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Minimizing Co-Sleeping Disruptions: A design intervention

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ABSTRACT

A recent survey indicates that 30% of adults in the United States sleep separately from their partners because of co-sleep disruptions (Rogojanski et al., 2013). However, research suggests that sleeping together is good for couple relationships (Holt-Lunstad, Smith, & Layton, 2010). While there are many products on the market designed to help individuals with sleep problems, there are few that address co-sleeping problems. This thesis addresses this gap in the market for co-sleeping products by exploring how a design intervention of bedroom furniture can help couples sleep together despite the disruptions to each other. This paper records the design process and the development of a functional, full-scale prototype. The resulting design is the “ECO-sleep system.” The product is effective because it minimizes disruptions caused by sound and light. However, it does not completely eliminate them. This paper provides conclusions about design potential and limitations, and recommendations for improving the design of the ECO Sleep System.

keywords: sleep, co-sleep, product design, sleep disruption

Minimizing Co-Sleeping Disruptions: A design intervention

by

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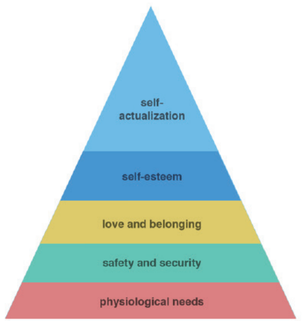
INTRODUCTION

Many people face co-sleep problems. A recent survey indicates that 30% of adults in the United States sleep separately from their partners because of co-sleep disruptions (Rogojanski et al., 2012). These couples have two choices: to sleep together with poor sleep quality, or to sleep separately with less intimacy. The sacrifice of sleep quality is unhealthy for individuals, and for life-long relationships (Reid et al., 2006). Sleep has a critical role in promoting health (Mignot, 2008; Irwin, 2015). So sleeping together is not a good option for couples who have co-sleep problems. However, sleep is a shared romantic activity between adult partners. Loving & Slatcher (2013) suggest that intimacy and romantic relationships have a unique impact on individual health and well-being. In addition, Rogojanski et al. (2012) suggest that the majority of couples prefer sleeping with their partner. Thus, research suggests that there is a need for couples to sleep together despite disruptions from each other. Given the importance of sleep quality and the occurrence of co-sleeping disruptions, it is surprising to find that not many sleeping products on the market address this need.

The research suggests that artificial light, sound, and partner attitudes are the most important aspects of a co-sleep environment. But, co-sleep products available on the market today are not focused on solving these problems. There is a need for co-sleep products that address these issues.

EXISTING KNOWLEDGE AND PRODUCTS

According to the Maslow's Hierarchy of Needs (Figure 3.1), sleep is the most basic physiological need. If that need is not satisfied for an individual, they cannot achieve the next level; a sense of love and belonging, self-esteem, and self-actualization (Bayne, 2015).



Maslow's Hierarchy of Needs
Figure 1.1

Sleep also plays a critical role in promoting health (Mignot, 2008; Irwin, 2015). Mignot (2008) suggests, "The functions of sleep include recovery at the cellular, network, and endocrine system levels, energy conservation and ecological adaptations plays a role in learning and synaptic plasticity" (p.661). Moreover, it is important for people who want to stay fit to know that sleep is as important as diet. A 14-day research study revealed that shortened sleep can lead to increased snacking, as lack of sleep leads to hormone changes that influence eating behavior (Nedeltcheva et al., 2010). Inadequate sleep is also related to a growing risk of becoming obese because it has been linked to hormone changes (Gangwisch,2005; Patel et al., 2006).

Figure 1.2

Products in the market that address sleep problems.

Many designers have developed solutions for general sleep problems. The existing products were reviewed and analyzed, and then organized based on individual or couples-use. A visual graphic of the analysis (Figure 1.2) was developed. The graphic shows that most of the available products are designed for individual use. There are few products designed for use by couples to meet sleeping needs. This is a potential area of development.

One modern attempt to improve individual sleep is through mobile applications, or “apps.” Most of the existing apps provide data about users’ sleep habits. The type of sleep app individuals use could show their needs and influence their life to a great extent. For that reason, iPhone apps were reviewed as precedent.

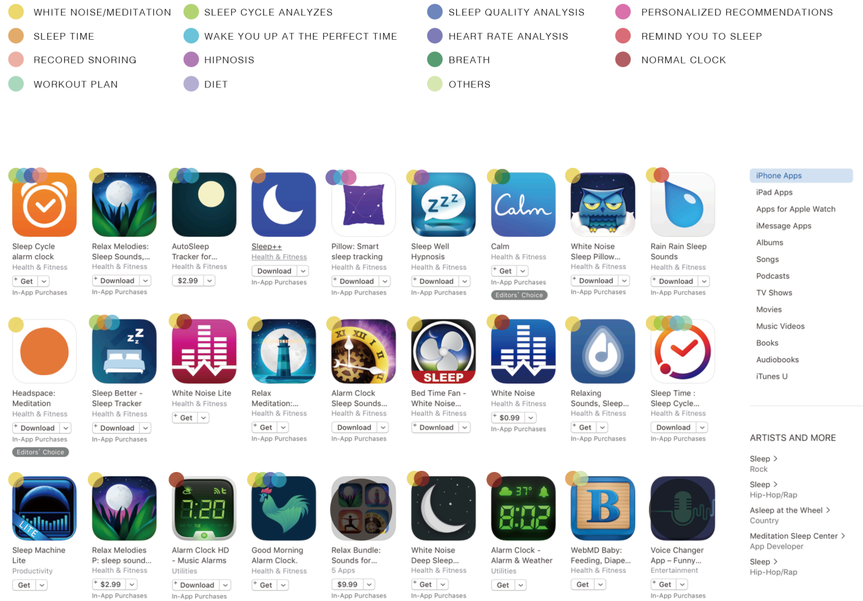
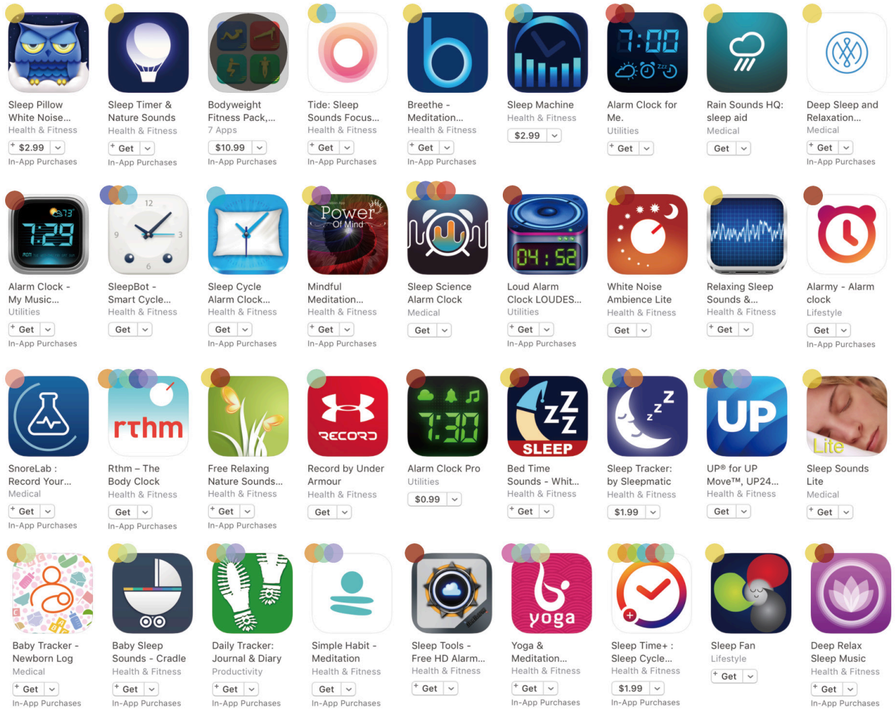


Figure 1.3 Phone apps that related to sleep



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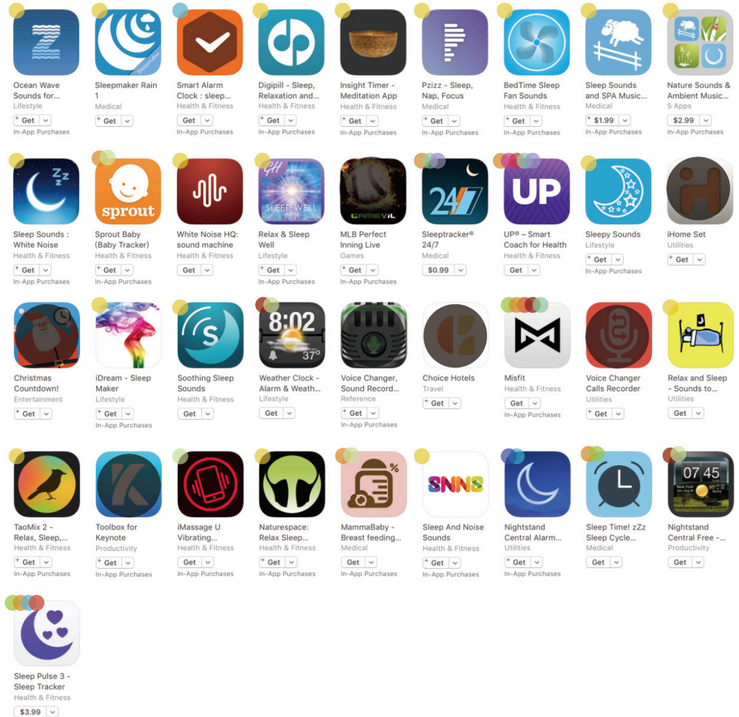


Figure 1.3 Phone apps that related to sleep

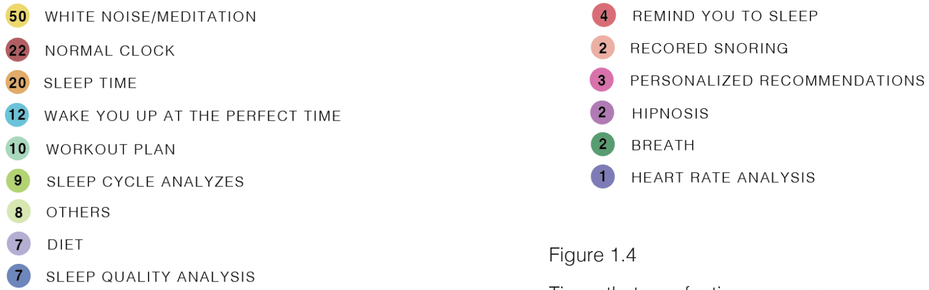


Figure 1.4

Times that app fuctions appear

The analysis classified the apps by function, including: basic clock, white noise/meditation, breathing exercises, hypnosis, sleep cycle analysis, sleep quality analysis, heart-rate analysis, sleep reminders, sleep time, wake up time, records of snoring, personalized recommendations, workout plan, and diet. The analysis revealed that white noise/meditation, basic clock function, and sleep time were the most most common features of these apps. noise/meditation were featured in 50 of the apps, basic clock function was featured in 22 of the apps, and sleep time were featured in 20 of the apps. These apps possibly assist individuals with sleep, but they are likely to have an impact on a co-sleep partner. For example, a sleep partner may not want to hear white noise, and might actually be a disruption. This research shows that few apps on the market address co-sleep problems.

In addition to digital products such as mobile apps, there are also physical products that aim to address sleep needs. To satisfy both partners' sleep or relaxation needs, there are two products on the market: dual adjustable beds and "Luna." One common adjustable bed is the Split King, which is a large bed divided into two sides. Compared to traditional adjustable beds, the Split King has more flexibility for couples to use. Even though the bed is shared, individuals can raise one side up when they want to read. This option supports inclusiveness and a degree of freedom which makes the sleep environment more harmonious. The alternative product "Luna" is a "smart" mattress cover that tracks user sleep patterns and adjusts its temperature based on couples' different sleeping habits. It helps couples who prefer a different temperature to sleep in the same environment. However, it does not always work when couples sleep close to each other. Both of these products are good examples of how to improve a co-sleep environment based on individuals' different needs. However, it is uncertain if they solve the most important problems in a co-sleeping environment. If existing products do not solve the most prevalent co-sleeping problems, more products should be developed.

Many people face co-sleep problems. A United States survey of 1500 adults shows that 61% of individuals sleep with a partner on most nights, and 30% of individuals sleep separate from their partner because of their own or their partner's sleep problem (Rogojanski et al., 2013). Differences in body temperature, preferences for room temperature, frequent trips to bathroom, and habits before sleeping may disrupt partners. For these reasons, 30% of individuals choose to sleep in a separate bed or bedroom.

Disadvantages of couples sleeping separately

Sleep is a shared romantic activity between adult partners (National Sleep Foundation, 2013). Loving & Slatcher (2013) suggest that intimacy and romantic relationships have a unique impact on individual health and well-being. In addition, Rogojanski et al. (2012) suggest that the majority of couples prefer sleeping with their partner, and that separated sleep may increase relationship conflict and disconnection. Troxel et al. (2007) suggest that for certain couples, sleep problems and relationship problems are correlated. These researches provide evidence that sleeping together is important and has benefits. However, it is surprising that few studies explore issues concerning relationships and sleep. Rogojanski et al. write, " Only recently have researchers begun to examine the dyadic nature of sleep, and there is growing evidence that bed partners can play a role in the onset and maintenance of insomnia" (2013, p.55). Fortunately, research efforts are increasingly addressing this problem (Troxel et al., 2010).

In summary the review of related literature suggests that there is a need for couples to sleep together despite disruptions from each other. So, what are the most important elements in co-sleep environments?

RESEARCH METHOD

Important elements in co-sleep environment

Sleep hygiene, health practices (e.g., diet, exercise, substance use) and environmental conditions (e.g., light, noise, room temperature) can influence sleep quality (Rogojanski et al., 2012). This paper focus on addressing the following elements in co-sleep environments: artificial light, noise, body contact, temperature, fresh air, movement, and bed partner's attitude.

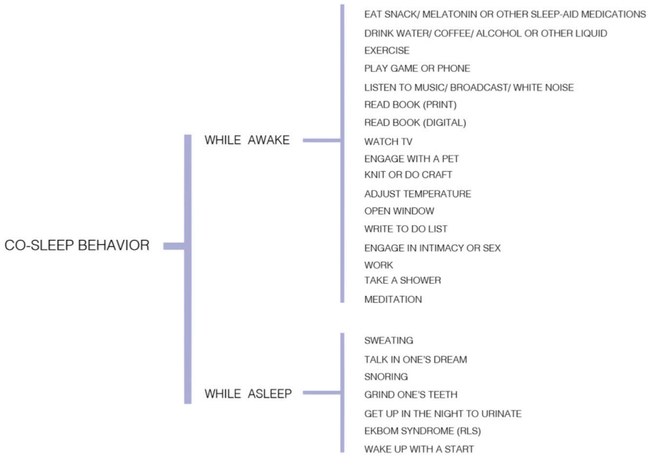


Figure 2.1 Co-sleep Behavior Brainstorm

Brainstorming was used as an ideation strategy for considering possible co-sleep behaviors. This involved making a list of activities that might occur while asleep and while awake, such as drinking, watching TV, meditating, snoring, and so on. Each list item was annotated further to indicate elements (eg. artificial light, noise, body contact, temperature, fresh air, movement, and bed partner's attitude) that may occur while sleeping and while awake.

This thesis asks: What do people think is the most important element to getting a good night's rest with their partner? To enhance discovery I developed a digital questionnaire and distributed it on Facebook in both the U.S. and China.

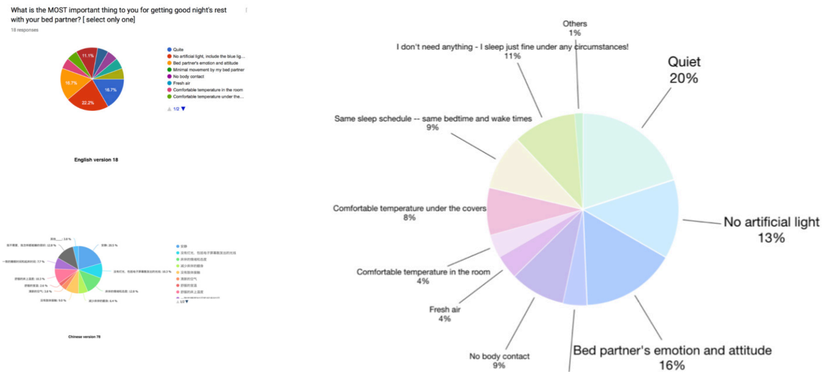


Figure 2.2 Questionaire data analysis of the question: What is the most important thing for getting good nights' rest with your partner?

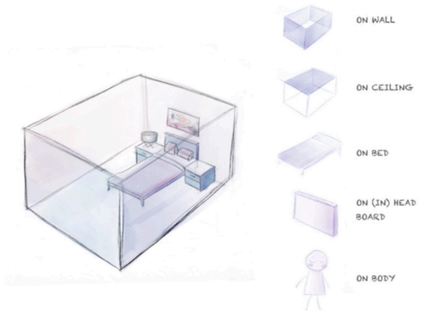
18 responses from United States participants and 78 responses from China were received. 21 invalid questionnaires were deleted, as determined by the fact that respondents do not actually have sleep partners on most nights. The remaining sample of 75 responses was analyzed and organized data into a Pie chart. "Quiet," "bed partner's emotion and attitude" and "no artificial light" were the top three answers, accounting for 20%, 16% and 13% in the pie chart, respectively.

Ronald Waldron of the Upstate University Sleep Center suggests that there are few products out there to deal with co-sleep problems. During the interview he asked, *“Where do you sleep? On the bed, in the bedroom? Not many products serve co-sleep purposes. What if we can have an environment that could serve two people in the same environment?”*

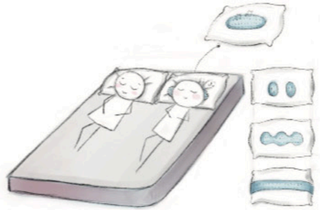
The review of related literature demonstrates that heat and movement are the least problematic of co-sleeping issues. The most problematic issues relate to light, sound, and a partner’s attitude. Figure 3.2 shows that few sleep products that are designed for one person address the broader, shared sleep environment. Some products cover individual’s eyes to block the light. Some use light to mimic waking to the sun rising. Some provide a more comfortable experience for individuals to sleep in seats, at tables, or in offices. Some record sleep cycles and give helpful suggestions. Some use odor and rhythmic flashes to initiate sleep. Reviewing and analyzing the existing products inspired ideas for developing an innovative product that is not currently available on the market.

The focus of this thesis is to create a design intervention that helps couples sleep in the same bed despite one person’s disruptions. The goal is to create an environment that could minimize sound and artificial light disruptions and improve relationships.

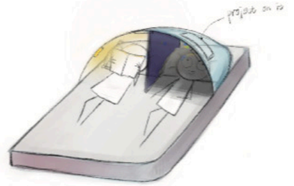
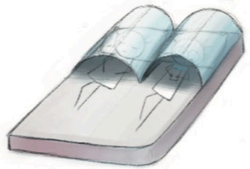
DESIGN PROCESS

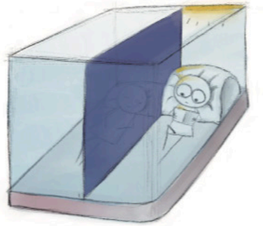
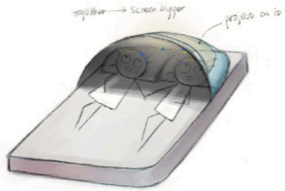


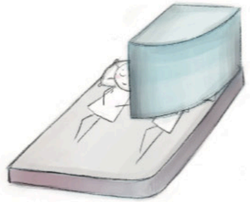
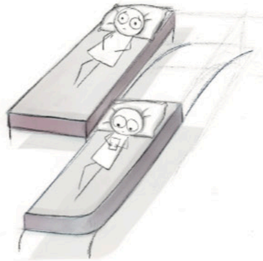
The wall, ceiling, floor, furniture, and body are all spatial possibilities for developing a design intervention that reduces disruptions. Design possibilities were explored and iterated visually through sketching and computer modeling.

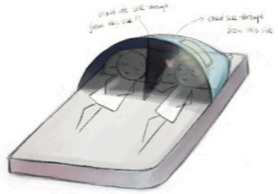





foam

people on it



fantastic seam


people on it

Trajectory





My goal was to optimize the design for couples to use together, and in a way that one individual's activities do not compromise the other's. For example, if one individual snores, they may not w ant to use a product that minimizes the snoring because in doing so, they are admitting that they have a problem which may create inequalities in their relationship dynamic. If the couple could use the product at the same time, and the product could help minimize the disruptions from both sides, the product and disruptions will no longer be a barrier to their relationship. Considering that a semi-enclosed environment can decrease sound and artificial light while maintaining intimacy between couples, it was therefore a fitting direction for the design intervention.

Two ideas (design 4 and design 6) were combined to design a structure with an adjustable cover. When one individual wants their immediate environment to be dark and quiet, they could pull down the cover to make the space into two relatively separate partitions that still allow for a level of physical intimacy. Further, when they want to share the space to read and watch videos together, the shape can also transforms into one overall cover. If optimized, the design could encourage them to do activities together before sleep. For example, each cover is its own projection screen inside; if they connect these two separate projection screens together, the couple could share a video with a now much bigger projection screen.

Support material

Size

Projector

3D Model 1

Hinge

3D Model 2

Instable cover

To block sound and light

The first paper mockup explored using a long magnet in the middle of the cover and another one on the bed. In this way, the cover rises to create a big space, and then lowers to create two relatively separate spaces. The mockup suggested that the support material should have strong spring back in order to support a big curve but also be elastic enough to transform into two smaller separate spaces. Modeling a full-scale prototype required material exploration and research to create a design that was both functional, easy-to-use, and effective. Lexan (polycarbonate sheeting, 3-5 mm) was the most appropriate material for the design because it is elastic, strong, and provides the desired "spring back" effect. There might be better materials for this project that can be explored in future iterations of the design.

Support material

Size

Projector

3D Model 1

Hinge

3D Model 2

Instable cover

To block sound an

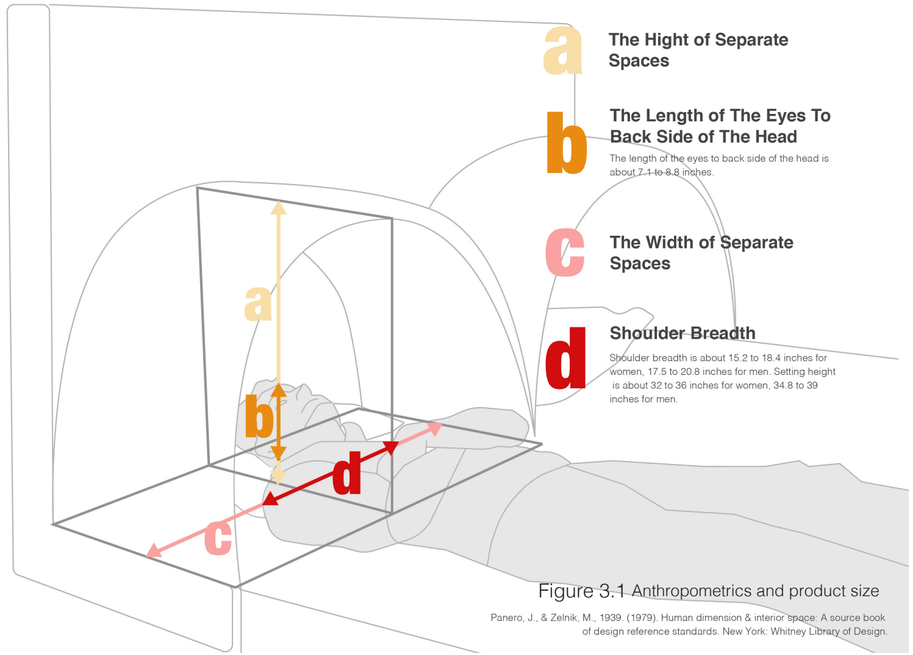


Figure 3.1 Anthropometrics and product size

Panero, J., & Zelnik, M., 1939. (1979). Human dimension & interior space: A source book of design reference standards. New York: Whitney Library of Design.

Anthropometrics shows shoulder breadth is about 15.2 to 18.4 inches for women, 17.5 to 20.8 inches for men. Setting height is about 32 to 36 inches for women, 34.8 to 39 inches for men.The length of the eyes to back side of the head is about 7.1 to 8.8 inches. The length and height of the prototype satisfies the data above. To make sure there is enough space for people to toss and turn in one separate space, different sizes and heights were tested and a final product standard size was chosen (Figure 3.1)

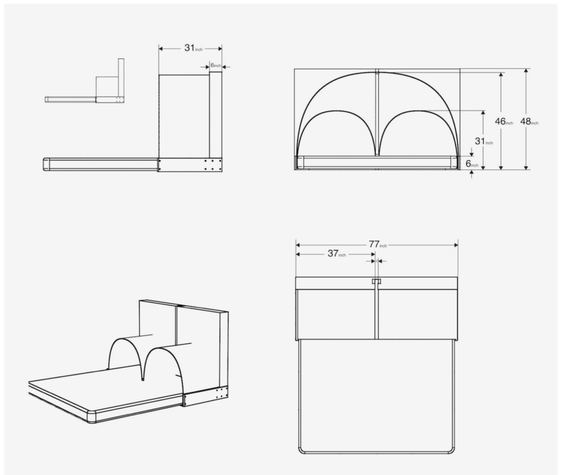
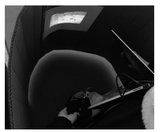
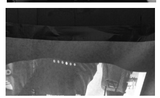
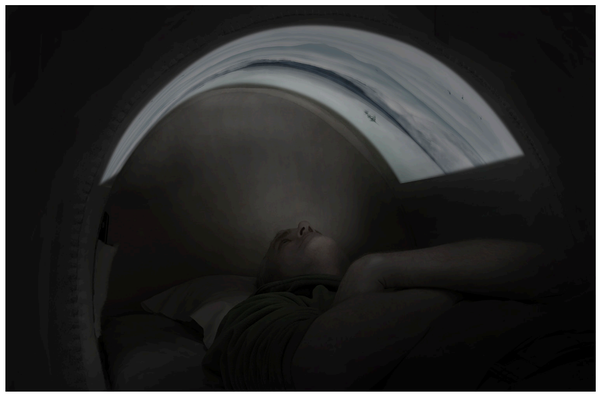


Figure 3.2 Product size

Projection was explored as a way to support a more immersive environment for users to relax. Miroir M55 is a small projector that was first explored to accomplish this. The projection distance and throw ratio was not effective; the resulting projection was too small (covering an area of about 8 by 4 inches). Some other projectors were researched to find a better throw ratio. The Optoma ML750ST was identified as a good choice for it's bigger projection area (19 by 9 inches). While finding the right projector confirms its viability in the project, considering the time and cost, the integration of a projector was not fully explored but could be in future markups.







Support material

Size

Projector

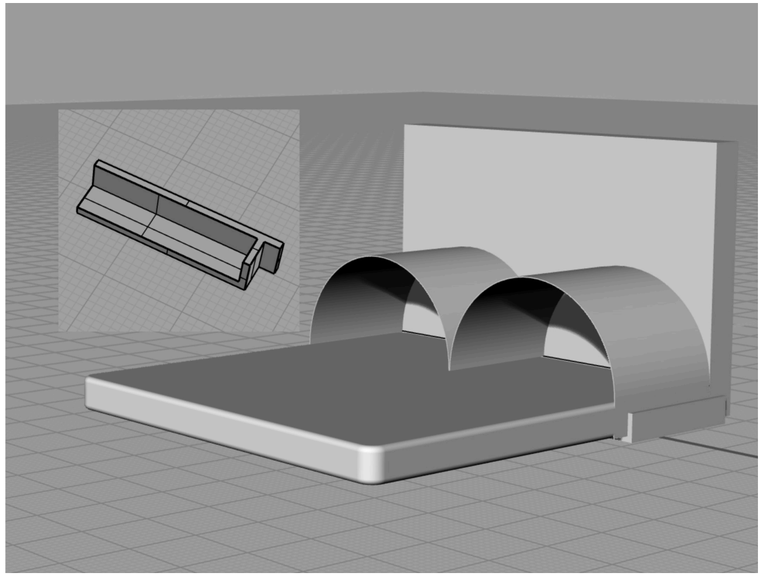
3D Model 1

Hinge

3D Model 2

Instable cover

To block sound and light



Based on the structure and size, the first version of the 3D model was developed. This 3D model built a more realistic vision for me to understand and to think about the structure. Based on the 3D model, I built an accessory structure that fixed the cover to the headboard.

Support material

Size

Projector

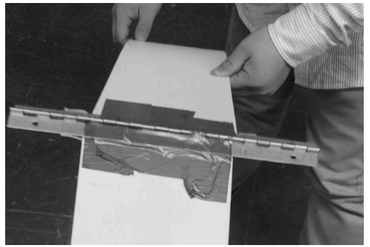
3D Model 1

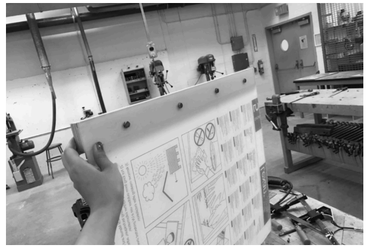
Hinge

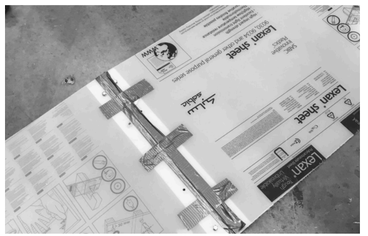
3D Model 2

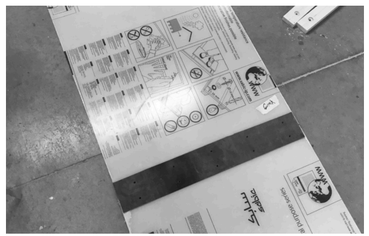
Instable cover

To block sound and light









Hinges were explored to make the cover move up and down smoothly and to stop the cover as an arc when it is up. A metal hinge was tried first and it was hard to stop from being an acute angle shape. To solve this problem, thick pieces stuck on the edge of the two lexan pieces were used to stop the cover from being at an acute angle. One rubber piece with holes in it was used as a hinge because it is lighter and neater than the metal piece.

Support material

Size

Projector

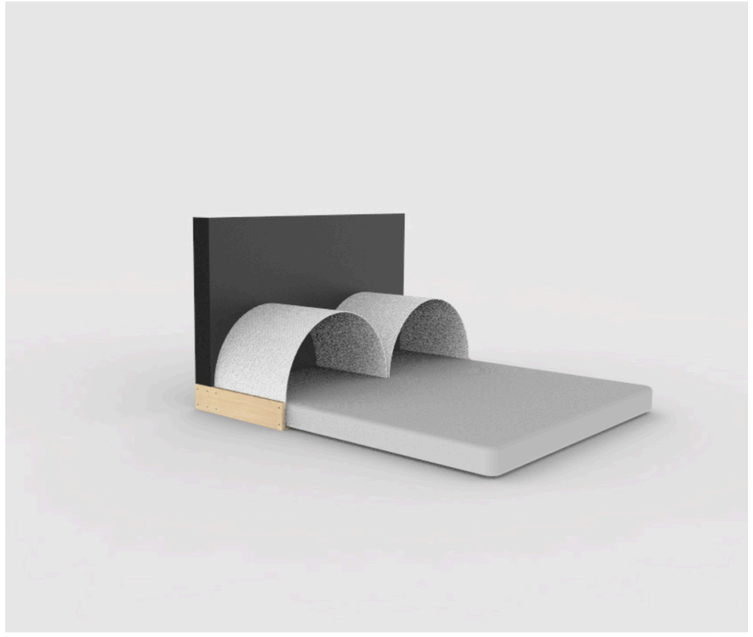
3D Model 1

Hinge

3D Model 2

Instable cover

To block sound and light



After the hinge was installed, the details for the cover and headboard interface were added to the 3D model.

Support material

Size

Projector

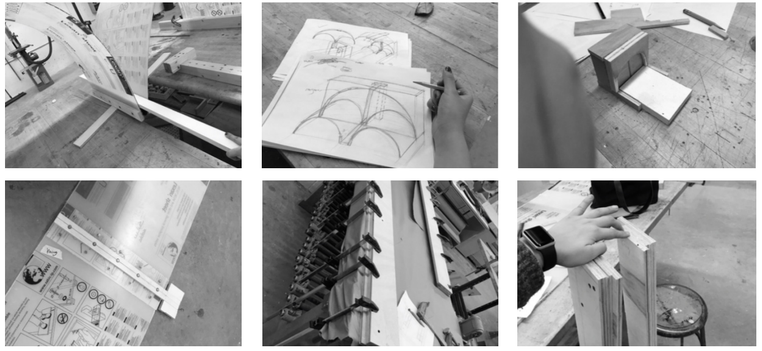
3D Model 1

Hinge

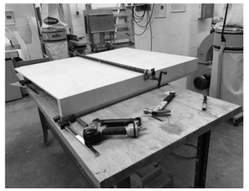
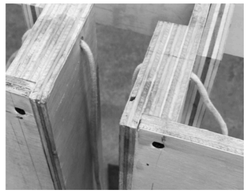
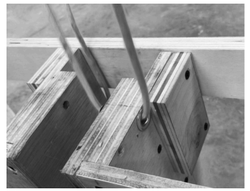
3D Model 2

Instable cover

To block sound and light

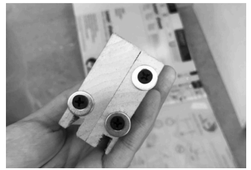


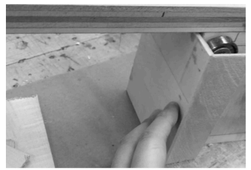
The cover was found to be unstable when it was moving up and down. To solve this problem, I implemented a slideway. A narrow slide block that stamped to the rubber hinge was used to connect the slideway and cover. Lots of sketches and a small wooden model were created to figure out the new structure. To make it more stable, a thick wood piece with a curve cut in front of the headboard to stop the cover was designed. Multiple magnets were designed to be installed in the edge of the curve and the cover to minimize the space between those sections. However, it was hard to fully realize the design because the cover shape was always changing; eventually, the curve cut piece idea was abanoned.

To make users use less force in moving the heavy cover, I connected a counter weight, pulley structure to the cover to counteract its weight. The first idea was to thread a rope through the slide block and the two sides of the slideway both of which then connect with one weight on each side. Unfortunately, the holes on the wood have too much friction with the rope, this friction would decrease the lifespan of the rope. Ultimately, grommets were used in the wood holes to make a smoother path for the rope.

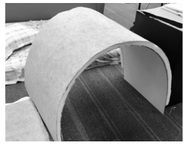
The structure with one counter weight on each side had a risk of imbalance, so I connected only one weight to the slide block by pulley; however, the center of the gravity was closer to the front, which made the cover lean forward and the middle slide block hard to move.


One thick block was added to the back edge of the slide block. While this made the cover more parallel to the ground, it added too much friction with the slot even after using vaseline. So I had to find another way to solve this problem. Replacing the thick block, a block with 8 bearings was tried. This structure worked very efficiently. Easy to move and the cover was parallel to the ground. A box was made to hide the bearings. Two pieces of wood were added to the bottom of the headboard to leave more space between mattress and headboard for the added part.






Support material

Size

Projector

3D Model 1

Hinge

3D Model 2

Shaky Cover

To block sound and light

To decrease sound, polyfill batting and sponge mat were used on inside and outside of the Lexan. Noico sound deadener and acoustic foam panels were considered in the beginning. Although noico sound deadener isolated sound very good, it was too heavy for the cover. Allow for the possibility use of projection, the inside surface should be smooth. For this reason, acoustic foam panels were not a good option. So cellular structure material, llike polyfill batting and sponge mat were considered to absorb the sound. To block more sound and light, were explored by using 3D model.

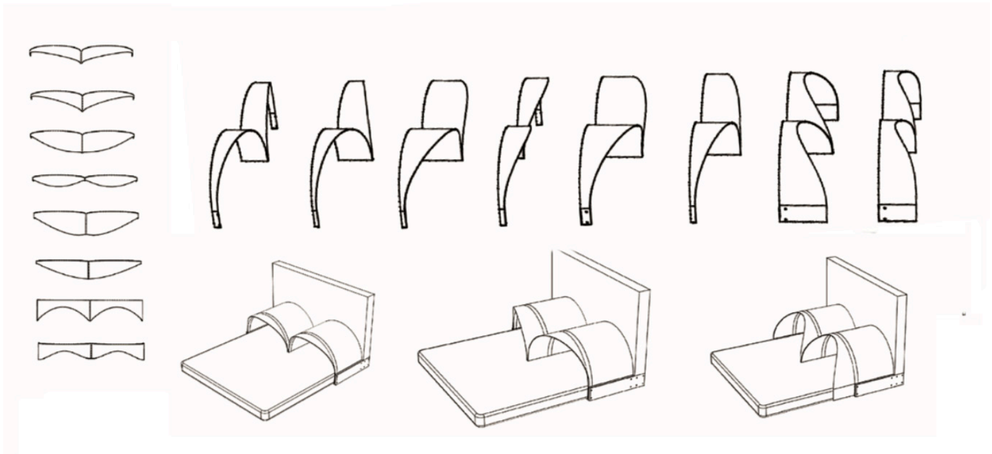


Figure 3.3 Possible shapes of the cover

ECO

SLEEP SYSTEM

Design for co-sleep environment

The development of a design intervention that minimizes co-sleeping sound and light disruptions resulted in an effective, working design. The ECO Sleep System allows couples have good nights' sleep despite disruptions from each other. It provides couples with separate environments when it be partitioned into relatively separate spaces.

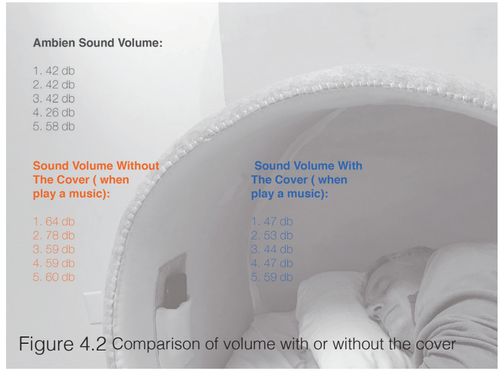
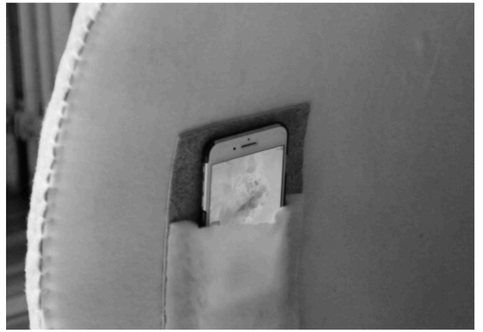


Figure 4.2 Comparison of volume with or without the cover

Figure 4.2 Comparison of brightness with or without the cover

A light meter and sound meter were used to test the lightness and volume the same distance from the light and sound source. According to Figure 4.1 and Figure 4.2, the ECO Sleep System prototype can reduce volume and brightness.

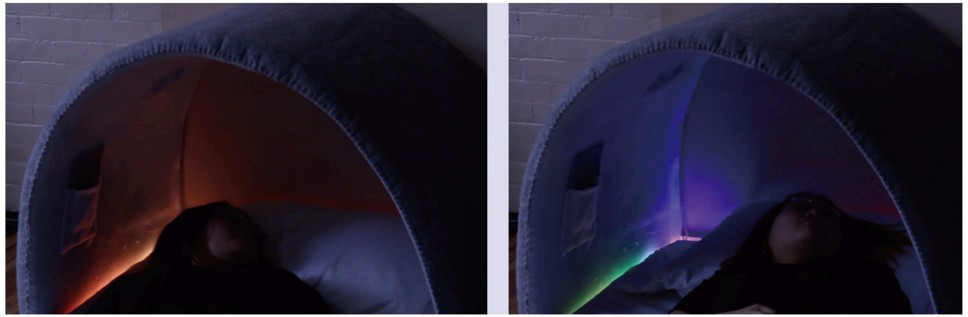


Considering the indispensability of digital devices, the design has two integrated pockets that can charge and hold a smartphone. No extra long charge wire is needed. This allows the sleep environment to be more organized to improve co-sleep experience. The material of the pockets is fluffy and soft and was selected to let users feel relaxed. The hope is to use this abstract touch feeling to remind the memory of spending time with a pet or other comfortable moments.

Users could control the light and sound in their own space by phone. The main color for app interface is dark grey to protect users' eyes in dark environment. Light, sound, and environment are three main functions of Eco Sleep System app. They are on the bottom of app interface.

For the light function, users can adjust brightness by using the slider on the right side. When they tap “read”, they can adjust the light color from cold to warm and set timer for reading. When users tap “clock”, they can set light alarm clock that use light to mimic sunrise to wake them up. The light alarm clock will only wake one individual up because of the cover that can decrease sound and light. In light function, users could also choose different light atmospheres to help them sleep without disturbing their partners.

The ECO Sleep System plays sound by choosing downloaded music, radio, or white noise to help them sleep. Users can adjust volume by the slider on the left side. Couples can enjoy different audios to initiate their sleep.



The design controls light and sound to give individuals a more immersive environment to sleep. Multi-sensory elements make people more engaged in the environment they set and relax. Users can adjust volume on the left side and adjust brightness on the right side. They can also set countdown time for this function.

Further, when they want to share the space to read or watch videos together, the shape could transform into a larger cover. If optimized, the design could encourage them to do activities together before sleep. For example, by connecting two projectors, they could share a video with bigger projection.

By using ECO Sleep System, Couples can enjoy their space together or quickly separate the space for certain moment to decrease light and sound from their partners. And adjust their environment based on their own needs.

DESIGNER'S FINDINGS

During the whole process of this thesis study, I learned a lot about finding potential gaps and solving problems. First of all, I improved my research skills and I am able to use professional studies to guide my design process, making my designs more palpable. Second, I learned to alternate my design practices in different ways to help me think through design mockups from different angles: I cycled through various sketches, paper models, full size models, 3D models, all working towards a functioning prototype. This nonlinear process helped me think through different aspects of the mockup. For example, sketching ideas gives me more of an imaginative space while the first version, full-sized model helped me understand the scale of the design; the 3D model helped me understand how to approach actually building a prototype. Lastly, the full-size prototype making process specifically helped me to be more confident in solving complicated, unexpected problems; I learned to better weigh the pros and cons of solutions as they pertained to the larger goals of the project.

CONCLUSION

Many couples face co-sleep problems. While there are many products on the market designed to help individuals with sleep problems, there are few that address co-sleeping problems. This thesis addresses this gap in the market for co-sleeping products by exploring how a design intervention of bedroom furniture can help couples sleep together despite disruptions from each other. This paper records the design process and the development of a functional, full-scale prototype. The resulting design is the “ECO-sleep system.” The prototype is effective because it reduces sound and light disruptions from their partners; however, it does not completely eliminate them. More effort could be put into further decreasing sound and light disruptions. Additionally, time could be spent finding a lighter support material for the cover.

My product addresses a certain co-sleeping need and suggests that more attention be paid to the multitude of co-sleep problems that currently exist. Essentially, more products should come out to fulfill users' various needs. The concept of the Eco Sleep System is one possible solution in this untouched area. Furthermore, the form and the influence of the Eco Sleep System could be valuable for co-sleep studies concerned with the balance between intimacy and privacy in co-sleep environments.

There are other applications for this product beyond the bedroom. If I am able to find lighter, more flexible support material, it would be possible to make the ECO sleep system portable. For instance, a user could take the ECO sleep system with them for use in public spaces to create temporary private spaces. If placed in a park, the ECO sleep system could

provide refuge from the sun for users who are looking to take rest. If taken to the library, you could create a resting or quiet reading space. There are as many potential applications of the ECO sleep system as there are spaces to use it.

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