Waking up without having others to do so

Arthur, Daniel, Shuan, Wayne

What is Sleep?

1920s – scientists regar
sleep as an inac
brain state

ard Medical School
vision of Sleep Medicine
[HMSDSM], 2007)

Sleep is…

a period of reduced physical activity

(HMSDSM, 2007)

Physiological Changes

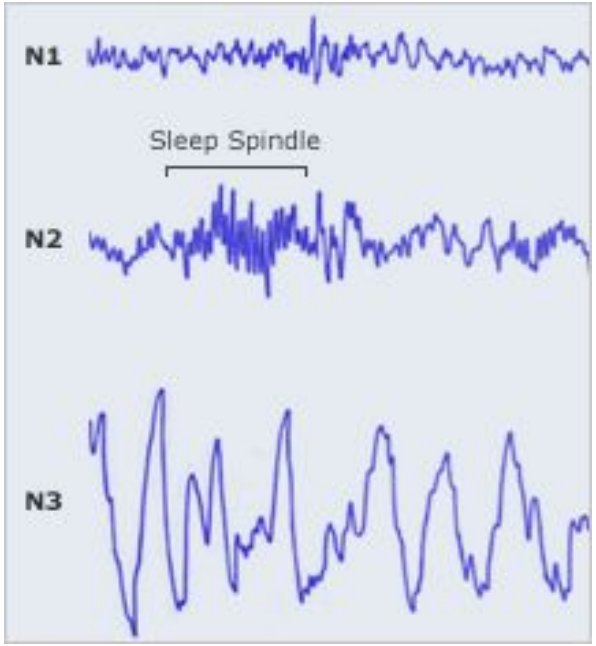
- E.g. temperature, blood pressure, levels of oxygen
- Reduced and constant during NREM sleep
- Increase in hormone, cell repair and growth

(HMSDSM, 2007)

NREM (n.)

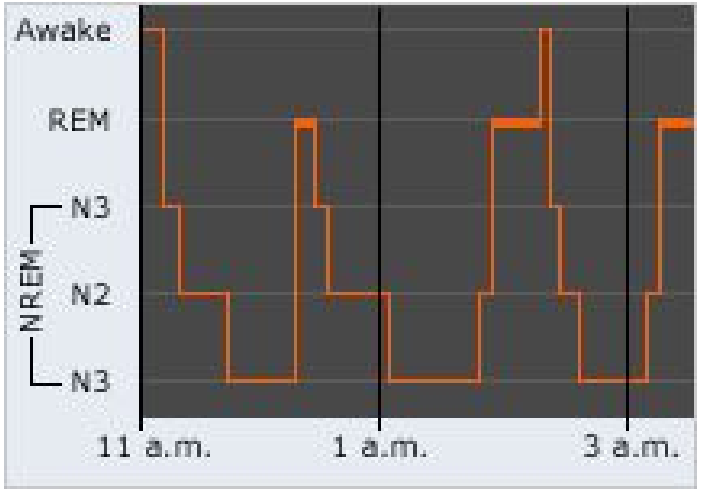
Non-Rapid-Eye-Movement

a.k.a. Deep sleep



Brain Activity

- Remains active during sleep
- Patterns of neuron → random and variable:
  - Non-REM sleep → coordinated and synchronous
  - REM sleep → more active than awake



(HMSDSM, 2007)

Sleep is...

associated with a typical posture (e.g. lying down with eyes closed)

(HMSDSM, 2007)

Sleep is...

results in a decreased responsiveness to external stimuli

(HMSDSM, 2007)

Sleep is...

a state that is relatively easy to reverse than hibernation and coma

(HMSDSM, 2007)

Why do we ~~need~~ sleep?

Hunger : Eating

=

Sleepiness : Sleep

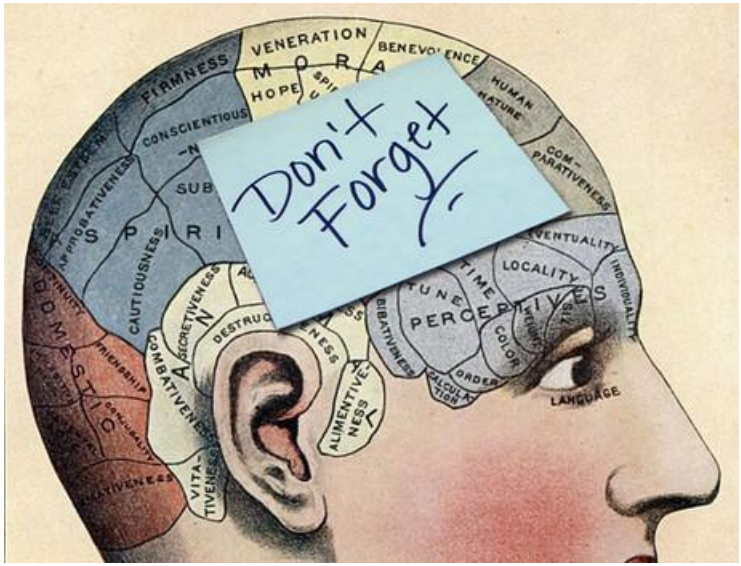
Learning

- ➔ Optimize attention → accept new information efficiently
- ➔ Sleep deprived → cannot coordination information properly
- ➔ Lose the ability to make sound decisions and the right behaviours

(HMSDSM, 2007)

Memory

- ➔ Consolidation of memory to process the information to become a stable memory mostly during REM sleep
- ➔ To be able to recall it when needed
- ➔ Declarative memory: more REM sleep to process new knowledge
- ➔ Procedural memory: remembering how to do something



(HMSDSM, 2007)

Reduce Diseases Risks

- Chronic disease
- Obesity
- Heart disease + hypertension
- Mood disorders
- Immune function

Identify Issues, Constraints, Users, and Interview

Issues

- How to wake our users up effectively?
  - How to wake only the user up without waking the others around our users?
  - How to wake our user up right on time or in a range of time, so our users won't mess up their daily schedules?
  - How to improve our users' sleeping condition

Constraints

- The involvement of new development shouldn’t go against the law
- Our user's health condition (ears, heart, body...)
- Our user’s sleeping habits (irregular sleeping habits might lead to unexpected result)

Users

We set our users mainly as PAS high school students who have troubles waking up by themselves.

- Who try to wake up without bothering others
- Who are willing to try new technology on solving their problems
- Who hope to improve their sleeping condition

Interview

1. How do you wake up?
    a. Do alarm clocks work on you?
    b. Have you ever been unwillingly woken up by someone else waking up?
    c. Have you ever woke someone up unintentionally because you woke up?
2. Do you find yourself lacking the motivation to wake up or simply can’t be waken up from sleep?
3. Are you satisfied with your current sleeping habit? Why?
4. Are you able to fall asleep quickly after using electronic devices?
5. Do you have an experience of trying to adjust your current sleep pattern? If yes, tell us about the process–how you did it and whether it succeeded or not?
6. How would you redesign alarm clocks so that they fit your need?
7. Would you mind trying some unpopular methods, like alarms without using loud noises?
8. Do you sleep with a vital signs tracking device on?
    a. Are you a heavy sleeper (深度睡眠者)?
    b. Tell us a little bit about your sleeping habit (e.g. wake up/sleep time)
    c. (Sleep cycle data, start and end time, heart rate, hydration level)

Possible Solutions

Sleep analysis wake up time determination

Analyzes sleep cycle to determine best approximate wake up time

Modify the body's temperature

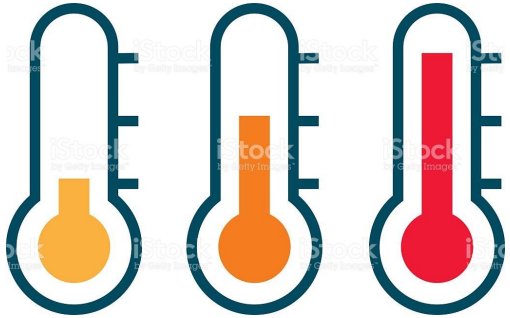
Cooler air is sleep friendly and is a circadian regulator

(NCBI, 1997)

https://www.ncbi.nlm.nih.gov/pubmed/9322266

Implementations

Program the AC to turn off *x* minutes before wake up.



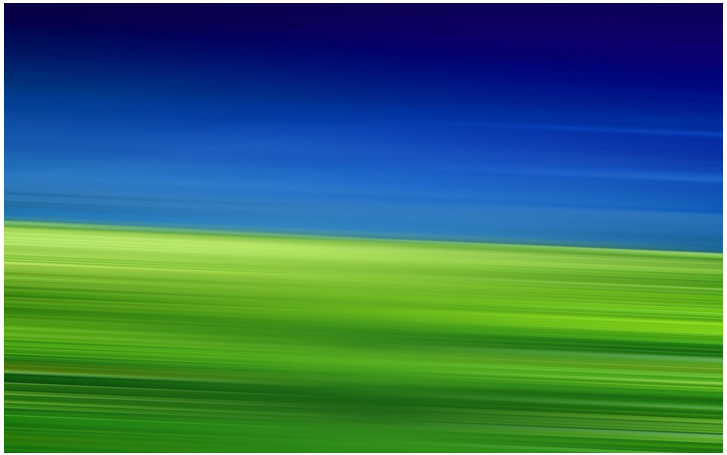
Sheets that roll up away from you *x* minutes before wake up

Color of light

Green light promotes sleep

Blue lights prevent sleep by delaying

Men concentrate better in blue-enriched lighting environment



Quality of light

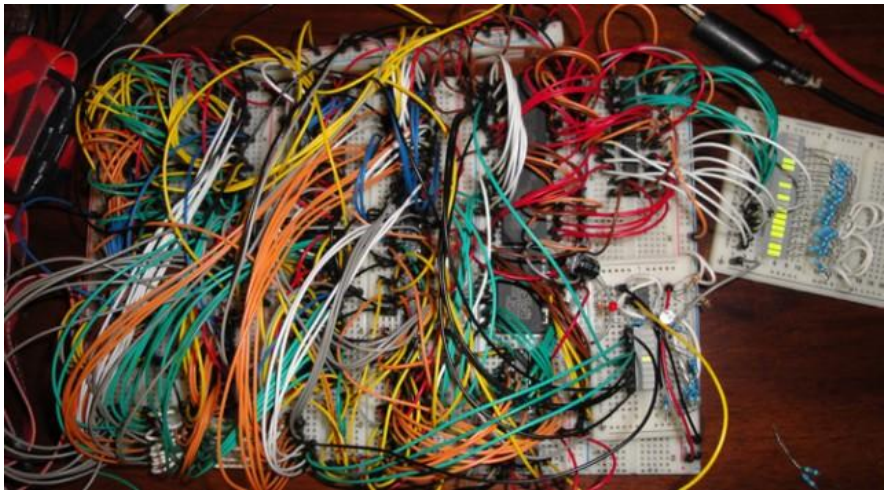
Natural light wakes people up better

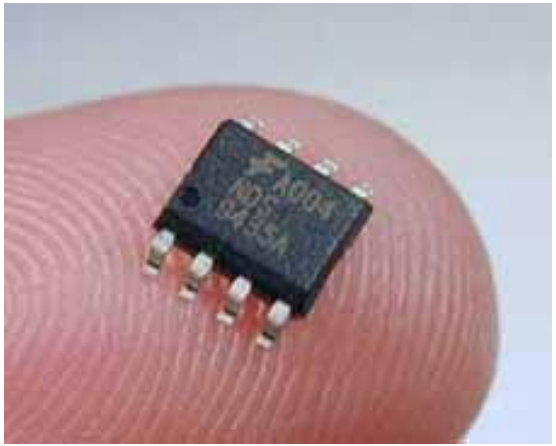
In contrast to women, men had higher brightness perception

Prototype Plan

Low quality prototyping on Arduino and breadboard with proprietary sensors.

Once prototype successful, we print our product onto a custom IC.





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