

Understanding How an Online Setting Affects Learning and How to Adjust Classes Accordingly

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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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“Our technologies mirror our societies”
~ Bjiker & Law, 1994

“And vice versa”
~ Ryan Torbic, 2021

Introduction:

Over the past year, the COVID-19 pandemic has drastically changed the state of the world, and the United States in particular – shutting down borders, businesses, public spaces, and even schools. As a consequence, educational institutions across the country have pivoted to online or hybrid learning as solutions to educate students while minimizing risks to public health. While online learning has been a mainstay in education for quite some time, such a dramatic and unprecedented shift has led to massive readjustment efforts on the parts of administrators, faculty, and students (Zhao, 2021).

As could be expected, this change has not been without growing pains. One pre-COVID study looked at two identical courses, taught by the same teacher with the same content – the only difference was that one course was in-person and the other was online. An end of semester surveyed showed at the 99% confidence level that students in the in-person class felt that their course was better designed, more effectively taught, and made them more likely to achieve their learning objectives as compared to the online course (Slaydon, 2020). As a result, even though enrollment in online classes has been steadily increasing over the past decade, student retention is lower in online classes compared to their in-person counterparts (Bawa, 2016, p. 1).

The significance of this research is clear. With educational institutions across the country engaging in online learning with hitherto unseen reliance, it is necessary to ensure that schools are providing the best possible education for their students. To accomplish this, online learning

needs to become better understood – what are its benefits, its drawbacks, its areas for improvement and innovation? With almost an entire generation engaged in online learning in one form or another, a thorough understanding of online learning is not only pertinent, it is urgent.

I will answer this research question by analyzing how students learn in an online setting. This will be accomplished by studying learning methods, varying class structures, and different subjects to gain a comprehensive understanding of how the complete educational experience changes while online learning. In doing so, the relative advantages and disadvantages of online learning as a teaching tool will become apparent, which can be used to make inferences and predictions about how online learning will develop moving forward.

A Double-Edged Sword: Analyzing the Drawbacks and Benefits of Online Learning:

A common cliché is the ruining of technology taking over the world, replacing all that is dear and traditional. You’ve heard it before – newspapers are all going out of business, books are no longer made of paper, and those darn kids won’t ever look up from their gadgets. While these complaints are not anything new – people have been distrustful of new technology ever since the discovery of fire – in this case, they do hold some merit. To put it simply, learning is different in an online setting than a physical one, and the differences are not always beneficial.

Psychologists have been studying the issue of learning for quite some time, and have come to the agreement that many forms of learning exist. While the exact number of different learning styles is debated – some psychologists isolate as many as eight learning types – common consensus narrows learners into four main groups: “activists (learn primarily by experience), reflectors (learn from reflective observation), theorists (learn from exploring associations and interrelationships), and pragmatics (learn from doing or trying things with practical outcomes)” (Romanelli, 2009). It stands to reason that the more diverse the learning

environment, the more accessible a lesson will be to all different types of learners. Research has shown that “mismatches between an instructor's style of teaching and a student's method of learning have been cited as potential learning obstacles within the classroom” (Romanelli, 2009). In an in-person classroom environment, this can be addressed by providing learning resources – such as hands-on activities – in addition to more traditional lesson structures.

However, this multi-dimensional teaching approach is severely inhibited by online learning. When the entirety of the lesson is communicated via computer screen, it becomes much more difficult to structure courses to appease all different learning styles. This is a benefit for some – both reflective learners and those that were accustomed to constant technological use preferred online courses. However, “active and visual learners demonstrated a significant preference for face-to-face study groups” as opposed to learning in an online setting (Romanelli, 2009). It is imperative that all students, regardless of learning style preference, are able to thrive while learning online. In other words, online learning needs to be able to engage active and visual learners as well as it does reflective in order to be a truly effective learning tool.

The issue of how learning differs from an in-person to an online setting may be explained by our brain’s ability to absorb information. A study conducted on the note-taking process of graduate students showed that those who took notes online provided less annotations, performed less critical analysis, and experienced “fragmented and disengaged reading” (Qayyum, 2008, p. 591). Likewise, it has been shown that students vastly prefer print textbooks over their online counterparts, and that they are more likely to read captions and figures, spend more time reading, and engage deeper with printed material than digital (Woody, 2010). Michelle Wolf wrote in her article “Skim Reading is the new normal. The effect on society is profound” that this lesser comprehension is a result of “cognitive impatience” brought upon by the abundance of easily

accessible information offered digitally (Wolf, 2018). Considering how much learning is heavily dependent upon reading, the development of other necessary skills – such as inference, critical analysis, and empathy – suffer as a result (Wolf, 2018).

The potential damages of online learning extend to other skill sets besides just reading comprehension. A study conducted with over 14,000 pre-calculus courses at Southeastern University found that “students enrolled in the technology-assisted courses did not perform at the same level as the students in the traditional setting” (Vilardi, 2014, p. 16). Students enrolled in the traditional course averaged a 2.14 grade point average (GPA), while the online group averaged a 1.70 GPA (Vilardi, 2014, p. 19), which was found to be a statistically significant discrepancy. Moreover, the traditional pre-calculus course had a statistically significant higher retention rate than that of the online class (Vilardi, 2014, p. 24). As a consequence, it is not surprising to see that in general mathematics students are comparatively dissatisfied with online courses (Mills & Raju, 2011).

In general, when online learning is conducted in the same manner as in-person courses, student satisfaction lessens. Over the course of several years, one study interviewed students in a corporate finance class in Lamar University. Half of the students were taking the class online, and the other half were in an in-person setting. On the whole, the study found that at a 99% confidence level, students in the in-person class felt that their course was better designed, more effectively taught, and more likely to lead to them achieving their learning objectives as compared to the online course (Slaydon, 2020). Classes that do not take into account their new environment and instead rely on in-person teaching methods invariably suffer. One study, for example, randomly assigned students randomly to either an online or in-person algebra class. Instruction, content, and class structure was a constant between the two courses, yet students

who took the course online experienced lower test scores on average and rated their class as more difficult (Hart, 2019).

It is easy to look at that results of that study and claim that online learning is inadequate for effective study, and that in-person classes are the optimal form of education. However, life is rarely ever so clear-cut. as a matter of fact, substantial data shows that online learning carries significant advantages. Online classes offer more flexibility in scheduling and location, which studies have shown are valued greatly by both students and teachers (Hetrick, 2019, p.12). Moreover, and perhaps surprising given the evidence of the previously mentioned research, online classes do not negatively affect student performance (Angiello, 2010, p. 57). One meta-study analyzed the results of sixteen different comparisons of online courses and their in-person counterparts, and found online learning, when utilized properly, actually enhances results. Online classes in the study that utilized “static, non-interactive learning resources that largely resembled offline learning” had no difference in grades between online and in-person students, but classes that optimized their structure, such as one that offered “rich feedback and guidance [and] matched task difficulties to students’ developmental level” had very high levels of student performance (Pei, 2019). When the benefits of online learning are understood and implemented properly, students are able to flourish, even in a virtual setting.

Moreover, online learning has been shown to lead to increased levels of critical thinking in students. A meta-study of 42 different case studies of online learning found that “with active learning instruction and experienced tutor facilitation, students’ [critical thinking] could be enhanced in a variety of e-learning environments” (Chou, 2018). More specifically, one study found that four main themes, highlighted in the table below, were highly correlated with augmented critical thinking in online students.

Table 1

Main themes and categories associated with promotion of critical thinking in virtual education

Instructional design	Philosophical outlook and theoretical framework	
	Learning management system	
	Virtual teaching–learning process	Course objectives and outcome-based assessment
		Problem-based teaching strategies Feedback
Educational leadership and management	Meritocracy	
	Empowering the instructors	
	Support system for virtual environment	
Local evidence	Thinking within the academic framework	
	Evidence-based teaching	
Belief systems	Sociocultural roots of thinking	
	Previous experiences and intellectual backgrounds	
	Personal characteristics and differences of the instructors	
	Personal characteristics and differences of the students	

Figure 1: This table details the four themes associated with increased critical thinking in online teaching: instructional design, educational leadership and management, local evidence, and belief systems. Each theme also contains several sub-themes that further specify common aspects of a successful online course (Gharib, 2016).

Evidence shows that teachers emphasize these themes in their teaching styles, “e-learning improved student perceptions, communication, quality of education, critical thinking, [and] self-learning” (Khan, 2019, p. 1). These improvements effectively reverse the drawbacks of online learning detailed above, instead turning a virtual learning experience into a benefit.

Analyzing the Shift Towards Online Learning:

The purpose of this research is centered around the saying “Our technologies mirror our societies” (Bijker, 1994, p. 3). As such, our societies are currently in the midst of a monumental paradigm shift. Cultural and social standards of conduct are changing rapidly, and student mental wellness and empowerment is being emphasized like never before (Grise-Owens, 2018). Equally as significant is the COVID-19 virus, which has just passed the year anniversary of its status as a pandemic in the United States. It seems to be a reasonable assumption that this past year has been one of the most dramatic and abrupt shifts in U.S. and global culture that any of us will experience in our lifetimes. It likewise seems an equally reasonable assumption that the cultural and technological shifts that occurred over the past year are not a flash in the pan, but rather early, albeit hurried, steps into a deeper understanding of our society’s values, particularly, as I focus on in my research, in the realm of education.

To properly analyze this shift, I plan on utilizing the multi-layer perspective (MLP) as described by Frank W. Geels in his paper, “The multi-level perspective on sustainability transitions: Responses to seven criticisms” (Geels, 2011). Multi-layer perspective is focused on transitions – or when technology rapidly shifts from one paradigm – or as Geels calls it, a regime – to another. These transitions happen at three levels: 1) the niche level, such as laboratories or other areas where technological innovation occurs; 2) the regime level, which encapsulates a socio-technical system (such as the education system); and 3) the socio-technical landscape, which includes all of society.

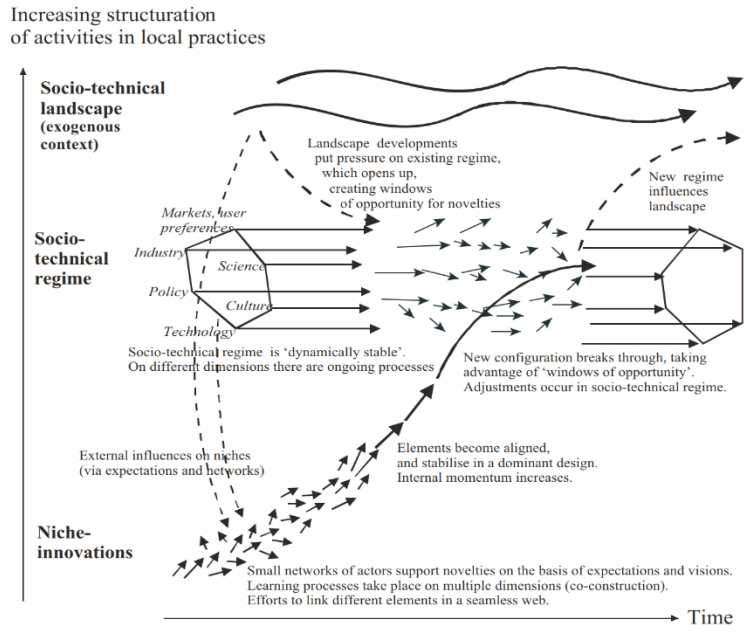


Figure 2: The multi-level perspective on transitions. Each layer applies pressure to the others, leading to a regime change, or transition (Geels, 2011).

As one layer undergoes a change, it proliferates across the others; alterations to the socio-technical landscape enable socio-technical systems to incorporate new innovations developed at the niche level (Geels, 2011). By applying this point of view, the MLP perspective can be used to

understand the full ramifications of the shift in education that we are currently undergoing as a result of the COVID-19 pandemic.

One major transition is the shift from in-person to online classes, as visualized in Figure 3: *Multi-Level Perspective of Transition in Education*, below. Like most regime-level transitions, it was generated by a fundamental shift in the socio-technical landscape – in this case, the emergence of the COVID-19 pandemic and the need for social distancing and government-mandated lockdowns. At the regime level, policies are enacted to ensure social distancing, such as government-mandated lockdowns. These lockdowns close schools, opening up markets for online learning technologies to thrive. This opening allows niche level innovations to burst into prominence, such as Zoom, which grew from 10 million daily meeting participants in December 2019 to 200 million in March 2020 (Zoom, 2020).

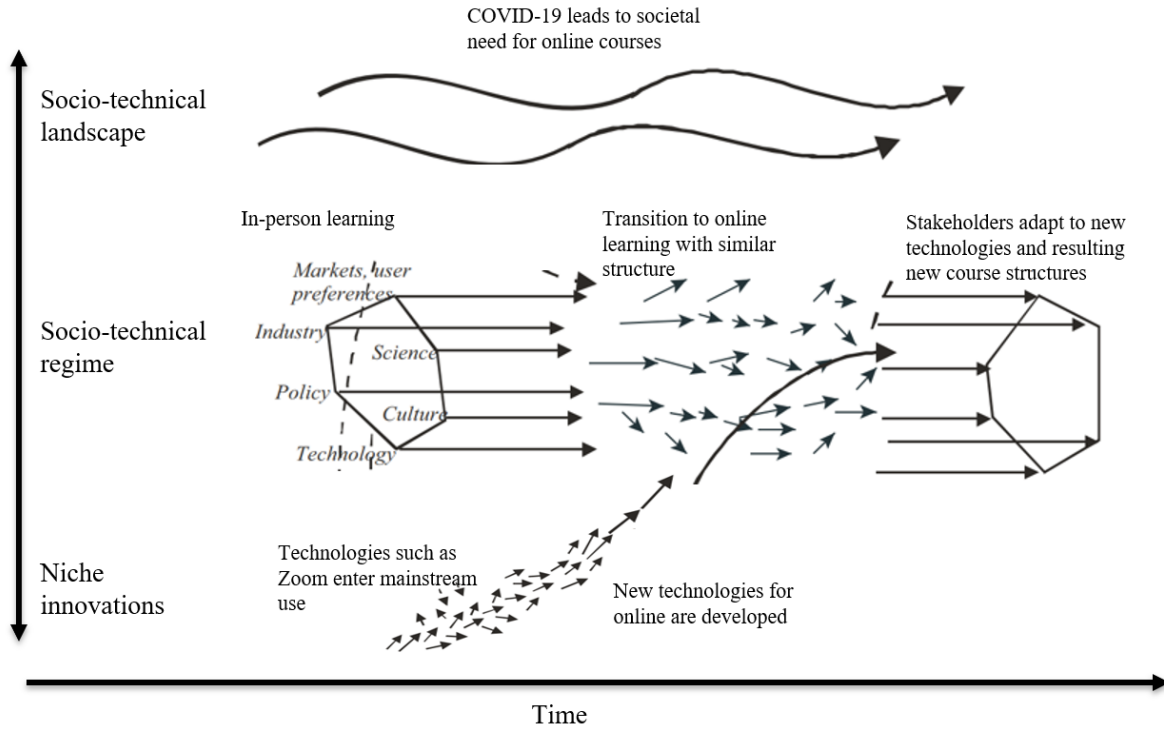


Figure 3: Multi-Level Perspective of Transition in Education. Adapted by author from graphic presented in (Geels, 2011).

Meanwhile, independently of the COVID-19 pandemic, online learning is undergoing a regime change of its own, as online course structure shifts from traditional in-person archetypes to interactive-learning based, dynamic classes rich with feedback and personalized instruction. This transition is depicted in Figure 4: *Transition from in-person to online class throughout the COVID-19 pandemic.*

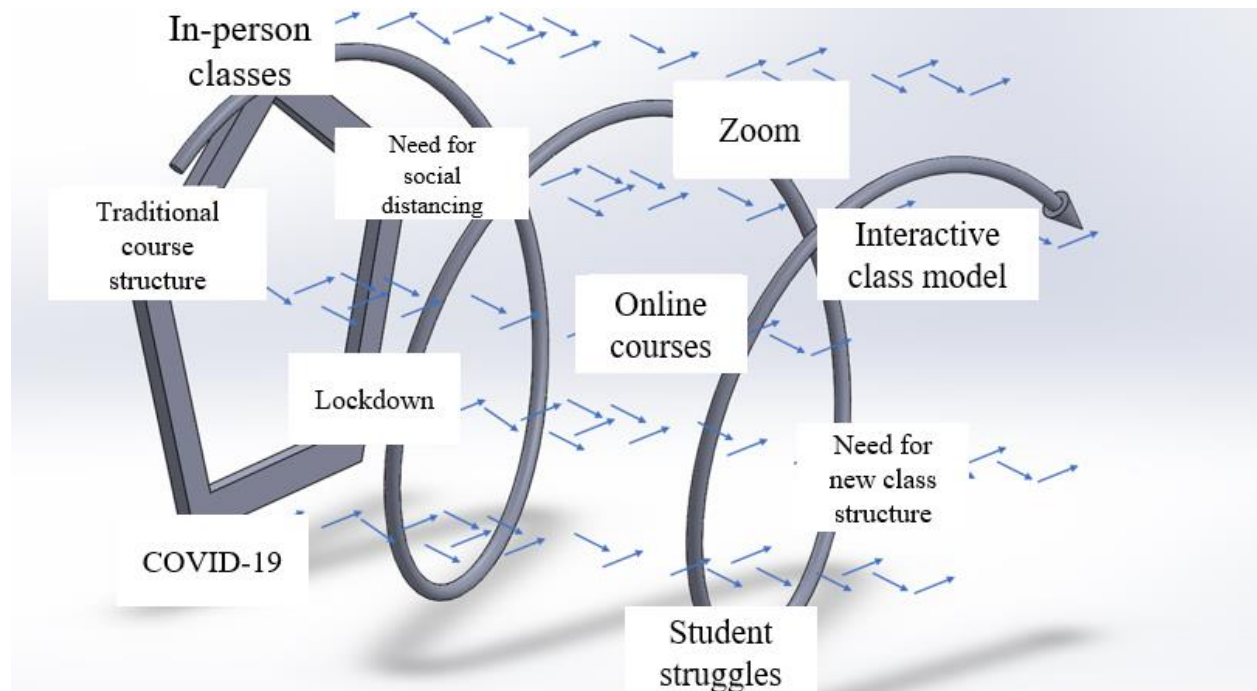


Figure 4: Transition from in-person to online class throughout the COVID-19 pandemic. Graphic created by Skyler Moon, based on ideas presented by (Gales, 2011).

The interactive class model at the end result of this transition and other courses of its style have been proven not only to result in higher test scores, but also higher levels of student engagement, satisfaction, and critical thinking. This regime shift is in part driven by niche-level innovations – such as constantly being developed Web 2.0 technologies including interactive lessons, videos, and simulations. The momentum in the lower layers of this model will, according to Geels, place upward pressure on the socio-technical landscape, possibly resulting in a broader redefinition of course structure across the entire educational system.

Predicting the Future of Online Learning:

As previously stated, we are in the midst of an unprecedented moment in the history of the United States educational landscape. While online learning has certainly been implemented in the past, never has it been engaged with in such large numbers, nor – in most cases – by requirement (Distance, 2021). Both teachers and students are being exposed to new technologies,

new learning methods, and in general participating in the pedagogical process in ways to which they were hitherto unaccustomed.

This is a unique moment for study because we are currently living out the period of experimentation; how can one fully understand the effects of online learning in so-called “Zoom University” until the long-term effects and patterns have had time to become clear and identify themselves? I do not doubt that in the years moving forward, there will be countless studies into the effects of the past year on the educational development of mine and younger generations (I’m particularly curious to see how online learning has affected younger, elementary-level students, who weren’t a focus of this study). However, this study does not benefit from the luxury of several years’ worth of perspective, and thus we will have to engage in a bit of extrapolation and speculation moving forward. Over the course of this section, I intend to make predictions on how classes – both in-person and online – will be structured in the future, on the effects of online learning on the current generation of students, and on some new technologies that will emerge as a result of the online learning boom.

Based on the research conducted throughout this study, I predict that online course structures will continue their trend toward shorter, interaction-focused classes. Teacher testimony says that their students are less engaged in online classes (Hetrick, 2019, p. 27). This is a critical flaw – student engagement is shown to be a primary indicator of their achievement of learning objectives (Carvalho, 2018, p. 418). Some schools are already combatting this phenomenon by making their online courses “fun-sized”, shortening lectures times to instead emphasize practical demonstrations and hands-on student interaction. Changes like these are designed to amplifying student engagement and thus lead to increased learning.

To maximize this effect, I anticipate a movement away from the traditional class as a lecture model, with teachers using class time and resources to offer individual feedback, host class discussion, and encourage students to personally engage with the material. Lectures can be given asynchronously over video, much in the style of the flipped classroom model. Conversely, teachers may transition away from lectures altogether; since reading comprehension, mathematical development, and critical thinking are at risk in an online setting, teachers may be in search of another way to impart information to students.

This need for a new method of teaching will likely lead to an abundance of new technologies, specifically geared to increase student interaction. One example that could be introduced into curricula is smart textbook readings, designed to combat the lower reading comprehension that occurs when consuming virtual material. Instead of online textbooks being identical to their source material, they can take advantage of the new medium. Videos can take the place of pictures; diagrams can be animated to portray entire processes; learning checkpoint questions can give real-time feedback and support instead of just being words on a screen. A mere textbook reading will transform into a full learning experience.

I do not anticipate these new technologies to be limited to just textbooks, however, but rather integrated throughout entire courses. One problem commonly noted by teachers in regards to online learning was the inability to interact fully with students and properly assess their learning progress and needs (Hetrick, 2019). This problem would only be exacerbated in asynchronous courses, were the only assessments a professor could possibly make would be while grading assignments or during office hours. Depending on the frequency of assignments or the student's willingness to reach out on their own time, this leaves the teachers with very limited ability to ascertain their student's level of progress. However, it is conceivable to imagine

software that could use artificial intelligence to judge students' knowledge levels and report those back to professors, highlighting students who appear to need more instruction and thus giving teachers the ability to assess their students in a way that online learning currently lacks.

Automated assessment in this manner may actually turn out to be more effective than merely relying on a teacher's intuition. Consider a massive lecture hall of hundreds of students – it is unfeasible to expect a professor to accurately assess each student's level of comfort with the material on a personal basis. Such large data pools would not be a problem for a virtual assessor. This is not to say automation would replace teaching; rather, automation would provide professors with more connection to their students by augmenting the what a faculty member knows about their students, enabling more meaningful interactions.

These are just ideas on possible changes that will develop in the realm of education. They may or may not happen – however, the one guarantee is that change *will* happen. According to Geels, major transitions – enabled by changes to the sociotechnical landscape – are driven by niche-level innovations. The emergence of COVID-19 and the surge of online learning has changed the sociotechnical landscape, and the education regime is changing accordingly. Geels argues – and this research agrees – that the time is ripe for niche-level innovations to burst into prominence; the educational sphere is changing, and with it, the ways in which we educate must change as well.

Conclusion:

If there is one constant in life, it is that change is inevitable. The same is true of education; in 2016, only 28% of college students were enrolled in at least one online course (Report, 2021), with that number experiencing slowing growth. However, by 2020 – thanks to the arrival of the COVID-19 virus – approximately 34% of universities offered their courses almost entirely online, with another 21% practicing hybrid learning (Distance, 2021). This was, needless to say, a rapid shift, and one ripe with future consequences.

The fact of the matter is, in-person course structure does not transfer painlessly to online learning environments. Part of the reason is psychological – there are many different learning types, and active and visual learners both struggled when not face-to-face with their peers while studying. Part of it has to do with our brain chemistry – humans engage comprehend digital text less than printed, leading to less understanding and critical thinking, which in turn leads to lower scores in fundamental courses such as mathematics, and in general, more dissatisfaction with class structure and the learning experience.

However, that is not to say online courses are a lost cause – they just need to be adapted to optimize their benefits and minimize the pitfalls. Some schools have already taken steps in this direction by shortening lectures to keep students attentive and engaging in discussions, demonstrations, and other hands-on activities. When classes restructure to adjust to the online environment, students score better and flourish.

The tone of this research is meant to be optimistic. Online learning still has to hurdles to clear, to be certain, but it is making strides. New technologies are being developed daily to take advantage of this new environment, and teachers, students, and administrators are adjusting in

kind. I can say from personal experience that, after three semesters of online learning, the entire experience is more positive than how it began. The shift to online learning may have begun under unfortunate circumstances, but like all change, it was a shift that was coming nonetheless. Geels teaches that all major transitions are powered by the bubbling force of innovation, with new ideas and technologies driving markets to previously unforeseen possibilities. We are clearly in the midst of such a transition, and I, for one, am excited to see what new possibilities develop.

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