# Sleep as Android

## Evaluation and Redesign

Final Project

6.13.18


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# 1. Executive Summary

This report is designed to provide an in-depth analysis and evaluation of the application, Sleep as Android. Sleep as Android is more than just an average everyday alarm clock. At its core, Sleep as Android aims to wake a person up at the optimal time based on their current sleep cycle. Aside from tracking a person's sleep, Sleep as Android employs a host of additional features from lullabies and sleep talk with snore recording, to creative ways to get a person out of bed along with smart watch integration. This report will showcase the extensive research done in verifying the usability of Sleep as Android along with its many features. It aims to provide validity to the proposed changes of the application through competitor and user research, user testing, and evaluation of potential redesigns for the key features identified through the research.

The research for Sleep as Android began with a goal of uncovering the applications user base along with potential stakeholders. With these two groups identified, interviews were then conducted to gain a better understanding of the overall lifestyle and sleep habits of the target population. A survey, which generated over 140 responses, was also formulated to gather quantifiable data to be used in further testing. Usability tests were then conducted based on the combined findings from the interview and survey with both existing and new users of the Sleep as Android application. These tests, along with the results of a cognitive walkthrough with an expert user led to the discovery of the proposed changes to the application.

The following are the five areas to be redesigned from the Sleep as Android application based on the findings from aforementioned research:

1. Tutorial
    - Through usability testing and the cognitive walkthrough, both revealed that it inadequately explained how to use the noted features but instead only provided an overview leaving the user unaware of how to use them.
    - Recommended redesign: discoverable menu that provides "just in time" pop-ups for each setting and option.

2. Hamburger Menu
    - Through the same tests, the conclusion was made that it contained too many options, causing the user to become overwhelmed and unable to find what they were looking for in a timely manner.
    - Recommended redesign: reorganized menu with large headers so that users can narrow down which option they're looking for
3. Settings
    - Having two different settings menus caused confusion in the participants as to which menu offered which options, leading them to become lost in a sea of options.
    - Recommended redesign: combine the two menus into one and use clear headers and tabs to make it easier to navigate.
4. Sleep Tracking
    - Usability test revealed that it was too cluttered with unimportant information while leaving out relevant details such as if the application was tracking the users sleep or not.
    - Recommended redesign: limit the page to only absolute key features, removing all unnecessary clutter and making it obvious when sleep tracking begins.
5. Graphs
    - Usability testing proved that the graphs were often missing key pieces of information along with units of measure and accurate labels.
    - Recommended redesign: simplify the graphs, clearly label the axes, organize the page to clearly display user's data.

The information presented in this document provides researched backed evidence of these purposed redesigns. It showcases how the research was conducted, provides detailed documentation of the process, and summarizes the findings from each.

## 2. Introduction

The purpose of this document is to convey the research done by our team in connection with the usability aspect of the mobile application, Sleep as Android. Our research includes the insights we gained through doing a competitive analysis as well as the data we collected from conducting interviews which lead to an in-depth survey with over 140 individuals participating. After collecting the data, we conducted usability tests and a cognitive walkthrough to pinpoint potential usability issues. After analyzing the data we collected, our team has come up with 5 different areas in need of a redesign. We have documented them here along with a heuristic evaluation for each one. Additional items in this document include our usability test data along with the user demographics we used to form our evaluations. From that data, we developed redesigns that addresses these problems  and that we believe will improve user's experience with Sleep as Android and improve retention for new users.

# 3. Product Description & Competitive Analysis

## 3.1 Product Description: Sleep As Android

Sleep as Android is a sleep management application that uses the built-in accelerometer in your phone to track your movements as you sleep. Based on those movements, the application can detect your sleep cycle which it then uses to determine the optimal time to wake you up based on your current alarm. Aside from this main functionality, Sleep as Android also has the ability to sense and record audio while you sleep in an effort to detect snoring or sleep talking. It has several other features, including lullabies, specialty alarms, recommended advice based on lifestyle habits, and third-party integration with a multitude of health and wellness apps and products.

Instead of working with a subset of its features, we chose to work with the complete product. Sleep as Android is a completely finished product produced by the development team Urbandroid Team. The app was released in October of 2010 and, due to its age, has had many iterations and updates.

Our team chose Sleep As Android as our application of interest because it had the most potential for redesign; we were able to brainstorm several inefficiencies with its design almost immediately.

Additionally, the potential for redesign was only second to our belief in the features of Sleep As Android. The goals of this application are simple and are widely in demand, as sleep improvement is something a lot of us need in this day and age. With our evaluation and redesign of Sleep As Android, we seek to make its features more accessible and usable to a wider range of audiences.

## 3.2 Competitive Analysis

### 3.2.1 List of Competitors

Sleep as Android isn't the only alarm clock app out there by far. It's not even the only sleep-cycle alarm app. There are a variety of sleep related apps and products on the market that may compete with Sleep As Android. The following table lists the competitors that interested our team. We chose these products based on two categories: direct competitors and indirect competitors. Direct competitors have essentially the same goals and features, and indirect competitors are not necessarily similar products, but could potentially fulfill the same needs for users.

| Our Product | Description |
|---|---|
| **Sleep as Android**<br>https://sleep.urbandroid.org | Sleep as Android is a smart alarm clock app with sleep cycle tracking, which aims to wake up its users at their lightest sleep cycle shortly before their alarm time. |
| **Competitors** | **Description** |
| **Sleep Cycle (iOS)**<br>***Direct Competitor***<br>https://www.sleepcycle.com | Sleep Cycle monitors you as you sleep to wake you up when you're in your lightest sleep cycle, so you feel more rested. The application also uses sound analysis to monitor snoring, making it very similar to the features of Sleep as Android |
| **Alarm Clock Xtreme (Android)**<br>***Direct Competitor***<br>https://play.google.com/store/apps/details?id=com.alarmclock.xtreme.free | Alarm Clock Xtreme is focused on making sure you wake up and stay awake by giving you complicated tasks before you can wake up. |
| **Physical Alarm Clock**<br>***Indirect Competitor*** | A standard alarm clock that supports basic functionalities, such as the alarm itself, and snooze. |
| **Fitbit**<br>***Indirect Competitor***<br>http://fitbit.com | Fitbit motivates you to reach your health and fitness goals by tracking your activity, exercise, sleep, weight and more. It features an alarm that vibrates your arm. |

*Figure 3-1: Table of Competitors*

### 3.2.2 Comparisons Between Competitors

Let us first discuss the direct competitors. Sleep Cycle is an iphone app that has similar functionality at first glance. It simply monitors your sleep and wakes you up at the lightest point in your sleep. That's about all it does though, which gives Sleep as Android an edge in terms of sheer number of features. However, Sleep Cycle provides a simplistic design due to its lack of features, and that is something Sleep as Android is severely lacking in: simplicity. Sleep Cycle would be much more easy to use as a new user, which is what we're looking to remedy in Sleep as Android.

Regarding indirect competitors, there is always the physical alarm clock as an option. Physical alarm clocks are inexpensive devices that allow for regular alarms to be programmed in, and work even if you lose your phone, or your battery is dead. They also have the added benefit of usually being louder than most phone speakers and are more suited for checking the time with their always-on display. While reliable, physical alarm clocks have many limitations to their features and are more difficult to set different times and patterns, whereas most apps make it easy to set different alarms for different days. Fitbit's wake up application on their wearable products is an indirect competitor where rather than waking you up via a loud noise, it vibrates strongly on your arm, rousing you from sleep. This is an excellent option for people who live with others and may not want to disturb their housemates, but requires the user to not be a very heavy sleeper. It also does track your sleep but not its cycles, meaning that you can't be sure it's waking you up at your lightest sleep, which can cause grogginess.

Nearly everyone uses an alarm in some capacity, but there are a lot of different needs regarding sleep hygiene. Some people need more sleep than others, some struggle to fall asleep, and others struggle to wake up. Some people like to hit snooze a few times and some need a mechanism to prevent them from doing so. While all these products solve one core goal (to wake the user up), the methods and tools with which they use are as different as the people using them. Some products are more similar than others (Sleep Cycle is likely the closest competitor we'll be dealing with), but rather than just packing features in on top of each other, our biggest concern for Sleep as Android is to make it pleasant to use. It should be easy and tactile, and all of those features mean nothing if the app is so complicated to use that people end up using their built-in alarm program instead.

# 4. User and Stakeholder Research

## 4.1 Target Population

Due to the nature of the application, we felt that many people could benefit from the sleep tracking the app provides. We initially concluded that the target market consisted of health-minded individuals who are already using health tracking applications like Fitbit, S Health, and Google Fit, and students, as student life is often associated with poor sleeping habits. In later stages of our evaluation however, we revised that conclusion and expanded our target population to additionally include more general, every-day users, and new users.

Additionally, indirect stakeholders may consist of partners or roommates that share the sleeping environment with our primary user. Their sleeping habits may be affected by our primary stakeholders' usage of the app. Because the app's tracking can be skewed by movement from partners, our target market in terms of sleep tracking leans towards unmarried users.

## 4.2 Methodology

Our research consisted of user interviews and surveys. We sought in-depth information with our user interviews and conducted them with 6 participants from our target population, at an average interview length of 40 minutes (See Appendix 9.3). The purpose of our survey was to obtain more quantitative information from a large sample size so it was distributed across social media (See Appendix 9.2).

Because phone-based alarms are so ubiquitous, we felt confident that most people would be appropriate to interview. Our only requirement for interviewees was that they used their phone alarm so that our questions would be relevant to them.

Our survey touched on more quantifiable questions from the Sleep Quality and Lifestyle Choice categories, as shown in Figure 4-1. We distributed the survey to as many friends, family, and students as possible via social media accounts. We also posted the survey in the UCI Discord channel, which admittedly has more CS majors than any other major and thus may have slightly skewed our results. We received 140 survey responses, with a 73% of them being college-age students.

## 4.3 Findings: Interviews

We wanted to go beyond inquiring how our participants used the application as an alarm clock while tracking their sleep patterns. Although we did include some questions about alarm usage, the majority of our questions focused on lifestyle habits. We touched on all aspects of their lives that could affect their ability to get a good night's sleep and wake up, not only on time but also feel well-rested. Our interviews mainly revolved around their overall lifestyle with questions that were centered around allowing us to gain some insight into their behaviors and habits, both before going to bed and after waking up in the morning. When considering a person's overall lifestyle, we found that there are many factors that contribute to getting a good night's sleep. Many of our participants noted that managing other aspects of their health played a vital role in obtaining a good night's sleep.

### 4.3.1 Physical Activity

We found that many alluded to the fact that any type of physical activity made a noticeable difference in their sleep, whether they slept better because they had done physical activity throughout the day or whether they slept worse because they hadn't. The majority also stated the somewhat obvious, that they almost always went to sleep easier when they were tired.

### 4.3.2 Caffeine

For each person, the amount of either caffeine or alcohol varied, but the majority of participants noted a difference in sleep quality based on this. When they kept these amounts in check they were able to improve their sleep quality.

### 4.3.3 Nightly Routine

We also looked each participant's nightly routines. Some participants described very detailed and complex nightly routine, one that may take several hours to complete before finally falling asleep. Others described a very short night routine that may only take 15 - 30 minutes. Either way, all of our participants described the importance of having some type of nightly routine that allowed for them to sleep better at night. That being said, we found that even though our participants needed to have some type of nightly routine, many of them also noted that managing their sleep habits did not have a great amount of importance. Many of them often went through the motion of getting ready for bed without really thinking about what they are doing and what affect it may be having on their sleep habits.

#### 4.3.4 Alarm Use

Another aspect of our interviews focused on how our participants thought about and used alarms. For some, setting an alarm was just a subconscious aspect they performed each night before bed. However, we found that many participants to alluded to the notion that they wanted customizable alarms. They wanted to able to set the tone, the volume, the amount of times the snooze button could be pressed, along with what the alarm would do once the snooze button was pressed. The topic of snoozing was a favorite amongst our participants in that we found that snoozing options were a top priority. Participants wanted to be able to customize their snoozing options from the amount of time each snooze would allow for, what a person would need to do if they snoozed longer than they wanted to, and also what would happen if they bypassed the snooze button and accidentally turned their alarm off.

#### 4.3.5 Napping

Finally we looked at the act of napping. We found that the majority of our participants enjoyed some form of napping on a semi-regular basis. However, we discovered that short naps seemed to be most popular with the vast majority of participants. Interestingly enough, these short naps didn't always help a person make it through the rest of the day. Many noted that it all depends upon the day in regard to how much they felt that a nap would improve their overall sleep quality the next night. Additionally, when considering our interviews as a whole, it to the conclusion that many of our participants have different but identifiable issues with their sleep. Whether or not they track their sleep habits and patterns, there is evidence that our participants' quality of sleep is not always what they wanted or expected.

## 4.4 Findings: Survey

In looking at the survey findings, we were able to obtain good, quantifiable numbers on each of the topics that we proposed to our respondents. We discovered that about 60% of the individuals reported feeling groggy in the morning, another 52% of people reported having difficulty waking up, while 42% of people reported having trouble falling asleep. When examining theses numbers together as a team, we were pleased because these specific problems are what Sleep as Android is looking to address.

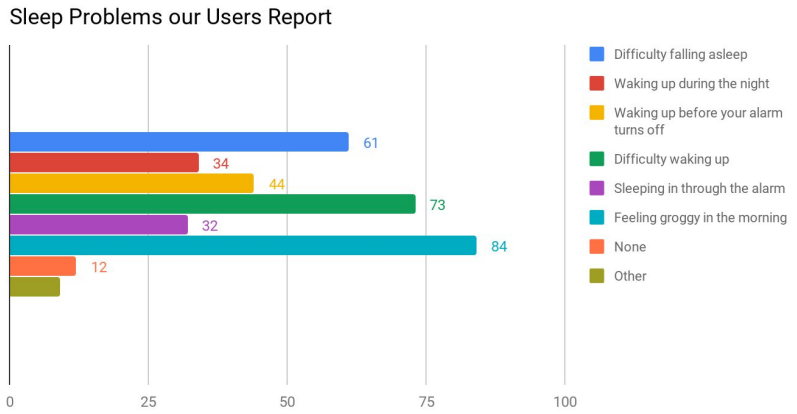



*Figure 4-1: Results from survey regarding sleep problems user issues*

Another interesting factor that we looked at was how and when our participants set their alarms. Whether on not our participants set multiple alarms or just one alarm, we found that 51.1% of people did not set a new alarm each night while 48.9% of people said that they did set a new alarm each night. Additionally, we found out that out of all the participants surveyed, only 8% reported having no sleep problems.

When we contrasted this with the number of participants who reported that they were currently tracking their sleep habits and the numbers were quite different. Our survey showed that currently only 14.3% of the people are tracking their sleep habits. This number alone means there is a large population of people that Sleep as Android will be able to help in the future to not only see the need to track sleep, but also leading to the accomplishment of the overall goal of the application, which is to continue to improve sleep quality while helping each person get the best night's sleep possible.

Based on the responses we received, we conclude that the critical redesign elements to focus on are reducing clutter, allowing the most desirable features to shine while hiding less frequently used features, and providing additional integrations.

# 5. Usability Research

## 5.1 Methodology

Our usability tests involved both performing tasks within the application from a new user's perspective and more in-depth cognitive walkthroughs from an expert user's perspective. Simulating both usage of the application with and without prior experience with the application helped us determine what features we wanted to test.

### 5.1.1 Usability Tests

During the usability tests we asked our participants to think aloud for all tasks. While efficiency is a factor in an alarm-clock, there were more concerned with brand new users being able to understand their tasks and finding the correct menu item to get them closer to their goal. If a user got stuck during their task, we'd point them in the right direction if they asked for help. Once that happen, we'd consider said task to be a failure.

Due to the nature of having to sleep with the app, we wanted to gauge how our user's could interpret their own data after sleeping. We felt that knowing roughly when and how they slept would give the graphs more context and give us more reliable data -- thus we made the second half of the usability to be test a follow-up survey asking them to evaluate their own data as well as sample data.

Our usability tests were performed individually. Being aware that it's more difficult to both facilitate and note-take at the same time, we got permission from our users to record the session, so that we could give them our full attention.

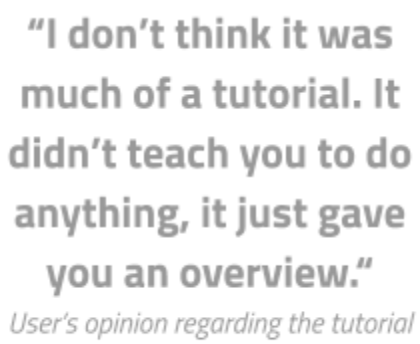
### 5.1.2 Expert Cognitive Walkthrough

We designed our cognitive walkthrough tasks to focus on particular problem areas that a user might only notice or run into after using the app for a short while.  One person took notes of what the user said out loud as he did his tasks, while another documented what he did on the app. The other two members took turns being the facilitator.  After collecting the data from all of our users, we combined it and the data retrieved from the cognitive walkthrough and grouped it into sections by problem. Repeated critical issues were given the highest billing, while smaller, specific feature issues were noted as such. We found interest in six distinct and general issues. These issues, which are detailed in the following section, formed the basis of our redesign in Section 6.

## 5.2 Usability Issues

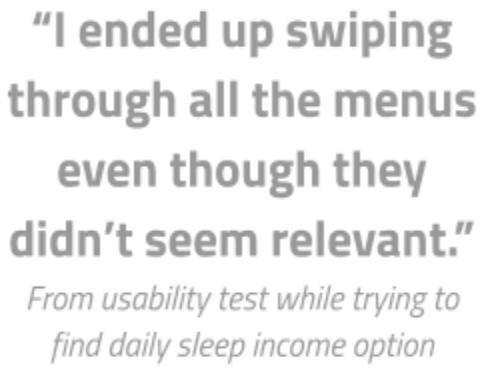
**Issue 1: The tutorial needs to be more informative.**

When using the app for the first time, the users are presented with a tutorial that simply informs them of the features instead of actually teaching them how to navigate or use them. Users describe the tutorial as unnecessary because it does not demonstrate the true purpose of the app, which is to use it as an alarm. The tutorial fails to act as a walkthrough and only allows users to fully grasp what features the app consists of. Overall, the tutorial does not benefit the users in a way that would give them a good understanding of how to fully use the app and its features because it lacks specific information. The app does provide access to documentation, but that must be opened outside of the app in the device's internet browser. Some of the participants in our usability tests, when being redirected out of the app to the external documentation, even went as far as saying that they did not want to go there and tried to go back to the app.




**Issue 2: Users found difficulty in finding the settings.**

The app has a variety of different filters, preferences, and options that can be adjusted. Our participants had trouble locating a place in the app where they could adjust settings. Participants tended to navigate to and search through the hamburger menu because they assumed that the settings menu will be listed there. This resulted in them having to either search up how to do it online or settle for default settings. This issue restricted many of our participants when it came the task of adjusting an alarm according to their daily lives or personal preferences.



**Issue 3: Users were overwhelmed and confused by the graphs and charts.**
When users navigated to the graphs page or charts page, they seemed to be instantly overwhelmed by the amount of details presented to them. The pages show detailed information about their sleep. However, it is in a cluttered manner, with several graphs and various metrics all on one screen. Accessing and managing the graphs and charts were confusing for the users as well because there were no instructions given beforehand. Overall, the option to view data from graphs and charts can be quite useful when trying to get a better understanding about one's sleep, but being presented with all that information at once can be overwhelming for the users to understand.

"The way that they're labeled and the different formats is a lot to process. I would have to funnel [a] notable chunk of time into this to feel comfortable processing this on the fly without putting too much thought into it."
*On reviewing the ease of the sleep charts*

**Issue 4: Some graphs seemed unnecessary.**
Users did not believe that having the amount of graphs and charts that the app has is necessary because the main purpose of the app is to wake them up in the most ideal time and way. However, there are users that did enjoy this feature, but only seemed to be interested in a few of them.

"The charts give me more detail than I need. I did not dislike them, but to me I found it unnecessary."
*Regarding the post-sleep graphs*

**Issue 5: Basic settings/features for an alarm clock is all over the place.**
When users tried to simply set up an alarm and adjust some additional basic functions, it proved to be more complicated than it should have been. Users believed that the process of doing these things should be organized in a way that is simpler and quicker to do. Everything was too separated, which resulted in having to do a lot of looking around and memorization. The main purpose of the app is to give users the best experience when setting up an alarm and getting the best quality sleep, which is affected negatively by having basic settings and features anywhere else other than in one consolidated place.

**Issue 6: Interface needs to be more simple and understandable.**

The app's interface caused a lot of confusion because of unclear hierarchies in presentation and placement of features and menus. Specific complaints from our participants consisted of things such as screens being too cluttered and menus needing reorganization. The overall structure and presentation of the UI needs to be refined and should only retain details for functions and features that need it.

**"I accidentally set several alarms and started sleep tracking repeatedly because I didn't know what I was doing..."**

*On user's confidence in changing the settings*

# 6. Suggested Redesigns

Our early findings on usability issues, as detailed in our previous section, were refined into the following redesign targets during our redesigning phase.

## 6.1 Tutorial

Based on our cognitive walkthrough and usability testing we found many problems that negatively affected the features that we wanted to redesign. We found out that the tutorial seemed to be the part of the application that needed the most attention regarding a redesign. The tutorial was not only “boring to get through”, but also lacked explanation about how to operate and navigate the app’s many features. Another main problem was that there would be uncertainty for some terms and buttons, which led to users having fears when making certain decisions because they were not confidence or even knowledgeable of what they meant or did. For example, we had an incident where two participants accidentally made several alarms while tapping the “ideal” button. This could have been avoided if the tutorial had done a better job of informing users about the concept of ideal sleep.

The original tutorial seemed like a slideshow of potential features that overloaded users with a broad range of topics. There was definitely a need to give the user more information, but not all at once. We decided to make this the core concept with our redesign, since the app has a multitude of features. We realized that while one user may love the specialty alarm clocks and lullabies, they may disregard other features like graphing or sleep tracking. We wanted the tutorials to be discoverable so that users would be able to pick and choose what they wanted to learn more about and what they were actually interested in.

The beginning process of our design created lots of potential ideas, such as a walkthrough for every time a user went into a new page. However, we did not like that it was too controlling, and also too time-consuming, especially if it went through every option when the user only wanted to do something simple. We also had an idea for video tutorials integrated into the slideshow, but were worried that it still would not hold the user’s attention, and might result in information overload. Ultimately, we decided to get rid of the opening tutorial entirely, and replace it with just small markers on each page that would bring up a broad tutorial for that page. Then we focused on the main key features that we believe would improve the tutorial vitally. These feature were to have discoverable tutorials that the user can view at their own pace, broad tutorials for larger topics are available on the main pages with a large button, small

tutorial or explanation on any setting that is new compared to your average default alarm clock, small looping animations that show the process to give the user a visual without boring them or asking them to commit to a video , and help icons that would disappear after the first viewing with an option in the settings that would allow them to be always on, always off, or to reset your progress in it.

From our favorite parts of the final design, we created a second-level sketch that was more polished and incorporated all of the chosen key features. We also noted that the color should be universal across the entire app, so that when users see the color, they would know what it meant. We ended up debated whether or not to remove the Broad Tutorial button after the first viewing, but decided to include it for future reference.

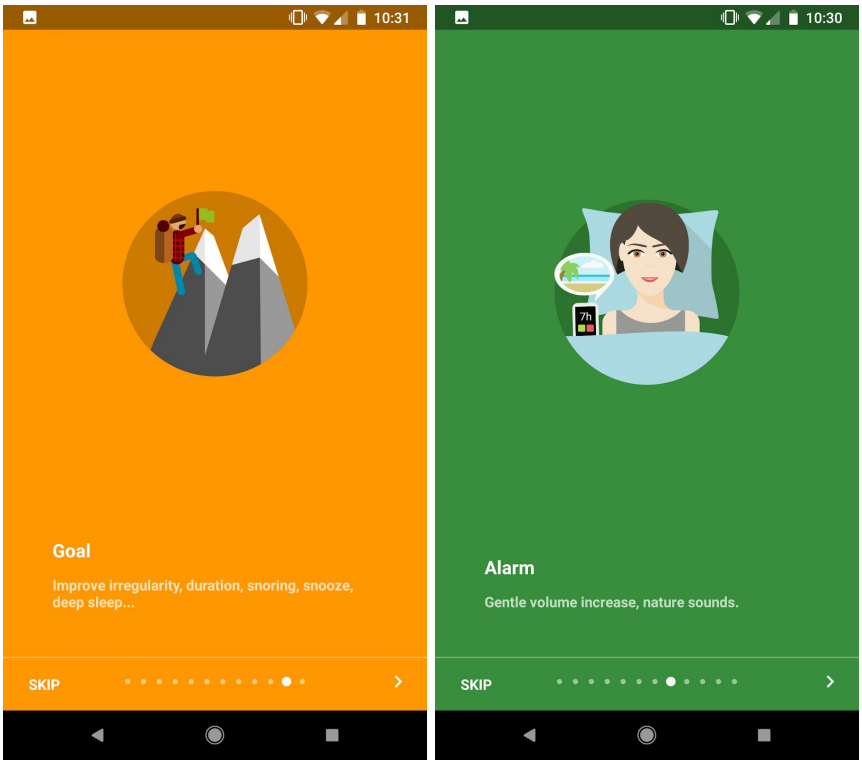



*Figure 6-1: Tutorial Original Design*


*Figure 6-2: Tutorial Redesign*

## 6.2 Hamburger Menu

The hamburger menu was another feature that we wanted to redesign, and one of the main things that we found out about it was that it had too many options. Users believed that it was too overwhelming to navigate through because there were too many things to look at. There were a lot of instances where users struggled to find certain features because some of them were too similar to each other or were difficult to find. This made us decide that the menu should focus on simplicity, since the menu is the core for navigation. We ended up deciding to prioritize the hamburger menu in a way where it would keep its purpose and also change in a way where it would improve usability as well. Our redesign focuses on presenting users with fewer options when first opening up the menu, which will not only make it easier for users to find what they are looking for, but also allow them to navigate through the app without much issues.

Our initial design focused on making the menu presentable and that users could see all of the options and understand what they do. Some of the ideas that we talked about consisted of having help buttons, useful headers, and customizable headers. Even though we did consider implementing these into our redesign, we did not think it would fix it from being too overwhelming. We also wanted to reduce short term memory load and let the user view a few options at a time. One issue that related to this problem was that the original hamburger menu had shortcuts that did a combined action of starting sleep tracking and setting an alarm. These buttons confused users who did not understand why there were buttons that started sleep tracking. As a result, we initially wanted to give users the ability to completely customize the menu and rename and create your own headers, but we decide that was unnecessary and too much work to put on the user. Ultimately, we decided to add a Favorites menu that the user could add or remove pages from, and also make their own combination sleep tracking actions for whatever suited them best.

Once we decided on the key elements that we wanted to include in our redesign, we ended up having a better initial screen, customization, guidance, and understandability. The Favorites menu also gave control and customization back to the user, and followed the golden rule of allowing users to use shortcuts, without bombarding new users with any confusion regarding the menu options. The high-fidelity mockup was finalized by mainly redesigning the layout and labeling the correct options. We decided to go for a darker shade for the layout because we believe that it would be more suited for users when viewing the app in a dark environment or setting. We also added more options to the customization page for the Favorites section because we thought that it would make it easier for users to find what they are looking for.

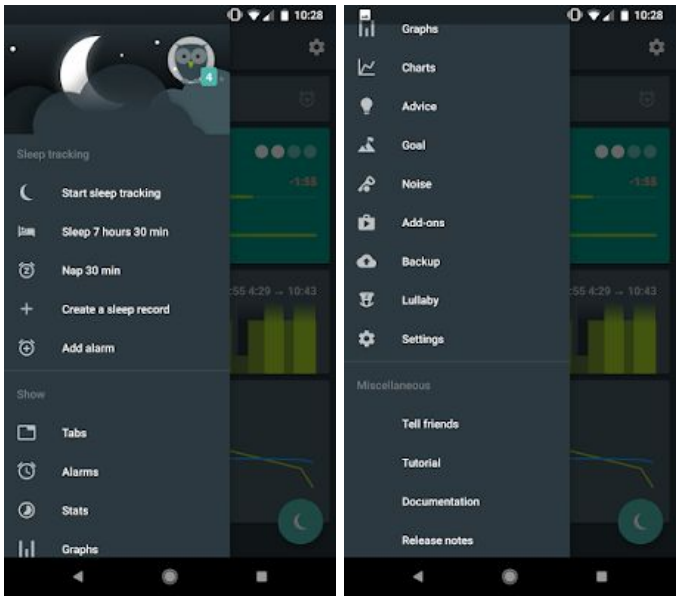



*Figure 6-3: Hamburger Menu Original Design*

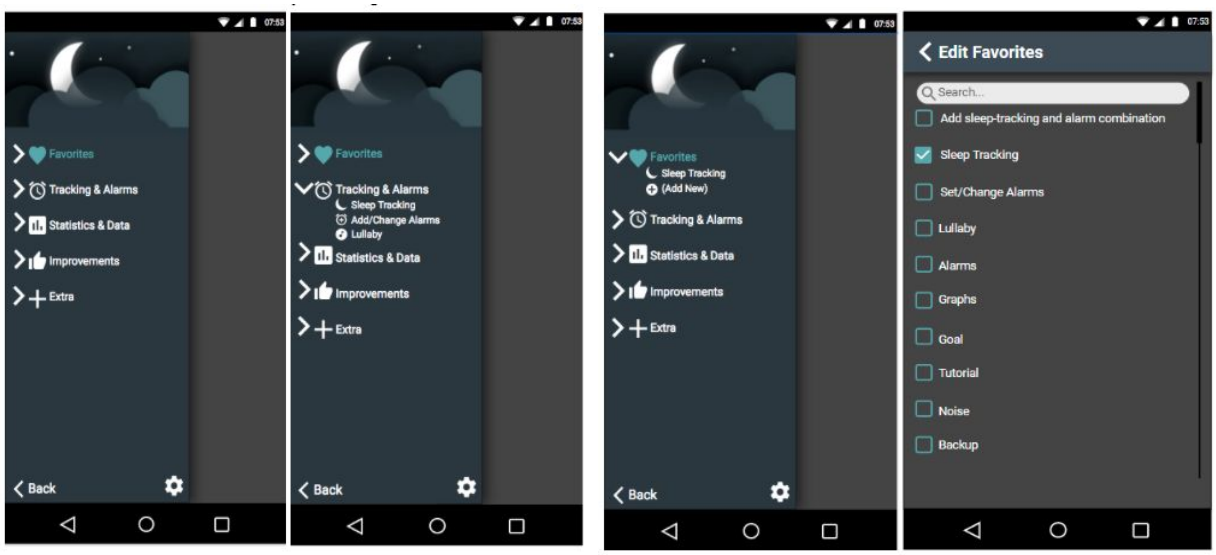



*Figure 6-4: Hamburger Menu Redesign*

## 6.3 Alarm Settings

The main issue with the current alarm default settings menu was that it was very difficult to find. The issues lied in there being two separate menus, one for general settings and another for the alarm default settings. For example, many of the participants spent a lot of time searching in the general menu for alarm settings, but never found them because they were in a completely different menu. The general menu can be found in the applications hamburger menu while the default alarm settings menu was off in the right corner of the application. Our redesign addressed this specific problem by not only combining the menus, but also adding in clear headings for each type of alarm setting, thus allowing the user to quickly find what they are looking for.

Our initial thoughts for our redesign ranged from combining the two menus into one and leaving them as-is, to having card-like options that would take them to a specific menu. We also discussed about how the user might react if the settings were all in the form of a drop-down menu, which would allow them to expand certain areas to see additional options instead of having the options listed out in a single row with toggle switches next to each other. Additionally, we had an idea of arranging each of the four major types of settings into tabs that would form a bar across the top of the screen. This would allow users to select from one of those to reveal additional settings. At the end, we decided to use a combination of all of the design ideas by taking the tabs idea and combining it with additional main subheading below that would reveal specific settings based on that heading.

After incorporating the tabs feature to our redesign, the next step was to focus on our final redesign that would pinpoint which elements would go where in the settings menu. Each of the four squares would represent a specific setting tab that would feature a unique icon that would allow the user to easily navigate to a specific setting. Once inside that tab, the user can then select a main headings by using the arrow on the left to reveal additional setting options. A search bar was also added, along with a question mark on the bottom left, which could be found throughout the application. Tapping on the question mark will bring them to a specific tutorial for that section based on what area of the application the user is in. We picked recognizable icons for the four main categories in the settings menu which consisted of alarms, lifestyle, sleep tracking, and extras. We also incorporated on and off switches for certain settings which will make it easier for users to see that the setting is set. Based upon our usability test we believe that this revision of the settings menu will make it easier for the user to find exactly what they are looking for in a shorter amount of time. By combining

both the general settings and the default alarm settings this will allow for better use of the application based on recognition rather than recall as they no longer have to search through two different settings menus.

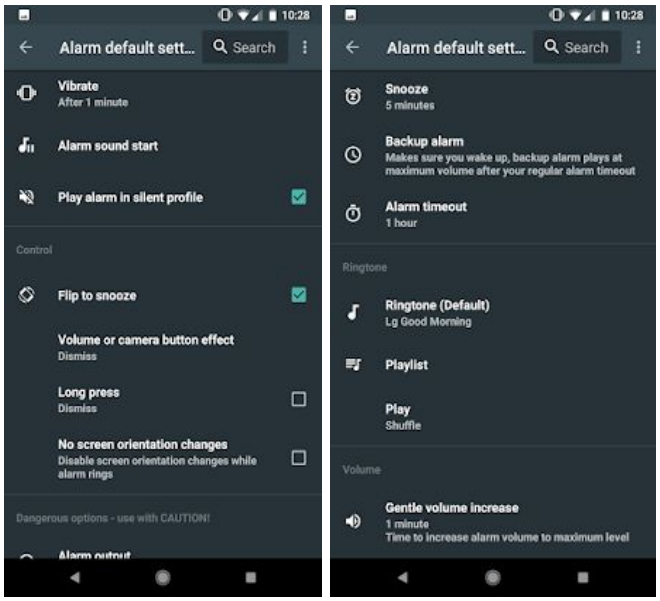



*Figure 6-5: Alarm Settings Original Design*

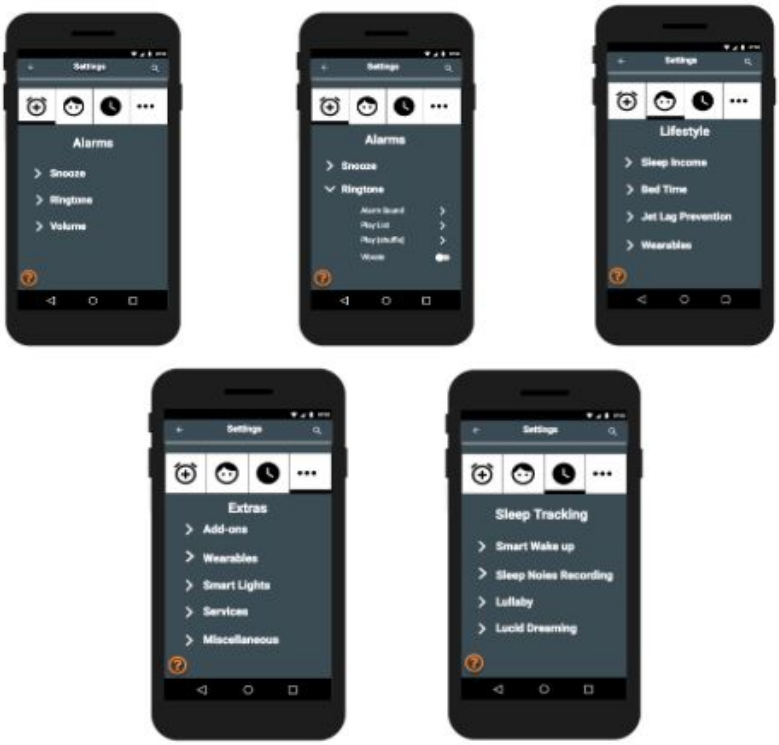



*Figure 6-6: Alarm Settings Redesign*

## 6.4 Sleep Tracking

One problem about our sleep tracking screen was that it was extremely cluttered and had a lot of unimportant and confusing information. Also, the tracking would start immediately after clicking “Sleep Tracking” from the hamburger menu, but the screen did not provide any feedback to the user to indicate that sleep tracking had started. Sleep tracking is a primary function of this application, so we chose this as a target for redesign because we thought a main feature should not have any ambiguity. The biggest issue that we identified was that the screen did not have any user feedback, which confused users to wonder what their phone was even doing.

After we discussed about what we needed to focus on and fix about the sleep tracking screen, we reviewed and realized that the app currently presents users with warnings and reminders that are not necessary. We chose a sketch that included the warnings and reminders, but in a pop-up window that appears before the user starts sleep tracking. The sketch also has a “Start tracking” button, which we decided was necessary to provide feedback to the user. We also decided that the main sleep tracking page should be minimal and include only the most relevant information. We chose the sketches that included information that we deemed the most important: current time, smart alarm window, time remaining, and a “stop tracking” button. We chose this revised sketch as our basis for our final design because it includes all ideal features such as separate pop-windows with reminders, a “Start tracking” button, a decluttered sleep tracking screen, a smart alarm window, a display for the remaining time before alarm would go off, and a swipe to stop alarm feature. We also wanted to change the background color of the screen to a darker shade because users were most likely in bed with the lights off when they start sleep tracking. We wanted the screen to be dark to not disturb the user, because a bright blue screen can negatively affect sleep.

With our final redesign, we changed some aspects based on feedback from the professor. The word “Reminder” seemed too urgent and did not necessarily make sense with the information that we were presenting. We replaced that with “Heads up:” instead to make it less format and because it just made more sense in context. We also decided to change the action of pausing the tracker to having the user need to interact with the screen with a the swipe-up motion. Previously it would stop sleep tracking but we changed it to open up an options window. The feedback we received indicated that the user might want to change features of their alarm but they should not have to end sleep tracking to do so. We included the setting a lullaby feature, an option to change their alarm settings, and the end sleep tracking button. When sliding the

options menu up, we wanted to make it obvious that sleep tracking was paused, so we wanted the background to be greyed out and include “Sleep tracking paused” over the time. We believed this would eliminate any ambiguity about the state of the sleep tracking.

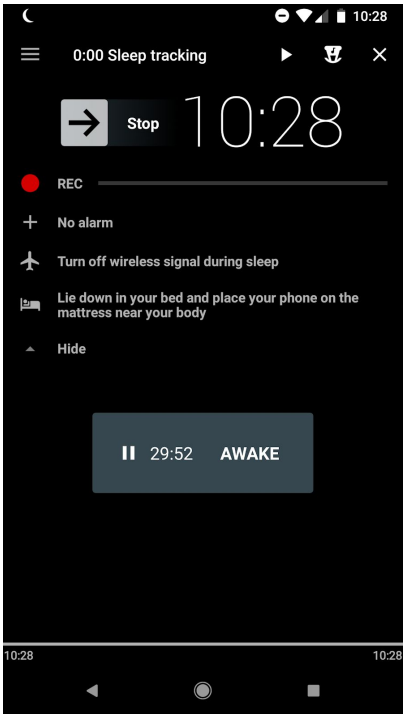



*Figure 6-7: Sleep Tracking Original Design*

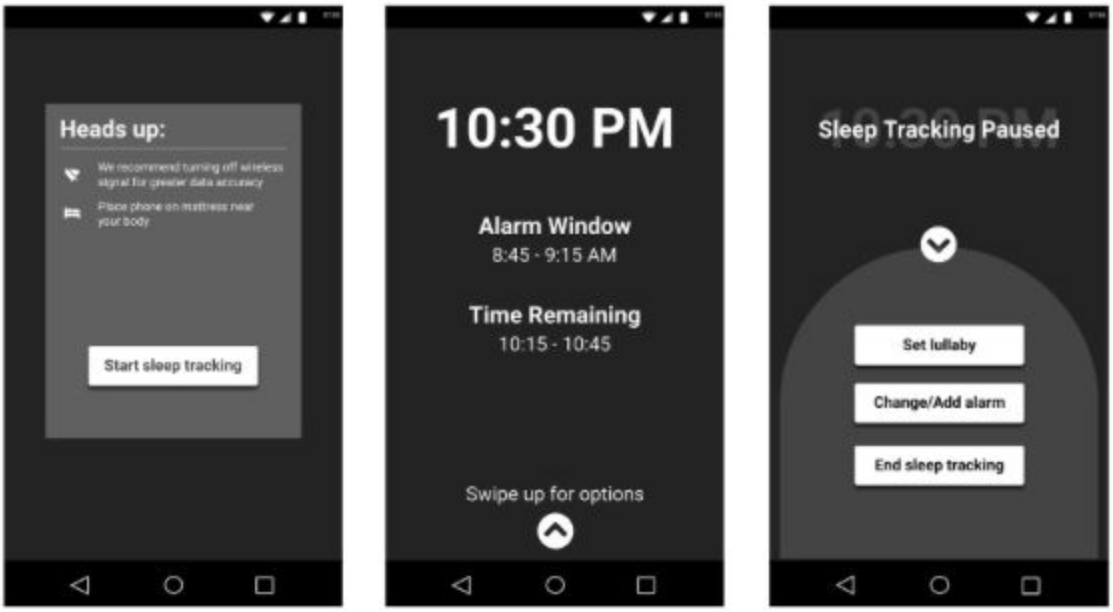



*Figure 6-8: Sleep Tracking Redesign*

## 6.5 Graphs

Our graphs page made a lot of users confused about the purpose of certain graphs and that the information presented to the user were cluttered and overwhelming. Many key pieces of information were ambiguous, and units of measurements and labels were missing. For example, one of the graphs displays the duration of time the user was asleep, but it was often confused as a specific time rather than a duration. The graphs also showed very little information about what the lines and bars meant and it felt all forced. Many users were also confused  about the stars, especially upon first impression. It wasn't clear what they were for, and that users could rate their sleep. Another issue was the ambiguity of the saw and wood icon that is supposed to symbolizing snoring.

After discussing about our redesign for this feature, we decided that for sleep rating, adding text that tells the user to rate their sleep would make it less ambiguous. We also considered and eventually ended up choosing to make rating sleep mandatory on its own separate screen that shows up before the main graph screen. Another big change was condensing the graphs and putting more detailed graphs on a separate expandable view. The ambiguous snoring icon was also replaced with different icons. The various changes that were made allowed us to recognize and prioritize fixing the the following issues: the ambiguity of key sleeping metrics at the top of the screen (recognition vs. recall), the ambiguity of the snoring icon, the disorganized and overwhelming presentation of the graphs (information overload), and overall UI cleanliness.

For our final design, we opted for key features such as descriptively and concisely labeling our key sleeping metrics at the top, and getting rid of unnecessary metrics to remove all ambiguity, forcing the user to rate their sleep before proceeding to the main graphs page. The rating that the user gives it is reflected in the top metrics section, simplifying the graphs into previews that can optionally be expanded into a more detailed view, adding a listen button to the snoring metric to remove confusion on how to listen to the snoring, and to let the user know in the first place that that is possible, and replacing the snoring icon with the more universally recognized icon of 3 Zs.

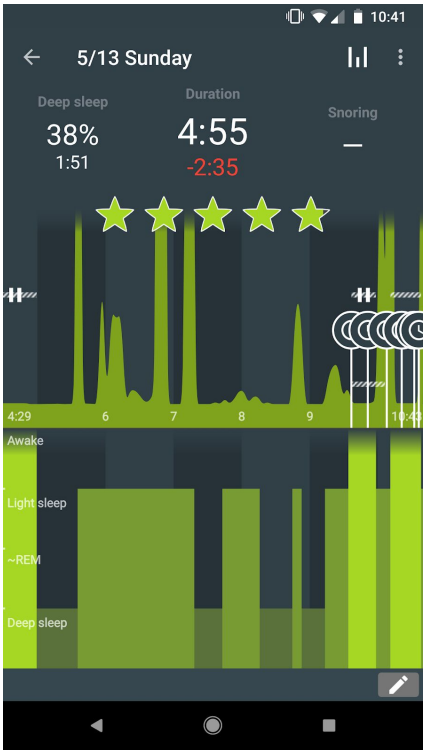



*Figure 6-9: Graphs Original Design*

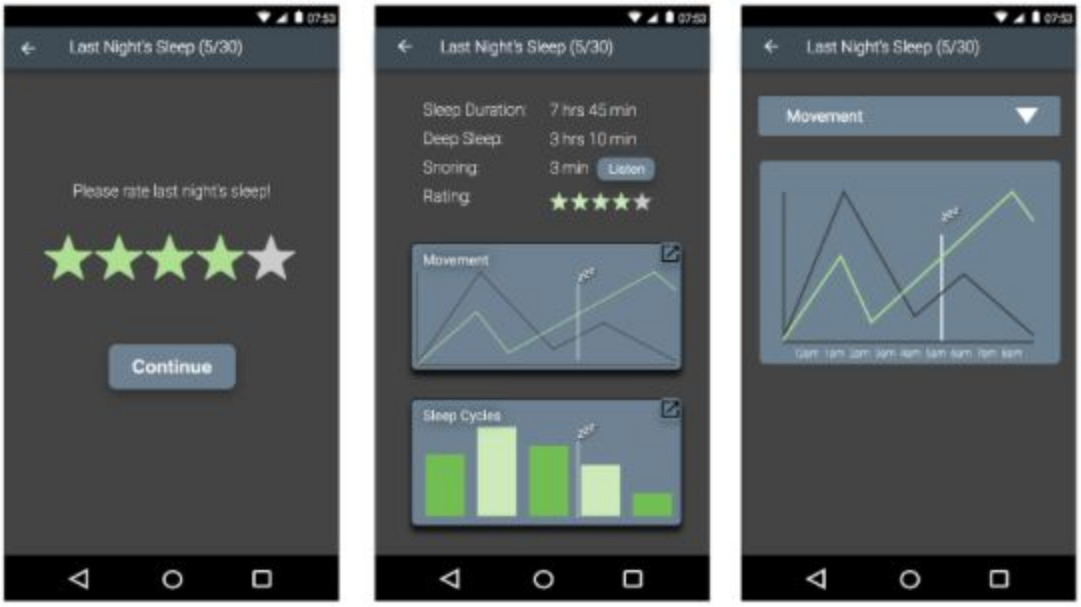



*Figure 6-10: Graphs Redesign*

# 7. Heuristic Evaluation of the Redesign

## 7.1 Tutorial

1. Visibility of system status

   The tutorial informs the user of their status of tutorial progression because orange dots appear near features that the user has not looked at the tutorial for but they disappear after the user has viewed the tutorial. An improvement that could be made is adding a “Do not show this again” so the user knows why the orange dot will not show up again after viewing the tutorial.

2. Match between system and the real world

   The app uses everyday, yet instructional language, and provides the user with images to avoiding any issues involving a language barrier. The tutorial order is logical, with users finding the tutorials in the order they would use the features. There is not much room for improvement in this redesign.

3. User control and freedom

   The tutorial to give users more freedom; they can access the tutorials for features they are interested in and are not forced to learn about features they don’t care about. Users also have the option to reset tutorials if it’s been dismissed and they want to see it again. It’s also very easy for the user to exit from a tutorial. There are a few things to be added to better adhere to this heuristic. Adding a “Do not show again” button would give the user the ability to dismiss the tutorial instead of the system doing it automatically. Also, allowing users to only reset one of the tutorials instead of resetting all of them.

4. Consistency and standards

   The tutorials are consistent throughout the application. The tutorials are accessible by clicking an orange question mark, which is a universal symbol and color to indicate “this is where to find help.” This redesign goes against some standard tutorials that shows the user everything the app has to offer, and instead focuses on giving the users more freedom.

5. Error prevention

   Incorporating this heuristic could use improvement. As mentioned in another heuristic, adding an option for users to explicitly opt-out of seeing a tutorial again, instead of it disappearing automatically after being viewed, would prevent error. Also, there is no easy way for the user to view a tutorial again if they dismiss it.

6. Recognition rather than recall

   The redesign adheres to this heuristic well. Users always have the option to see a short tutorial or documentation near each feature when they need it. The help icons are also recognizable and visible at all times, unless dismissed by the user.

7. Flexibility and efficiency of use

   The tutorial is very efficient for a new user because instead of having one tutorial page, they have access to small tutorials. This allows them to see only the information they want/need much faster than if there was one large documentation page. A useful addition, for the expert user, would be the ability to dismiss all tutorials.

8. Aesthetic and minimalist design

   Instead of showing the user all the information about the app at once, they can discover it through small orange question marks throughout the app. One thing to consider, though, is how the orange question marks might clutter different screen. If it did end up being too clutter that way, there would need to be a reduction in the amount of help questions marks, possibly on only main features on a page.

9. Help users recognize, diagnose, and recover from errors

   While the user cannot make any errors in the tutorial, the user could accidentally dismiss a tutorial. The redesign allows for the user to reset the tutorial if they do this. There are no error messages in this redesign because they are not necessary.

10. Help and documentation

    The tutorial is designed to assist the user needs it. The tutorials are easy to find because the applicable tutorial is located near the feature that it explains. The tutorial explain what each feature does and gives a step-by-step breakdown of how to use it. The documentation is now in the app in our redesign, instead of sending users to a webpage to view documentation. The tutorial focuses on breaking that documentation up into smaller, bite-sized pieces that were easier for the user to digest.

## 7.2 Hamburger Menu

1. Visibility of system status

   The app to gives immediate feedback to the user through drop down menus and carrot icons. Clicking a header brings down a dropdown menu. Each header has a carrot that changes from > to v to show they user which header the dropdown menu is associate with. There are no obvious improvements to me made for this heuristic.

2. Match between system and the real world

   The menus are written in natural, not system-oriented, language. The headers are organized in a logical order. Each header also has an icon, so the user understand what that header means, even without the text (e.g. an alarm clock icon next to “Alarms”). The header titles and icons are familiar to the user.

3. User control and freedom

   While the menu is in a logical order, there is now the ability to customize the options in the menu and change their position in the menu. If the user does not like their customization, they are able to reset it to the default order. A possible addition to our redesign would be an ‘undo’ and ‘redo’ button when the user is changing their menu. The user is already able to change the menu freely, but adding an undo and redo may save time.

4. Consistency and standards

   The hamburger menu is accessible from every page in the app and it remains consistent. The color scheme and layout remain consistent no matter what page the user is on. Language in the menu is standard and users will understand what each menu item means, e.g “Alarms” will take them to a page to view, set, or change their alarms. The hamburger menu icon (☰) is standard across multiple platforms. The dropdown menu arrows (> & v) are also standard across multiple platforms. There are no obvious improvements to be added to this redesign.

5. Error prevention

   There is some error prevention in the menu, but it’s focused more on recovering from error. The language in the menu is clear, which should prevent users from navigating to the wrong page. When customizing the menu, the user must ‘save’ before the changes go into effect to prevent them from accidentally changing their menu. It is unclear if this section of the app require error messages; users did not make mistakes in the menu that would require any error messages.

6. Recognition rather than recall

   The redesign allows users to create shortcuts so they don't have to remember where settings/features are located. The headers in the menu are clear and are preceded by a small icon that is easily recognizable for the user. One issue with this heuristic is that the drop-down headers in the menu contain submenus, and the user would have to remember which setting is in which menu. The headers are as clear as possible, but it could potentially be an issue.

7. Flexibility and efficiency of use

   The hamburger menu simple and organized in a logical way, making it easy to use for the novice user. Expert users can customize the menu increase efficiency of using the application. The expert user can adjust the system to easily access their frequently-used features.

8. Aesthetic and minimalist design

   The original menu was cluttered with a bunch of different titles. The redesign involved combining similar features and organizing them into five different broad categories. Some of original menu items were very specific and didn't need to appear alone on the menu because they were distracting from the more used/more important features in the menu. Putting them into categories created a cleaner interface while still making it easy for users to access the features they desire. It limits information overload and is aesthetically pleasing.

9. Help users recognize, diagnose, and recover from errors

   There is a stronger emphasis on error prevention than error recovering and diagnosis. It is unlikely that a user would encounter an error in the menu, so we did not included ways to recover from error. If the user changes the menu order and doesn't like it anymore, they can reset it to the default order. However, it's possible that the user could reset to default on accident. A suggestion to this would be including a redo and undo button. Another possible solution would be allowing the user to save the customized menu order as a preset and, if they change it, they can revert back to the saved preset.

10. Help and documentation

    Tutorial help icons are present near option in the menu so the user can quickly access documentation on a certain feature.

## 7.3 Alarm Settings

1. Visibility of system status

   The menu tab that the user is on is highlighted, so the users know where they are in the app. A possible option to look into in another redesign would be to provide more feedback to the user when they are changing their settings. A feature we included from the original application is, when creating an alarm, the system immediately provides a notice the user that their alarm is set for X amount of time from now.

2. Match between system and the real world

   The icons and symbols in the redesign relate to real-world conventions. For example, an alarm clock icon to represent the “Alarms” section of the menu. The language in the menu is natural, in a logical order, and are familiar to the user.

3. User control and freedom

   The menu has a back button so users can easily return to the previous screen. All options can be changed and the user has the freedom to change them how they wish in any order they wish. The redesign also includes redo and undo buttons.

4. Consistency and standards

   The language in the settings is consistent throughout the app and also standard in other alarm and sleep tracking apps. The navigation bar at the top is standard in other apps and websites. The icons also remain consistent throughout the app and are standard. The redesign merged two menus into one. From the usability tests, users got confused because on some pages the gear icon would take them to one menu, but clicking the gear icon on a different page would take them to a different menu.

5. Error prevention

   During the usability testing, users were confused if they were changing the master alarm settings of changing an individual alarm’s settings. To prevent this problem the settings page is clearly labeled “DEFAULT.” A suggestion for future redesign would be to ask for more confirmation from the user when changing certain important settings (e.g. “You are about to disable snooze. Proceed?”), but not for insignificant features, so the design is still minimal and non-intrusive.

6. Recognition rather than recall

   The settings page uses icons that are familiar to the user, which allows the user to recognize the menu instead of having to remember what each menu tab does. The menu also includes examples to show the user what to do, if they need the help, instead of making them remember how to do it.

7. Flexibility and efficiency of use

   The settings menu can be accessed from any page via a gear icon. The settings design was more tailored to the novice user. The settings page also includes a search bar, so an expert user can find what they are looking for without having to scroll through all the settings options. There is room for improvement to cater more to the expert user.

8. Aesthetic and minimalist design

   The original settings page is cluttered and nothing appears in a logical order. The redesign focuses heavily on this heuristic. The settings options are in four main categories, each represented by a tab with a related icon instead of text. This makes the screen less cluttered and prevents information overload, especially for novice users. Sub-features are tucked into smaller submenus to reduce clutter, but this could cause an issue with users not being able to find what they are looking for. Then, users would have the same problem as they did with the original app design, but for different reasons.

9. Help users recognize, diagnose, and recover from errors

   The redesign allows the user to restore the settings to default, so recovery from error is all or nothing. There are no error messages, so if the user were to reach an error state, they would not know why or how to recover from it. Also, the settings options automatically save when changed, which could prove to be frustrating. Possible solutions include: putting in a ‘save’ button instead of automatically saving any changes, implementing error messages if, for example, the changes don’t save, and include ‘undo’ and ‘redo’ buttons to fix the “all or nothing” undo.

10. Help and documentation

    Similar to the other redesign targets, the app provides ample help and documentation for each feature. They are presented to the user in the form of small, unintrusive icons and bite-sized tutorials.

## 7.4 Sleep Tracking

1. Visibility of system status

   In usability testing, participants ran into an issue of not knowing if sleep tracking had started. Now, the user is presented with a pop-up message with a “Start sleep tracking” button. The sleep tracking screen clearly displays to the user that it is tracking sleep, that an alarm is set, and the time remaining before the alarm. When opening up the menu on the sleep tracking screen, there is a bold status message indicating that sleep tracking is paused.

2. Match between system and the real world

   The redesign includes as little text as possible, but the text it does have is in natural language and in a natural, logical order. The text on the page, “current time”, ‘alarm window”, and “time remaining” are all familiar concepts. The display also mimics how time would be displayed on a smartphone.

3. User control and freedom

   Users can now pause sleep tracking and make changes to their alarm during sleep tracking. Previously, if the user needed to change their alarm settings, they had to stop sleep tracking and then restart it. The redesign allows users to fix their mistakes while minimizing the amount of clicks. Also, if they accidentally enter sleep tracking, they can easily end it from the sleep tracking menu. It does not account for the user accidentally stopping sleep tracking. A solution to this would be having a dialogue box asking the user if they are sure they want to stop sleep tracking. After sleep tracking ends, the users are taken to a graph page. That page is out of scope for this target, but that page should include a “back” arrow so the user can go back to the sleep tracking screen and resume tracking.

4. Consistency and standards

   The screen background and color scheme are dark, which is consistent with applications that users use at night time to reduce strain on their eyes (night mode). The time formats are standard with other alarm and sleeping tracking applications. The language and terms are consistent with other sleep tracking applications. The menu is a swipe up, indicated by an up arrow when untouched and a down arrow after is has been swiped up. There are many formats of menu that we could have chosen, so, depending on how users would respond to this redesign, another format might be more suitable or intuitive for the situation.

5. Error prevention

   The pop-up status window prior to sleep tracking tells the user if they don't have an alarm set, which should reduce the possibility of the user forgetting to set an alarm before they start sleep tracking. The users' freedom is limited by giving them less options to choose from to prevent them from making errors. An improvement could be to give the user a little more control while also maintaining a decent amount of error prevention.

6. Recognition rather than recall

   The swipe up action for the menu is standard for most touchscreen applications. Everything on the screen is clearly labeled so the user knows what everything means without having to remember.

7. Flexibility and efficiency of use

   The design is very simple, so the novice and expert user will have similar experiences. The page contains a few, frequently-used features, but the user is not able to customize this screen in any way. A solution to look into would be allowing the user to customize this screen, but not in a way that allows them to clutter it or increase their chance of error.

8. Aesthetic and minimalist design

   One of the main goals of this redesign was simplicity. The original screen had way too much information that either wasn't important or wasn't labeled. Everything that users thought were unnecessary in usability testing were taken out. The main screen only includes current time, alarm time, and time remaining. Other features are in a swipe-up menu to add more functionality without cluttering the screen.

9. Help users recognize, diagnose, and recover from errors

   The pop-up notifier that appears before sleep tracking starts alerts the user if they don't have an alarm set. The alert is in natural language and tells the user exactly what they need to do. If the user accidentally swipes the menu up, they'll see a message that sleep tracking is paused. The application tells the user in natural language that they need to swipe down to close the menu to resume sleep tracking. However, we did not implement anything to help the user recover if they accidentally end sleep tracking. An undo or back feature would be useful here.

10. Help and documentation

    Similar to the other redesign targets, the app provides ample help and documentation for each feature. They are presented to the user in the form of small, unintrusive icons and bite-sized tutorials.

## 7.5 Graphs

1. Visibility of system status

   The user is shown the graph page immediately after sleep tracking, so they are given immediate feedback about their quality of sleep. Graphs are clearly labeled so the user knows what each graph represents and what the data means. When opening the graph in a new window, it has a clear header, clearly labeled x-axis and y-axis, and clear labels on other parts of the data depending on the type of graph.

2. Match between system and the real world

   The graphs are standard bar and line graphs that the average user should be familiar with. The graphs use natural language. The data is presented in a logical order, from least detailed to most detailed. It also incorporates a 5-star rating system, which is a familiar concept to most users.

3. User control and freedom

   The user can exit the graphs page and the pop-out graph windows at any time. This heuristic could use improvement. The page does not include any redo or undo features. The user is able to edit their star-rating at any time, but they are forced to rate before they can see their sleep data. The logic behind this is that users seeing their data first might influence their rating. However, this might be taking away too much power away from the user. Instead, they should first be asked to rate their sleep, but provide the user with a ‘skip to data’ button in case the are not interested in the rating feature. This increase the usage of the rating feature but also makes the user feel more in control.

4. Consistency and standards

   The wording in this redesign is consistent with the wording throughout the app to avoid any ambiguity. All the graphs are now consistent (header, x-axis, y-axis, etc), making it easier for the user to understand the data. It includes a rating system, which is indicated by the standard 5 stars. The graphs include a  , which is standard to mean “click this to expand in a new window.” It is also common for a pop-out window to indicate that the user is going to see more details or a bigger picture of that object. This redesign is consistent and standard and will not confuse the user.

5. Error prevention

   The user can always go back to the graph page for any day if they accidentally close it. Star ratings are important in graphing the user's sleep quality, so the design makes rating mandatory so the user won't forget. If the user tries to delete that sleep tracking log, they are promoted with an 'Are you sure?' dialog box. Clear labeling prevents users from clicking/deleting the wrong thing.

6. Recognition rather than recall

   Each graph is labeled, so the user does not have to remember what each graph means. Each graph has a legend to avoid having to recall what each icon represents. When the user opens a graph in the pop-up window, the graph contains all the information the user needs, so they do not have to navigate back to the main page to retrieve any information.

7. Flexibility and efficiency of use

   The experience is the same for the novice and expert user; there is no ability to had shortcuts. The user can either quickly scan over a basic view of each graph or they can expand for a more detailed view, depending on their preference. This target could be more friendly to the expert user. For example, having an option for customization, like being able to choose what information appears and in what order.

8. Aesthetic and minimalist design

   Each graph only shows one aspect of the user's sleep data so the graphs do not become cluttered with an excessive amount of labels, data points, etc. There is no hashtag feature because it was an overlooked feature and was cluttering the screen. Instead of having the detailed graphs on the main graphs page, the user can open up a detailed view ( ) in pop-up window.

9. Help users recognize, diagnose, and recover from errors

   It is uncommon for a user to make a mistake on this page. A possible issue is a user accidentally rating their sleep 5 stars when they only wanted to give it 3 stars. The app doesn't provide any message or prompt tell the user about their mistake. An improvement could be presenting the user with a message that lists everything they changed, and then they must confirm. Another would be an undo/redo, since there is no recovery option if the user deletes their sleep data.

10. Help and documentation

    Similar to the other redesign targets, the app provides ample help and documentation for each feature. For graphs, the tutorial also explains what the sleep data and graphs mean if the user is confused (e.g. "What is REM sleep?")

## 8. Conclusion

We thank you for your time and hope that this report was enlightening. This was an unbiased evaluation of Sleep as Android and the only goal was to improve the technology you have created. We are aware that the user base we gathered is limited compared to the wide variety of people that can use Sleep as Android, but we believe they represent a good sample. There are many different kinds of people that can use Sleep as Android for a number of its features. That's why it's important that the features are accessible and easy to understand, especially to new users. Improvements for the issues mentioned above would lower abandonment rates of the app due to user confusion and frustration. Lowering the early abandonment rate would lead to higher adoption of the app, which is likely to increase of PRO version sales. We believe that mistakes with alarms can be hugely punishing to the user, more so than other types of mistakes, and users are hesitant to try new apps and systems because of that. Our users expressed fear of making a mistake when it came to using your app. Our redesign gives the power back to the user and takes away that fear, so both you and them can rest easy.

# 9. Appendices

## 9.1 Individual Heuristic Evaluations

**1. David - Tutorial**

- ✓ Visibility of system status
    - The application does keep the user informed as to what tutorials they have completed and provides feedback when the alarm is set in the form of both a digital and analog clock.
- ✓ Match between system and the real world
    - The app uses everyday language to describe the different features for the most part in the tutorial while providing an explanation of features the user may be unfamiliar with.
- ✓ User control and freedom
    - The tutorial now supports this as it no longer forces the user to complete the entire tutorial if they don't want to, but instead gives them the option to pick and choose.
- ✓ Consistency and standards
    - The tutorial is consistent with the rest of the app in many of its features including the orange question mark that is now throughout the application.
- ✓ Error prevention
    - The user could potentially make an error if they set the alarm to the wrong time since the app doesn't provide any restrictions on what time an alarm can be set, and they may accidently remove a tutorial feature that they didn't
- ✓ Recognition rather than recall
    - The user now has the option to view shorter documentation on just about every part of the application making it much easier for the user to quickly access it should they need to.
- ✓ Flexibility and efficiency of use
    - Every user will have the same experience to skip around the tutorial but there is no shortcuts that an expert would use other than skipping the tutorial altogether.
- ✓ Aesthetic and minimalist design
    - This was a main feature of the tutorial redesign in that all of the unnecessary information was taken out of the tutorial so that the user only sees the tutorials that they want to.
- ✓ Help users recognize, diagnose, and recover from errors
    - There is no error messages in the tutorial section as they can always revisit the tutorial at anytime.

- ✓ Help and documentation
    - Any time the user clicks on the orange question mark this will take them right to a condensed version of the documentation, giving them brief description instead of taking them to the full documentation like before.

**2. David - Hamburger Menu**

- ✓ Visibility of system status
    - The app provided immediate feedback to the user when clicking on the the dropdown arrows to show additional options or features.
- ✓ Match between system and the real world
    - The menu options are straightforward and simple to understand to even the novice user.
- ✓ User control and freedom
    - The menu now offers the user ultimate control and freedom over how the menu can look as the new favorites option has been added to it allowing the user to create their own menu.
- ✓ Consistency and standards
    - The same wording for features and settings is used throughout the application making it easy for the user to navigate through this menu and all the others.
- ✓ Error prevention
    - The new hamburger menu doesn't really have the need for error messages because the menu can always be changed back to a default setting.
- ✓ Recognition rather than recall
    - The favorites portion of the menu allows the user to create shortcuts, so they don't have to remember where a certain setting or feature can be found in the app.
- ✓ Flexibility and efficiency of use
    - They hamburger menu provides the same type of usage for both the novice and the expert user, other than the new favorites menu that a novice user may not use at first.
- ✓ Aesthetic and minimalist design
    - The hamburger menu was redesigned with this in mind as it now contains subheading that only when clicked on reveal additional options so as to keep a minimalist design.
- ✓ Help users recognize, diagnose, and recover from errors
    - The hamburger menu doesn't offer a way to recover from errors other than restoring the menu to its default setting.
- ✓ Help and documentation
    - Help and documentation of features can easily be found from this menu.

**3. David - Settings**

- ✓ Visibility of system status
    - The status of each menu is highlighted at the bottom of each of the four icons when the user clicks on them letting them know what part of the settings they are on.
- ✓ Match between system and the real world
    - The icons provide a familiar visual for user such as the alarm clock and the person which reflects the lifestyle settings.
- ✓ User control and freedom
    - The user can easily escape from the settings menu by pressing the back button on the top left corner of the screen while clicking on any of the arrows next to a heading will reveal more features.
- ✓ Consistency and standards
    - The names of each of the setting are consistent within the app itself as well as within industry standards of other sleep applications.
- ✓ Error prevention
    - There are no error prevention techniques built into the settings feature so the user could turn a feature on or off by mistake.
- ✓ Recognition rather than recall
    - The icons allow the user to recognize what settings fall into what category allowing them to remember where a certain set of features are instead of searching through the whole application.
- ✓ Flexibility and efficiency of use
    - Both the expert user and the novice user will have the same experience using the setting features of this application as it does not provide any shortcuts.
- ✓ Aesthetic and minimalist design
    - The settings menu has been redesigned with this in mind as it provides only 4 main icons with only several main headings below each one. It's not until the user clicks on the arrow of a heading that they will see additional information.
- ✓ Help users recognize, diagnose, and recover from errors
    - The settings menu doesn't offer a way for a user to recover from an error other than restoring all setting to a default state.
- ✓ Help and documentation
    - The app provides ample documentation for each of its settings and features.

**4. David - Sleep Tracking**

- ✓ Visibility of system status
    - The sleep tracking clearly indicates when the application is tracking a user's sleep, when the alarm is set, and time remaining.
- ✓ Match between system and the real world
    - The wording is minimal, and the time is easy to read on the display as it mimics the time on an everyday cell phone.
- ✓ User control and freedom
    - Sleep tracking offer the user the ability to pause, end, and make changes as need be giving them the freedom they need.
- ✓ Consistency and standards
    - The digits and small amounts of text is consistent with the everyday cell phone.
- ✓ Error prevention
    - The user is notified if sleep tracking is paused and if the alarm is set or not to prevent them from failing to wake up due to an alarm not being set.
- ✓ Recognition rather than recall
    - The swipe up for options is a popular motion for majority of all major smartphone carriers thus giving the user functionality that they are already used to.
- ✓ Flexibility and efficiency of use
    - Both the novice and the expert user will have the same experience in using this part of the app as the interaction are minimal with no real shortcuts.
- ✓ Aesthetic and minimalist design
    - Sleep tracking was designed with a minimalist view, only showing the user the most pertinent information.
- ✓ Help users recognize, diagnose, and recover from errors
    - The app shows the user when sleep tracking is paused in a clear fashion so as not to have them wondering if the phone is still tracking their sleep or not.
- ✓ Help and documentation
    - Proper help and documentation is also readily available for the sleep tracking feature of the app.

**5. David - Graphs**

- ✓ Visibility of system status
  - Each graph provides a descriptive title which lets the user know what they are looking at.
- ✓ Match between system and the real world
  - The graphs shown represent a real-world graph that should be self-explanatory to the average user, along with a familiar star rating that can be found in many other contexts.
- ✓ User control and freedom
  - The graphs section does offer a back button that the user can press to get out of the graphs section along with an arrow button in the top of each graph to expand it to full screen.
- ✓ Consistency and standards
  - The graphs provide similar wording to the rest of the app allowing the user to make the connection between the graph and the rest of the app.
- ✓ Error prevention
  - The user can always go back to the graph menu at any time thus minimizing any errors the user may come across.
- ✓ Recognition rather than recall
  - Each graph is labeled and offers information in a similar fashion as the user does not have to know how to read multiple different types of graphs.
- ✓ Flexibility and efficiency of use
  - The interaction with the graphs section of the app will be the same for the expert user down to the novice user with no shortcuts available.
- ✓ Aesthetic and minimalist design
  - Each graph only shows one aspect of a person's sleep thus aiding to the minimalist design of the app while also keeping out any unnecessary distractions.
- ✓ Help users recognize, diagnose, and recover from errors
  - Reading the graphs won't cause the user to experience any type of error. However, entering in the incorrect number of stars could affect their sleep rating as once this is entered there is no way to go back and change it.
- ✓ Help and documentation
  - The app provides thorough documentation on how to read the graphs and how to interpret them to get the best night's sleep.

**1. Nessa - Tutorial**

- ✓ Visibility of system status
  - The orange dots will tell the user if they have already completed a tutorial while reminding them of yet unexplored areas .
- ✓ Match between system and the real world
  - The animations show visually the real-world steps it takes to press each button, making the instructions match the real world concept without having a language barrier.
- ✓ User control and freedom
  - The user is never forced to sit through any tutorial or instruction, the help is only there when necessary. They are also able to leave and exit at any time, and repeating the tutorials is an option in the menu.
- ✓ Consistency and standards
  - Designating a universal ‘help’ color will help users to know no matter what page they’re on, if they press the orange icon, it will help them learn more or explain what they need to do.
- ✓ Error prevention
  - There is a slight concern of users clicking the tutorial dot, and pressing OK before they understand, making it a slight hassle to see it again. A potential solution would be to set each tutorial bubble to disappear only when you confirm a ‘Do not show again’ checkbox.
- ✓ Recognition rather than recall
  - The entire premise of this redesign is focused on this heuristic -- our ‘just-in-time’ method of
- ✓ Flexibility and efficiency of use
  - Hopefully that this will take overall less time for the user to find the help they need rather than opening the website for documentation, then navigating to the relevant part.
- ✓ Aesthetic and minimalist design
  - We wanted the orange dot to be just big enough to tap, without obscuring or cluttering the interface. It might be slightly overwhelming at first see them all at once, but as the user starts using things, it should get much more manageable.
- ✓ Help users recognize, diagnose, and recover from errors
  - Explaining that status of the current setting will help users understand and recognize the decisions they are about to make, which will lessen mistakes.
- ✓ Help and documentation
  - The entire premise of this redesign is focused on this heuristic -- a better understanding of what the application does and how to do it brings the documentation IN to the app to make it easier to consume and more accessible.

**2. Nessa - Hamburger Menu**

- ✓ Visibility of system status
  - The carrot icons and indentation help to signify which category you're in and what's under what each header.
- ✓ Match between system and the real world
  - Organized smartly so that each menu item makes logical sense
- ✓ User control and freedom
  - The favorites menu allows users to set their commonly used categories above the rest
- ✓ Consistency and standards
  - This menu will be available regardless of what page you're on which will make it easy to navigate back and forth around the application.
- ✓ Error prevention
  - All menu options can be added to and removed from favorites easily, making it hard to 'mess up'.
- ✓ Recognition rather than recall
  - Small icons and clear header names will help people figure out what each menu does
- ✓ Flexibility and efficiency of use
  - The favorites menu and ability to set up combo actions lends for quicker efficient use.
- ✓ Aesthetic and minimalist design
  - Large headers prevent user information overload and aesthetically looks much less cluttered
- ✓ Help users recognize, diagnose, and recover from errors
  - The back button helps users to return from any mistake or section they did not mean to enter. May be confusing that that would return you to the Dashboard.
- ✓ Help and documentation
  - As per our tutorial redesign, on first use these would all have the universal tutorial help icon to get to the documentation quickly.

**3. Nessa - Settings**

- ✓ Visibility of system status
  - The large tab bar on top tells the user exactly what location they're in. Adding in toggle switches helps you visually see which menu options are on or not.
- ✓ Match between system and the real world
  - Uses icons and symbols that relate to the real world system.
- ✓ User control and freedom
  - Nearly all options will be available to change, and there is no order that the user has to do them in.
- ✓ Consistency and standards
  - The same font, organization method, and toggle switches will be available regardless of which section you're in. Merging the two menus into one helps so there is one place the user goes to change ALL settings.
- ✓ Error prevention
  - It being very clear that you are changing DEFAULT settings will prevent users from confusing it with the singular alarm settings.
- ✓ Recognition rather than recall
  - Current status and examples will show users what settings do rather than asking them to memorize previous settings.
- ✓ Flexibility and efficiency of use
  - Settings menu can be accessed from any page via the hamburger menu.
- ✓ Aesthetic and minimalist design
  - By splitting the menu into 4 tabs and using large headers, we prevent user overload and aesthetically looks much less cluttered
- ✖ Help users recognize, diagnose, and recover from errors
  - Automatically saves options as they are changed, so if user accidentally changes something, they will not be able to leave the menu without saving. Potentially frustrating.
- ✓ Help and documentation
  - As per our tutorial redesign, on first use these would all have the universal tutorial help icon to get to the documentation quickly.

**4. Nessa - Sleep Tracking**

- ✓ Visibility of system status
  - Clear status message at beginning informs you of sleep tracking starting and when it is paused
- ✓ Match between system and the real world
  - Keeps track of current time and alarm time, like an alarm clock would
- ✖ User control and freedom
  - We prevent the user from exploring other sections of the app while in this mode, to prevent accidental leaving of sleep tracking on.
- ✓ Consistency and standards
  - A completely black screen is the sleep tracking page will be easier on their eyes.
- ✓ Error prevention
  - By locking the user into the sleep tracking and limiting their control, we prevent a lot of mistakes and confusing about whether or not the app is in sleep tracking.
- ✓ Recognition rather than recall
  - The heads up menu explains why it makes it recommendations, so you can make the decision to follow them
- ✓ Flexibility and efficiency of use
  - It should be very simple to enter and exit sleep tracking, so the user feels free to leave it to change things, but that it is a clear notification of leaving and entering.
- ✓ Aesthetic and minimalist design
  - The sleep tracking menu will ONLY have the very most important data on it, because it's really not to be looked at unless you're checking time or setting up a lullaby, etc.
- ✓ Help users recognize, diagnose, and recover from errors
  - Warns users if they don't have an alarm setup
- ✓ Help and documentation
  - As per our tutorial redesign, on first use these would all have the universal tutorial help icon to get to the documentation quickly. Additionally reminders would be clearly explained every time so user knows why we recommend certain options.

**5. Nessa - Graphs Page**

- ✓ Visibility of system status
  - Clear labelling to explain
- ✓ Match between system and the real world
  - The x axis will now be better labeled so it'll be easier to read and understand the time at any given point on the chart.
- ✓ User control and freedom
  - Though we ask that the user rates the night's sleep before seeing the data, they are able to tap and change it at any time, so if after seeing the data they want to adjust, they are able to.
- ✓ Consistency and standards
  - Our design is much cleaner and would adjust easily if the user did not have snore recording data. Also consistent graphing and charting will make the data easier to understand (labeled x and y axises).
- ✓ Error prevention
  - By forcing the user to rate last night's sleep before getting to see the data, we are much more likely to get their star ratings, which is necessary for a lot of the long-term graphing and charting options.
- ✓ Recognition rather than recall
  - A legend that explains icons such as the snoring icon, sunrise icon, and other markers will help the user better understand the graphs and not rely on memory.
- ✓ Flexibility and efficiency of use
  - Being able to 'pop-out' a graph will help it to be seen better, but being able to switch between all the graphs without having to go back and pop out another individual one saves the user time.
- ✓ Aesthetic and minimalist design
  - Removing the mostly unused hashtag menu greatly declutters the screen. For users that did use this feature, a small pencil icon could be added in at the bottom of the screen to attach their hashtags.
- ✓ Help users recognize, diagnose, and recover from errors
  - The clear labeling on top tells the user exactly what day they are on to prevent confusion.
- ✓ Help and documentation
  - As per our tutorial redesign, on first use these would all have the universal tutorial help icon to get to the documentation quickly.

**1. Lauren - Tutorial**

- ✓ Visibility of system status:
  - The tutorial provides feedback to the user by indicating which features they have watched the tutorial for and which features they have not. This is indicated by orange dots near each unexplored feature.
- ✓ Match between system and the real world:
  - It provides a GIF of how to use a feature, information appears in a natural order, does not use system-oriented terms.
- ✓ User control and freedom:
  - The user is able to view tutorials on each feature, but is not forced into a tutorial that goes overall features. They can watch the tutorials and leave the tutorials at anytime. There is a clear X to exit the tutorial.
- ✓ Consistency and standards:
  - Each feature has an orange ? that leads them to the tutorial for that feature. A question mark in a circle and the color orange are standard to indicate “I need help.”
- ✓ Error prevention:
  - Each feature tutorial has a “Do not show again” box that the user must check to no longer see that tutorial again. This prevents users from accidentally clicking through the tutorial and having it disappear.
- ✓ Recognition rather than recall:
  - The user does not have to recall information because they have access to a brief tutorial of each feature while using it.
- ✓ Flexibility and efficiency of use:
  - Users have the flexibility of accessing tutorials for features that interest them instead of having to go through a tutorial of all features. Expert users can choose to dismiss the tutorials by checking “Do not show again.”
- ✓ Aesthetic and minimalist design:
  - The orange ? is small and doesn’t take up much space on the screen. The tutorial pop-up box is simple, containing a short image/GIF and a brief overview of how the feature works.
- ✓ Help users recognize, diagnose, and recover from errors:
  - The user can reset the tutorial at any time if they accidentally dismissed it. They also need to check a box to no longer be shown a tutorial, and that extra step should eliminate accidentally dismissing the tutorial.
- ✓ Help and documentation:
  - This provides help and documentation for the whole application. The information is focused on that task, explains how to accomplish said task, and is very brief/minimal.

**2. Lauren - Hamburger Menu**

- ✓ Visibility of system status:
  - Users get immediate feedback when selecting the hamburger menu icon. They also get feedback after pressing a header to reveal a dropdown men.
- ✓ Match between system and the real world:
  - The menu titles use natural language. Each header also uses icons (like alarm clock icon for “Alarm” section) that relate to the header.
- ✓ User control and freedom:
  - When pressing a header in the menu, it reveals a drop-down menu instead of taking users to a new page. If a user goes to a page they didn’t want to go to, the hamburger menu is accessible from every page in the applications. Users can customize the hamburger menu.
- ✓ Consistency and standards:
  - Language in the hamburger menu is standard.
- ✓ Error prevention:
  - The language in the menu is clear and straightforward, preventing users from navigating to a page they didn’t want to go to.
- ✓ Recognition rather than recall:
  - The 3 stacked lines is a universal indicator of a menu.
- ✓ Flexibility and efficiency of use:
  - Expert users can customize the hamburger menu. Hamburger by default has most commonly-used features for new users.
- ✓ Aesthetic and minimalist design:
  - The menu has a few simple headers to keep it simple and clean, and they can then be expanded to reveal more options.
- x Help users recognize, diagnose, and recover from errors:
  - The redesign does not incorporate this.
- ✓ Help and documentation:
  - The features in the hamburger menu have an orange question near it to provide help to the user.

**3. Lauren - Settings**

- ✓ Visibility of system status:
  - There is a bold line underneath the header tab that the user has selected, so they are not confused which menu they are in.
- ✓ Match between system and the real world:
  - The navigation menu uses icons that are familiar to the user, i.e. a speaker to indicate the menu for adjusting sound settings.
- ✓ User control and freedom:
  - Users are able to customize the alarm features to their liking. Users can change settings back easily or restore to default.
- ✓ Consistency and standards:
  - The top tab navigation bar is standard to other apps and websites. All of the icons indicate the same thing as they would in other applications.
- ✓ Error prevention:
  - Users can change settings back/undo easily or restore to default.
- ✓ Recognition rather than recall:
  - The navigation menu uses icons that are familiar to the user, i.e. a speaker to indicate the menu for adjusting sound settings. The settings menu has dialog boxes and ON-OFF sliders that are standard to other applications.
- ✓ Flexibility and efficiency of use:
  - The commonly used features are the most prominent, designed for the novice user. More advanced/less frequently used features are inside on Miscellaneous (...) menu. Still easy to find for the advanced user, but not confusing to a novice.
- ✓ Aesthetic and minimalist design:
  - The page is minimal and only shows the user settings for the specific feature they have selected from the navigation bar at the top. The navigation bar uses icons instead of text headers for a cleaner design.
- ✓ Help users recognize, diagnose, and recover from errors:
  - The user must save the settings after changing them for them to go into effect. If a user changes something they didn't want to change, it will not change their settings unless they save it.
- ✓ Help and documentation:
  - The features in the settings menu have an orange question mark that provides the user with help and documentation related to that feature.

**4. Lauren - Sleep Tracking**

- ✓ Visibility of system status:
  - This page has a “time elapsed” to indicate to the user that sleep tracking has started.
- ✓ Match between system and the real world:
  - The page uses natural language and everything is in a logical order. “Current time”, “alarm window”, “time remaining” are all familiar concepts to the user.
- ✓ User control and freedom:
  - The user change add or change their alarm without having to end sleep tracking if they didn’t set their alarm correctly. Users can easily swipe the menu down if they accidentally swiped it up.
- ✓ Consistency and standards:
  - Swipe up arrow is consistent with other applications. The displayed time is in a standard clock time format.
- ✓ Error prevention:
  - “End sleep tracking” is inside a menu instead of on the main page to prevent accidentally ending the tracking.
- ✓ Recognition rather than recall:
  - The menu on the sleep tracking page is clearly labeled and tells the user to swipe up in order to access the menu. The up arrow changes to a down arrow when the menu is up, which is standard to indicate the user must swipe down to close the menu.
- ✓ Flexibility and efficiency of use:
  - The main screen provides the most relevant information that a novice user may be looking for. There is a additional menu with more options and settings for a expert user, but does not impact the simplicity of the design.
- ✓ Aesthetic and minimalist design:
  - It includes the minimal amount of information necessary to the user at that time. Additional options are inside a menu that can be opened from the bottom of the screen. The menu options allow for more user customization.
- ✓ Help users recognize, diagnose, and recover from errors:
  - When swiping the men up, the application indicates to the user that sleep tracking is paused and let’s them know that they need to swipe the menu back down to resume sleep tracking.
- ✓ Help and documentation:
  - Help is available for the sleep tracking page in the form of orange question marks near the features.

**5. Lauren - Graphs**

- ✓ Visibility of system status:
  - The system provides proper headers to tell the user what they are looking and so they know what the application is doing.
- ✓ Match between system and the real world:
  - The application uses natural language to explain to the user what is on the screen. The information presented appears in a logical order, going from least detailed to most detailed.
- ✓ User control and freedom:
  - Allows the user to delete the graphs from that night's sleep if they no longer want that information. They can easily navigate to and from the graphs from any night.
- ✓ Consistency and standards:
  - It includes a rating system, which is indicated by the standard 5 stars. The graphs include a  , which is standard to mean "click this to expand in a new window."
- ✓ Error prevention:
  - The user can always go back and change the information about that night's sleep.
- ✓ Recognition rather than recall:
  - The screen provides clear titles, headers, and labels in a natural language so the user does not have the remember what each piece of information means.
- ✓ Flexibility and efficiency of use:
  - The application gives a brief summary to the user about their sleep. This is good for the novice user who does not need much detail other then how long they slept and deep sleep/snoring/rating. The expert user can expand the graphs via a little pop out window, revealing more detailed information about each graph.
- ✓ Aesthetic and minimalist design:
  - The design is minimal and includes the most relevant information to the user. Additional, more detailed information can be accessed from the  on each graph.
- ✖ Help users recognize, diagnose, and recover from errors:
  - The application does not include this heuristic.
- ✓ Help and documentation:
  - Help is available for the graphs page in the form of orange question marks near the features.

### 1. Eric - Tutorial

- ✓ Visibility of system status
    - The orange notification disappears after the user acknowledges a pop up page or is finished with the topic. This allows users to be informed if they have looked at the documentation or tutorial already.
- ✓ Match between system and the real world
    - Dashboard page uses instructional language to guide the users. For example, “Add/Remove Cards” and “New Tutorial”, both can be familiarized by users that makes information appear in a natural and logical order.
- ✓ User control and freedom
    - Users are able to redo tutorials or go back to certain pages when progressing through the requirements.
- ✓ Consistency and standards
    - The colors and actions for specific buttons are the same. Also, the design and color of the layout are the same as well, which provides users with consistency and lessen any confusion.
- ✖ Error prevention
    - There is no confirmation option for anything in the tutorials, which does not satisfy error prevention. It would be better to ask users for confirmation when they want to open or start a specific tutorial.
- ✓ Recognition rather than recall
    - Users are shown the title of the page they are on, along with a minimal amount of main buttons that are enough to navigate through the tutorials.
- ✓ Flexibility and efficiency of use
    - Experts can edit topics to the tutorial so that they will be able to access more advanced or newer parts of the application. They can also go back to it and pinpoint certain areas of the tutorial that they want to either go back to or learn more about.
- ✓ Aesthetic and minimalist design
    - The dashboard displays each topic that the tutorial covers, which is a minimalist design. It does not overload users with unnecessary information and just gets straight to the point.
- ✖ Help users recognize, diagnose, and recover from errors
    - There are no error messages that would appear in the tutorials page if a user were to ever run into one. They would fail to recognize, diagnose, and recover from them.
- ✓ Help and documentation
    - The tutorial provides users with a help button to instruct novice users if they run into any confusion or need assistance with certain features.

### 2. Eric - Hamburger Menu

- ✓ Visibility of system status
    - There is an animation or transition for the drop-down menus, which shows users that the menu is being expanded into submenus.
- ✓ Match between system and the real world
    - The app provides users with familiar language that guides them through the menu. For example, users are given the title of each menu's topic, along with an icon that represents that topic.
- ✓ User control and freedom
    - There is a "back" button for users to go back to the previous page. There are also checkboxes on some pages that allows users to check or uncheck certain options.
- ✓ Consistency and standards
    - The color of the layout always remains the same. Also the same buttons (back and gear icon) are always visible in the hamburger menu. Every button does the same thing.
- ✖ Error prevention
    - There is no confirmation option for anything in the hamburger menu, which does not satisfy error prevention.
- ✓ Recognition rather than recall
    - The drop-down menu allows users to see both the main menu's topic along with its submenus. This provides them with less memory load or the hassle of remembering what menu topic they are on.
- ✓ Flexibility and efficiency of use
    - The favorites section can be utilized by expert users because they can organize the menu to their own likings in regards to which feature or function they use the most. The simplicity of the section can also be used with ease by novice users.
- ✓ Aesthetic and minimalist design
    - The initial stage of the hamburger menu displays users with 5 menus, which is a minimalist design. It is not too overwhelming and has the right amount of information needed for users.
- ✖ Help users recognize, diagnose, and recover from errors
    - There are no error messages or solutions to an error that would appear in the hamburger menu if a user were to ever run into an error. They would fail to recognize, diagnose, and recover from them.
- ✓ Help and documentation
    - There are no information or helpful tips at all for the hamburger menu. It would be better to provide users with some sort of help by detailing the topics or show what they can expect from them.

### 3. Eric - Settings

- ✓ Visibility of system status
    - There is a small bar that transitions to whichever menu that the users is currently on, which provides them with awareness of the system status. There is also drop-down menus that provide transitions when dividing into submenus.
- ✓ Match between system and the real world
    - The words for every option are familiar to the users, which guides them to understand their purposes better.
- ✓ User control and freedom
    - There are switches that can be turned on or off when adjusting certain settings. This allows for the undo and redo features that enhances user control and freedom.
- ✓ Consistency and standards
    - The color of the layout always remains the same. There are also no fancy or unordinary switches for adjusting settings, which prevents confusions.
- ✖ Error prevention
    - There is no confirmation option for anything in the settings menu, which does not satisfy error prevention. It would be better to ask users for confirmation when adjusting specific settings.
- ✓ Recognition rather than recall
    - The important settings are most visible and makes sure to keep users on track with what page or topic they are adjusting the settings to.
- ✓ Flexibility and efficiency of use
    - There is a search function that allows expert users to look up specific settings that they want to find. This is also useful for novice users as well because they can explore other settings that they might not know about.
- ✓ Aesthetic and minimalist design
    - There are 4 main settings that are divided into subsections, which is enough information to initially show users when accessing the settings menu.
- ✖ Help users recognize, diagnose, and recover from errors
    - There are no error messages or solutions to an error that would appear in the settings menu if a user were to ever run into an error. They would fail to recognize, diagnose, and recover from them.
- ✓ Help and documentation
    - Small help button provided to users on the bottom left of the settings menu to provide users with help if they are confused or need more information about something.

### 4. Eric - Sleep Tracking

- ✓ Visibility of system status
  - The users can swipe up to see options, which would make the screen go up as the user's finger goes up. This allows for the user to actually see what the system is doing and that it is reacting to actions.The users can also swipe down to exit the options page or stop pausing the sleep tracker.
- ✓ Match between system and the real world
  - The language with words and phrases are familiar to the users, which makes the information appear in a natural and logical order. For example, "Heads Up" and "Start Sleep Tracking" are both phrases that can be easily familiarized by users.
- ✓ User control and freedom
  - Users are able to undo and redo sleep tracking. They can stop and restart it whenever they want to. They are also able to pause it and resume as well.
- ✓ Consistency and standards
  - Every word, situation, and actions do the same thing or do as they are labeled. The layout is also consistent with the coloring, which does not lead to any confusion.
- ✖ Error prevention
  - There is no confirmation option for users when starting sleep tracking, which should exist to prevent any errors or mistakes.
- ✓ Recognition rather than recall
  - The entire process of starting and stopping sleep tracking is simple and straightforward. It does not require a lot of recalling in regards to information because every option is labeled and the status of the tracker is always visible. Users will always be able to recognize what is happening throughout the entire tracking process.
- ✓ Flexibility and efficiency of use
  - The options page provides expert users with accelerators, which consists of settings or options that can be adjusted to change the sleep tracker to their own liking. The process of starting and stopping sleep tracking is also very flexible and efficient to use for people who are either novice users or expert users.
- ✓ Aesthetic and minimalist design
  - The dialogue and information in every page of the sleep tracking feature are very minimal and will not overwhelm users. It does not have any unneeded information or details that would diminishes any important information.
- ✖ Help users recognize, diagnose, and recover from errors
  - There are no error messages that would appear if the user runs into any problems. It would be better to provide them with solutions or a diagnosis of any errors.
- ✖ Help and documentation
  - A help button or documentation of the sleep tracking feature does not exist, which can prevent users from easily understanding how to use the feature and not running into any problems.

### 5. Eric - Graphs

- ✓ Visibility of system status
    - When users rate their sleep from the previous night, they are able to swipe the screen to do so. This allows them to get a better feel of the system working and also to visually see it increase or decrease as well.
- ✓ Match between system and the real world
    - The users are given a question when they are to rate their sleep, which gives them more familiarity when given a task.
- ✖ User control and freedom
    - The page does not satisfy user control and freedom because they are unable to redo or undo certain options. There is no way that the user can re-rate their sleep within the same function page.
- ✓ Consistency and standards
    - Visualization and labels for the graphs are all the same, which should not lead to any confusion when looking at different graphs.
- ✖ Error prevention
    - There is no confirmation option for anything in the graphs page, which does not satisfy error prevention. It would be better to ask users for confirmation when rating their sleep.
- ✓ Recognition rather than recall
    - There are labels for every graph and not too much information displayed along with them, which is not too overwhelming for users.
- ✓ Flexibility and efficiency of use
    - The graphs are very straightforward and easy to access, which makes the graphs page flexible and efficient.
- ✓ Aesthetic and minimalist design
    - The graphs page provides 4 details or information about the users' sleep, and a descriptive graph that is not difficult to read and understand.
- ✖ Help users recognize, diagnose, and recover from errors
    - There are no error messages that would appear if the user runs into any errors. They would fail to recognize, diagnose, and recover from them.
- ✓ Help and documentation
    - There is no help function or documentation that further informs users about the graphs page or the information provided in it. It does not satisfy providing help and documentation.

**1. Cody - Tutorial**

- ✓ Visibility of system status
  - Orange dots indicate whether or not a tutorial has been completed or not
- ✓ Match between system and the real world
  - Tutorials show examples, animations, and diagrams of the actual app, complete with user gestures that may be needed
- ✓ User control and freedom
  - Users are able to choose to whether ignore them, reset them, and hide them. Users can easily exit out of a tutorial pop up.
- ✓ Consistency and standards
  - All tutorials follow the same format and are accessible the same way.
- ✓ Error prevention
  - Errors are prevented because there are no paths the user can take that could lead to an error.
- ✓ Recognition rather than recall
  - The fact that the orange dots indicate an unexplored tutorial is easily learned, especially on the main screen.
- ✓ Flexibility and efficiency of use
  - Tutorials are a simple matter of opening up a tutorial, reading it, then close it. Tutorials are able to be bypassed or hidden by advanced users.
- ✓ Aesthetic and minimalist design
  - Tutorials are indicated by minimal dots that disappear after being explored.
- ✖ Help users recognize, diagnose, and recover from errors
  - n/a: errors are impossible to reach with how tutorials work.
- ✓ Help and documentation
  - The tutorials on the main screen are labeled, which should be enough for the user to associate the orange color with tutorials.

### 2. Cody - Hamburger Menu

- ✓ Visibility of system status
  - Arrows preceding collapsed headings clearly indicate whether or not a menu is. Expanded checkboxes in the favorites editing view clearly indicate whether or not a menu item is selected or not.
- ✓ Match between system and the real world
  - Headings categorize all menu items by their general function.
- ✓ User control and freedom
  - User has the option of adding customized menu items to the hamburger menu.
- ✓ Consistency and standards
  - Menu items are all consistently sorted under headings.
- ✓ Error prevention
  - The hamburger menu and menu items don't allow for errors.
- ✓ Recognition rather than recall
  - Hamburger menu uses the universally recognized "hamburger" icon.
- ✓ Flexibility and efficiency of use
  - Customizable favorites allow for more advanced users to add shortcuts to commonly used features.
- ✓ Aesthetic and minimalist design
  - Collapsible sections minimize clutter.
- ✖ Help users recognize, diagnose, and recover from errors
  - n/a: errors are prevented from happening in the first place.
- ✓ Help and documentation
  - Tutorial component of the app is easily accessible.

### 3. Cody - Settings

- ✓ Visibility of system status
  - Tabs indicate which tab is active.
- ✓ Match between system and the real world
  - Tabs categorize setting items into logical categories.
- ✓ User control and freedom
  - All settings allow for simple toggling and switching between their different states.
- ✓ Consistency and standards
  - Each tabbed category of settings follow similar hierarchies of menu items.
- ✓ Error prevention
  - Changes to settings are easily reversible.
- ✓ Recognition rather than recall
  - Tabs have logical icons that correspond to the category that they represented. However, the tabs could additionally use labels.
- ✓ Flexibility and efficiency of use
  - Advanced settings and features that are more hidden away are still accessible to advanced users.
- ✓ Aesthetic and minimalist design
  - Tabs significantly reduce clutter, considering the large amount of settings offered.
- ✖ Help users recognize, diagnose, and recover from errors
  - - n/a: errors are prevented in the first place through design.
- ✓ Help and documentation
  - Tutorial component of the app is easily accessible.

### 4. Cody - Sleep Tracking

- ✓ Visibility of system status
  - It is not immediately clear that the system is sleep tracking, but can be inferred from the fact that tracking only starts after clicking on “start tracking”, and when the time and remaining time progress in real time. It is very clear when tracking is passed.
- ✓ Match between system and the real world
  - Labels have intuitive non-technical language.
- ✓ User control and freedom
  - Users can still access the back button.
- ✓ Consistency and standards
  - The different times are clearly differentiated by their labels.
- ✖ Error prevention
  - Errors are impossible by the design.
- ✓ Recognition rather than recall
  - Clearly labeled times and buttons minimize the need to learn or recollect.
- ✓ Flexibility and efficiency of use
  - Additional features are accessible in the paused menu.
- ✓ Aesthetic and minimalist design
  - The initial pop up displays content that previously cluttered the main tracking screen.
- ✖ Help users recognize, diagnose, and recover from errors
  - n/a: errors are impossible.
- ✓ Help and documentation
  - Tutorials are easily accessible via orange dots.

**5. Cody - Graphs**

- ✓ Visibility of system status
  - Stars in the main screen clearly indicate the rating that the user gave it. Drop down menu in the expanded graph view indicates which graph is in view.
- ✓ Match between system and the real world
  - Graphs clearly show where snoozing happens.
- ✓ User control and freedom
  - Back button is consistently accessible.
- ✖ Consistency and standards
  - Users may not know what Deep Sleep means.
- ✓ Error prevention
  - There are no scenarios that can lead to an error.
- ✓ Recognition rather than recall
  - Stars are universally recognizable as used for ratings. The “Zzz” icon is also universally recognizable for snoozing, but might be confused with sleeping and may be a little ambiguous.
- ✖ Flexibility and efficiency of use
  - There are no accelerators for advanced users.
- ✓ Aesthetic and minimalist design
  - Presented information is minimal and succinct.
- ✖ Help users recognize, diagnose, and recover from errors
  - Errors are prevented in the first place.
- ✓ Help and documentation
  - Tutorials are accessible via orange dots.

## 9.2 Sample Survey

### 9.2.1 Sample Survey Questions

The survey contained a mix of questions that gathered qualitative data (e.g. hours of sleep) and questions that gathered more categorical data (e.g. employment status). Options for answers generally consisted of radio buttons, checkboxes, and a few open-ended text fields.

**Survey Questions**

- Statement of Consent
- How old are you?
- Employment Status
- How many times do you exercise a week?
- Do you feel you need caffeine in the morning?
- How many alcoholic drinks do you consume per week?
- How many hours do you typically sleep?
- Which (if any) sleep problems do you experience?
- To what degree would you consider yourself a morning person?
- Do you need an alarm to wake up in the morning?
- If you use an alarm, do you set a new alarm every single night?
- If you use an alarm, do you set multiple alarms?
- If you 'snooze' your alarm, how long do you typically press snooze before getting up?
- If you use an alarm, how many times in the last week have you slept through your alarm?
- If you use an alarm, how many days in the last week have you turned off your alarm and then fallen back asleep?
- How many times in the last week did you nap?
- If you nap, generally how long are your naps?
- Have you ever tracked or managed your sleep habits in the past?
- Are you currently tracking or managing your sleep habits?
- Are you currently tracking any of the following health metrics?
- Have you ever used any of the following specialty alarm types?
- How would you rate your quality of sleep?
- Is there anything else you'd like to tell us about your sleep habits, that wasn't covered in this survey?

## 9.3 Usability Test

### 9.3.1 Tasks

We gave the user a series of sheets with their tasks printed out. The contents of each sheet is as follows.

1. Task: Complete the tutorial.
   *Print out: This is a brand new app that has just been recommended to you by a friend. You are a college student looking to improve your sleeping health and miss less morning classes due to oversleeping. You know that Sleep as Android is a special alarm-clock app that tracks your sleep. As you open the app for the first time, you will see a tutorial. Please read through each tutorial page aloud and note any thoughts you have on the content -- especially if you are confused about an aspect or have questions.*
2. Task: Set sleep income to 7 hours and bedtime notification to 45 minutes.
   *Print out: Trying to balance your busy schedule with your health, you have decided that you work best on 7 hours of sleep. The application needs to know how many hours of sleep you want to get so that it can measure your progress. Please change your desired sleep income to 7 hours. You have also been recommended to cut down on screen time before bed, so you want a reminder to get off your computer and read a book before bed. Ask the application to send you a bedtime notification 45 minutes before you need to sleep.*
3. Task: Set a recurring alarm for 8AM on Mondays and Wednesdays with a simple math CAPTCHA.
   *Print out: Now that all the preliminary options are set up, you are ready to set an alarm for that early morning class you have. Set an alarm up for 8AM on Mondays and Wednesdays. Since you want to make sure that you don't disable the alarm and fall back asleep, set up the alarm to require simple math to disable it.*
4. Task: Start Sleep Tracking, and enable the Thunderstorm lullaby.
   *Print out: Now that your alarm is set up, you've settled down with a good book, brushed your teeth, and now you're in bed and ready to fall asleep. Start Sleep Tracking. Once you've begun sleep tracking, you start to feel a bit restless, so turn on the Thunderstorm sound.*
5. Task: Stop Sleep Tracking and delete the alarm you made.
   *Print out: You've just remembered tomorrow is a national holiday, and there's no class tomorrow! You can sleep in! Turn off sleep tracking and delete the alarm that you've made.*
6. Task: Use the app for the night and track your sleep. Tomorrow, take a survey about your experience.
   *Print out: Tonight please use the app to set an alarm and track your sleep. You are welcome to customize your alarm however you'd like and use any or all of the features that are part of Sleep as Android, but it is important that you use the Sleep Tracking function we just went over.*

### 9.3.1 Post-Test Survey Questions

Part 1:

- Did you experience any confusion when you configured the alarm to your liking?
- Did you use the Bedtime Notification to remind you to go to bed? (by default, it was set for 45 minutes ahead of time)
- If you answered yes to the previous question, was the reminder helpful?
- Did you use any of the CAPTCHA specialty alarms?
- If you answered yes to the previous question, how successful was the specialty alarm?
- Why did you choose the specialty alarm you chose (or why didn't you choose to use one?)
- Did you give your sleep a star rating when examining the sleep graph? (for partial ratings, you can select more than one option)
- Were you able to understand the sleep graph that was shown to you after turning off sleep tracking?
- Regarding your sleep chart, can you tell what time the sun came up?
- Regarding your sleep chart, can you tell how long you slept for?
- Regarding your sleep chart, how much time over or under your expected sleep amount were you? (by default we set it to 8 hours)
- Regarding your sleep chart, can you tell how long you were in deep sleep?
- Regarding your sleep chart, can you tell what the top graph represents? (this is referring to the two graphs that are shown when reviewing how you slept)
- Regarding your sleep chart, can you tell what the bottom graph represents? (this is referring to the two graphs that are shown when reviewing how you slept)
- Regarding your sleep chart, is there any part that you find confusing or anything you don't understand?
- Regarding your sleep chart, is there anything you expected or wanted to see but did not?
- On a scale of 1 to 10, do you feel that Sleep as Android woke you up at the optimal time?
- On a scale of 1 to 10, how groggy did you feel when you woke up?
- How many times did you hit the snooze button?
- Was this more or less snoozing than usual?
- On a scale of 1-10, how do you feel about the alarm sound that you chose in helping you get out of bed?
- How many times did Sleep as Android record you snoring throughout the night?
- Were you surprised by that?
- What rating did Sleep as Android rate your sleep quality? Put "unsure" if you do not know.
- Were there any features about Sleep as Android you really liked?
- Were there any features about Sleep as Android you didn't like?
- How easy or difficult did you feel Sleep as Android was to use?

Part 2:

[Note all questions in this section included a screenshot from a user with a long sleep history]

- Exactly how long (in hours and minutes) was this user in Deep Sleep for?
- At the bottom of this graph is a hashtag, #home, along with some additional icons. What do you think is the purpose of these icons? What is the purpose of the hashtag?
- In this example, the user dragged their finger across the sleep chart to select a period of time. What do you think is the purpose of this?
- What is the time that this user most commonly falls asleep at?
- What day does this user get the least amount of sleep?
- What do you think that the red and green lines shown in this chart represent?
- Do the following 'advice' blurbs make sense to you? Why or why not?
- What do you think the sleep score is generated by?
- What do you think that this chart is describing?
- Overall, how do the charts you've seen make you feel? Was there anything in particular that confused you, or that you really liked or didn't like?

Part 3:

- How likely would you be to use Sleep as Android on a consistent basis?
- How likely would you be to recommend Sleep as Android to a friend?
- What would you want to change, if anything, about Sleep as Android that make you want to use it on a consistent basis?
- Was there anything else you'd like to tell us about your experience with Sleep as Android? (could be positive, negative, or neutral)

## 9.4 Cognitive Walkthrough Tasks

Task 1: User goes through the tutorial, sets desired sleep income, and bedtime notification.

Action Sequence

1. User opens application.
2. User swipes 11 times through the left.
3. User presses set alarm button.
4. User presses sleep tracking button.
5. User presses settings button.
6. User presses gear icon.
7. User presses + button.
8. User selects bedtime notification.
9. User selects next bedtime notification.
10. User selects desired bedtime notification.
11. User presses the back arrow.
12. User drags ideal daily sleep income to desired amount.

**Task 2**: User changes the default alarm settings to have alarms timeout after an hour, to be able to snooze by flipping the phone over, and to make the snooze duration 5 minutes and to add a captcha alarm for simple math.

Action Sequence

1. User presses Dashboard.
2. User presses gear icon.
3. User presses alarm default settings.
4. User presses alarm timeout.
5. User selects 1 hour.
6. User presses snooze.
7. User presses snooze duration.
8. User selects 5 minutes.
9. User presses arrow.
10. User selects flip to snooze.

**Task 3**: User checks sleep score for this week and all time, views graph from previous night, sees if they snored, lower their sleep quality rating and add a #snoring tag to that night.

Action Sequence

1. User selects sleep score panel.
2. User selects Week from drop-down menu.
3. User selects All time from drop-down menu.
4. User finds sleep score from the dots in the upper right-hand corner on the sleep score panel.
5. User presses back arrow.

6. User presses graph icon in top-right corner.
7. User selects graph from the previous night.
8. User selects part of graph over the saw icon.
9. User presses play icon.
10. User presses pencil icon in bottom-right-hand corner.
11. User presses star icons to desired rating.
12. User types “#snoring” into the notes.

## 9.5 Summary of User Demographics

### 9.5.1 Demographics From Initial Survey

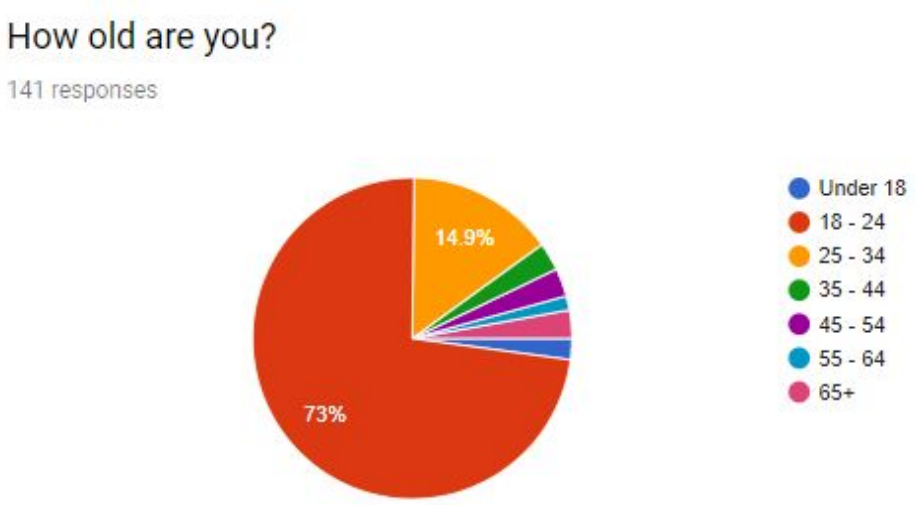



*Figure 9-1: Age results from our initial survey*

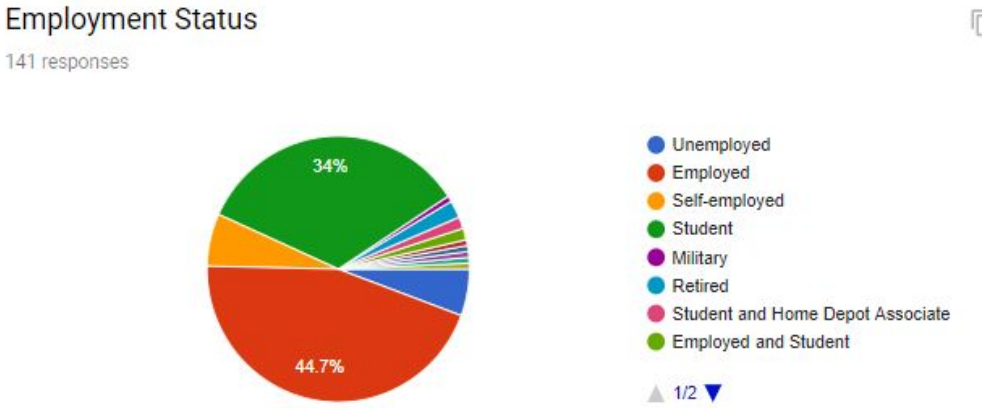



*Figure 9-2: Employment status results from our initial survey.*

### 9.5.2 Demographics from our interviews

| Participant | Gender | Age Window | Description |
|---|---|---|---|
| N1 | F | 20-24 | single, heavy social media user |
| N2 | M | 20-24 | in a relationship, heavy screen usage |
| D1 | F | 20-24 | in a relationship, heavy screen user before bed |
| D2 | F | 24-28 | married, heavy sleeper with little screen usage before bed |
| E1 | M | 20-24 | single, college student |
| E2 | F | 20-24 | single, intern for dental office |
| C1 | M | 20-24 | single, engineering student. |
| C2 | M | 20-24 | in a relationship, computer science student. |
| L1 | M | 24-28 | in a relationship, paramedic |
| L2 | M | 24-28 | single, customer service representative |

*Figure 9-3: Demographics of our interviewees*

### 9.5.3 Demographics from our usability tests

| Participant | Gender | Age | Details about participant |
|---|---|---|---|
| L1 | M | 28 | avid gamer, customer service agent, works on weekends, narcolepsy |
| L2 | M | 26 | avid gamer, paramedic, works 12-hour overnight shifts, works 4 days a week, works weekends |
| N1 | F | 20 | musician, student. On screens constantly, pulling consistent late nights, |
| N2 | M | 28 | avid gamer, extreme night owl, full-time student, works 11-hour shifts on weekends. Uses Sleep as Android for the complex alarms. |
| N3 | M | 38 | avid gamer, has multiple sclerosis that affects his sleep, works full time with heavy screen usage. |
| C1 | M | 20 | documentary filmmaker, lots of computer screen use, hectic class and work schedule |

*Figure 9-4: Demographics of our testers*

## 9.6 Affinity Diagram

We used an affinity diagram to produce generalized statements from dozens of statements from users obtained from our user interviews. These generalized statements guided our redesign.

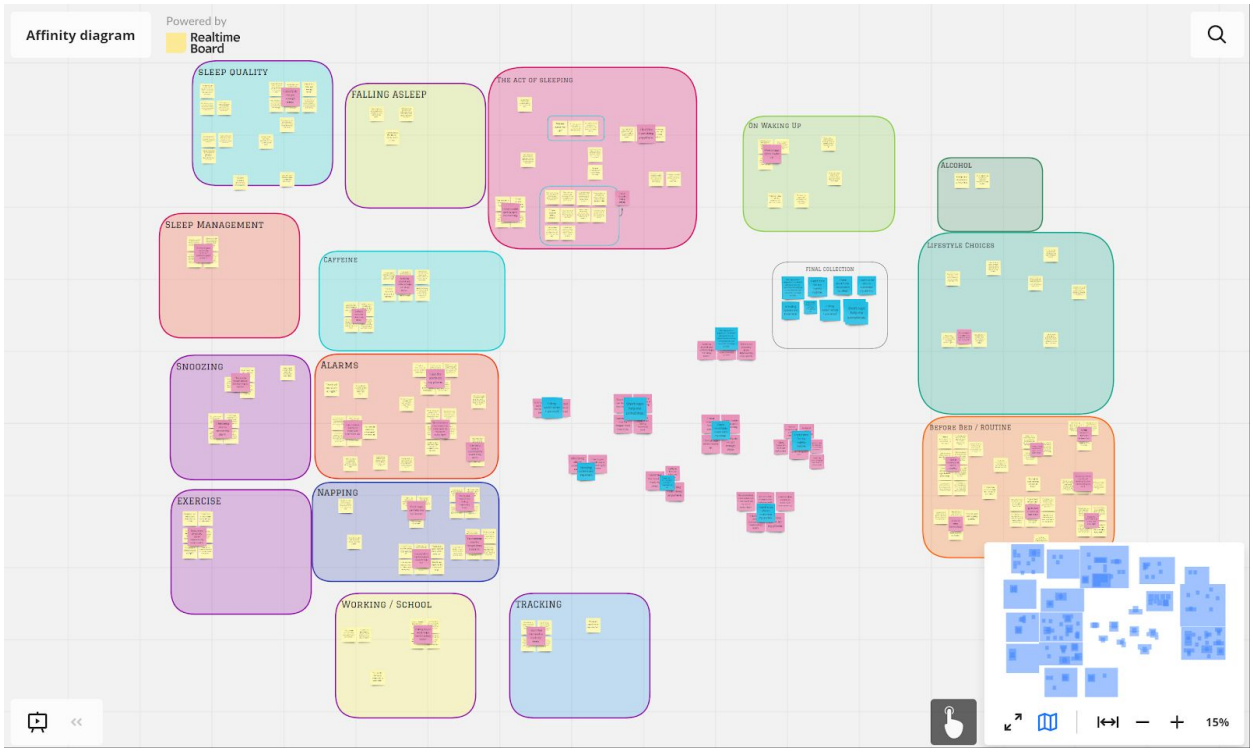



*Figure 4-2: Affinity Diagram*

## 9.7 Interview Protocols

The main question we seek to answer:

"What positively and negatively impacts a person's sleep?"

Other questions we'll address along the way:

"What are this person's sleeping habits?"

"Are they happy with the quality of sleep they get?"

"What are the external factors we should consider in our design?"

Opening to the Interviewee

- Introduction, "Hello, I'm ___"
- Explain to interviewee that the goal of the interview is to get a better view of someone's sleep habits
- Go over Statement of Informed Consent, briefly explaining each part (if phone or internet interview, get verbal consent)
- "Alright! Let's get started. I want to start by asking some basic questions about how you sleep. Remember, there's no wrong answers and if you need any clarification just let me know."

- **Sleep Quality and Quantity**
    - How many hours of sleep do you get?
        - Do you feel as if it is enough?
            - If no, why do you not sleep enough?
                - If not, how many hours do you feel is enough?
            - If yes, what makes you say that its enough?
    - Do you have trouble falling asleep?
        - How much time does it take for you to fall asleep on average?
        - What keeps you from falling asleep?
    - Do you have trouble staying asleep?
        - Are you aware of what wakes you up?
        - If you wake up in middle of night, how hard is it to go back to sleep?
    - Do you consider yourself a light sleeper or a heavy sleeper?
        - What is your sleeping environment like?
            - Is having a specific environment important to your sleep quality, or do you feel like you can sleep anywhere?
        - Do you find your bed comfortable?
        - Do you sleep with a partner?
            - Do you feel that your partner can impact your sleep, either positively or negatively?
        - Do you sleep with any sort of night light?
        - Are there any noises in the sleeping environment?
            - Do you feel that it impacts your sleep, either positively or negatively?
    - Do you use external equipment to fall asleep? (Music, white noise, TV)
        - If so, what kind of noises do you use?
    - Do you have trouble waking up from your sleep?
        - Do you feel groggy in the morning when you wake up?
        - How long does it take you to feel awake?
        - How soon would you be willing to interact with others after waking up?

- Sleep Alarms
    - What kind of alarm do you use?
        - What do you like/dislike about it?
        - Do you use it every time you go to sleep/nap?
    - Do you set multiple alarms?
        - If yes, does it affect you positively or negatively?
    - Do you set your alarm every night, or did you set your alarm to repeat?
        - If you set a new alarm every night, why?
        - If you have a repeating alarm, do you have the same wake-up time every day, or do your alarms change based on your schedule? (for example, if your day off alarm is for an hour later than your workday alarm)
    - What is your thought process behind when you set your alarm?
        - Do you give yourself extra time to snooze, or set it at the very last minute, for example?
    - Do you snooze?
        - How often do you snooze?
        - How long are your snoozes?
        - Has your snoozing ever caused you to be late?
            - Do you ever disable the alarm and fall back asleep?
    - Do you ever wake up before your alarm goes off in the morning?
        - If yes, what do you do when this happens?
- Sleep Routine
    - What time do you usually go to bed?
    - How do you decide to go to bed?
        - Is it a regular time or do you wait until you feel tired?
    - Do you have any nightly routines when preparing for bed?
        - Tell me about an average school/work night.
        - Tell me about an average weekend night.
- Napping
    - Do you nap regularly?
        - If yes, how long do you typically nap for?
            - Is there a particular time or reason you nap?
            - Do you nap in your bed or in another location?
            - Do your naps typically make you feel better when you wake up?
            - Do your naps ever end up being a lot longer than you intended?
        - If no, is there a reason why not?

- Lifestyle Choices
    - How many alcoholic drinks do you consume per week, on average?
        - Do you feel that it impacts your sleep, either positively or negatively?
    - How much caffeine do you consume per week, on average?
        - Do you feel that it impacts your sleep, either positively or negatively?
    - What level of activity do you have in your day to day life? (working on feet vs desk job)
        - Do you sleep differently after working?
            - How so? Do you feel it's better, or worse?
    - How many times do you exercise a week, on average?
        - Do you generally exercise at the same time every day?

            - What time?
    - Do you stop eating after a certain time
        - If yes, what time?
            - Do you feel that it impacts your sleep, either positively or negatively?
        - If no, why not?
            - Do you feel that it impacts your sleep, either positively or negatively?
    - Do you spend time in your bed doing activities other than sleeping and sex? (Examples might include eating, reading, phone or TV usage, drawing, gaming, etc.)
        - If yes, what are they?
            - How often do do these activities?
            - When do you do these activities?
    - How much do you look at screens in the hour before you go to sleep?
        - Do you try to limit your time looking at screens?
        - Do you use any blue-light filters on your screens?
    - Do you have any typical winding-down activities, like reading before bed, or meditation?
        - If yes, what are they?
            - Do you feel that they impact your sleep, either positively or negatively?
- <u>In Summary</u>
    - Do you feel there are things you could do to improve your sleep quality?
        - If yes, what are they?
        - If no, why not?
    - Have you ever tried to improve your sleep with tips or tricks you'd read or heard?
        - If yes, what were they?
            - Did they work?
            - How long did you try them for?
    - Do you track your sleep in any way?
        - If yes, how do you do it?
            - Does it impact your sleep, either positively or negatively?
        - If no, have you in the past?
            - If yes, how did you do it?
                - Did it impact your sleep, either positively or negatively?
                - How long did you do it for?
                - What made you stop?
    - Do you do any other health tracking?
        - If yes, what do you track?
        - If no, what makes you not want to?
    - Do you think managing your sleep habits is important to your overall health?
        - Why?

<u>Final question:</u>

Is there anything else you'd like to tell me today, anything we didn't get to talk about?