Exploring Mindfulness in the Age of Information and Communication Technologies

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

"Mindfulness" refers to the quality or state of being aware and conscious—it is a term typically unused in technical contexts given its spiritual connotation. The emergence of information and communication technologies (ICTs) has created a noticeable shift in our ability to construct and promote mindful interactions with technology as a whole. With access to vast pools of information through the internet, we are slowly becoming used to the overconsumption of digital media and relying on endless streams of content for instant gratification.

This compelling ability of digital technologies is a shared experience among users and introduces questions regarding how and why such a relationship between technology and user persists. Bearing that continued exposure and habituated practice of digital distraction can lead to consequences that lie on a psychological level (reduced attention span, poor memory, inhibited deep learning), it is necessary that we investigate what particular devices digital technologies implement and, furthermore, how those devices interact with our brain. While it can be argued that users are at fault for possessing vulnerabilities that put them at risk of falling into distracting technological practices, ultimately, it is up to the developer to shape the architecture of digital media in a way that promotes their user's general wellbeing.

To begin this investigation, we will conduct a literature review of psychology and neuroscience papers that embrace the subject of human behavioral patterns, specifically, how the brain adopts new habits and why certain practices are more easily adoptable than others. After understanding those behavioral vulnerabilities, we will review case studies and research papers that explore the relationship between human practice and digital technology design. Digital technology design can consist of interface features, accessibility components, and safety limitations—all of which will be evaluated in accordance to the responsible research and

innovation (RRI) concept and the Actor Network Theory (ANT) theoretical framework (Stilgoe et al., 2013; Bijker, 2017; Rodger et al., 2009; Peine et al., 2017; Law, 1992).

Background and Significance

In an attempt to understand how we want to define "mindfulness" in the context of technology, Valasek introduces the "duality of attention" to explain a key difference between automatic and deliberate attention. While deliberate attention is characterized by one's ability to observe and explore new information with a motivation or intention in mind, automatic is the natural course of one's thoughts. In this duality structure, it is less about the content that is being exposed to us, but rather the way in which we approach it (Valasek, 2012).

Chen et al. discusses automatic attention further to identify what factors influence an individual's digital distraction intensity by drawing on the theory of "automatic thinking behavior." Automatic thinking is an "information processing approach that normally involves four features: (1) unplanned, (2) effortless, (3) without thoughtful consideration of the reasons and consequences, and (4) difficult to stop or modify" (Chen et al., 2020, p. 2). Generally, the combination of unplanned and effortless qualities of a certain action becomes a habit when we are unable to persuade ourselves that the consequences outweigh the momentary gratification the action provides us. The absent-mindedness required of automatic thinking behavior is unable to fully grasp our need to stop or modify the action because pursuing the action was not deliberate from the start.

We can breakdown deliberate thinking into its finer components by viewing it as a process. Sun et al. uses the "Mindfulness of Technology Adoption (MTA)" model to explain, step by step, how we are able to implement technological practices into our routines, provided

that we, as users, have a certain level of jurisdiction over the relationship we form with the technology themselves. The model depicts the adoption of ICTs in two phases: (1) finding a perceived usefulness and intention for the technology and then (2) a post-adoptive perception that will influence one's intention to continue (Sun et al., 2016). Phase one of the model depicts the fundamental feature that sets apart deliberate attention from automatic—that is intention. Here, the user is immersing themselves into media content with the motivation to take something away from the experience that goes beyond a momentary sentiment of gratification. In phase two, intention is still at the forefront of decision making. In this step, the user has to possess a level of awareness to decide whether the usefulness of the technology practice was beneficial enough to keep implementing in their routine.

Generally, with automatic thinking practices that have turned habitual, the user has little incentive to provide explanation or persuasion as to why they should keep moving forward with the practice because our brains are designed to find a sense of comfort in the actions that we automatically implement into our routines. This is also not to say that the duality of attention of deliberate and automatic thinking information processes exist on a scale of good and bad, but rather to shed light on why malpractice of distracting technology practices tends to develop easier due to the vulnerabilities we possess from automatic thinking.

The relationship between user and digital technology is heavily dependent on how much agency the user gives the digital technology. Information communication technologies are designed to cater to their users in a way that is not only effortless, but thoughtless. While some can argue that this quality promotes ease of use, ultimately, it takes advantage of one's inability to control their own awareness. Through the use of interface and accessibility features, ICTs have the ability to expose individuals to large streams of content very quickly. Even if the

content users are being exposed to counts as “good content”, say for educational use, it is unnatural for our brains to absorb so much of a certain concept or idea in such a short span of time. Adapting to that sort of information influx can potentially deregulate how we normally respond to new content. When we reduce the processing time we have to take in new information, our brains acknowledge the information without fully comprehending what it means or how it makes us feel. Not knowing the meaning or feeling we possess towards the media we have ingested makes us more prone to falling into automatic thinking behavior. Regardless of whether the content we are being exposed to is good or bad, relying on ICTs to feed our need for new information slowly warps our ability to observe and learn from real life. As users become more reliant on digital technologies to mimic the sensations felt during in-person experiences, the role of ICTs in our society becomes increasingly a distracting one.

Research Methods

In order to explore the relationship between behavior and digital design, we will be discussing both sides of this dilemma: (1) what causes individuals to stray from engaging practices of digital technologies and (2) how does the technology itself promote positive or negative engagement? To understand the behavioral segment of this research question, we will be using a literature review of neuroscience and psychology papers to understand what thinking processes are responsible for our ability to form habits and why some are easier to adopt than others. From there, we will use research papers written by past STS scholars that have already touched on the subject of digital design and its possible manipulative capabilities.

To understand the relationship of these two larger pieces together, we will be using the Actor-Network Theory (ANT), which is a theoretical and methodological STS framework that

allows us to dissect the relationship of various social groups and factors. These social groups serve as "players" that we can discuss as components of a larger network where each player's social influence is held accountable by others in the network. What is interesting about ANT, is that, non-human factors can also serve as players—thus, objects, ideas, processes, and any other relevant influences are seen just as important as humans in creating social situations.

Using ANT, we are able to include the design of digital technologies into our network (Rodger et al., 2009; Peine et al., 2017; Law, 1992). This is inclusive of interface features, accessibility components, safety limitations, etc. In addition to the digital technologies, our network will consist of the engineer/designer and the user/consumer. Incorporating the technology in our system of players alongside the engineer and user groups enables us to have a holistic approach of all the influences that pertain to our research question. Though engineers and users are at fault for promoting and perpetuating distracting practices of digital technologies, the technology is worth discussing on its own without association to a social group because its inherent design has qualities that contribute to our problem. It is also worth giving the user group accountability in our discussion because the interaction users choose to have with the digital technology is not entirely the fault of the designer. The duality of automatic and deliberate attention discussed earlier explains that users possess vulnerabilities that make them more likely to engage in distracting practices, and though engineers should take note of these vulnerabilities as they approach their designs, users, to some extent, are complicit in deciding how much prominence the technology should take in their lives.

The drawback of ANT analysis, is that, evaluating each player on an equal playing field can make it more challenging to assign responsibility to any one group. To avoid this, we are taking advantage of Stilgoe et al. and Bijker's responsible research and innovation (RRI) concept

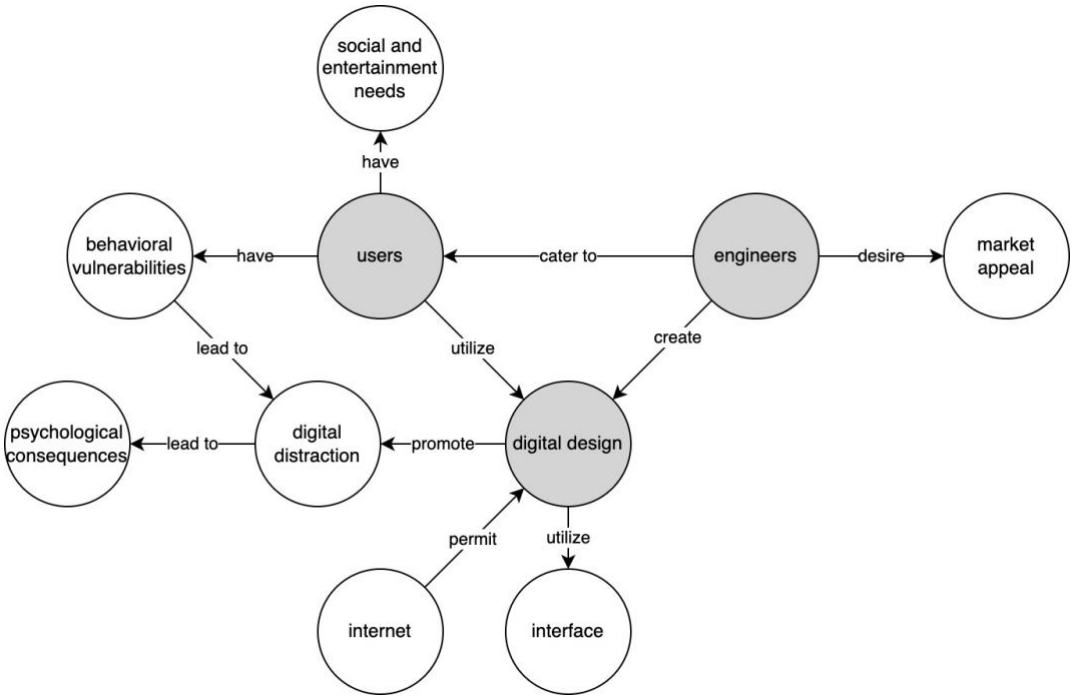
by putting engineers in a higher position of responsibility because they are the primary party introducing the digital technologies into the problem frame. RRI is an abstract concept that promotes designing for social good and requires engineers to anticipate future issues and respond to social realities (Stilgoe et al., 2013, Bijker, 2017). By using RRI in our discussion alongside ANT, we acknowledge that engineers play a role in the digital design of such technologies to an extent that users cannot be held accountable for. Ultimately, the design of the technology will help us investigate how much leverage each group has in this larger dilemma.

Results and Discussion

As digital devices become more accessible, the user group starts to take on traits of a more general population than that of a niche one. Because of this, the vulnerabilities specific to digital technology users are no different than the human behavioral vulnerabilities we already possess and, consequently, questions arise regarding what factors are contributive in the design making process of this technology. As seen in Figure 1, the engineers, users, and design of ICTs are key players. The network provides these three players with the most agency because they are either the most influenced by the technology or most influential in shaping it. As mentioned, utilizing the ANT framework allows us to be inclusive of how ICTs are designed in relation to both the user and engineer social groups. By including design as its own actor, we are separating the role of engineers as a social group from their designs so that the digital technology can be investigated unbiased of the social incentive it may impose. Each of the three players exist with their own limits and requirements, and as we visualize their relationship in our network, we are able to discern where the friction lies between the stance of the user and engineer social groups, respectively.

Figure 1

Actor-Network Theory Diagram



I. Users

A fundamental reason users opt to have access of information and communication technologies comes from the inherent desire to feel interconnected in an already woven network of media and online personas (Oeldorf-Hirsch & Chen, 2022). Users of information and communication technologies extend to any individual that has access to a device that connects to the internet. Internet accessibility is a functionality difference between analog and digital technologies, in that, it introduces users to a portal of information that rarely has set regulations built into its design. While the internet was not created with the intent to exploit massive amounts of information, the development of digital technology platforms promotes users to have incentives that go beyond seeking information and communication (Chi et al., 2007). The emergence of computers, and eventually cellphones turning into smartphones, meant access to

the internet was now available at your fingertips. Immediate access to an outlet that mimics the sensations of communicating and learning minimizes our need to seek it in the present world (Wilmer et al., 2017). This combination of expansiveness and accessibility has caused users to become accustom to fulfilling their social and entertainment needs primarily through the means of digital devices. Building a relationship with anything at this level of dependency cultivates internet addiction.

Hadar and Ergas explain that our brains are slowly becoming habituated into fragmented, quick satisfaction-demanding interactions that work against conditions that forge a level of awareness (Hadar & Ergas, 2019). These interactions evoke similar sensations to gambling. This cyclic process usually begins with users needing momentary gratification. To receive that dopamine hit, automatic thinking behavior will kick in and users will turn to their devices to move across platforms, searching for media content that can garner the intrigue or excitement they were hoping for. Usually, this search ends either when (1) deliberate thinking behavior occurs, or (2) the user experiences their dopamine hit (Koessmeier & Büttner, 2021). The problem with this cycle is that, like most addictions, the requirements to undergo a fulfilling dopamine hit become increasingly more difficult with each instance. The user's next craving for instant gratification will be reliant on an even more fulfilling digital interaction which will, in turn, cause users to spend longer lengths of time on digital platforms during their search (Chen et al., 2020). Like gambling, the uncertainty of whether the user will receive their dopamine hit makes the rush all that more exciting. It is difficult to back away from a slot machine after zero winnings because there is hope that the next try might finally be the lucky win, but it is also hard to back away from subpar winnings if you believe that you can still get better.

Pulling out of this viscous cycle requires users to possess a level of awareness in their attention approach. With smartphones specifically, users have become conscious of their passive screentime and have made personal limitations to reduce their digital practices. Attempts could include removing notifications, hiding certain applications from the primary interface, or setting restrictions on screentime, but like any other addiction, this level of discipline takes a great deal of determination. Because the consequences of non-contemplative digital practices and short-term effects of internet addiction are yet to be fully understood by the collective user group, there is little incentive to reject digital distraction entirely. The act of sitting on our devices has become so normalized that, individually, we are unable to hold ourselves accountable for the guilt attributed with the practice. Doomscrolling has yet to become anything more than a "guilty pleasure" and if the user group continues to lack awareness of the hold that it has on them, they only experience more detriment from this emerging dilemma.

II. Engineers

Engineers are a player worth discussing as two separate social groups: the executives and the developers/designers. Companies (like YouTube, Facebook, and Riot) that gained popularity at the very start of the digital technology epidemic were founded primarily by software developers, so the concept of an "executive power" did not fully emerge until the tech industry developed. As tech joined the frontlines among other businesses, companies that were once start-ups required greater executive backing and a power disparity formed among those that were actually designing the technologies of the business and those that were subjecting commands. Tech companies that wanted to promote themselves as businesses faced the dilemma of having to engineer as a business. The revenue that companies earn in the market is proportional to the

popularity of their product, and in the case of digital technologies, this means applications and software that can yield greater screentime and interaction.

By formulating digital designs that are addictive in nature, engineers are able to guarantee greater traffic on their platforms. These designs are intended to leave the user wanting more, and that desire to feel even more entertained or interconnected only gets stronger when the design only half-heartedly fulfills what the user needs (Bruder, 2022). While executives are pushing for this outcome, "subordinate" engineers/developers are caught in a moral dilemma of choosing between monetary gain and engineering for the common good.

Bhargava and Velasquez highlight the importance of "not divorcing business ethics and engineering ethics" given that falling short of either results in, either, a) a technology that has no funding, or, b) a technology used for exploitation, but this situation becomes tricky when individuals of different roles share the responsibility of finding direction for the company together (Bhargava and Velasquez 2021, p. 342). Companies that have a reputation to uphold can usually get by with disguising their lack of engineering ethics to uninformed users with the way they promote and design their products, but have to maintain stricter protocol when it comes to functioning as a business.

According to Martinez and Adi, the gaming industry alone has grown upwards of 28% in recent years and is only gaining more prominence in the market of digital technologies provided that the pipeline from user to programmer requires no formal credentials in software development or engineering ethics. The concept of "home-based development" was recently coined to explain how accessible it has become for individuals to join in on the lucrative journey of making profit within tech simply by learning how to program on their own. Game development, especially in smaller industries, have become attempts to construct the most

addictive hybrids of plot lines, graphics, and maneuvers that can outsell other games on the market (Martinez & Adi, 2011). Because the industries curated by digital spaces have yet to abide by a well-established governing code of ethics, the gaming industry can continue being a platform where developers compete in the exploitation of their users and, often times, users will comply because their need for entertainment may be fulfilled (Sliwinski et al., 2015).

While we have named gaming and social networking as contenders of harmful engineering, the exploitation that exists in programming is not limited to certain industries but is, more so, dependent on the goal of the designer. Jablonsky explains that even meditation applications such as Headspace and Calm are at stake of navigating their way into an addictive genre. She coins the phrase "attention by design" to describe the promise put forth by meditation companies as a "discursive strategy that frames attention as an antidote to technology addiction, which is ostensibly made possible when design is done right" and argues that attention by design is generally a promise unfulfilled (Jablonsky, 2022, p. 1). Her claim is that attention by design is promissory in that it keeps promising even when it doesn't deliver, compelling the user to return to a practice that represents socially desirable traits that can never be fully acquired.

By luring any form of mindful practice onto a digital platform that is inherently distracting and compulsive, the user receives a "mental nudge" to reinterpret similarly designed experiences as different. These applications gamify the experience of meditating by documenting frequency and sending consistent notifications, and therefore, the attention designed into meditation applications is no longer the mindful attention promised by the company, but rather a form of attention considered more valuable and profitable to the broader technology industry (Jablonsky, 2022).

III. Digital design

The design of ICTs is our final, and only non-human, player. As seen in the network diagram, it is the product of engineers that directly links to the user group. For the sake of understanding the connection design has between engineer and user, we will be breaking down various design devices to understand 1) why they are implemented by engineers and 2) what response it gauges in users. Based on the previous discussion of deliberate and automatic thinking behavior, we can draw upon Csikszentmihalyi's research on the theory of flow to understand what qualities a device must exhibit in order to encourage internet addiction.

A flow experience occurs when an individual fully engages in a certain activity or practice, when their attention is unprecedently focused, and when all external influences are filtered out (Csikszentmihalyi, 1990). Flow state is not to be confused with mindfulness; the distinction here is that mindfulness always exists with intention—while mindfulness can occur in a flow state, not every flow state is a practice of mindfulness. Csikszentmihalyi summarizes the nine characteristics of a flow experience which Liang et. al has grouped into three phases based on the process of flow experience generation (see Table 1): antecedent conditions, characteristics, and sequences of experiences (Liang et al., 2021).

Table 1

Nine Characteristics of Flow Experience (Liang et al., 2021, p. 91)

Flow experience process	Flow experience characteristics
Antecedent conditions	Clear and explicit goals Balance between challenge and skill Timely and valuable feedback
Characteristics	Integration of awareness and action Complete concentration A sense of control over the experiential activity
Consequences of experience	Loss of individual self-awareness An altered sense of time in life A sense of involvement in experiencing an activity

Though not all of these nine characteristics must be present when a mindful experience occurs, even if three of the nine are exhibited and paired with higher intention, the more likely the basic conditions that motivate users to have a mindful flow experience are met. The same holds true for the opposite—pairing these characteristics with addictive practice urge the strong likelihood of distracting flow states. Using Liang et al.'s case study on anti-addiction research of digital design and Csikszentmihalyi's characteristics of flow experience, we can assess the various techniques that promote distracting digital technology uses with the table below.

Table 2

Flow Theory Techniques Contributive of Distracting Practice (Liang et al., 2021)

	Reasons for addiction	Enlightening principles
Balance between challenge and skill	Easy enough to start, but adapts to user skill set with diversified modes	With the process of in-depth use of game products, users are matched to challenges of gradually increasing difficulty and can explore new modes and new functions, which constantly generate a sense of acquisition and freshness. In the game anti-addiction design, after the user has been addicted to the game for a long time, the balance of challenges and skills in the game is broken by applying the theory of flow in reverse, so that the boredom of matching low challenges with high skills or the frustration of matching high challenges with low skills is generated, and the purpose of stopping game addiction is achieved. This is also apparent in social networking as the desire to "outperform" one's past content in relevancy is heightened by the fact that the bar for "success" keeps increasing and the interface's limitless feedback system (LinkedIn's cap at five hundred connections would be an example of anti-addiction design).
Clear and explicit goals	Reward system	Clear goals spark greater encouragement and motivation in users. Users pine for a specific outcome or sensation before engaging with the platform and feel a dopamine hit once their goal is achieved.
Timely and valuable feedback	Reward system	The reward mechanism of feedback has the ability to leave the user feeling satisfied and enhance their sense of participation and challenge in the activity, which is essential in prolonging the time of flow and addiction. Feedback makes the user feel present within the platform and the sensation of feeling acknowledged becomes more

		desirable the greater the feedback is. Gaming uses this technique by scoring and ranking whereas networking platforms may use relevancy numerics with likes, dislikes, and follower counts.
A sense of control over experiential activity	Easy to start	This exists during the second stage of flow experience, i.e., the "characteristics" stage, which indicates that the user can feel the operational autonomy and control over the activity. When the operational autonomy and control is too small, it is easy to trigger anxiety and boredom. In the design of anti-addiction, when the user exceeds the set interaction time, the controllability of the activity can be limited.
Loss of individual self-awareness	Psychological needs	Users, often times, are aware of the consequences digital practice has on them and have begun to develop a sense of self-management. Even with that in mind, implementation of maneuvers and eye-catching interface pull the user into interacting with the platform for "just a bit longer." Bright colors keep the interface inviting and interesting, notifications promote alertness and serve as reminders that the platform is ready for interaction, and movements like scrolling and swiping are simple enough that they encourage the user to keep moving in the direction of new information.
A sense of involvement in experiencing an activity	Social needs	Participation is fueled by a desire to experience the platform both as a third-party member and interacting with it directly. Social connectivity online can replace the need to seek it in real spaces and those off such platforms may feel like they are lagging behind in their own connectivity.

According to Liang et al., distracting flow experiences can be limited by using the reverse application of flow theory. The reverse application requires flow experience characteristics to exist with restraint so that interaction with addictive models is halted before it can begin. As seen in Table 2, the anti-addiction design for the flow characteristic relating to "a sense of control over experiential activity" would be to implement devices within the digital technology that prohibit the user from continuing a certain interaction.

Attempts at this sort of solution have been seen by Apple's recent feature "Screen Time," which allows users to examine how much time they have spent on certain applications and view

summaries of their daily and weekly interactions. Users are even able to set restrictions on themselves by setting limits on the amount of time they can spend on certain applications and restricting applications to a single genre specific to certain parts of the day. While the design of this feature serves as a step towards anti-addiction design, it is not transformative of the device as a whole because it urges users to construct their own contemplative experience, which we have seen from earlier discussion to be a dilemma met with behavioral vulnerabilities. Because the device itself is an inhibitor of mindful practice, Apple's Screen Time provides little real impetus to put the phone down and forces users to fall into a conundrum of self-discipline.

Implementations like these halfheartedly dissect the actual problem and provide solutions that shift the responsibility over to the consumer. Alternatively, engineers could change the designs of their technology entirely by filtering out techniques that exhibit non-contemplative practice so that users are no longer enabled by them. The conflict with going this far is the pushback tech industries will receive financially. Despite the prominence of tech in the current market, the success rate for companies that make use of anti-addiction design is rare and the few that do are overpowered by tech giants that rely on bad ethics (Bhargava and Velasquez 2021, p. 344).

Using Stilgoe et al. and Bijker's responsible research and innovation concept (RRI), we can discern that the conflict lies with the ethical dilemma of engineering as a business. According to RRI, designing for social good is dependent on engineers responding to social realities, and in this case, failure to design digital technologies in a way that accommodates for user vulnerabilities is less of an overlooked part of development and, more so, an active decision to hold business ethics over engineering ones.

Conclusion

In the foreseeable future, it is almost inevitable that the emergence of information and communication technologies will only become more prevalent and while this paper heavily builds a case against them, it should be known that critiques and discussion are catered to its implementation in design rather than its functionality entirely. Our analysis of anti-addiction design suggests that there is room within the development of ICTs to shift towards contemplative design and transformative changes in this movement are reliant on discovering a business model that can support engineering ethics.

Finding a business model that is complicit in preserving the nature of engineering ethics requires an industry that is inherently uncompetitive and non-exploitative, but this is a problem that exists beyond the industry of just digital technologies. Solutions on a smaller scale could consist of constructing a code of ethics specific to digital platforms or barring platforms to enter the market stream if they do not fall in accordance to RRI. For tech companies that have fixed their standing in the industry, this means completely reevaluating the nature of their products to an extent that diminishes the functionality of their products almost entirely.

Discourse regarding these ideas beg the question of what the tech industry would even look like if leading companies reimagined their designs to be more contemplative. Would the industry have to downsize or would new contemplative platforms emerge to preserve the position of tech as a leading industry? Either way, there is no reason to preserve an industry that is working against the well-being of their users, and if that means companies have to take the hit, it may be a chance worth taking.

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