2020-2021
Science Fair Project

How Do Sleep Positions Affect Dreams In Teenagers?

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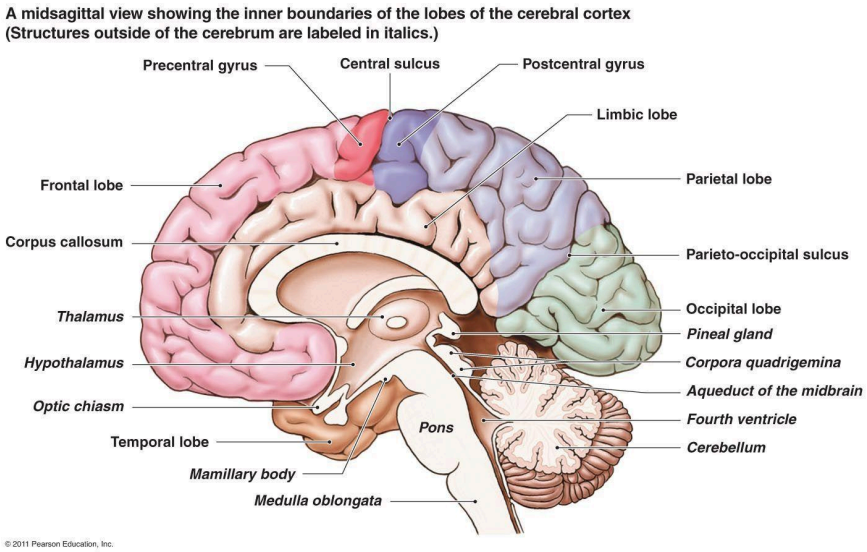
Background Information

Sleep Anatomy

Sleep is a relatively dynamic routine that people do every day. During sleep, several brain structures are actively involved. They are the brain stem, hypothalamus, thalamus, cerebral cortex, basal forebrain, pineal gland, midbrain, and amygdala. The hypothalamus is the brain part that controls a person's waking and sleep, while the brain stem is a structure that ensures a smooth transition between arousal and sleep. The brain stem collaborates with the hypothalamus to reduce the activity of arousal centers during sleep. They do this by generating a neurotransmitter called gamma-aminobutyric acid (GABA), which helps enter the sleeping stage. Additionally, the muscles are paralyzed by the brain stem not to act out what a person dreams. In dreams, the thalamus is an essential brain part, which works mostly during REM sleep. The thalamus forwards sensations such as noises and pictures to the cerebral cortex, making up the contents of dreams. The amygdala also assists the thalamus and processes feelings in REM sleep. Further, melatonin, a hormone that makes a person sleepy, is composed by the pineal gland. The basal forebrain accumulates the chemical called adenosine during wakefulness, which also helps support sleepiness in the dark.



Sleep Stages

Dreams are hallucinations that happen during sleep. Dreams develop during the REM (rapid-eye movement) stage, though some dreams do occur during NREM (non-rapid-eye movement). People dream every day. Each person's dream is unique and contains different emotions. Several factors such as sleeping positions, length of sleep, and screen time affect dreams. There are usually four sleep stages, with three stages belonging to the NREM category and the last stage in the REM category. The first stage is a short period that lasts for several minutes. A person's heartbeat and respiratory rate are slower than when they wake up. Muscles are also relaxed. The second stage of sleep is where a person spends most of the time during the repeated cycles. At this stage, the body temperature decreases and the brain activities slow down. Stage three induces the deepest sleep. The levels of heartbeat and respiratory rates have been decreased to the lowest. Finally, REM sleep makes the eyes move quickly from side to side, and most of a human's dream happens at this stage. We have become very intrigued about dreams. Before deciding to conduct this study, we had several discussions about what we dreamed of. We then read research papers about the sleeping position affecting dream content. Therefore, we decided to conduct a study about the correlation between dreams and sleep positions in teenagers. [1]

Purpose

The purpose of our experiment is to find the correlation between sleep positions and subjective dream quality in teenagers. We can do so by creating a Google Form survey inquiring about sleep habits and sleep positions, collecting data from people aged 13-19, and identifying factors that could affect subjective dream quality in certain sleep positions.

Question

How do sleep positions affect dreams in teenagers?

Variables

- *Independent*- sleep positions
- *Dependent*- subjective emotional parameters of the dreams
- *Controlled*- range of age (13-19)

Hypothesis

We hypothesize that sleeping in back positions will reportedly lead to the happiest dreams. Sleeping on the left side of the body will prompt the scariest dreams, sleeping on the right side will contribute to the least vivid dreams, and sleeping on the stomach will incite the most romantic dreams.

Resources

- Google Form survey
- Sample population size of 1225 teenagers

Procedure

1. Create the survey on Google Forms inquiring about sleep habits and sleep positions.
2. Include the following questions on the questionnaire:
    A. How old are you?
    B. What is your gender?
    C. On average, how long do you sleep?

D. Which position do you usually wake up in? Select the option from the image.

E. How vivid are your dreams on a scale from 1 to 10? (1 - not vivid, 10 - very vivid)
F. How scary are your dreams on a scale from 1 to 10? (1 - not scary, 10 - very scary)
G. How happy are your dreams on a scale from 1 to 10? (1 - very sad, 10 - very happy)
H. How bizarre are your dreams on a scale from 1 to 10? (1 - not bizarre, 10 - very bizarre)
I. How romantic are your dreams on a scale from 1 to 10? (1 - not romantic, 10 - very romantic)
J. Are you an early bird or a night owl?
K. Do you consume any sleep medications/caffeine
L. On average, how long is your screen time? (hours per day)
M. Is there anything else you would like us to know about your sleep?

3. Distribute the survey on various social media platforms, such as Instagram and Reddit. Create a paid advertisement on Instagram targeting teenagers and run it in the course of a week.
4. Collect the data from teenagers and import it from Google Forms to Google Sheets through the form settings.
5. Create a data analysis computer program using the Java programming language.

   Procedure for creating the code:

   A. Export the survey results from Google Sheets as a .csv file for analysis purposes.
   B. Import the apache.commons.csv, java.util.Arraylist, java.util.Arrays, and edu.duke* packages to make data analysis an easier, more efficient process.

```
import org.apache.commons.csv.*;
import edu.duke.*;
import java.util.ArrayList;
import java.util.Collections;
import java.util.Arrays;
```

   C. Categorize the sleeping positions into four categories: back, stomach, left and right.
   D. Find the correlation between the waking position and each of the following emotional parameters: happiness, vividity, bizarreness, romance, scariness.
   E. Retrieve the waking position and each user's dream emotional parameter by using CSV (Comma-Separated Values) methods for calculating the result.
   F. Check which category the sleeping position is in. Add up all the ratings given by users and store this number in a variable for that category.
   G. Calculate the average for each category by using the variable defined earlier and dividing it by the number of users.

H. Display the average for each waking position on the screen in a way

```
public class wakePosBizarreness {
    static ArrayList<Integer> backPoses = new ArrayList<Integer>(Arrays.asList(1,4,5,12,13,14,16,20,22));
    static ArrayList<Integer> leftPoses = new ArrayList<Integer>(Arrays.asList(3,6,11,21));
    static ArrayList<Integer> rightPoses = new ArrayList<Integer>(Arrays.asList(9,18,19,23));
    static ArrayList<Integer> stomachPoses = new ArrayList<Integer>(Arrays.asList(2,7,8,10,15,17,24));

    public static void wakePosBizareness (CSVParser parser) {
        int countBackPoses=0, countLeftPoses=0, countRightPoses=0, countStomachPoses=0;
        int backBizarreAvg=0, leftBizarreAvg=0, rightBizarreAvg=0, stomachBizarreAvg=0;
        double right=0.0, left=0.0, back=0.0, stomach=0.0;

        ArrayList<Integer> bizarrenesses = new ArrayList<Integer>();
        ArrayList<Integer> wakePoses = new ArrayList<Integer>();
        for (CSVRecord record : parser) {
            String bizarreness = record.get("bizarreness");
            String wakePos = record.get("wakePos");
            int wakePosInt = Integer.parseInt(wakePos);
            int bizarre = Integer.parseInt(bizarreness);
            if (bizarre != 0) {
                bizarrenesses.add(bizarre);
            }
            wakePoses.add(wakePosInt);

            if (backPoses.contains(wakePosInt)) {
                countBackPoses+=1;
                backBizarreAvg+=bizarre;
            }
            if (leftPoses.contains(wakePosInt)) {
                countLeftPoses+=1;
                leftBizarreAvg+=bizarre;
            }
            if (rightPoses.contains(wakePosInt)) {
                countRightPoses+=1;
                rightBizarreAvg+=bizarre;
            }
            if (stomachPoses.contains(wakePosInt)) {
                countStomachPoses+=1;
                stomachBizarreAvg+=bizarre;
            }
            double countBackPosesD=countBackPoses,countLeftPosesD=countLeftPoses,
                countRightPosesD=countRightPoses, countStomachPosesD=countStomachPoses,
                backBizarreAvgD=backBizarreAvg, leftBizarreAvgD=leftBizarreAvg, rightBizarreAvgD=rightBizarreAvg,
                stomachBizarreAvgD=stomachBizarreAvg;
            right = rightBizarreAvgD/countRightPosesD;
            left = leftBizarreAvgD/countLeftPosesD;
            back = backBizarreAvg/countBackPosesD;
            stomach = stomachBizarreAvgD/countStomachPosesD;

        }
        System.out.println("WAKING POSITIONS - BIZARRENESS");
        System.out.println("The average bizarreness for poses on the right side is " + right);
        System.out.println("The average bizarreness for poses on the left side is " + left);
        System.out.println("The average bizarreness for poses on the back side is " + back);
        System.out.println("The average bizarreness for poses on the stomach side is " + stomach);
    }
```

that is readable to humans.

```java
public class wakePosVividity {
    static ArrayList<Integer> backPoses = new ArrayList<Integer>(Arrays.asList(1,4,5,12,13,14,16,20,22));
    static ArrayList<Integer> leftPoses = new ArrayList<Integer>(Arrays.asList(3,6,11,21));
    static ArrayList<Integer> rightPoses = new ArrayList<Integer>(Arrays.asList(9,18,19,23));
    static ArrayList<Integer> stomachPoses = new ArrayList<Integer>(Arrays.asList(2,7,8,10,15,17,24));

    public static void wakePosVividity (CSVParser parser) {
        int countBackPoses=0, countLeftPoses=0, countRightPoses=0, countStomachPoses=0;
        int backVividAvg=0, leftVividAvg=0, rightVividAvg=0, stomachVividAvg=0;
        double right=0.0, left=0.0, back=0.0, stomach=0.0;
        ArrayList<Integer> vividities = new ArrayList<Integer>();
        ArrayList<Integer> wakePoses = new ArrayList<Integer>();
        for (CSVRecord record : parser) {
            String vividity = record.get("vividity");
            String wakePos = record.get("wakePos");
            int wakePosInt = Integer.parseInt(wakePos);
            int vivid = Integer.parseInt(vividity);
            if (vivid != 0) {
                vividities.add(vivid);
            }
            wakePoses.add(wakePosInt);

            if (backPoses.contains(wakePosInt)) {
                countBackPoses+=1;
                backVividAvg+=vivid;
            }
            if (leftPoses.contains(wakePosInt)) {
                countLeftPoses+=1;
                leftVividAvg+=vivid;
            }
            if (rightPoses.contains(wakePosInt)) {
                countRightPoses+=1;
                rightVividAvg+=vivid;
            }
            if (stomachPoses.contains(wakePosInt)) {
                countStomachPoses+=1;
                stomachVividAvg+=vivid;
            }
            double countBackPosesD=countBackPoses,countLeftPosesD=countLeftPoses,
                countRightPosesD=countRightPoses, countStomachPosesD=countStomachPoses,
                backVividAvgD=backVividAvg, leftVividAvgD=leftVividAvg, rightVividAvgD=rightVividAvg,
                stomachVividAvgD=stomachVividAvg;
            right = rightVividAvgD/countRightPosesD;
            left = leftVividAvgD/countLeftPosesD;
            back = backVividAvgD/countBackPosesD;
            stomach = stomachVividAvgD/countStomachPosesD;
        }
        System.out.println("WAKING POSITIONS - VIVIDITY");
        System.out.println("The average vividity for poses on the right side is " + right);
        System.out.println("The average vividity for poses on the left side is " + left);
        System.out.println("The average vividity for poses on the back side is " + back);
        System.out.println("The average vividity for poses on the stomach side is " + stomach);
    }
```

```java
public class wakePosHappiness {
    static ArrayList<Integer> backPoses = new ArrayList<Integer>(Arrays.asList(1,4,5,12,13,14,16,20,22));
    static ArrayList<Integer> leftPoses = new ArrayList<Integer>(Arrays.asList(3,6,11,21));
    static ArrayList<Integer> rightPoses = new ArrayList<Integer>(Arrays.asList(9,18,19,23));
    static ArrayList<Integer> stomachPoses = new ArrayList<Integer>(Arrays.asList(2,7,8,10,15,17,24));

    public static void wakePosHappiness (CSVParser parser) {
        int countBackPoses=0, countLeftPoses=0, countRightPoses=0, countStomachPoses=0;
        int backHappyAvg=0, leftHappyAvg=0, rightHappyAvg=0, stomachHappyAvg=0;
        double right=0.0, left=0.0, back=0.0, stomach=0.0;
        ArrayList<Integer> happinesses = new ArrayList<Integer>();
        ArrayList<Integer> wakePoses = new ArrayList<Integer>();
        for (CSVRecord record : parser) {
            String happiness = record.get("happiness");
            String wakePos = record.get("wakePos");
            int wakePosInt = Integer.parseInt(wakePos);
            int happy = Integer.parseInt(happiness);
            if (happy != 0) {
                happinesses.add(happy);
            }
            wakePoses.add(wakePosInt);

            if (backPoses.contains(wakePosInt)) {
                countBackPoses+=1;
                backHappyAvg+=happy;
            }
            if (leftPoses.contains(wakePosInt)) {
                countLeftPoses+=1;
                leftHappyAvg+=happy;
            }
            if (rightPoses.contains(wakePosInt)) {
                countRightPoses+=1;
                rightHappyAvg+=happy;
            }
            if (stomachPoses.contains(wakePosInt)) {
                countStomachPoses+=1;
                stomachHappyAvg+=happy;
            }
            double countBackPosesD=countBackPoses,countLeftPosesD=countLeftPoses,
                countRightPosesD=countRightPoses, countStomachPosesD=countStomachPoses,
                backHappyAvgD=backHappyAvg, leftHappyAvgD=leftHappyAvg, rightHappyAvgD=rightHappyAvg,
                stomachHappyAvgD=stomachHappyAvg;
            right = rightHappyAvgD/countRightPosesD;
            left = leftHappyAvgD/countLeftPosesD;
            back = backHappyAvgD/countBackPosesD;
            stomach = stomachHappyAvgD/countStomachPosesD;
        }
        System.out.println("WAKING POSITIONS - HAPPINESS");
        System.out.println("The average happiness for poses on the right side is " + right);
        System.out.println("The average happiness for poses on the left side is " + left);
        System.out.println("The average happiness for poses on the back side is " + back);
        System.out.println("The average happiness for poses on the stomach side is " + stomach);
    }
```

```java
public class wakePosRomance {
    static ArrayList<Integer> backPoses = new ArrayList<Integer>(Arrays.asList(1,4,5,12,13,14,16,20,22));
    static ArrayList<Integer> leftPoses = new ArrayList<Integer>(Arrays.asList(3,6,11,21));
    static ArrayList<Integer> rightPoses = new ArrayList<Integer>(Arrays.asList(9,18,19,23));
    static ArrayList<Integer> stomachPoses = new ArrayList<Integer>(Arrays.asList(2,7,8,10,15,17,24));

    public static void wakePosRomance (CSVParser parser) {
        int countBackPoses=0, countLeftPoses=0, countRightPoses=0, countStomachPoses=0;
        int backRomanticAvg=0, leftRomanticAvg=0, rightRomanticAvg=0, stomachRomanticAvg=0;
        double right=0.0, left=0.0, back=0.0, stomach=0.0;

        ArrayList<Integer> romances = new ArrayList<Integer>();
        ArrayList<Integer> wakePoses = new ArrayList<Integer>();
        for (CSVRecord record : parser) {
            String romance = record.get("romance");
            String wakePos = record.get("wakePos");
            int wakePosInt = Integer.parseInt(wakePos);
            int romantic = Integer.parseInt(romance);
            if (romantic != 0) {
                romances.add(romantic);
            }
            wakePoses.add(wakePosInt);

            if (backPoses.contains(wakePosInt)) {
                countBackPoses+=1;
                backRomanticAvg+=romantic;
            }
            if (leftPoses.contains(wakePosInt)) {
                countLeftPoses+=1;
                leftRomanticAvg+=romantic;
            }
            if (rightPoses.contains(wakePosInt)) {
                countRightPoses+=1;
                rightRomanticAvg+=romantic;
            }
            if (stomachPoses.contains(wakePosInt)) {
                countStomachPoses+=1;
                stomachRomanticAvg+=romantic;
            }
            double countBackPosesD=countBackPoses,countLeftPosesD=countLeftPoses,
                countRightPosesD=countRightPoses, countStomachPosesD=countStomachPoses,
                backRomanticAvgD=backRomanticAvg, leftRomanticAvgD=leftRomanticAvg,
                rightRomanticAvgD=rightRomanticAvg,stomachRomanticAvgD=stomachRomanticAvg;
            right = rightRomanticAvgD/countRightPosesD;
            left = leftRomanticAvgD/countLeftPosesD;
            back = backRomanticAvgD/countBackPosesD;
            stomach = stomachRomanticAvgD/countStomachPosesD;

        }
        System.out.println("WAKING POSITIONS - ROMANCE");
        System.out.println("The average romance for poses on the right side is " + right);
        System.out.println("The average romance for poses on the left side is " + left);
        System.out.println("The average romance for poses on the back side is " + back);
        System.out.println("The average romance for poses on the stomach side is " + stomach);
    }
```

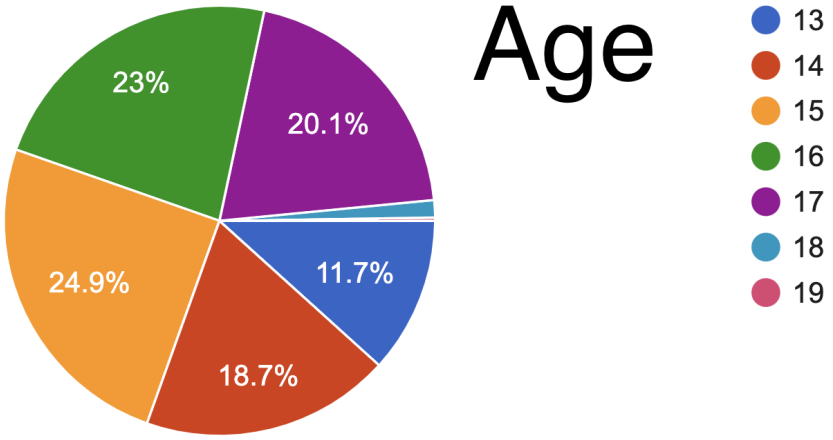
```java
public class wakePosScariness {
    static ArrayList<Integer> backPoses = new ArrayList<Integer>(Arrays.asList(1,4,5,12,13,14,16,20,22));
    static ArrayList<Integer> leftPoses = new ArrayList<Integer>(Arrays.asList(3,6,11,21));
    static ArrayList<Integer> rightPoses = new ArrayList<Integer>(Arrays.asList(9,18,19,23));
    static ArrayList<Integer> stomachPoses = new ArrayList<Integer>(Arrays.asList(2,7,8,10,15,17,24));

    public static void wakePosScariness (CSVParser parser) {
        int countBackPoses=0, countLeftPoses=0, countRightPoses=0, countStomachPoses=0;
        int backScaryAvg=0, leftScaryAvg=0, rightScaryAvg=0, stomachScaryAvg=0;
        double right=0.0, left=0.0, back=0.0, stomach=0.0;
        ArrayList<Integer> scarinesses = new ArrayList<Integer>();
        ArrayList<Integer> wakePoses = new ArrayList<Integer>();
        for (CSVRecord record : parser) {
            String scariness = record.get("scariness");
            String wakePos = record.get("wakePos");
            int wakePosInt = Integer.parseInt(wakePos);
            int scary = Integer.parseInt(scariness);
            if (scary != 0) {
                scarinesses.add(scary);
            }
            wakePoses.add(wakePosInt);

            if (backPoses.contains(wakePosInt)) {
                countBackPoses+=1;
                backScaryAvg+=scary;
            }
            if (leftPoses.contains(wakePosInt)) {
                countLeftPoses+=1;
                leftScaryAvg+=scary;
            }
            if (rightPoses.contains(wakePosInt)) {
                countRightPoses+=1;
                rightScaryAvg+=scary;
            }
            if (stomachPoses.contains(wakePosInt)) {
                countStomachPoses+=1;
                stomachScaryAvg+=scary;
            }
            double countBackPosesD=countBackPoses,countLeftPosesD=countLeftPoses,
                countRightPosesD=countRightPoses, countStomachPosesD=countStomachPoses,
                backScaryAvgD=backScaryAvg, leftScaryAvgD=leftScaryAvg, rightScaryAvgD=rightScaryAvg,
                stomachScaryAvgD=stomachScaryAvg;
            right = rightScaryAvgD/countRightPosesD;
            left = leftScaryAvgD/countLeftPosesD;
            back = backScaryAvgD/countBackPosesD;
            stomach = stomachScaryAvgD/countStomachPosesD;
        }
        System.out.println("WAKING POSITIONS - SCARINESS");
        System.out.println("The average scariness for poses on the right side is " + right);
        System.out.println("The average scariness for poses on the left side is " + left);
        System.out.println("The average scariness for poses on the back side is " + back);
        System.out.println("The average scariness for poses on the stomach side is " + stomach);
    }
```

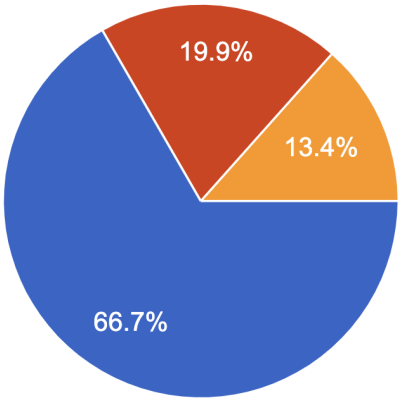
6. Run the code and record the results.
7. Collect the remaining data from Google Forms. This information will allow us to know the distribution of answers.

Results

```
WAKING POSITIONS - VIVIDITY
The average vividity for poses on the right side is 6.225
The average vividity for poses on the left side is 6.465863453815261
The average vividity for poses on the back side is 6.2748538011695905
The average vividity for poses on the stomach side is 6.2373887240356085
WAKING POSITIONS - ROMANCE
The average romance for poses on the right side is 4.183333333333334
The average romance for poses on the left side is 4.140562248995984
The average romance for poses on the back side is 4.200779727095517
The average romance for poses on the stomach side is 4.350148367952523
WAKING POSITIONS - BIZARRENESS
The average bizarreness for poses on the right side is 6.891666666666667
The average bizarreness for poses on the left side is 6.863453815261044
The average bizarreness for poses on the back side is 6.822612085769981
The average bizarreness for poses on the stomach side is 6.899109792284866
WAKING POSITIONS - SCARINESS
The average scariness for poses on the right side is 3.783333333333333
The average scariness for poses on the left side is 4.236947791164659
The average scariness for poses on the back side is 3.686159844054581
The average scariness for poses on the stomach side is 3.7566765578635013
WAKING POSITIONS - HAPPINESS
The average happiness for poses on the right side is 5.55
The average happiness for poses on the left side is 5.457831325301205
The average happiness for poses on the back side is 5.5282651072124755
The average happiness for poses on the stomach side is 5.448071216617211
```

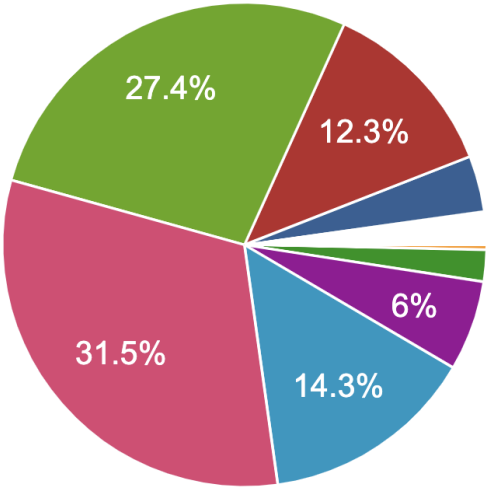
Calculated with code





Female
Male
Prefer not to say

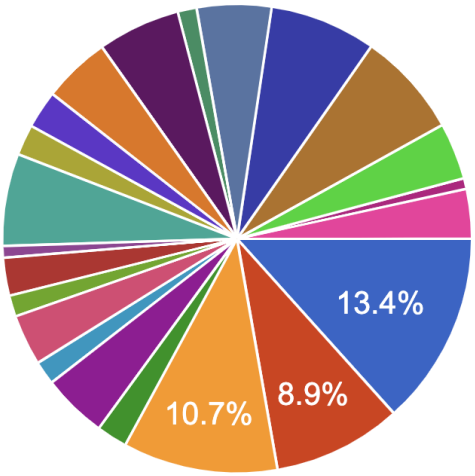
Gender



Hours of sleep

1
2
3
4
5
6
7
8

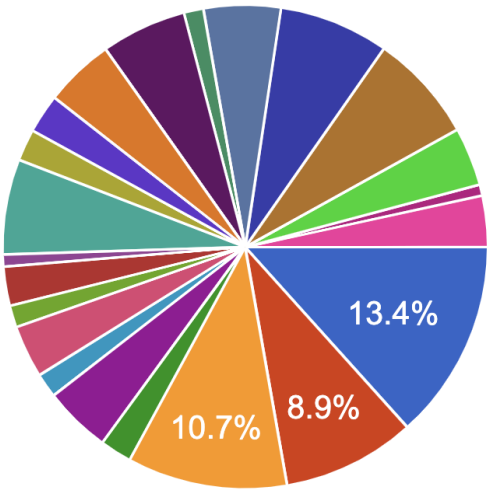
1/5



Waking positions, 1

1
2
3
4
5
6
7
8

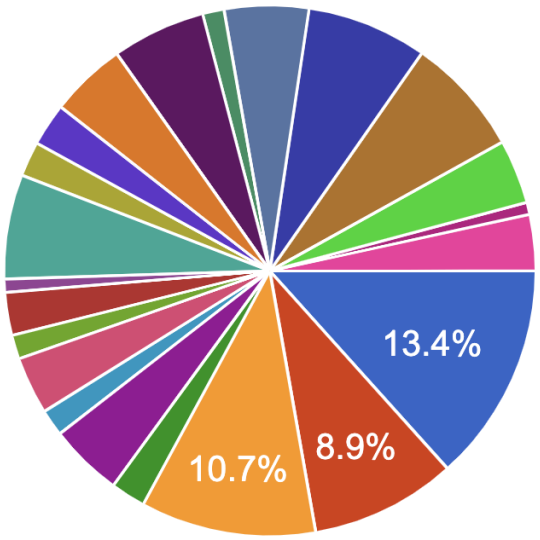
1/3



Waking positions, 2

- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16

▲ 2/3 ▼



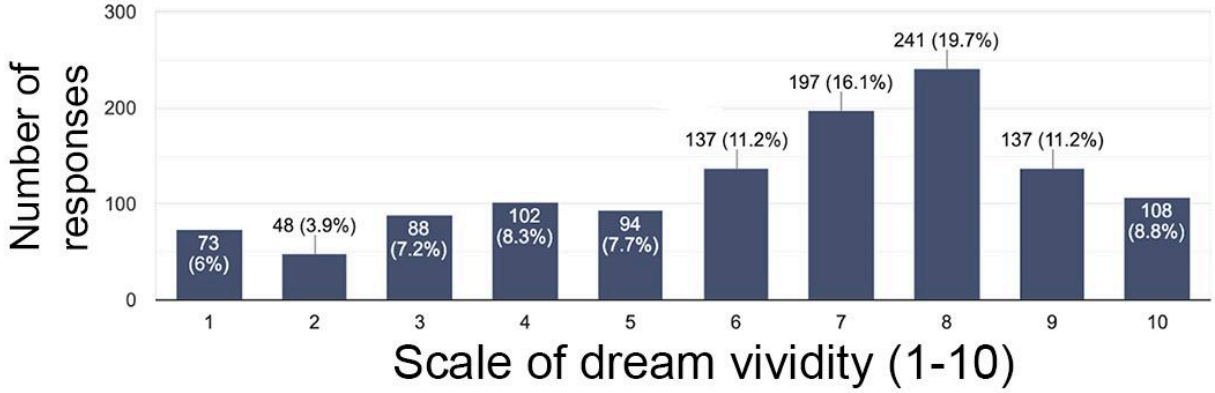
Waking positions, 3

- 17
- 18
- 19
- 20
- 21
- 22
- 23
- 24

▲ 3/3 ▼

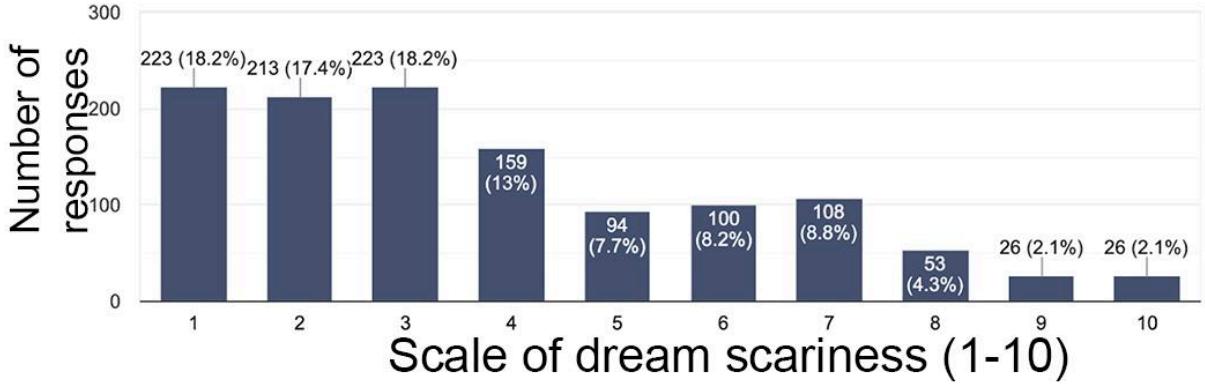
How vivid are your dreams on a scale from 1 to 10? (1 - not vivid, 10 - very vivid)

1,225 responses



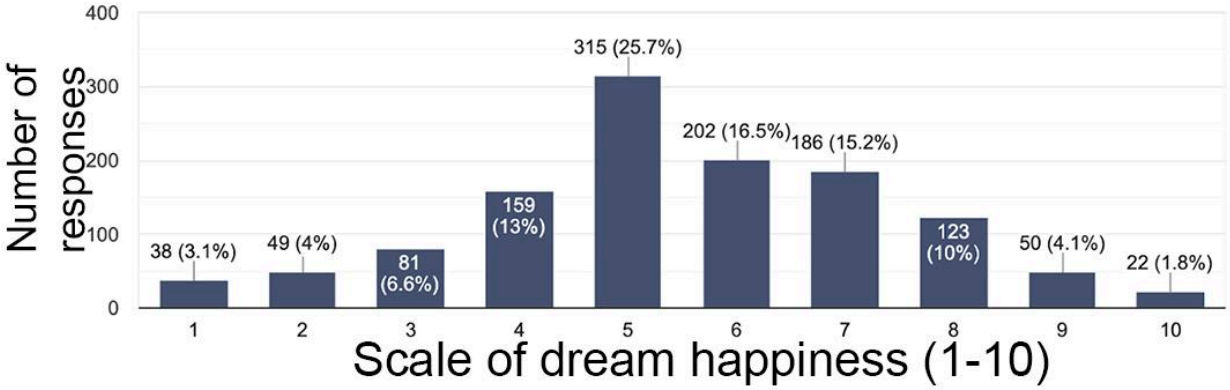
How scary are your dreams on a scale from 1 to 10? (1 - not scary, 10 - very scary)

1,225 responses



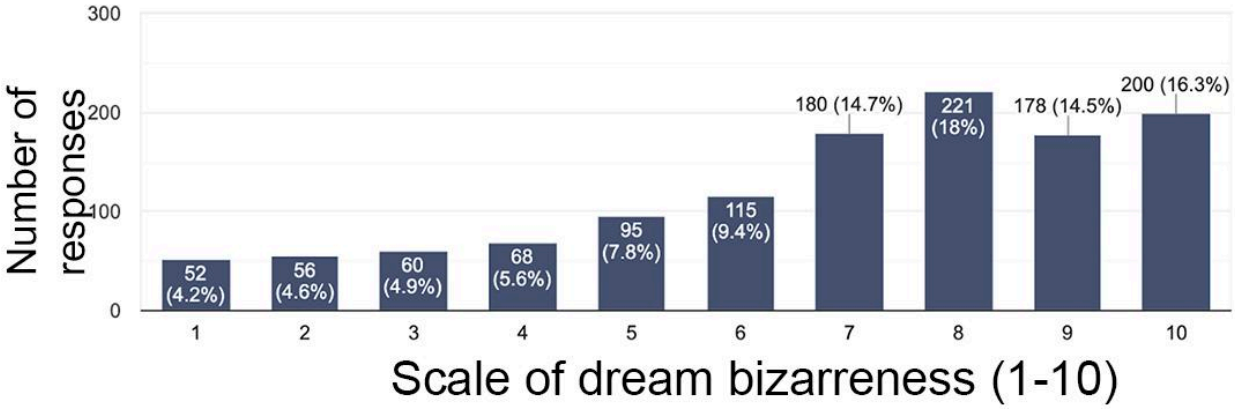
How happy are your dreams on a scale from 1 to 10? (1 - very sad, 10 - very happy)

1,225 responses



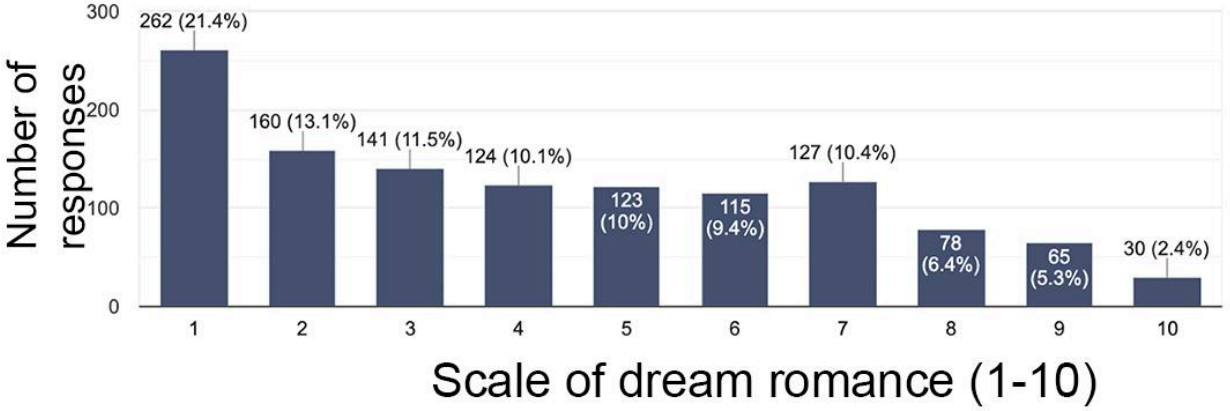
How bizarre are your dreams on a scale from 1 to 10? (1 - not bizarre, 10 - very bizarre)

1,225 responses



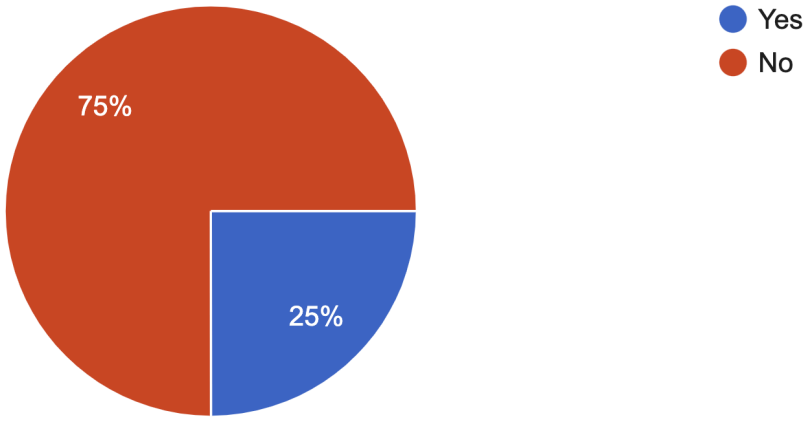
How romantic are your dreams on a scale from 1 to 10? (1 - not romantic, 10 - very romantic)

1,225 responses



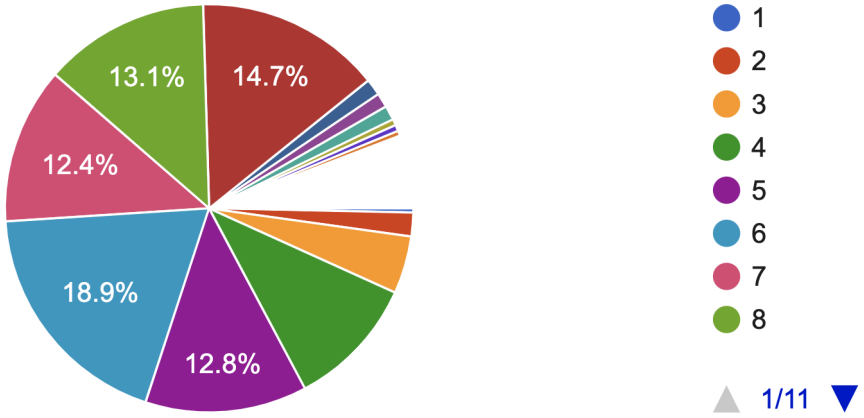
Do you consume any sleep medications/caffeine?

1,217 responses



On average, how long is your screen time? (hours per day)

1,225 responses



Conclusions

Survey takers reported having the happiest dreams when sleeping on the right side, with an average score of 5.55 out of 10. Sleeping on the right side will also bring an individual less vivid dreams, which the average score stated 6.23/10. On the other hand, the most vivid dreams happen when an individual enters sleep on the left side with an average of 6.47/10. The chances are the highest for sadder dreams to occur when sleeping on the stomach, with an average score of 5.45/10. Sleeping on the stomach could also potentially result in dreams that are likely more bizarre and romantic, with scores of 6.899/10 and 4.35/10, respectively. The scariest dreams occur when sleeping on the left side, with an average score of 4.24/10. Unsurprisingly, dreams experienced when sleeping on the left were the least romantic, with a score of 4.14/10. The least scary and the least bizarre dreams occur when sleeping on the back, with average scores of 3.69/10 and 6.82/10, respectively.

Discussion

Compared to other similar experiments [2], our experiment has the largest teenager sample size of 1225 people, and therefore, we have collected the most accurate data. Larger sample sizes provide more precise and accurate mean values, identify outliers that could skew the data in a smaller sample and provide a smaller margin of error.

When people sleep in different positions, various body parts experience different pressure. The body's responses to those pressures might result in a variety of different emotion-related dreams. When people sleep on the left side, the heart experiences a lot of pressure. The heart is uncomfortable and has a "stressed" heartbeat. When the heart is stressed, the brain may evoke negative feelings such as fear. Thus the likelihood of nightmares is increased. The dream is more likely to be vivid since people wake up in cold sweat, making the dream hard to forget [3]. The heart is at ease when sleeping on the right side. Therefore, there are fewer nightmares. Lying on the right side results in happier and less vivid dreams since

people wake up not remembering much from happy dreams rather than scary dreams. On the other hand, sleeping on the back is the most comfortable position since fewer muscles are involved. Back sleepers experience the least bizarre and least scary dreams. Sleeping on the stomach is the most uncomfortable position to sleep in. Therefore, the most bizarre and saddest dreams occur on it. The reason for the increased induction of romantic dreams on the stomach is uncertain. However, according to an associate professor at Hong Kong Shue Yan University, Calvin Kai-Ching Yu, Ph.D., it could be because of restricted breathing and stimulation, as your private parts are pressed against the bed [4].

Another factor that affects the subjective dream quality is sleep medicine and caffeine intake. In the survey, the participants are asked whether they take caffeine before going to bed. The results show that people who intake caffeine before going to bed have a higher dream vividity. Caffeine induces people to be more conscious by blocking the chemical called adenosine, which contributes to sleep. A conscious person will remember their dreams better since they are more aware of their dreams.

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NO CAFFEINE - WAKING POSITIONS - VIVIDITY
The average vividity for poses on the right side is 6.127659574468085
The average vividity for poses on the left side is 6.46448087431694
The average vividity for poses on the back side is 6.283505154639175
The average vividity for poses on the stomach side is 6.155737704918033
YES CAFFEINE - WAKING POSITIONS - VIVIDITY
The average vividity for poses on the right side is 6.52
The average vividity for poses on the left side is 6.46969696969697
The average vividity for poses on the back side is 6.520325203252033
The average vividity for poses on the stomach side is 6.377777777777778
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Furthermore, the length of sleep and how it may affect the emotional parameters is analyzed and explored using computer coding to investigate if sleeping 1-5 hours would influence the current data. In the results, we discovered that if the sleeping length is reduced, more vivid dreams will occur for each position. The updated data has higher scores than the old data by an average of 0.3 (it is different in every position). There is only one exception- the right side. The vividity score on the right side decreases by 0.3. If a person sleeps for 6-12 hours, then the results would increase by 0.1 as an average. According to the website called Scientific American, it states: "'When someone is sleep deprived we see greater sleep intensity, meaning greater brain activity during sleep; dreaming is definitely increased and likely more

vivid,' says neurologist Mark Mahowald of the University of Minnesota and director of the Minnesota Regional Sleep Disorders Center in Minneapolis." [5] Thus, vivid dreams are affected by the sleep length as well as the sleeping positions. Another intriguing result is the correlation between sleep length, happiness and how that impacts the current scores. When an individual sleeps for 1-5 hours, the dream content's happiness decreases by an average of 0.8 for each position.
On the other hand, sleeping for 6-12 hours makes the current data results rise by an average of 0.1. When people lack sleep, the amygdala is more active. Amygdala is the brain part that evokes the fight or flight response. When this brain part is active, people have a tendency to react in aggressive ways when provoked, causing the happiness data to drop down in the results. Lastly, the scariness affects the data as well, with the score increasing by 0.9 on average for sleeping 1-5 hours. The scores decrease by an average of approximately 0.2 when an individual sleeps for 6-12 hours. Meanwhile, the other emotional parameters are not considered since they do not form a trend when analyzed with the sleep lengths. Overall, less sleep causes the dreams to be more vivid, less happy, and scarier, while more sleep causes the dreams to be less vivid, happier and less scary.

Screen time is another factor that we took into consideration. The vividity surprisingly decreases with the screen time of 5-18 hours by an average of 0.1, while it increases when the screen time is 1-4 hours by an average of 0.4. Another unusual result we have is about the scariness of the dream in correlation to screen time. If a person looks at the screen for about 1-4 hours per day, then the score would rise by 0.3 on average. If the screen time is 5-18 hours, the score is decreased by an average of 0.1. According to outside research, blue light blocks melatonin release, a chemical that makes the subjects sleepy [6]. Therefore, it would supposedly make people more conscious and have more vivid and scarier dreams as people are exposed to the light for a longer time. However, these new conclusions contradict outside research, and it is not fully understood why screen time affects the current result in this fashion.

In one of our hypotheses, we stated that sleeping on the backside would result in the happiest dreams. We believe that because it is the most comfortable position. Few muscles are used, and the back position aligns the head, the neck and the spine

in their natural positions. Since we know that emotions are tied to dreaming, and people experience happy emotions when they are relaxed, we theorized that happy dreams would occur.
If we were to conduct the study again, we would change the options for gender to include non-binary people. We would also try to promote the survey to more males since most of our survey takers are females. Moreover, we would target the sample size to a more diverse audience by increasing the age range.

The Value of Our Work and Our Verdict

Our work's value isn't just determined by our study's results but also by how we analyzed our data and the methods we used. Our study is at the junction of three sciences: computer science, biology, and health sciences, which modern neuroscience is all about. Working on this project was very inspiring for both of us, and we will undoubtedly continue studying and improving in this field and topic.

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