With how many people do you share your accommodation?
I share a kitchen with 6 other students

Make a quick sketch of yourself



1.

Diary Studies | prompts to understand morning routines

This booklet contains five research prompts which will be used to explore and document your typical night and morning routine. Feel free to be as creative as possible. There are no right or wrong answers.

Assignment 1: Introduce yourself

Name: [redacted]

Age: 50

Gender: Male ☒ Female ☐ Other ☐

Occupation: Teacher

Country of residence: Czech Republic

Do you have a history of sleeping disorders?
Yes ☐ No ☒

Do you have a regular work schedule?
Yes ☐ No ☒

With how many people do you share your accommodation?
4

Make a quick sketch of yourself



1.

Diary Studies | prompts to understand morning routines

This booklet contains five research prompts which will be used to explore and document your typical night and morning routine. Feel free to be as creative as possible. There are no right or wrong answers.

Assignment 1: Introduce yourself

Name: [redacted]

Age: 23

Gender: Male ☒ Female ☐ Other ☐

Occupation: Student

Country of residence: Netherlands

Do you have a history of sleeping disorders?
Yes ☐ No ☒

Do you have a regular work schedule?
Yes ☒ No ☐

With how many people do you share your accommodation?
0

Make a quick sketch of yourself



1.

Diary Studies | prompts to understand morning routines

This booklet contains five research prompts which will be used to explore and document your typical night and morning routine. Feel free to be as creative as possible. There are no right or wrong answers.

Assignment 1: Introduce yourself

Name: [redacted]

Age: 24

Gender: Male ☐ Female ☒ Other ☐

Occupation: Student

Country of residence: Netherlands (unique situation)

Do you have a history of sleeping disorders?
Yes ☐ No ☒ (sometimes hard to fall asleep)

Do you have a regular work schedule?
Yes ☐ No ☒

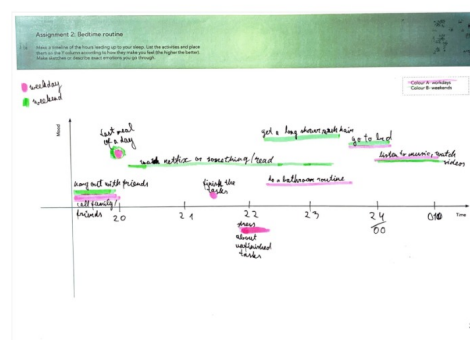
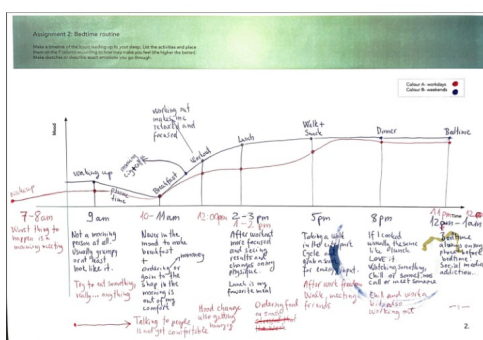
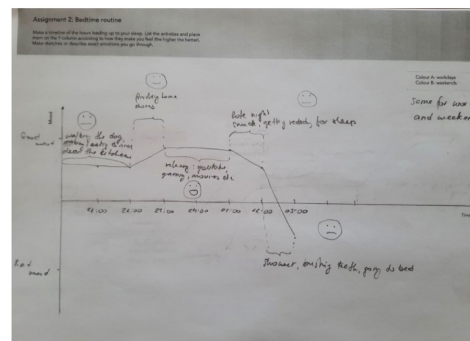
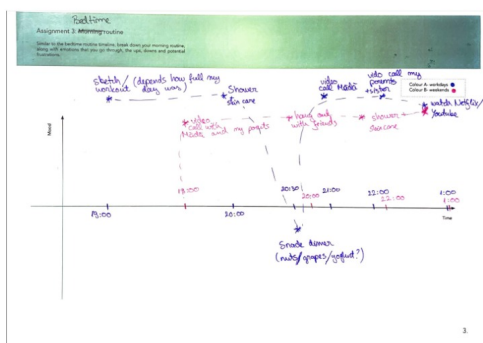
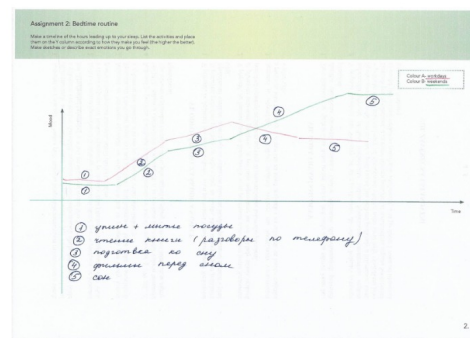
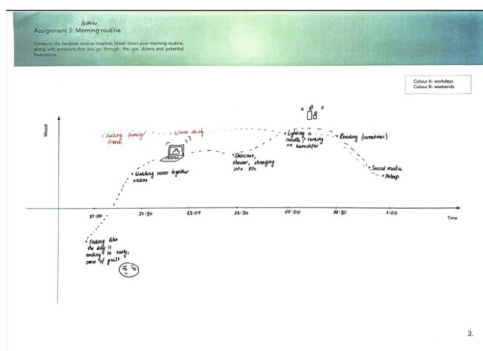
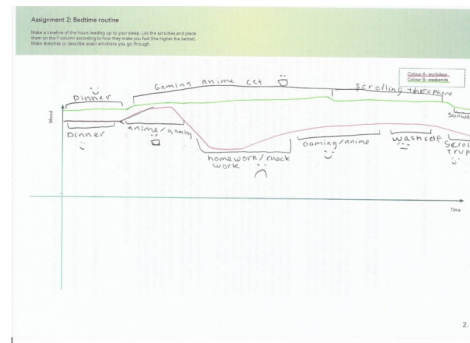
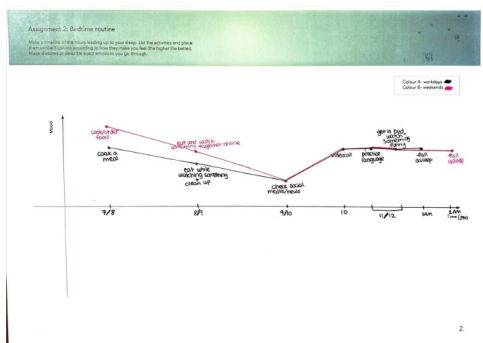
With how many people do you share your accommodation?
1 + dog

Make a quick sketch of yourself

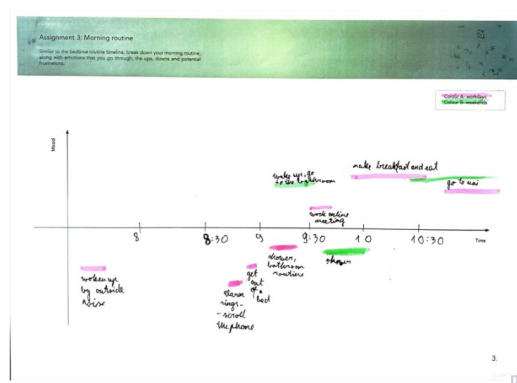
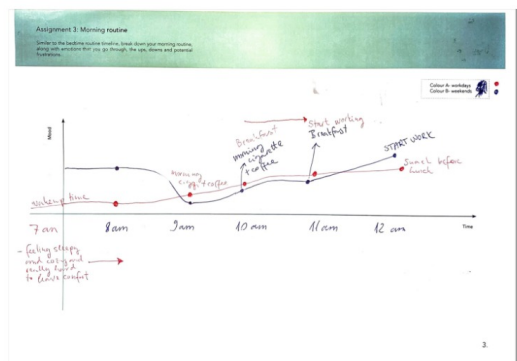
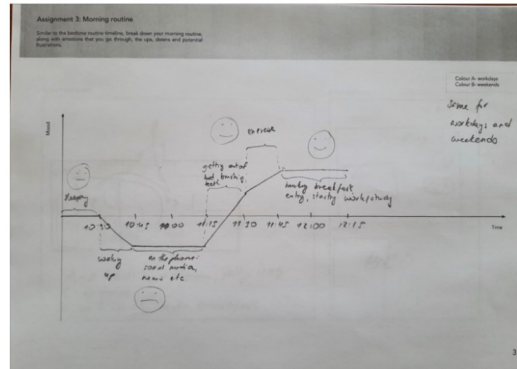
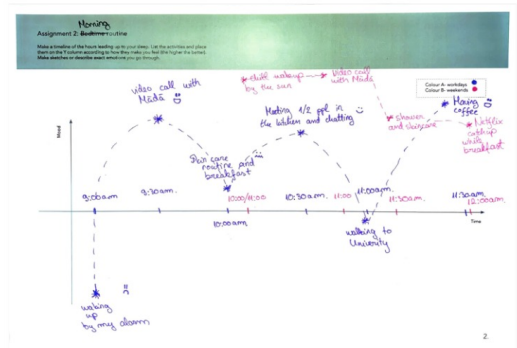
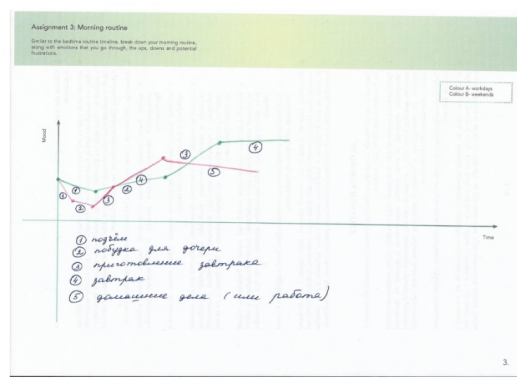
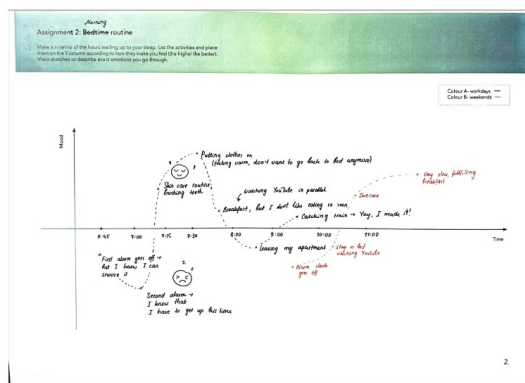
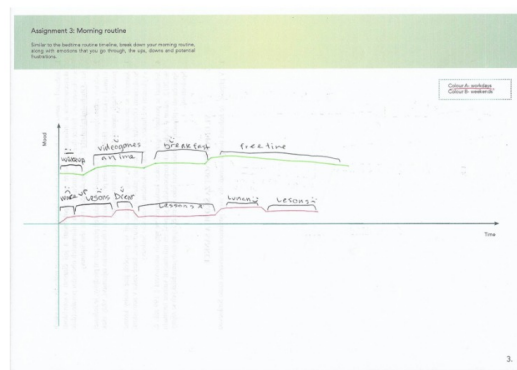
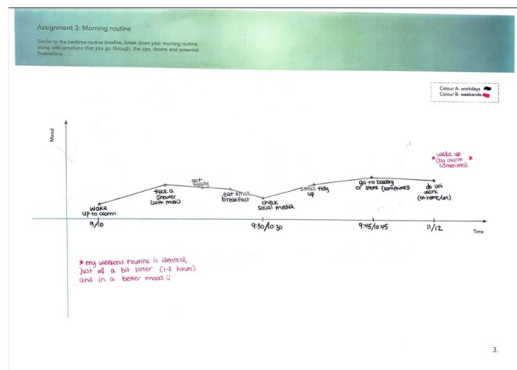


1.

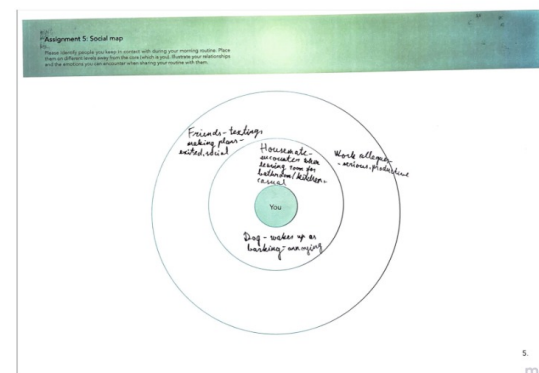
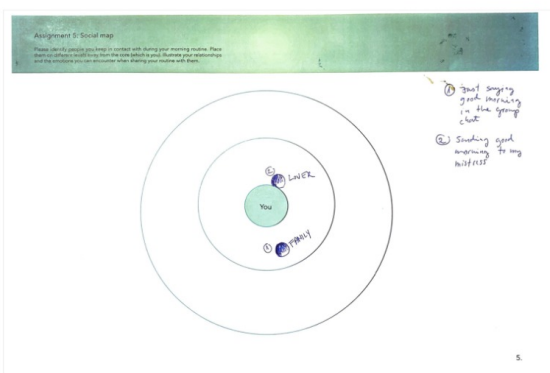
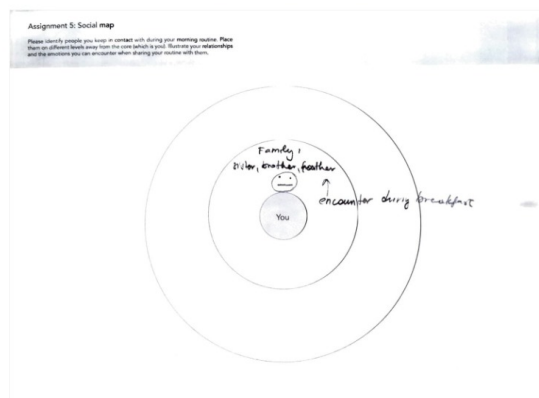
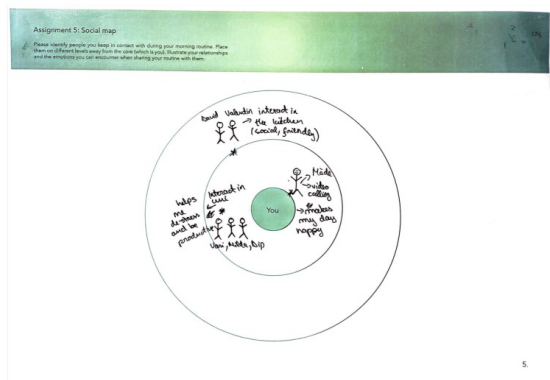
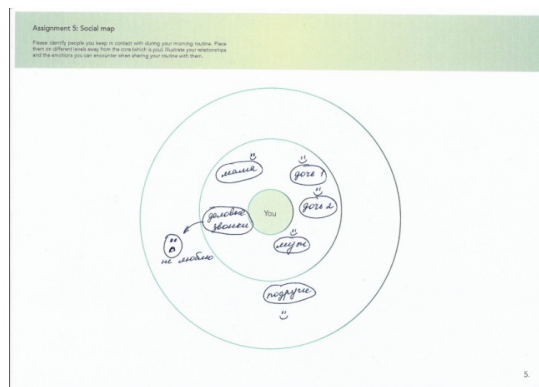
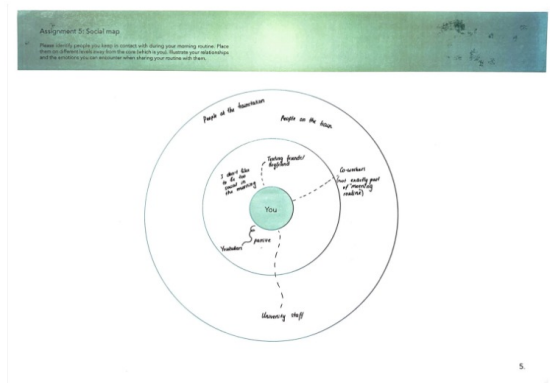
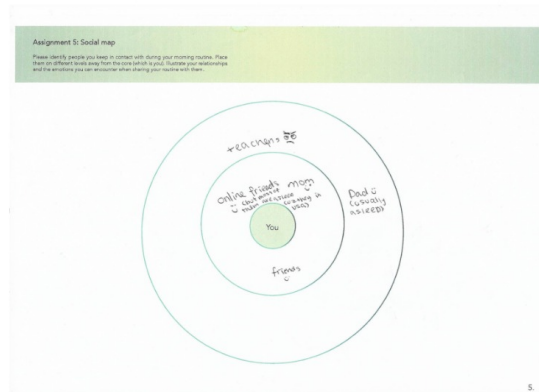
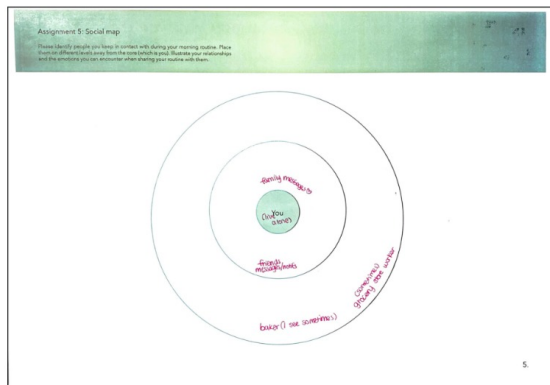
Contextual research: Bedtime routine



Contextual research: Morning routine



Contextual research: Social mapping

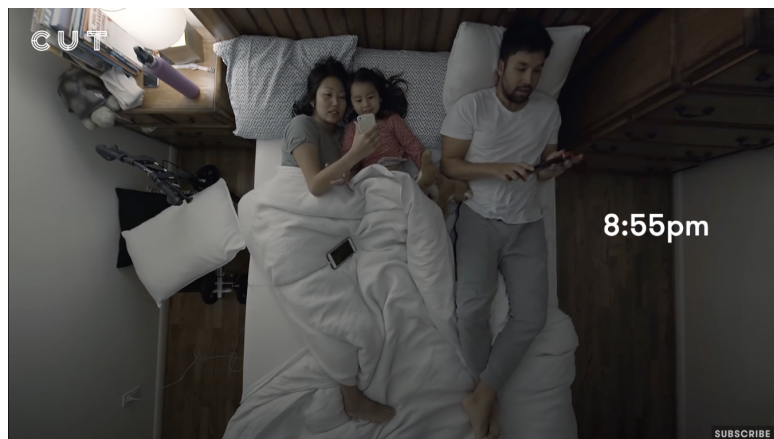


4. Secondary observations screenshots

a) Genie & Ralph



b) Jason & Stella



c) Serena & Zach



5. Diary studies

- ALARM TESTING DIARY -

12/03 Technoline Projection alarm clock (UT 549)

- the product comes in a simple carton box (kind of cheap looking)
- everything wrapped in bubble wrap
- difficult to set up
 - not sure which buttons to press
 - going in loop without success
 - checked the manual
- Controls are really confusing - you have to press and hold "mode" button to change settings
- At this point I'm impressed at how much information the alarm contains (weather in/out, day, month, day of the week, time, weather predictions...

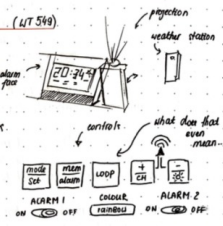


Diagram labels: projection station, weather station, alarm base, controls, what does that even mean... (pointing to a button), ALARM 1, ALARM 2, CHARGE, SLEEP, OFF, ON, 100%, 50%, 25%, 0%.

time, radio controlled syncing

weather predictions

day of the week

day and month

outside temp.

inside temp.

number of the probe

I can't set up the weather probe outside, so I place it near my window (which is usually open)

I accidentally unplugged the alarm and the settings are lost... super frustrating! (to be fair, there is back up battery slot, I just didn't use it)

Another weird thing I notice - I cannot set the angle for the projection correctly. It can be flipped 180°, but I needed it to turn 90° (so that I see the projection correctly, while having the alarm the correct way - towards me)



Overall, the product gives me mixed feelings. I feel curious to explore / use it, but it's also frustrating to set up. I'm not sure if I set it up correctly and the alarm will go off in the morning. I'm also unclear on how the radio function work.

14/03

- It's Sunday, but I still tried the alarm feature. In the evening before I set the alarm to 10:00. I also realised there is an option to set a second alarm.
- I was expecting that the alarm will play radio in the morning, but it turned out that "radio connection" is made specifically to set time (not even set, but to count seconds correctly).
- At 10:00 (as planned) the alarm went off. It was a very annoying beeping sound, which woke me up. However, I was able to snooze it by lightly tapping the front top panel.
- I'm not sure how much time has passed, but the alarm started making sounds again, now even more intense beeping.
- At that point I got up, but I also realised that I don't know how to turn it off! So I had to turn the switch from the back panel.

CONCLUSIONS:

- Overall, the product has interesting features and it's really easy to get used to projection on the ceiling. When I had to return the alarm a week later, I was sad to see it go.
- However, the design of the alarm is quite intrusive. It's bulky, flashy and demands attention. It was a real eye sore on my nightstand, but the projection was too convenient to let go.

Features I actually used:

- projected time
- internal weather

Other features:

- multiple weather channels
- "radio control"
- actual alarm

- In the end, this alarm clock was more of a bed time clock, than an alarm. It was annoying to wake up to and I found myself setting "backup" alarms on my phone, just in case.

18/03 Sensor Wake

- Unlike the previous clock, Sensor Wake feels more thoughtful and higher-end.
- Packaging is designed to be fun and visual, making me excited about the product.
- As I take out the alarm clock, my first impression is that it's quite bulky.
- The one which connects the alarm to a plug is designed so that it can't be lost. This is a big problem, since the charging plug is placed at the bottom.
- I had to make a whole book conception to make it stand correctly. Does not look appealing at all.
- Easy to set up, nice UI sounds!
- It is clear whether the alarm is set.
- Alarm sounds and loudness can be set (4 options of each).

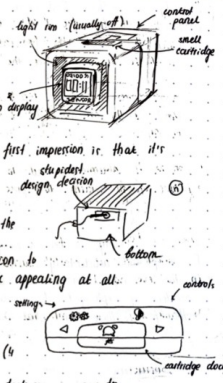


Diagram labels: digital time (usually off), control panel, small cartridge, time & alarm display, bottom, controls, settings, cartridge dock, small cartridge (I had mine).

The cartridge dock is very easy to set up.

Overall, I'm really curious about tomorrow morning.

19/03 (Saturday)

- I'm kind of disappointed with the alarm. I really did not feel any small changes and only woke up because of the sound alarm.
- The idea:
 - Smell → Light → Sound (for gentle awakening)
- In reality, I did not feel the first 2 stages at all.
- The melody of the alarm is pleasant, but not very loud since the speaker is at the back.
 - the loudness (or lack of it) surprised me, since the product itself is quite big and definitely had extra space for a good speaker.

Partially, the problems that arose can be explained with the fact that my nightstand is lower than my bed. (≈ 20cm lower).

It's difficult for me to see the time on the alarm.

"small" takes longer to reach me.

I can't see the alarm light at all, especially if I'm facing the other way.

To snooze the alarm you need to tap the top panel of the clock (or to turn off the alarm, long press the top panel).

21/03 (Sunday)

- Today is Sunday, so there is no pressure for me to wake up too early.
- I overslept and accidentally turned off the alarm completely.
- In the evening I made the same mistake as with the last clock - I accidentally unplugged. This made me lose the settings.
- thankfully, there aren't that many settings to begin with.

CONCLUSIONS:

- The product is very creative, especially with its marketing story.
- "Wake up. Motivated & in a better mood"
- However, it still has a very startup feel. Some design decisions are questionable at best and the main "small" function does not work.
- Currently the alarm clock is sold for €120, which is way too much for the functionality and aesthetic it offers.

What I liked:

- overall story / intention
- packaging design
- intuitive and simple settings.

What I disliked:

- small function not working
- replaceable cartridges → ecofriendly?
- bulky design
- small screen
- quite alarm sound

For the current pricing I would not purchase this product. It is easy to give away, since I did not form attachment with it.

22/03 Stark alarm clock

This alarm is more high end than others tested → it's designed by Philippe Starck and it has a huge marketing backstory.

"Understanding the Universe precisely" (2)

The box that the alarm clock comes in is disproportionately large with transparent plastic to show the alarm itself.

↳ similar to a doll box

Similar to the projector alarm, it measures temperature and pressure, serving as a mini weather station.

↳ but unlike the projector alarm, it costs €100

The alarm is a bit difficult to take out of the box, but the way it's packaged makes it feel more expensive and important.

Along with the alarm, a small sensor unit is attached (mini version of the alarm/main unit).

When opening the box, I feel curious but intimidated.

The alarm can be attached to main circuit or run on batteries.

↳ batteries included, but they don't work (had to use mine).

A definite eye-catcher is the back panel.

Made out of soft green plastic, it's really well built and asks to be explored.

Curiously, not all buttons are functional → some "squares" are not labeled and do not press.

Some are labeled: so avoided ("select", "alarm", "radio", "tuning", "station").

↳ others are just labelled ("up", "down", "channel", "stop").

↳ it's a bit random, but it's great to not keep turning the alarm over to see what you are actually pressing (and focus on the display instead).

The alarm took a while to set up and once again I had to look up certain settings in the manual.

The alarm is overwhelming with information, I can't really apply.

LCD display is confusing (some preset numbers are a little visible) and require a lot of focus to actually read.

↳ had to give up half way through installation.

23/03

Finally set everything up.

Tried to use radio, but it sounds horrible and I struggled with the antenna position for way too long.

I cannot use the weather probe, since I need a screwdriver to install batteries in it.

↳ set alarm for 7:00 next morning.

24/03

The alarm is a loud piano sound.

↳ thought it's going to be a melody, but it's literally one note... ↳ annoying and loud.

Snoozed by pressing large wide button on the top of the alarm.

After some time it plays more intensely. I don't know how to turn it off (2).

↳ I end up pressing the button at the back, not sure if it's correct but it turns off the alarm completely.

CONCLUSIONS:

Big marketing, not much real value.

The design is a product of its time (early 2000's).

What I liked:

- ↳ back panel material
- ↳ solid plastic frame
- ↳ large time numbers

What I disliked:

- ↳ awful radio sound
- ↳ overwhelming information
- ↳ slight pretentiousness

When I set up the date, it suggested year 2003 - back at the time when information was scarce, the product would be prestigious, but now it's outdated.