

The Perils and Promises of Closed Loop Engagement

Every generation grows up with new media and new culture. Every generation faces their parents' romanticism of a simpler time and the fear of corrupting, changing social mores. Unfortunately, with this generation the statistics around mental health are unlike any seen before (according to the director of the CDC's Division of Adolescent and School Health, Dr. Kathleen Ethier.)

From 2009 to 2019, Seattle schools watched as self-reports of persistent, debilitating hopelessness increased 30% in their students. What their children experienced is happening everywhere. The 2021 CDC report revealed a mental health crisis in today's youth— 4 out of 10 teens nationwide share those feelings, with 1 of 5 seriously considering suicide this year. The problem has grown most acutely among teenage girls.

Seattle administrators believe they know why. They have joined a growing legal movement pointing a finger at Tik-Tok, Instagram, and other social media companies. These lawsuits rest on internal Facebook research leaked by the Wall Street Journal (WSJ) in the 'Facebook Files' which acknowledge that Instagram can exacerbate negative mental health in young women.

The Search for a Smoking Gun

Unfortunately, the causes of declining teen mental health can be difficult to pinpoint. While the internal documents leaked from Facebook reveal self-reported negative effects on teenage girls, the vast majority of children report *positive* impacts on their lives. Depending on the child, the same content might inspire them or demoralize them. It could make them feel closer to their friends or isolated from them. The reports suggest that the underlying problems are not simple to diagnose; there is no smoking gun to explain the dramatic changes in teen mental health.

In fact, we have reason to distrust the self-report data revealed in the Facebook leak. Self-reports about social media usage are frequently inaccurate (for instance, college students are off by 45 minutes a day on average when reporting their usage), and users misunderstand the real impact of social media design and behavior on their lives.

In one case, according to WSJ reporter Jeff Horowitz, “teens told Facebook in focus groups that “like” counts caused them anxiety and contributed to their negative feelings”. Many users blamed this feature for sparking stress, social comparison, and self-loathing. However, internal documents reveal that when Facebook rolled out a feature

to hide the like counts to a large group of teen users, it had no measurable effect on their well-being.

Optimistically, social media keeps us connected with peers, friends, and family; it propagates culture democratically, curates content in line with our interests, and gives us a voice. Most teens actually self-report positive feelings about its role in their lives. "[W]e are pressured to cut out mindless activity like playing silly puzzle games, browsing social media, or surfing the internet so that we can be productive instead." writes Dr. Gloria Mark in her new book 'Attention Span'. "There is a reason why people are drawn to such rote activity– in short, we found empirically in our studies that it makes people happy." In moderate doses, social media can have a positive effect.

Moreover, symptoms of anxiety and stress are also reported by knowledge workers with respect to their email. These issues are bigger than any one specific application; social media alone isn't to blame.

With no smoking gun, what then explains the disturbing trends in youth mental health?

Closed-Loop Engagement

While social media can be a positive force in small doses, rarely do teens self-limit their use to a few moments during the day. We carry our phones with us everywhere we go– creating consistent, easy media access and giving it the power to interrupt us when it's ignored.

Moreover, the phone and its applications have been iteratively designed to maximize how much time we spend with them. It's easy to rapidly test and tweak new designs, always selecting the modifications that increase our in-app time. This was a common-sense goal– rationally speaking, people use things more often when they are more useful– but the logic breaks down when technology begins to resemble a drug more than a tool.

Drug-like experiences reshape the psychological structure of every aspect of our lives; this structure is where the damage begins. Overuse by itself simply doesn't explain the negative mental health trends, especially considering the extra couple hours spent on social media are happening during what were once unoccupied minutes as we transition through our day. The issue is much deeper.

In 'Reclaiming Conversation: The Power of Talk in a Digital Age', noted MIT anthropologist Sherry Turkle argues that smartphones have destroyed the quality of our *in person* connections with one another. She describes the 'Rule of Three', articulated to her by New Hampshire college students: "*When you are with a group at dinner you have to check that at least three people have their heads up from their phones before you give yourself permission to look down at your phone.*" (pp 36)

These students are experiencing what Linda Stone calls 'continuous partial attention'– a state where we *don't* engage deeply with the task at hand, and instead maintain an awareness of competing goals and desires. This corrosion of our social experience also plays out in all of our activities. Devices that allow us to mindlessly pass from one experience to another have shrunk our attention spans and diminished the time we spend focused on any one task. Research has shown that push notifications make us make us more likely to interrupt ourselves afterwards; training us to constantly check out. The research here is quite devastating– students last 3-5 minutes, on average, on task before they interrupt themselves to check their phones; one in three workers similarly check their email about every five minutes, even with alerts off.

This lack of deep engagement in real-world tasks is at the root of the mental challenges digital natives face. It robs our experiences of the depth that makes them viscerally and self-evidently meaningful.

This lack of emotional depth has led to a generation with significantly fewer close friends and intimate partners. It has created a foothold for social media and pornography—cheap, digital stand-ins for real human connection. It also has led to escapism. Infinite scrolls are perfect for a stimulating hour devoid of reflective awareness.

As our peer network relies more on technology to temporarily satiate these needs, real-world opportunities for connection dwindle further. Dr. Jean Twinge has shown that kids have increasingly replaced real-world interaction with various forms of screen time over the last decade. Our media has even started catering to the attentional patterns of digital life– bingeable shows with fast cuts and rapid pacing. This self-perpetuating loop that pushes deep absorption in real-world tasks further out of our reach.

The Lessons we Leverage

Despite their negative impact, there is something we can learn from the structure of social media feeds. We easily and deeply lose ourselves in them, just as we do when we fully engage with transcendent art, spiritual practice, and deep connection with another. By leveraging a closed-loop design process, social media has been crafted to inspire the depth of attention that it has robbed from our work, our play, and our relationships.

This deep, effortless quality of attention was described by the famous humanistic psychologist Abraham as a cornerstone of a well-lived life. He believed peak moments were best characterized by complete absorption– "self-validating, self-justifying moment[s] which carr[y their] own intrinsic value." In the modern era, Mihaly Csikszentmihalyi coined the term 'flow' to describe a similar concept of optimal life experience. These men pioneered the two major branches of psychology that study human flourishing and both described at this quality of attention as a central tenet of meaningful living.

This kind of attention is necessary for meaningful living, but it's not sufficient. It's easy to get pulled into experiences that only offer us that quality of attention— like social media or gambling— even when they're at odds with our articulated values. To craft meaningful lives, we require flow-like experiences that are grounded in real connection, spirituality, and individual aspiration.

The Solution

So how do we tackle this problem? Phones and social media aren't going away. While we have many theories and anecdotes about the impact of digital media on our real-world experience, strong evidence is scarce. Fine-grained analysis is further out of reach.

The first step to tackling this problem is to measure and understand the dynamics of deep, effortless states of attention in the real world. Once we are able to model the depth of our attention, we can start to test how changes in our digital world affect our experiences in the physical one.

1. Measuring Flow

Measuring deep states of attention is difficult— we can't see it or be certain about mental experience, so we must rely on secondary proxies to infer what's happening. We also want to continuously monitor someone's state of attention across their daily tasks so we can understand how introducing a phone or social media changes those dynamics.

Traditionally, mental states like flow are measured with surveys, and naturalistic data is collected by interrupting people during their day to ask about their focus state. There are a few problems with surveys as a method— interrupting people makes them less focused, so it alters the state we're trying to observe. Moreover, people do a poor job self-reporting about experiences when they're deeply absorbed (like how much time they spend on the phone). Surveys don't capture this uncertainty well, individuals have trouble precisely distinguishing these experiences, and surveys can't scale beyond a few measurements per day.

New psychophysiological and behavioral measurement techniques can give us a more objective window into someone's state of focus. We can typically observe when someone is really focused— they are still, they blink less, their pupils are dilated— and these cues can serve as an incredibly useful marker of attentional state. [Prior work has shown a unique physiological profile when people use Facebook](#)— indicators show high alertness combined with relaxation, an unusual combination of markers. The technology I have been developing includes a pair of smart glasses that allows us to capture physiological correlates of attentional states in daily life to improve our inferences about them— things like stillness, heartrate, blinking, and face temperature.



Unfortunately, it's very difficult to map physiology to mental states. Typically, researchers will collect data during an interval and see how well it predicts a survey result, but as we discussed, these survey results are not ideal measures of focus state at all. To improve our ability to understand the relationship of physiology to focus, I have also developed tools to measure focus behaviorally.

For example, I've designed a leg-strap that vibrates very faintly, and slowly increases in intensity. These vibrations only start after a participant has been working for half an hour, so they have a chance to get focused. When they notice the buzz, they indicate it in a companion application. This threshold of noticing varies as someone engages in a task– it's similar to walking up behind someone and gently poking them or calling their name to see if they are engaged. It provides a quantitative view into that person's depth of focus.



Another tool I've made is a new kind of watch, which requires the wearer to guess the time in order to reveal it. The amount of perceptual time distortion someone experiences— a major indicator of deep focus—once again provides a quantitative window into their mental experience.

By looking at the behavioral cues and the survey results, we can start to identify physiological states that are indicative of deep attention. As we collect more data, we can fuse information from *all* of these channels— survey results, physiological information, and behavioral data— to build much better insight into a user's moment to moment depth of focus and distraction.

This set of wearables and the models that underly them allow us to create a much better understanding of a user's focus state than we have previously been able to capture, based on real-world data and novel behavioral insight. Since these devices are socially acceptable and easily worn throughout the day, we can develop personalized models of a user's attention across their normal tasks.

Armed with this new window into daily flow states, we can begin to probe the influence of phones, media, and other design interventions on the daily dynamics of their attention by introducing or removing them from our lives.

2. Democratizing Design

One of the most important ways we shape our behavior is through the design of our physical and social environment. We hide distractions and lock away sweets; we befriend good people who we inevitably begin to resemble. Instead of consistently relying on our willpower, our most powerful behavior change tool is to shape our world with the barriers and expectations that put us on a path to success. This agency over our environment is a fundamental way we train our habits and shape ourselves into who we want to become.

When it comes to our digital world, the solution is analogous to the physical; we must *consolidate* our asynchronous communication interfaces and *resegregate* our digital tools. Instead of many constantly updating feeds and apps across our devices, we need one. Instead of all of our tools residing within one screen— each distraction a visible, simple click away— we need to reclaim task-specific workspaces and the barriers that keep us on task.

One example of this kind of technology is a type-writer inspired email client I've built, which also measures email usage statistics. This device is designed to physically separate out email tasks from our typical digital workspace and requires a user to make a conscious choice to move to a physically separate workspace to check their email. Paired with our techniques for measuring flow, this interface serves as a testbed to understand the real impact of integrated email on user focus across their tasks.



Unfortunately, for many aspects of our digital world, we have no agency over their design. We're forced to accept phones and applications wholesale or else completely go without them. While we will likely regain some of this control in the future, current legal precedence makes customization and interoperability with major social networks infeasible. It will take legislation—hopefully inspired by experimental work like this—to regain that control.

The Potential for Evil

At first glance, a set of tools to deeply elucidate the design features that lead to deep states of attention seems potentially problematic. In the wrong hands, wouldn't these tools actually make the problem *worse*?

Unfortunately, casinos, video games, and social media companies have already optimized their interfaces so thoroughly and personalized their content so well that it is difficult to imagine a significant increase in addictive design. The real value of this technology is not that it advances the state-of-the-art for measuring attention *within* the digital world, where we have simple proxies for engagement and absorption—it advances the state of the art *outside* of it. There is little to lose and a lot to gain by elucidating the real-world dynamics of attention and focus.

Ultimately, these tools for understanding the link between design and deep focus provide powerful and useful knowledge. At the moment, this knowledge exists asymmetrically—it is held by companies who study and iterate on the impact of their design in isolation. Only through whistleblowers do we see data that sparks lawsuits and public discourse.

It is my hope that we elucidate the underlying relationships for individuals across contexts, and not just within a specific activity or app; as soon as one experience starts to erode another, we can characterize that cost and discuss the dynamics at an ecosystem level. The more knowledge we create on this topic, the less likely it is that the current asymmetries of knowledge and power will persist.

A Hopeful Future

The digital world has re-structured our attention, robbed our real-world interactions of depth, and provided cheap but unsatisfying alternatives to meaningful experience. As more people have turned towards digital proxies to fill the void of real connection, the opportunities for real-world experiences have shrunk. Digital experiences have further reinforced fractured, impulsive attentional dynamics. The gulf between the digitally native attentional dynamics and the dynamics that serve meaningful, real world task engagement continue to grow.

Fortunately, we can start to tackle these problems using tools to measure and model the impact of our UI on our experience. With a platform that allows us to test and measure the impact of our technology on daily life, we can minimize the negative effects while preserving its benefit. These tools can inform legislation that protects our well-being without over-reach. Ultimately, it may serve as a target for the same closed-loop design process behind social media, repurposed to engineer consumer-aligned interfaces that protect and promote deep focus on the experiences we treasure the most.

Fortunately, there is a robust public discourse already occurring around this topic, but the data lags the theory. As we build tools that increase our understanding, the status quo will not stand for long; value-aligned technology will replace these early experiments of the information age. This technology is one tool to push us towards a future where engineered systems support balanced, fulfilling lives full of meaningful experience.