



Study Buddy – The Lockbox to help you focus!

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Description and Target User

It seems like our world is increasingly being taken over by technology. With new social media apps and algorithms designed to retain your time spent scrolling on their app, it may be difficult for people to focus on tasks outside of these apps. Studies have shown an increase in ADHD-like symptoms in children who spend more time spent on technology per week (Cleveland Clinic, 2018). With increased levels of distractibility, this can lead to poorer attention and academic performance later in life.

To address this issue of difficulty in focusing, I decided to create a Study Buddy to help middle and high school teenagers, of 13-19 years of age, to focus on their real-life tasks. However, this product can be used by any person who feels technologically dependent or addicted to their devices. Essentially, this product functions as a lock box for a phone or tablet, preventing the user from checking their phone and being distracted from the task at hand. As the common adage states, since the phone is “out of [the user’s] sight,” it will also be “out of [their] mind.” As the phone is in the box, the user’s cognitive load will be decreased, as their attention shifts from their phone to their current external task. Studies have shown that students perform worse on tests of memory when their phone is simply in their bags, compared with students whose phones are in another room (Ward, et al, 2017).

The concept of this Study Buddy lockbox can be considered in terms of increasing an individual’s exposure to delayed gratification, which is resisting something in the present in hopes of receiving a reward in the longer term. Since this Study Buddy requires the user to willingly put their phone into the box, the user is practicing delayed gratification, resisting their current urge to be on their phone, and instead working towards another, less enjoyable task. Furthermore, studies into delayed gratification have identified correlations to long-term positive benefits, such as higher measures of intelligence, social responsibility and social competence, and improved performance academically (Twito, et. al, 2019). Thus, people who use Study Buddy, by engaging in delayed gratification, may receive these long-term benefits as well.

Observations

Through informal observations of my younger sister, age: 16 years, and her various friends, ages 14-17, doing schoolwork in our house, I took notes on their studying needs and change in study behavior over time. I observed them in a group setting for a couple hours in one session and observed my sister studying individually.

For the group setting, the students were working on the same assignment: to study for the upcoming history exam. To further their productivity, some students put their phone on Do Not Disturb. One friend chose to play music while they were studying, so her phone was out the entire time as she enqueued songs to the ongoing list. Multiple students pulled out their phone to check the time or to reply to text messages they had received. When their phones were out, this led to more unrelated talk instead of studying.

For the independent setting, my sister was doing her math homework, which involved watching a lecture and completing a subsequent worksheet. She watched the lecture on her laptop, with her phone in her lap. While she was completing the worksheet, she left her phone in her backpack to reduce distractions.

Questionnaire

After conducting informal observations, I developed a questionnaire to address the issues of productivity levels and types of tasks done on phones while studying. The survey was conducted through [Google Forms](#) and distributed among my sister's friend network through messages and social media. 7 total people ended up filling out the form. The questionnaire items are as follows:

The following questions pertain to your method of studying and focusing on schoolwork. The results of this survey will be anonymized. Please answer truthfully.

1. What is your age?
2. On average, how many hours of homework/studying do you perform in a weekday (M-F)?
3. What is your current study setting? Describe it.
4. Are there any improvements to your current study setting that can help you increase your focus?

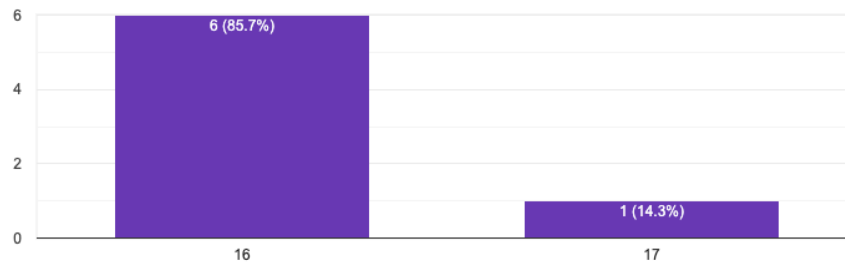
5. Where is your phone when you choose to do homework?
6. How often do you pick up your phone when you are doing homework?
7. If you are on your phone while studying, what tasks are you doing on your phone?
8. If you are on your phone while studying, for how long are you on your phone?
9. Do you have any other technological devices that you use while studying? What do you use them for?
10. On a scale from 1 (poor) – 10 (excellent), how would you rate your average productivity levels?
11. Any other comments?

For most of the questions, I left answers up to the user to fill in as short answer responses, because people can do a variety of things on their phone. I wanted to avoid assuming that people were on social media or messaging their friend while studying.

Questionnaire Results

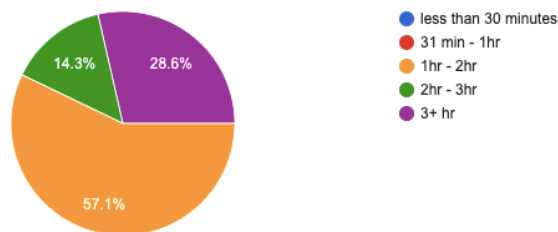
What is your age?

7 responses



2. On average, how many hours of homework/studying do you perform in a day (M-F)?

7 responses



Where is your current study setting? Describe it.

7 responses

Living room, study at table, some background noise

Sitting on my bed with music playing

In my room, moderately quiet, bright lighting

The kitchen at my laptop

The living room in a small corner with a desk.

On a desk in my cramped room.

My computer desk in the corner of my room facing away from my door.

Are there any improvements to your current study setting that can help you increase your focus?

7 responses

Less background noise

A desk with a good chair

Having a separate area for studying from my personal room

Not being in a place where people can just come up to me

I need a bigger desk currently since my desk is part of a couch.

I think probably removing my phone.

Preferably soundproof walls, but that's illogical.

Where is your phone located when you choose to do homework?

7 responses

Next to me or in my pocket

Next to me but on do not disturb

My phone is usually next to me or within reach

Next to my laptop

Right by my side

Either near my tv or next to me

On my bed.

How often do you pick up your phone when you are doing homework?

7 responses

3 times

Typically like two times an hour

Pretty often

A lot

Around every 20 minutes or so

I'm usually on FaceTime doing the hw with someone else or just talking to people

Very often - 10+ times

If you are on your phone while studying, what tasks are you doing on your phone?

7 responses

Texting friends, on google classroom

Responding to my notifications, maybe checking twitter quickly

I do go on my phone while studying if I get distracted by a notification, usually talking with someone

Playing games

Checking Social Media or asking people for help

Talking to people

sending answer keys from my phone to my comp, or quizlets, or going on social media

If you are on your phone while studying, for how long are you on your phone?

7 responses

Around 20 minutes

A couple minutes at a time, maybe 20-30 minutes collectively

Usually a few minutes but multiple times throughout studying

Probably like 30 minute intervals

10 minutes

Most of time

for no more than 5 minute intervals

Do you have any other technological devices that you use while studying? What do you use them for?

7 responses

Laptop, to watch videos or go on google classroom

I do work on my Chromebook but I don't have any non school related notifications on

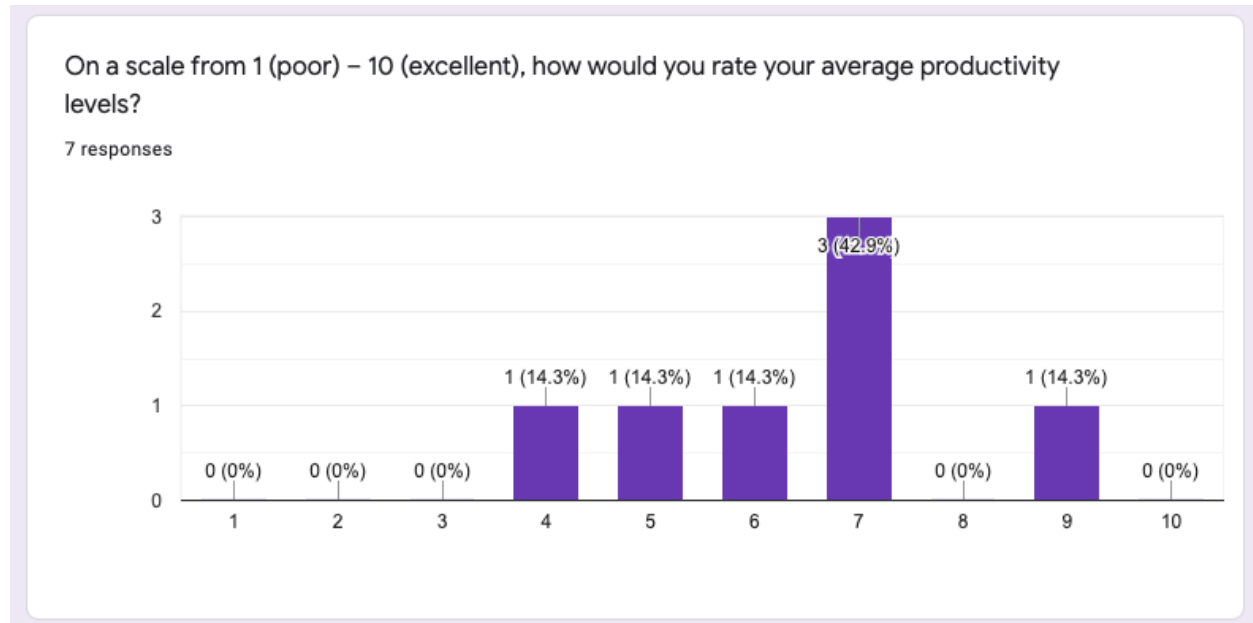
My laptop for online assignments

My laptop I use it for work and music

Computer to do my work.

I usually put Netflix on my Xbox for background noise

computer, to write and look at answer keys



Task analysis and cognitive task analysis

When asked to discuss her study process, my sister broke up the task into three parts: preparation, focusing, and study breaks.

1. *Preparation* – This subtask involved clearing the table of any external clutter, bringing out her laptop, notebooks/binders, and any writing utensils. By clearing the visual clutter around her, my sister states that she can “get into the zone” more quickly.
2. *Focusing* – This subtask takes the longest and is the primary part where she *does* the actual studying. This subtask normally starts with the hardest assignment, with an alternate pattern of “hard assignment” and “easy assignment.” Personally, my sister enjoys the differing effort levels for the ordering of assignment completion.
3. *Study breaks* – This subtask interjects into the focusing task. For her study breaks, she rewards herself with the ability to check her phone and reply to any messages or scroll on social media for a while. This subtask requires an evaluation of individual’s current progress and state of mind. Either a lot of work was just finished, and they deserve a break, or they hit a difficult problem and don’t know how to approach it yet. Either way, the results of the survey support my sister’s response: study breaks are important to consistent productivity levels.

As mentioned in the survey responses, constant phone use can prevent the person from focusing and reaching the flow state. People used their phone for various reasons: to check the time, to

check messages/notifications, to listen to music, or to ask people for help. Surprisingly, multiple people stated that they were on FaceTime with a friend while doing their homework. Notably, the school system of these high school children also gives out Chromebooks for their students to do homework on, so there is already another technological device present, sometimes necessary for the completion of the assignment.

Anthropometric, biomechanics and musculoskeletal injury concerns

As the purpose of this product is to assist in the focus of *another* task, the only interactions that users will have with this physical box is through the opening/shutting of the box, and through the buttons on the side of the box. Since the age range is 13-19, there is a wide range of hand sizes, as adolescents are prone to rapid growth sprouts. The dimensions of the box were decided based on the width of the current iPhone X, which is 8 cm. The size of the buttons was determined in relation to the size of most keyboard buttons on laptops, which range from 1.5-2cm in width and length. These were then rounded and color-coded for aesthetic reasons. The display dimensions of the screen were not considered, as it was simply the size that came with the Arduino kit.

As this product does not involve repetitive use, there is not much concern over the potential musculoskeletal injuries. The interactions with the device, over one session, are expected to take only a few minutes maximum, as users are only setting the lock time.

Note that the proposed screen and button interface on the side of the box is not fully implemented, even though it was modeled in CAD.

Arduino/mechanical setup

- CAD model:

<https://cad.onshape.com/documents/ef4a19e933945af428dcd3cd/w/afe951b75efe4194a47cd98f/e/90d7481b23246066bfb1377c>

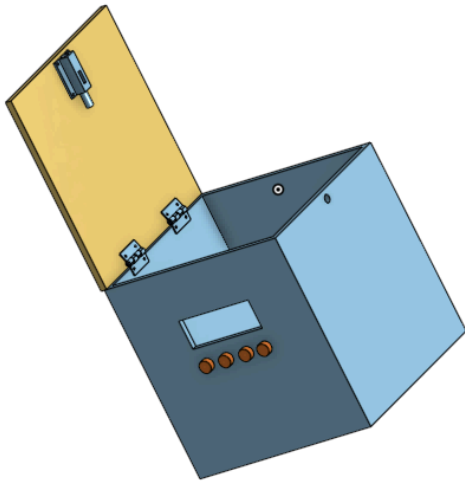


Image above: screenshot of CAD model

- Arduino code submitted separately
- Schematics/breadboard setup:

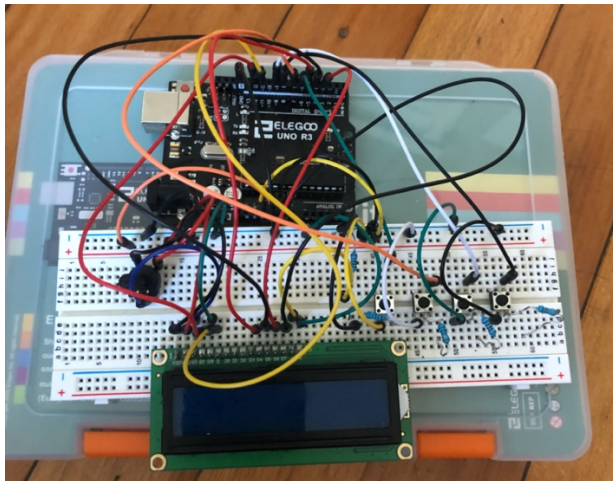


Image above: breadboard and LCD screen with buttons, hooked up to Arduino

App interface design considerations

****Link to app prototype:** <https://www.figma.com/file/Qiv1Pv3tRPkb2pbGAxbQdg/Study-buddy?node-id=6%3A81>

While the app interface is designed to be used on an iPhone 8, it can easily be scaled up in size to accommodate for tablet or laptop use.

Across the navigation bar, recognizable icons were used instead of text. These icons are associated with the purpose of each page:

- The About Page is represented by a Question Mark. Users who have questions about the function of the App and the usage of the Study Buddy can look for their answers in this tab. As Questions are easily associated with the Question Mark punctuation symbol, this is a natural association.
- The Customization Page is represented by a Paintbrush symbol. Users who want to change the Look of their Phone Avatar can click on this tab. As the paintbrush is also associated with color, this ties in well with the customization feature.
- The Statistics and Activity Page is represented by various bars, similar to a bar graph. This may be less easily recognizable but relates directly to the concept of user statistics and interactions with other friends.
- The Settings page is represented with gears, which is true of various other apps. Users can click this tab to edit their account information, give feedback, or log out. The color for this tab is also grey, which attracts the least attention.

All these recognizable icons convey the purpose of the pages with minimal effort and words. Often, these icons are used by other apps to indicate the same purpose, so this reduces the learnability curve. This is especially true within the About Page, with icons that break up the instructions of use into distinct, smaller steps.

The selection options for the customization of the avatar are implemented differently. For the color selection buttons, the selected color is indicated by an “X” through the color button. For the face selection options, the selected face is indicated by a color change from the regular black outline. Ideally, there would be another indicator aside from color, to allow for people who are color-blind or color-sensitive, but another “X” through the face would have a lot of visual clutter in the total detailing of the design.

Finally, most prototyping, from frame to frame on Figma, are done without animations, which increases accessibility, especially in folks that rely on screen readers to interface with their systems.



Usability considerations, User testing, and Design iterations on the App

People generally enjoyed the design of the app and thought that it was simple to use. They appreciated the consistency of the black, simple icons used throughout the navigation bar and the About page.

Within the Statistics page, the purpose of the “Type of Task” was unclear, since the Food, Exercise, and Study bars were not mentioned anywhere else on the app. This was added in the later stages of user testing, with the assumption that users can select the task they are engaging in. Further testing is required to determine the most popular tasks among people who use the Study Buddy. Another potential solution would be to allow for personalized, user submitted tasks. This would require more prototyping of screen interfaces.

Also, someone suggested that users should be able to see their Friend’s Ages in the Friend Activity section. This is a useful suggestion that allows for further competition. Currently, this section displays the most recent time the friend used the app. The ages can easily be added underneath or beside the friend’s listed name.

As suggested by a TA, to incentivize people to use the Study Buddy more, I created a “Challenge!” feature, for users to be able to challenge their friends to focus for a certain amount of time. People thought that was an effective competition strategy but wondered about the interface once you *receive* a challenge. Also, upon retrospect, there should be visual feedback for the sender of the challenge once the friend accepts, declines, or completes the challenge. Users also suggested a points system, which is interesting to consider. Currently, the age functions as a

measurement of total use of the Study Buddy over an extended period, but perhaps there can be other forms of reward for completing challenges and using the Study Buddy lockbox. This would potentially further the concept of gamification of tasks, by adding a point or level system beyond the ages.

Steps in usability analysis

Due to the time constraints of this project and its development cycle, usability analysis was conducted concurrently to the development of its design, factoring into the design of the physical and app prototypes. The 10 Usability Heuristics for User Interface Design, by Jakob Nielsen was used to assess and determine future changes to the product.

1. Visibility of system status – The color of the page's title and the user's current place within the navigation tabs matches up. However, future improvements might highlight or provide another visual indicator for the location in the system status, as users might scroll and not be able to see the page's title color anymore.
2. Match between system and the real world – The recognizability of the icons on the navigation bar and the About page matches the function of those icons in other apps and the real world. This allows for ease of learnability, as mentioned in the App Interface Design Considerations section above.
3. User control and freedom – Various cancel buttons are present whenever users are to submit a form, such as the login page or the Challenge! a friend form. While the Customization page's changes are implemented immediately, users can then quickly cycle through the colors to see which ones look the most aesthetically appealing to them.
4. Consistency and standards – Again, the icons and their associative functions are similar across different apps. Further research into user interface design must be done to fully explore this usability feature. I'm not sure about other features that should be consistent to others out there.
5. Error prevention – The current working prototype does not account for error prevention aside from the ones listed under "User Control and Freedom." This is due to the nature of the Figma app, not being able to take in actual user input beyond keystrokes and taps. For example, there would be error prevention if the user tries logging in with an incorrect username/password.

6. Recognition rather than recall – The app currently lists instructions that can be used with the Study Buddy physical prototype. Ideally, an interactive tutorial would be better for the users, linking up the user's current screen with the interactions with the box on a "Tutorial mode." For instance, if the user is on the "set the timer" part of the instructions, the screen could change color or flash "set timer here."
7. Flexibility and efficiency of use – Due to the simplicity of the current app prototype, there is not much customization beyond the color and the faces offered in the Customization tab. Perhaps for repetitive actions, such as if users *always* set their timer to be 1 hour, the timer system can remember the previously most used timer amount. Then, users will just have to press one button, rather than re-entering their preferred timer amount every single time.
8. Aesthetic and minimalist design – Unnecessary information is not visible to the user on the app. There are simple colors associated with each tab, and not that much information is displayed on each page. I considered splitting up the Statistics and Activity tab into two separate places on the navigation bar, but 5 tabs seemed like too much for the user to think about.
9. Help users recognize, diagnose, and recover from errors – Again, as discussed in heuristic #5, there is currently no error prevention or accountability built into the prototype. This would require a lot of more screens and user input on Figma. But error messages should use a clear description and be bolded in red text, to make the source of the error obvious to the user.
10. Help and documentation – The entire purpose of the About page is to help users understand how to use the Study Buddy product. If users have a question, maybe they can be redirected to an FAQ page, either from the bottom of the About page or the Settings page.

User testing outcomes

***Note: while user testing, users were told that the box locked itself – future iterations will include a functioning lock box and timer interface. Currently, there is a whiteboard on the side of the box for users to pretend to set a timer and press enter.*

Users of the physical lock box thought that the concept was well designed. They noted that the material used for the lockbox was rough and that the hinges did not appear to be well aligned to the sides of the box. Furthermore, the edges of the box appeared to be sharp, so some users suggested rounding out the edges of the box to account for young or clumsy people. Also, people appreciated the face that is on the front of the box and suggested more customization or personalization of that feature.

In general, users were happy with the Study Buddy and completed the task that they wanted to. Note that these results might be biased because I, the designer of the product, was present while they were using the box. This may have added pressure for the user to complete their intended task. However, since the box is only in its prototype phase, without the locking mechanism currently working, I needed to ensure that they did not just take their phone out of the box. Again, future iterations will test a working lock box.

Feedback and redesign

Due to time constraints, most implementation of redesigns based off feedback were not possible. However, there is much feedback that can be reincorporated into future iterations of the lockbox:

Physical prototype Improvements

1. **Use a pre-existing timed lock out there** – Since there is already existing technology out there, I can use that and then divert my focus from the mechanical hardware itself, and towards the *User Interface* itself, which is the primary purpose of this project.
2. **Change in material** – The same prototype can be made with a sturdier, thicker wood that is sandpapered down. This increases the stability of the lockbox, increases the smoothness of the box, and prevents people from breaking into the box.
3. **Decrease pointy edges of box** – Edges can be rounded out by either sandpaper or adding an external ball that clings to the outer edges of the box. This will prevent any injury in people who are young and/or clumsy.
4. **Different sizes of box** – Increasing the size of the box would allow for more devices to be stored inside, such as a tablet or a laptop.
5. **Customization of box face** – This can be marketed towards younger kids, expanding the market of this product. Kids can “create their own face,” essentially giving life to this

anthropomorphized Study Buddy box. This can make younger kids more engaged and care more about the product, also allowing for personalization in color and design.

App prototype Improvements

1. **More development on the Challenges feature** – Indicate the type of task the user is challenged to do. Also, provide feedback once your friend has completed a challenge.
2. **A point system** – This can function as another incentive for Study Buddy use. These points can also potentially lead to the purchase of “upgrades” in customization or other features. However, care should be taken not to overwhelm the user with the variety of rewards given for completing their intended task.
3. **Ability to see other friend’s ages** – Again, this allows for increased social competition, similar to competing with friends to see who has the most steps via an Apple Watch. Maybe list the “Most active” person in the most recent month or indicate the person with the oldest Age on the friends list.
4. **Increased customization of the Phone Avatar** – More colors and faces allow for more customization and attachment to the phone avatar. Also, potentially users can upload a picture to represent their current phone case/color.
5. **Variety in phones/devices** – In the process of setting up the timer, perhaps allow for users to select the type of device that they are locking up. This can be useful for people who lock up different devices for different reasons.

Discussion and Reflection/Takeaways

Overall, while there were a lot of moving parts to this project, I enjoyed the design process. User centered design is significantly important in the development cycle of *any* product. To understand what to create, you first need to understand the user and the problem itself. And then, after you design a prototype, you need feedback from the users themselves, to know what to improve on! Even though I chose a topic that is relatable – productivity and focus – the results from my questionnaire indicate that I didn’t know the complete story to how teenagers use their phone while doing homework. Further testing of phone use during different task would probably reveal even more surprising insights. The value of feedback and user interaction is simply invaluable in the design process, and I think that designers should definitely prioritize the

concept of feedback *throughout* the design of a product, rather than just at the beginning and end points of the product design.

For this project, I learned how to use [Figma](#), [OnShape](#), and [Arduino](#) software. In retrospect, it might have been too ambitious to try and code a lockbox and figure out the wiring for the hardware, in addition to learning all this new software. Nonetheless, it was a useful experience to create this product, developing it fully from its conception to its prototyping and testing phase. I particularly enjoyed the use of the working app prototype – from the user’s point of view, it looks like an actual working app instead of simply a wireframe! As someone who has manually coded websites, I know how difficult it can be to make things look *just right*, but the Figma software essentially lowered the barrier to entry. A few tutorial videos were all I needed to get started with prototyping my idea. And as for Onshape, I became frequently frustrated at the implied dependency of an external mouse to navigate the dimensions of the parts on Onshape. That might just be a feature of most CAD software though, as there is the orientation and zoom size of both the product part and the camera to consider.

In conclusion, I’m glad that I took this course and learned more about the development cycle. The process of designing and improving is an iterative process, like most other things in life. After taking this class, I will probably be more attentive to the design of everyday things around me, appreciating good design *especially* if it’s not obvious! This project was a great way to implement everything we’ve learned in this course, from start to finish. Moving forwards, I will most likely be using this product myself and improve the app further, to potentially even hard code the app! Hopefully I can clean up this project and use it in a portfolio!

References

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