Call to ACTION

"Eyeglasses are a good tool—you look at the world, not the eyeglasses"

- "World is not a desktop", Mark Weiser, Xerox PARC 1994

Call to Action
by
Vidit Bhargava

Augmenting Human Intellect through computers, without being distracted by them.

In today's attention economy, students face a constant battle for focus, with smartphones and apps vying for their attention, often hindering their learning process. This Thesis explores a radical new approach to computing, one that promotes a healthier and more balanced relationship with technology. By introducing an "action-centered design framework," the thesis shifts the focus from apps to actions, anticipating user needs and providing just-in-time information and support through ambient media. Through the framework, and artifacts it aims to create an environment where technology seamlessly integrates into our lives, fading into the background when not needed, much like eyeglasses enhance vision without drawing attention to themselves.

Abstract
We live in an attention economy. With software constantly trying to grab our attention, the current system of app-centric design and the measurement of engagement as a metric of success, has created a culture of distraction and addiction.

This thesis explores how these systems affect students lives who rely on these devices for learning. Their dependence on screens and the constant vying for attention by attention seeking and habit forming apps (like social media platforms) has led to a decline in focus, and an increased risk of anxiety and depression amongst teenagers.

Several methodologies and proposed solutions exist to counter the symptoms of smartphone addiction, including screen time restrictions that are designed to create a barrier interface to stop users from using apps; devices like Light Phone that are designed to help users accomplish specific tasks without the 'distractions' while these technologies have proven to be somewhat useful, they're still restricted in their ability to create long term positive impact.

Students need a way to accomplish every day tasks without being distracted by computers that are designed to keep them hooked.

Through this thesis, I propose a radically new way for students to interact with technology, that promotes helping them achieve their goals rather than rewarding engagement and distraction The solution holistically helps them engage with their environment through ambient media that follows an action centric framework to prioritize actions over apps. The action centric design framework leverages user context and emerging technologies to anticipate a student's wants and needs and work with them to achieve their goals faster.

Thus, lowering the reliance on screens and creating an environment where technology is available when students need it, and cedes into the background when they don't.

This thesis only explores the action centric design framework in a student environment, through three ambient media devices. The thesis doesn't answer questions around monetization and the complexities of a developer ecosystem arising from the proliferation of the system.
The research is built on the foundations laid by Mark Weiser's principles of Ubiquitous computing and Calm Technology, Hiroshi Ishii's Tangible bits, Brygg Ullmer's ambientROOM project and Alan Cooper's Goal Centered Design approach. It offers a vision for a future where computing seamlessly integrates into our lives without demanding constant attention

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without his support, love and care I wouldn't be where I am today.

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Introduction

Smartphones are great. They allow people to accomplish different tasks through a singular device, achieved by software applications a.k.a Apps, which make it easier to perform key actions and access information that help people achieve their goals driven by their wants and needs.

That said, by putting user intent into interactive silos has created an ecosystem that rewards engagement with those silos. When the product is an app, i.e. an interactive silo on a smartphone, engagement with it, becomes the most important metric to drive the product's revenue. Thereby creating a need to maximize. This creates a market that is constantly vying for people's limited attention.

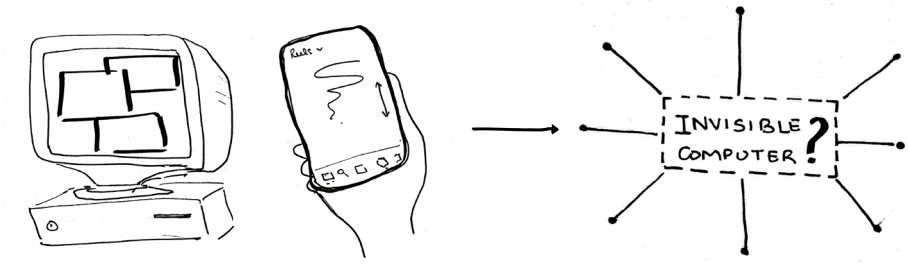
Maximizing engagement begets creating habit loops to keep people "hooked" on to the app, which in turn leads to addictive software. One that eventually has little to no "nutritional value" for the user, except they can't stop using it because they're in the vicious habit loops that hold them, addicted.

It doesn't have to be this way. Computers are designed to augment human intellect. [15] They are tools meant to aid us in performing our tasks. When we use a really good tool, it becomes invisible to us while we focus on the task it's helping us accomplish, like "eyeglasses" which help us see the world, we never really think

about seeing the eyeglasses. [8].

Today's computers are anything but that. They occupy our foreground attention and the more tasks they help us perform, the more messy that foreground attention becomes as each task is vying for the same attention space.

Through this thesis I envision a future where computers are like our environment, "invisible" available to aid us in accomplishing tasks when we need them, fading into the background when we don't. This vision is brought to life through a model room that represents a student's relationship with technology in the future, which creates a rich multi-sensorial environment, that conveys information through ambient, natural media. One where Information is not only conveyed via sight and sound, it's also conveyed through smell, touch and in the background.



Can we create computers, where the screen is not the center of attention?

Background

The software we use today is incentivized to grab our attention, to keep us hooked into using it, to keep us addicted. With engagement serving as the key performance indicator for most software services, maximization of engagement becomes a priority, leading to Habit Loops that cultivate a pattern of addictive user experiences designed to keep people hooked. [1]

While this is a problem for everyone, it is especially accentuated for young students who rely on smartphones and computers for learning. Their smartphones carry their notes, important study materials, as well as apps they use for unwinding and social engagement. The latter are constantly vying for their attention because of their engagement driven business models. For young students, their increased dependence on screens, exposure to social media platforms has led to a decline in focus and an increased risk of anxiety and depression [2]

Several methodologies and proposed solutions exist to counter the symptoms of smartphone addiction, including screen time restrictions that are designed to create a barrier interface to stop users from using apps; devices like Light Phone that are designed to help users accomplish specific tasks without the 'distractions' [3]. While these technologies have proven to be somewhat useful, they're still restricted in their ability to create long term positive impact [4][5].

These solutions act as duct-tape solutions, that patch the problem by imposing limitations and punishing the users for using their phones rather than cultivating a healthier relationship with technologies.

Students need a way to accomplish their every day tasks without being distracted by software that's designed to keep them hooked.

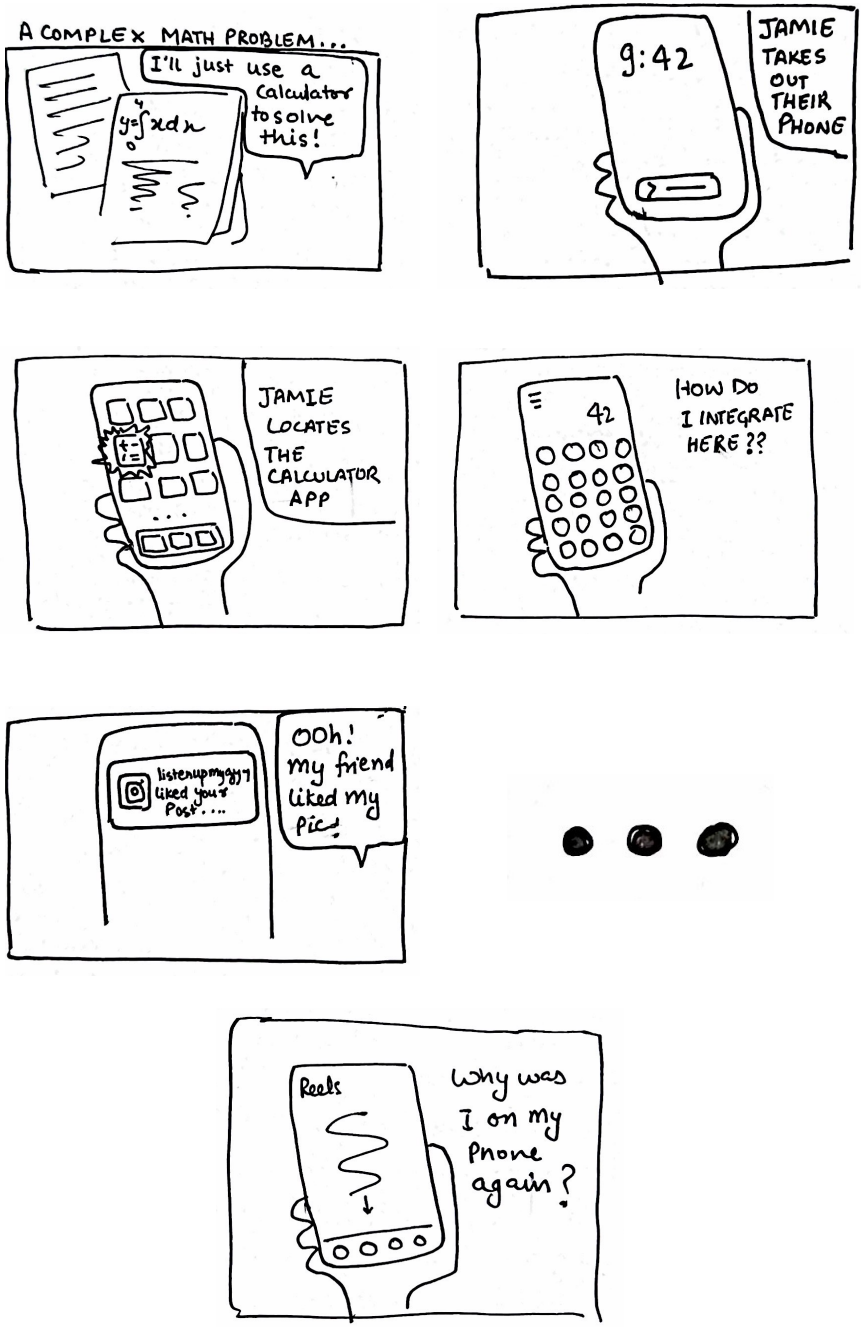
One of the many ways in which this problem can be tackled is the use of Calm Technologies [6], and Ubiquitous Computing [7] to make it easier for students to access key information and perform actions without needing access to an all encompassing device like a smartphone. Instead here, students are able to utilize more than just their visual sense, and access key information through both background and foreground attention. [6]. The goal for such a system of devices is to help students achieve their wants and needs and then fade into the background. This system would focus on making it easier and faster to perform tasks that students want to perform, as opposed to making it harder for them to access addictive software; thereby cultivating a healthier relationship with technology, where students decide where their attention is, rather than the software they use.

Ubiquitous Computing and Calm Technologies are not new, they were pioneered by Mark Weiser at Xerox Parc in the 1990s. Weiser through his essays lays out the foundations for a future where computing is "invis-

ible" i.e. people pay more attention to the task that the tool (a computer) is helping them with as opposed to the tool itself. [8]. Weiser also laid down the principles of Calm Technology, which serves as an extension of ubiquitous computing, moving computing to the user's periphery. [6].

This thesis is far from the only attempt at utilizing people's foreground and background attention to create a more holistic interface with computers. ambientROOM (1998) by Hiroshii Ishii, Craig Wisneski, Scott Brave, Andrew Dahley, Matt Gorbet, Brygg Ullmer, and Paul Yarin [9] and Tangible Bits by Hiroshii Ishii [10] serves as a similar peripheral awareness concept that utilizes ambient display to convey essential information.

While ambientROOM and Mark Weser's vision of "invisible" computers are great foundations to the idea of utilizing peripheral senses, they do not tackle contextual awareness and the challenges brought by contextual awareness. The artifacts in this thesis explore the potential of an ecosystem of action centered ambient objects that establish a shared understanding of an ever changing context amongst the students and their computers. [11]


A COMPLEX MATH PROBLEM...
I'll just use a calculator to solve this!
$y=\int_0^4 x\,dx$
9:42
JAMIE TAKES OUT THEIR PHONE
JAMIE LOCATES THE CALCULATOR APP
42
HOW DO I INTEGRATE HERE??
listenupmyguy7 liked your Post....
OOh! my friend liked my pic!
Reels
Why was I on my phone again?

Imagine this scenario:
On a slightly chilly October evening in Berkeley, Jamie is sitting in their dorm, slightly panicked about the upcoming Engineering Mathematics midterm.

Deeply engrossed in solving the calculus problems, they have their phone face down. Jamie needs to use a scientific calculator to solve the problem and reference some notes on the L'Hôpital's rule.

They take out their phone to make the calculations and see the notes, but before they can do that, they're greeted by notifications of their friend liking thier instagram post. Two hours later, they've forgotten about L'Hôpital's rule.

Motivation

This all too common scenario highlights a growing concern amongst students, the technology designed to help them often becomes a distraction. The apps that they use to perform every day tasks and get important information have to compete for their attention with entertainment apps. App centric systems are designed to silo each action into an app, where the user can interact with a device to perform the action they want to perform, providing value to the user. The economics of software development command that recurring value results in recurring revenue. This pushes app creators to maximize engagement, often by keeping users hooked, leading to addictive experiences.

Why Now?

Smartphone addiction, particularly among students, is escalating as technology becomes more immersive. With advancements in creating vivid, and immersive experiences, the urgency to rethink how students interact with technology is greater than ever. As technology plays a larger role in students' everyday lives, it's important to rethink how they engage with it without losing focus.

The challenge is to create tools that help students use technology as a tool to get their jobs done, rather than a distraction. We need to build experiences where technology fades into the background and appears only when they need it. As Mark Weiser points out in

his essay, the “The world is not a desktop”, “*computers need to be like eyewear, people see the world better with eyeglasses, they don’t constantly look at the eyeglasses instead.*” [8] How might we create computers that enable that?

Motivation to Pursue This Project

This project is driven by the idea that students need a better relationship with technology. It explores new concepts, like calm technology, where tech supports students without demanding constant attention, and contextual computing, where it adapts to their needs, engaging only when necessary.

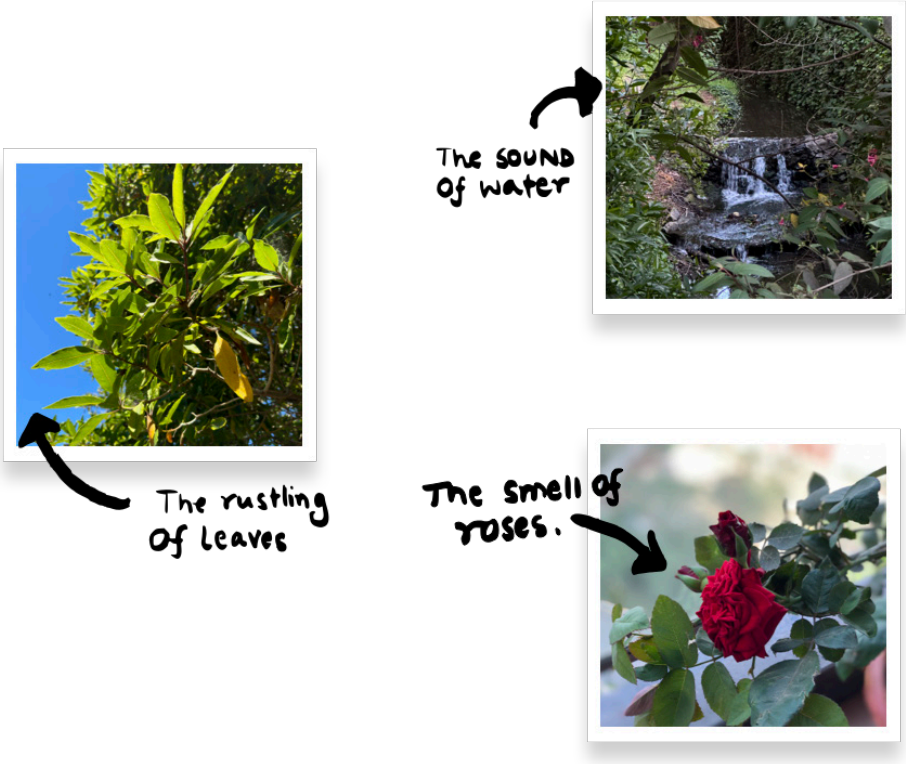
Our environment offers us information through different indicators, the rustling of leaves lets us know that there’s wind, the sound of footsteps tell us the presence of someone else, the smell of burnt toast tells us we messed up our breakfast, even before we see it. These are calm signals that live in our periphery, yet convey us information without distraction.

This thesis explores how technology can similarly live in the periphery helping us achieve things without being the center of attention, there when we need them but disappears into the background when we don’t. This shift will help students who struggle with focus or who find it hard to break free from the distractions of their smartphones.

Design and Technology Landscape

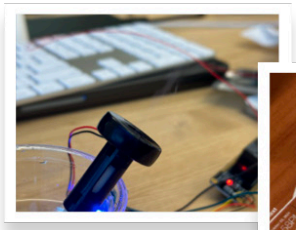
Social media addiction is only a symptom of the larger problem at play. In creating photo-realistic replicas of our world through digital screens, technology corporations have created a system that rewards being more engaged with these replicas instead of using them to help solve day to day problems.

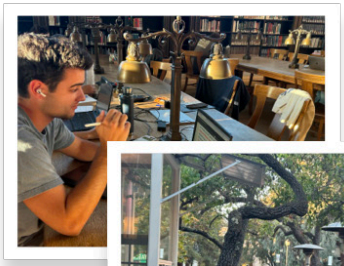
For technology to move forwards, it must meet people where they are, it must fade into the background, while it helps people live their lives more effectively.

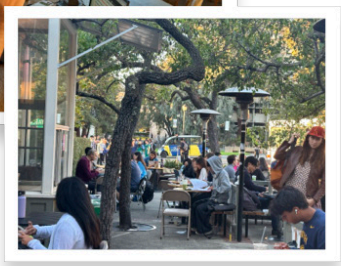


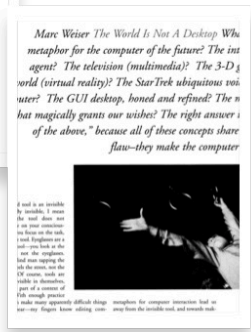
Our environment provides us with a lot of information, without ever demanding our undivided attention. The rustling of leaves, the sound of water, the smell of roses all convey information to us, through different senses.

Approach









To design an experience that helps student have a healthier relationship with technology, it was first important understand how students use technology today, how technology is designed and where it can go next to serve user needs. To address this, comprehensive research was carried out in the form of user interviews, ethnographic studies, desk research, expert interviews, background analysis and prototype testing. These methods aimed to uncover insights into how students use technology, how technology can provide meaningful interviews and to develop a robust system to tackle the problem of distraction caused by modern day computers.

User Interviews

A diverse group of students aged 17-25 across different geographies and academic journeys were interviewed. The interview protocol included questions about their daily routine, study habits, use of smartphone and computers, social media usage, and their organization of thoughts and ideas.

Figure 1: Ethnographic Research conducted at different sights

Ethnographic Research

Along with user interviews, ethnographic research was also carried out through participant observations and in-situations participant interviews. In this method, I observed participants in a real world setting without interrupting them. Ethnographic research was an important part the user research as there's often a difference between what students do and what they claim to do.

Participants were observed in three settings, The Doe Library at UC Berkeley, Strada Cafe in South Berkeley, and UC Berkeley class rooms. (Figure 1)

Key Insights

1. Smartphones are a constant source of distraction for students, even when they take measures like putting them face down to avoid using them. Students are aware that they're a source of distraction.

2. Students preferred analog study tools such as paper notebooks for their tactility. They sometimes used hybrid tools like ePaper note taking tablets for the convenience of search.

3. There's a key difference between students being distracted by social media when studying and students consciously using the platforms as a way to unwind. The latter is actually a healthy practice of taking breaks from work, the former is more concerning and reduces their focus.

Prototypes

Based on user research multiple prototypes were created. (Figure 2)

The first prototype was an early pre-research prototype that explored how AI systems could benefit from using LLMs as coordinators for traditional computing tasks and other LLM based responses.

The second, based on user research, two calm technology devices were created. One a "Thought Lamp" to help students jot down their thoughts and notes and revise later. The other, an olfactory pomodoro timer

that released scents instead of sounds to alert students of study blocks.

Showing the two prototypes to industry experts and key stakeholders led to key insights that informed the decision to build a framework and ecosystem of physical and digital artifacts that would focus on key student actions and how they can be accomplished as the system fades into the background when not in use.

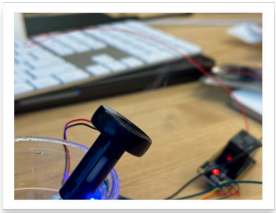
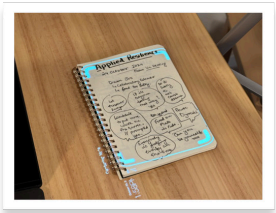
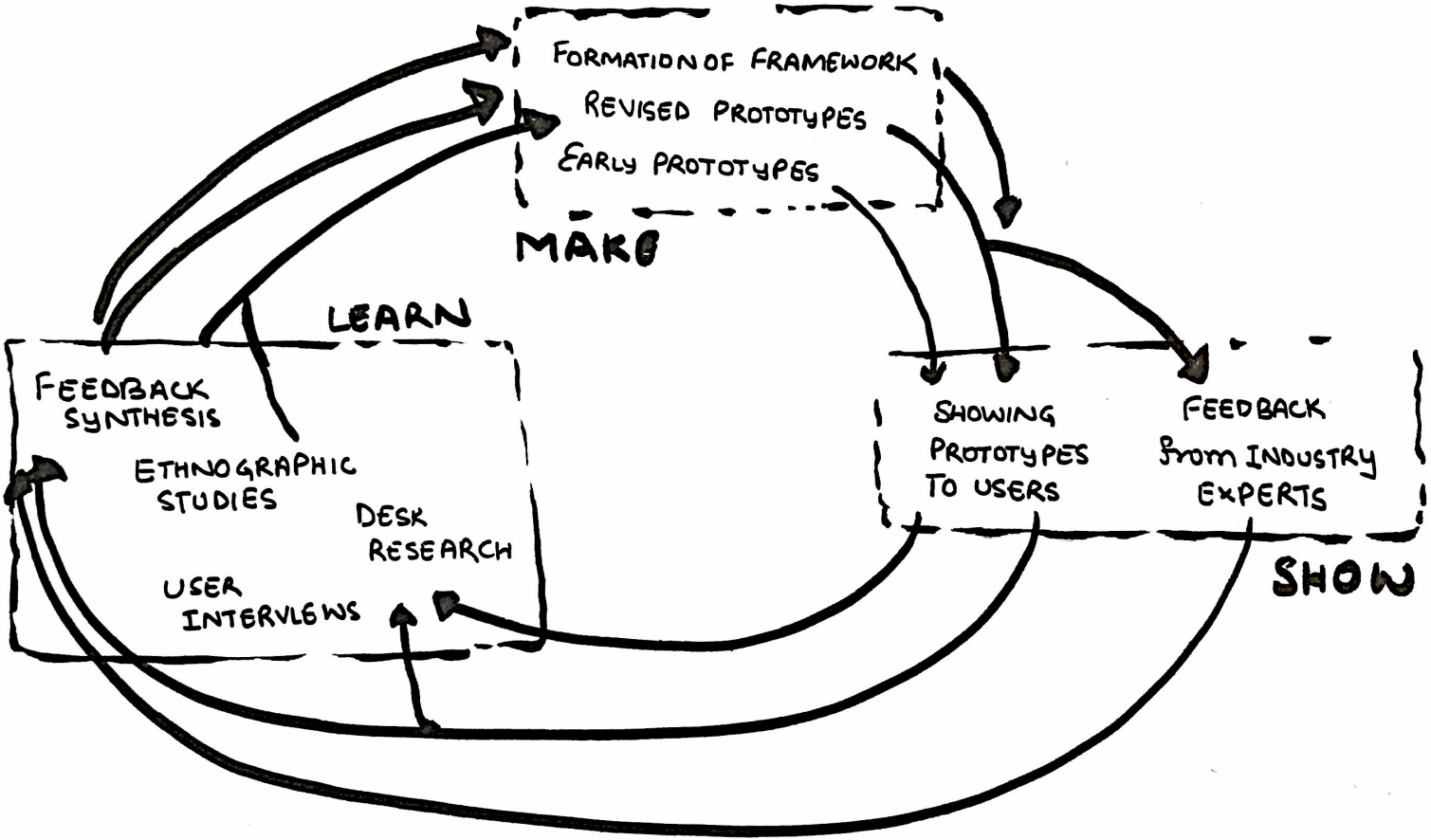




Figure 2: Early Stage Prototypes

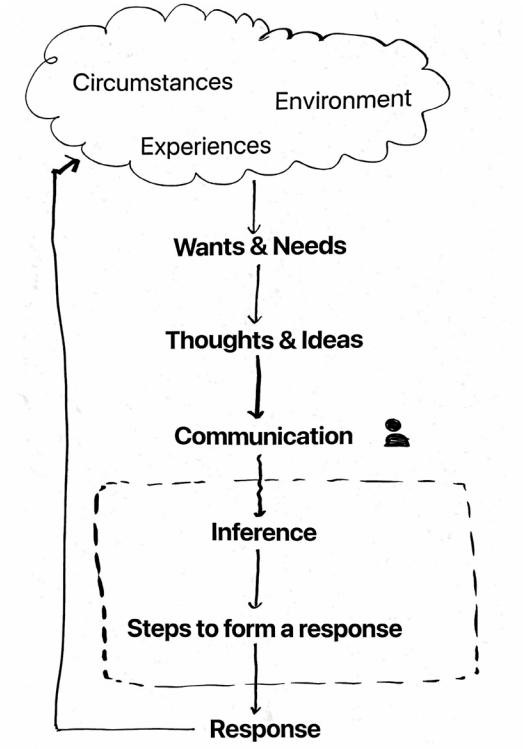
Learning from Prototypes

Based on the research and the testing or prototypes, an action centered design framework was drafted. The framework is designed to work as a foundation for an ecosystem of artifacts that contextually help students accomplish key actions and access information using ambient media, such that it's designed to integrate in the real environment and fades into the background when not in use.



The messy design process of designing, encompassed in a Make, Show, Learn loop

WHY DO WE USE COMPUTERS



Our *circumstances, environment & experiences*

shape our *wants and needs*

that help us form *thoughts and ideas*

which we then *communicate* with people around us, or computers

who then *infer* our communication to

formulate *a plan to generate a response*

the response brings about a change in our *environment, experiences and circumstances*

that *further* shapes our wants and needs ...

WE USE COMPUTERS TO FULFILL OUR WANTS & NEEDS (i.e. GOALS)

COMPUTERS ARE TOOLS THAT HELP US ACHIEVE OUR GOALS FASTER.

THE FOCUS IS ON THE ACT OF USING THE MEDIUM (APPS) THAN THE ACT OF ACHIEVING THE GOAL

WE NEED TO FOCUS ON THE ACTION OF PURSUING THE GOAL. & MAKE IT FASTER.

INTRODUCING THE ACTION CENTERED FRAMEWORK

1. FOCUS ON THE ACTION
2. ACTIONS EMBODY SPACES & OBJECTS TO MEET PEOPLE WHERE THEY ARE
3. BECAUSE THEY ARE NOT RESTRICED BY SCREENS ACTIONS CAN CONVEY INFORMATION THROUGH MORE SENSES LIKE SMELL, TOUCH, TASTE... CREATING A MORE HOLLISTIC COMPUTING ENVIRONMENT

Outcome

The final outcome of this thesis is the action centered design framework, that conceptualises how computers can help us achieve our goals faster by being medium agnostic, and a model student room that demonstrates the protopia (a term coined by Kevin Kelly that describes "*a state that is better than today than yesterday, although it might be only a little better*") [12] envisioned by the action centric system, showing how students can have mindful interactions with technology, where the actions they seek to perform are available to them when they need them, and fade into the background when they don't.

Action Centered Design Framework

To create an eco-system of contextually aware, ambient, invisible computers an action centered design framework was established. The action centered design framework focuses on user-intent, i.e. the action that the user wants to perform, and works to provide that results of the action in a way that's least distracting to the user.

An Action is defined as something done to achieve a goal. The goal in this case stems from the user's wants and needs being a function of their context. The user is performing an action when they're communicating with the computer. The action is in service of a goal.

Principles of Action Centered Design Framework

1. An action is the smallest possible representation of solving a user's intent.

2. To accomplish a user's wants and needs, the computer must create a chain of actions that can come together like lego bricks to provide an output.

3. Each action must infer a user's intent by understanding ambient input and user input.

4. The computer must not perform an action on the user's behalf. All actions are performed *with* the user, not *for* the user.

5. While performing an action the computer must always maintain a shared understanding of context with the user. There should be no surprises about what the computer knows about its user.

6. The efficacy of an action should depend on the reliability of the response, not the time spent on a particular action.

The framework builds on the works of Alan Cooper's Goal Centered Design [13], the Jobs to be Done framework [14] and Douglas Engelbart's HLAMT system [15]

The Action Room

The Action Room is an embodiment of the action centric design framework. The room, representing a student's dorm room includes three artifacts that show how how technology can help students better by focusing on a multi-sensorial, spatial embodiment of their actions.

Figure 4: The thought lamp

Artifact 1: Thought Lamp

The Thought Lamp (Figure 4) is a futuristic desk lamp designed to help students organize notes, references, and educational concepts in one place. When the student wishes to access their notes, they can nudge the lamp, which then turns into a projected display.

This artifact is centered around the student's actions during study sessions, providing a passive yet accessible way to consolidate educational materials.

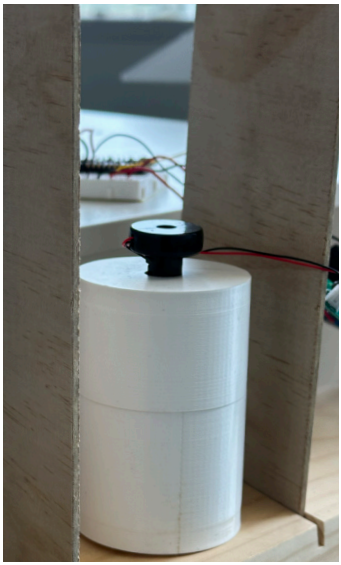


Figure 5: Olfactory Timer

Artifact 2: Olfactory Timer

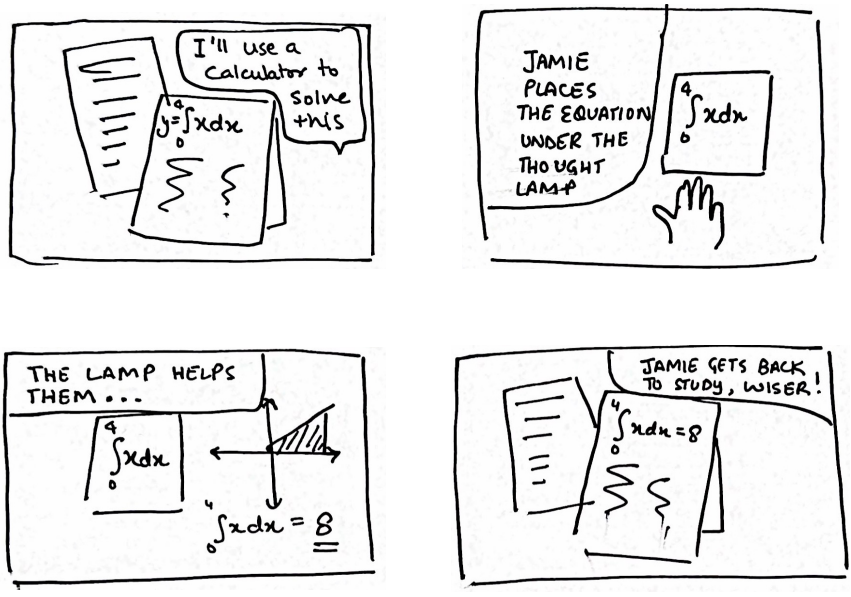
The Olfactory Timer (Figure 5) is a mindful tool designed to help students remain focused during study sessions, such as when using the Pomodoro technique.

Rather than an auditory or visual signal, this timer releases a scent when the time is up, activating the olfactory sense. This creates a non-intrusive alert system that blends into the background.

Artifact 2: Ambient Plant

The ambient plant (Figure 6) is an actual plant whose planter is fitted with a tiny connected motor that softly spins to move the leaves. The movement of leaves is designed to nudge the user calmly to perform certain tasks.

Figure 6: Ambient Plant

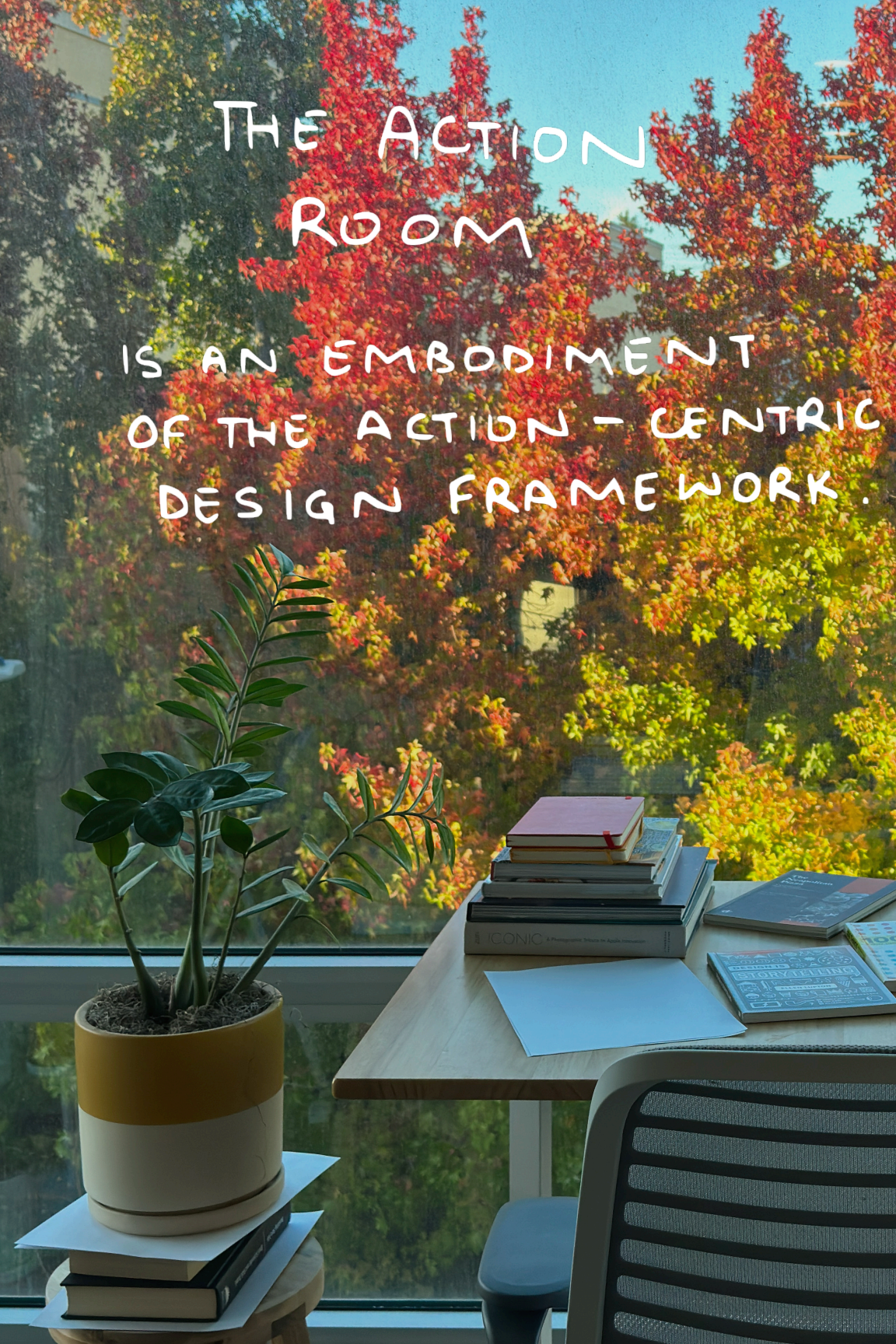


Let's revisit Jamie's scenario:
On a slightly chilly October evening in Berkeley, Jamie is sitting in their dorm, slightly panicked about the upcoming Engineering Mathematics midterm.

Deeply engrossed in solving the calculus problems, they have their phone face down. Jamie needs to use a scientific calculator to solve the problem and reference some notes on the L'Hôpital's rule.

Jamie slide's a sticky note to the thought lamp, makes a pinch gesture, and gets the problem solved. Jamie then asks the lamp to show notes on the L'Hôpital's rule and gets back to their study.

Figure 7: Doing Math with the Thought Lamp


THE ACTION ROOM
IS AN EMBODIMENT OF THE ACTION-CENTRIC DESIGN FRAMEWORK.
ICONIC
STORYTELLING

These artifacts come together to create a system that engages a student sensors through more than just audio-visual stimulus, they're designed to lower the cognitive load of a student by moving essential tasks in the background. They're not a perfect future, they're a representation of a possible future, one where we aren't just gazing at screens.

A platform where anyone can build an action

Finally, the action centered design framework doesn't just stop at the conceptual framework and a representation of the framework, it goes beyond that by creating a development framework that helps developers build their own actions for the platform.

The development framework includes examples, and guidelines for designers and developers to build their own actions. Making the platform open for anyone who wants to help people build for the framework.

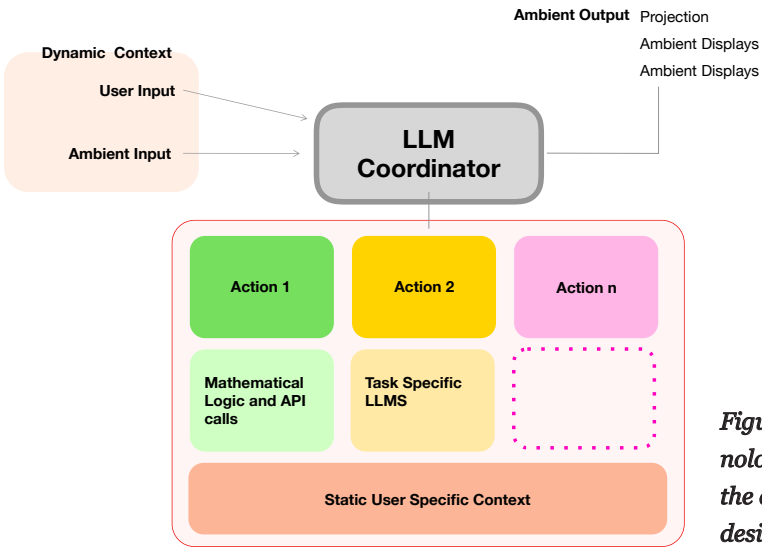


Figure 8: The technological model of the action-centered design framework

What does an action document contain?

Action Manifest File

The action manifest file contains a detailed description of the action. It's a summary of what the action aims to do, the input and context it needs, and the output media it supports.

Action Logic

The action logic contains the input variables, an asynchronous perform action that holds the logic to execute the action, including all the extraneous connections it makes.

Information Entities

If the action utilises local storage, it must contain an entity that describes how it will store the data.

Output View

The optional output view ties a visual representation for the thought lamp to accompany the action. *For sense based actions this could just be an indicator that the sense has been activated.*

Discussion

Privacy and Social Implications

The contextual computing system governing this ambient computing platform serves as a contextual hub of a student's context which makes it even more important to consider the societal and privacy implications of such a system. Therefore it's important that a user's context is always intentionally shared by student's freely given, informed consent [16] and that the student is always in control of what is shared with the computer.

The reasons that the Thought Lamp is not motorized like a Pixar lamp is because I wanted the use of camera input to always be intentional, there should never be a moment where the computer decides to point its camera at another human being. The slippery slope to a surveillance system is quick.

Future Work: A lifestyle change

Ambient Displays that help people make use of different senses only highlight the beginning of a future of computing that is more grounded in our nature. The goal is to move computing away from the display centric environments to one that's more balanced with our environment.

Through a more balanced, calmer relationship with technology, students can fight information overload, and constant distraction that are caused by a medium

that's always vying for our attention; by making use of their peripheral attention more often.

If technology is to become more pervasive in our environment, it must adapt to the environment. Instead of computers everywhere, we must strive for computing everywhere.

Designed to work with you, not for you

While all the artifacts made in this thesis include some sort of artificial intelligence to contextually understand a user's environment, wants and needs, in no way do they act on the user's behalf.

This stems from an understanding that context is never complete, it's always changing. Therefore, acting on a user's behalf leads to frustrating and sometimes erroneous experiences.

To create experiences that match user's expectations, context is always negotiated with the user, and both the computer and user have a clear understanding of the context at all times. Each of the artifacts work with the user, rather than for them.

With the advent of more artificially intelligent systems, I hope this shared understanding of context, creates a culture of tools that aid the user rather than try to replace them.

Beyond students

This thesis only explores one aspect of a student's life through its work, the action centered design framework and the use of ambient displays can be applied to multiple student environments and can even expand to multiple use cases.

For example in a kitchen environment, people will be able to perform the action of cooking new dishes with the help of projection displays that can offer step by step recipes including measuring ingredients. The freshness of fruits can be measured and indicated through capacitive sensing and calm displays.

Smartphone addiction is a wicked problem that presents more questions with every answer. The answer to smartphone addiction is not a carrot and stick approach of shaming people for using their phone, or rewarding them for using it less.

The answer to smartphone addiction is to create a healthier balance of using our screens, and interactive with our environment. It's a world where smartphones exist, screen based interactive computers exist, but are not nearly as all encompassing as they're today.

Conclusion

The thesis envisions a future where computers are no longer the focus of our attention, instead the task we are using the computer to accomplish is the future. They aim to be as good as eyeglasses are as a tool. [6] “Invisible” to the user, yet helping them perform the essential task of seeing.

Through the action centered design framework it establishes a system for human computer interaction in a world where computers are smart enough to infer context and understand human communication with succinct input. It drives that technological advancement to do more than just infer, by centering itself around the user’s wants and needs; the framework acts as a blue-print to move away from the attention economy, while maintaining a shared understanding of context and preserving user privacy.

The artifacts and the exhibition of the model student room act as a primer into such an action centered, ambient system. Promoting a lifestyle change from screens everywhere to a multi-sensorial experience designed reduce cognitive load.

This thesis aims to start a discussion on how we can *augment our human intellect through computers* [15] without being distracted by them.

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