



# Decentralized Voice Tech Will Disrupt Centralized Interfaces

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## I. INTRODUCTION

### Current Problem

Technological change has been the single greatest driver behind the gains in economic growth and human flourishing and the decline in poverty (Hansen and Prescott 2002<sup>1</sup>; Wehner and Brooks 2010<sup>2</sup>). Moreover, the Second Industrial Revolution has transformed the way that individuals communicate and collaborate with each other within and across organizations through the proliferation of information, data, and multimedia platforms. (Brynjolfsson and McAfee 2014<sup>3</sup>).

While the current digital infrastructure has contributed substantially to economic growth (Barefoot et al., 2018<sup>4</sup>) and the standard of living (Brynjolfsson et al., 2019<sup>5</sup>), these technological advances have also created new challenges. For example, the sheer surge in information has made it tough to access, digest, and create distinctive content.<sup>6</sup> Moreover, technological change has led to a hollowing out of the labor market (Autor and Dorn 2013<sup>7</sup>), reducing the demand for middle-skill jobs. Meanwhile, traditional forms of educational attainment have been unable to keep up with the growing demands for skill (Crow and Dabars 2015<sup>8</sup>) and, if anything, have deteriorated in quality (Rothwell 2016<sup>9</sup>), particularly with the transition to virtual learning (Makridis 2020<sup>10</sup>). Moreover, the ongoing coronavirus pandemic has highlighted these vulnerabilities in the labor force which affect lower skilled and less digitally intensive workers more than others (Mongey et al., 2020<sup>11</sup>; Gallipoli and Makridis 2020<sup>12</sup>), as well as higher education architecture, which in turn drives more students away from college and towards online learning (Makridis and Parassidis 2020<sup>13</sup>; Kizilcec et al., 2020<sup>14</sup>).

With the exponential growth in the breadth and complexity of information (Roser and Ritchie 2013<sup>15</sup>), together with the coronavirus, a change is required if we are going to remain attentive to the influx of content and understand how to process it for meaningful consumption and production. In particular, we will need new tools that reduce the time and hassle of accessing, processing, and learning from information...at scale. We also need tools to help creators process and sift through the noise while also allowing them to create distinctive content and distribute it to those who will most benefit from it. Furthermore, these tools must also respect the increasing demand for privacy and security, allowing both creators and consumers to own their data and providing a way for them to discriminate between trustworthy and untrustworthy sources of information.

<sup>1</sup> Hansen, Gary D. and Edward C. Prescott. 2002. "Malthus to Solow", *American Economic Review* 92(4): pp. 1205-1217.

<sup>2</sup> Wehner, Peter, and Arthur C. Brooks. 2010. "Wealth and Justice: The Morality of Democratic Capitalism," AEI Press.

<sup>3</sup> <https://www.economist.com/leaders/2012/04/21/the-third-industrial-revolution>

<sup>4</sup> Barefoot, Kevin, Dave Curtis, William Jolliff, Jessica R. Nicholson, and Robert Omohundro. 2018. "Defining and measuring the digital economy," Bureau of Economic Analysis (BEA).

<sup>5</sup> Brynjolfsson, Erik, Avinash Collis and Felix Eggers. 2019. "Using massive online choice experiments to measure changes in well-being", *Proceedings of the National Academy of Sciences* 116(15): pp. 7250-7255.

<sup>6</sup> The digital economy, according to the BEA, largely refers to internet and information and communication technologies, including: (i) digitally-enabled infrastructure (computer hardware, software, telecommunications equipment and services, certain structures like fiber optic cables, and the internet of things), (ii) e-commerce (business-to-business, business-to-business, and peer-to-peer), and (iii) digital media (direct sale, free media, and big data).

<sup>7</sup> Autor, David and David Dorn. 2013. "The Growth of Low Skill Service Jobs and the Polarization of the U.S. Labor Market", *American Economic Review* 103(5): pp. 1553-1597.

<sup>8</sup> Crow, Michael M. and William B. Dabars. 2015. "Designing the New American University", Johns Hopkins University Press.

<sup>9</sup> Rothwell, Jonathan. 2016. "The Declining Productivity of Education." Brookings Institution.

<sup>10</sup> Makridis, Christos A. 2020. "Is This the End of the College Experience?" *The Hill* <https://thehill.com/opinion/education/507972-is-this-the-end-of-the-college-experience?rd=1595107840>.

<sup>11</sup> Mongey, Simon et al. 2020. "Which Workers Bear the Burden of Social Distancing Policies?" University of Chicago, Becker Friedman Institute for Economics Working Paper No. 2020(51). SSRN: <https://ssrn.com/abstract=3586077>

<sup>12</sup> Gallipoli, Giovanni and Christos Makridis. 2020. "Sectoral Digital Intensity and GDP Growth After a Large Employment Shock: A Simple Extrapolation Exercise." SSRN: <https://ssrn.com/abstract=3660598>

<sup>13</sup> Makridis, Christos A. and Soula Parassidis. 2020. "COVID-19 Has Exposed Critical Weaknesses in Global Higher Education."

<https://quillette.com/2020/05/29/covid-19-has-exposed-critical-weaknesses-in-global-higher-education>

<sup>14</sup> Kizilcec, René F. et al. 2020. "Scaling up behavioral science interventions in online education" *PNAS* 117(26) <https://doi.org/10.1073/pnas.1921417117>

<sup>15</sup> Roser, Max and Hannah Ritchie. 2013. "Technological Progress." <https://ourworldindata.org/technological-progress>



## Disruptive Solution

We are on the precipice of a Fourth Industrial Revolution, or the Intelligence Revolution (Deloitte Canada 2017), marked by “virtually free data storage and communication, and ever-increasing computational power that rivals some human capabilities.” Searching for and processing data with ease will become the primary constraint, rather than computational capabilities<sup>16</sup>. We believe that the natural endpoint of this revolution is voice as an interface using artificial intelligence as the primary interactor and curator. While apps will maintain the traditional touch interface, they will increasingly feature voice as a primary mode of interaction (Ream 2020<sup>17</sup>).

This whitepaper introduces a vision for a technology infrastructure along these lines: an infrastructure that is fueled by voice and integrated into a decentralized blockchain DLT (distributed ledger technology). In this sense, rather than communicating with technology through our hands and by viewing a screen, we will communicate through our voice. Voice as an interface holds a wide array of benefits, ranging from saving time to greater productivity to expanded accessibility. Moreover, because technology platforms can now transparently store information on a blockchain, content creators can receive secure ownership over every piece of content that they author. This solution is a natural progression in our technological transformation and will serve as the vehicle for trustworthiness, knowledge, production, and consumption for generations.

## II. TOUCH vs. VOICE AS AN INTERFACE

### Problems with Touch

Whether curating social media posts, writing text messages, or interacting directly with applications, we almost exclusively interact with technology through touch while viewing a screen. That is not always the most efficient way *and makes significant demands of our time*. Although voice-to-text translation is available, most of our interaction with technology requires providing very explicit instructions. This contributes towards our unhealthy addiction to *touching devices and looking at screens*, which has been linked with declines in well-being especially for adolescents and children (Twenge et al., 2020<sup>18</sup>; Madigan et al., 2018<sup>19</sup>; Ivie et al., 2020<sup>20</sup>). Moreover, during the pandemic, social networks have had a more significant role in amplifying the effect of the pandemic on individual consumption--even more than the spread of the coronavirus in an individual's own county (Makridis and Wang 2020<sup>21</sup>). Nonetheless, since the advent of computers, and their subsequent counterparts, this is how we've interacted with technology.

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<sup>16</sup> Deloitte Canada. 2017. “The intelligence revolution: Future-proofing Canada's workforce.”

<sup>17</sup> Ream, Braden. 2020. “Every App Will Be a Voice App.” Voiceflow..

<sup>18</sup> Twenge, Jean M. et al. 2020. “Commentary: Screens, Teens, and Psychological Well-Being: Evidence From Three Time-Use-Diary Studies.” *Front Psychol.* 11(181) doi:10.3389/fpsyg.2020.00181

<sup>19</sup> Madigan, Sheri, Dillon Browne and Nicole Racine. 2019. “Association Between Screen Time and Children's Performance on a Developmental Screening Test.” *Journal of the American Medical Association* 173(3): pp. 244-250.

<sup>20</sup> Ivie, Elizabeth J. et al. 2020. “A meta-analysis of the association between adolescent social media use and depressive symptoms.” *Journal of Affective Disorders* 275 pp. 165-174. <https://doi.org/10.1016/j.jad.2020.06.014>

<sup>21</sup> Makridis, Christos, and Wang, Tao. 2020. “Learning from Friends in a Pandemic: Social Networks and the Macroeconomic Response of Consumption.” SSRN working paper: [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3601500](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3601500).



Now, there is a way to address these challenges and open an entirely new realm of possibilities, drawing on voice over touch as a form of engagement. Now, evidence is emerging that shows how voice is catching up in terms of accuracy. For example, (Ruan et al., 2018<sup>22</sup>) found that using voice over manual text entry was three-times faster in English and 2.8-times faster in Mandarin Chinese, including with 20.4% and 63.4% lower error rates, respectively. Put simply, people are faster, smarter and healthier when they speak to technology; people are slower, dumber and less healthy when they touch and read screens.

## Advantages of Voice

The defining feature of voice as an interface is the ability to speak to technology without having to touch or read a screen. Technological advances in voice-to-text translation have significantly improved in accuracy and speed, expanding the realm of possibilities for voice as the default interface.<sup>23</sup> Voice as an interface will generate significant time savings and gains in convenience. While the allocation of time varies greatly across people and occupations given heterogeneity in preferences and job requirements, nearly everyone engages daily in a set of routines and repetitive tasks. For example, HubSpot estimates that the average marketer allocates almost a third of their time to repetitive tasks, like sending emails or collecting, organizing and digesting data. Even though the individual cost of each action is low, the sum total can be large.<sup>24</sup>

### Access

Voice is a more experiential and efficient way to produce, communicate, and search for content, democratizing the process of idea creation and facilitating the matching of the supply and demand for skills. Although the proliferation of content has many advantages—access to an unprecedented amount of information at our fingertips, for example—it also creates new challenges. Many people often produce and publish content that is never used. For example, while there are nearly 1.3 billion unique websites, nearly 85% are never used and an even smaller fraction are accessed on a daily basis.<sup>25</sup> Some of these differences in site visits might be a result of quality, but many are also a function of SEO (search engine optimization) and convexity in the returns to influence—that is, higher quality content matters much more. The nature of SEO creates a “winner take all system,” reducing competition and increasing inequality.<sup>26</sup> Voice as an interface overcomes these barriers by reducing the cost associated with the search and production of content. For example, people who would otherwise be intimidated by technology may feel more comfortable verbalizing their search queries instead of typing them out on a touch interface. Voice provides more access to more people.

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<sup>22</sup> Ruan, Sherry, Jacob O. Wobbrock, Kenny Liou., Andrew Ng, and J. A., Landay. 2018. “Comparing Speech and Keyboard Text Entry for Short Messages in Two Languages on Touchscreen Phones.” Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies, no. 159.

<sup>23</sup> <https://www.nytimes.com/2019/10/02/technology/automatic-speech-transcription-ai.html>

<sup>24</sup> <https://blog.hubspot.com/marketing/marketers-routine-tasks-data>

<sup>25</sup> <https://www.internetlivestats.com/total-number-of-websites> and <https://www.millforbusiness.com/how-many-websites-are-there>

<sup>26</sup> <https://fs.blog/2018/09/mental-model-winner-take-all/>



## Productivity

Marketing Specialists earn \$30.67/hour as of 2019, according to the Bureau of Labor Statistics (BLS) Occupational Employment Statistics (OES) data. That means roughly \$10/hour goes to repetitive tasks, or a total of \$20,000 per year if they work 2,000 hours on average. Given that there are 678,500 of such workers in the economy, that comes to \$13.57 billion per year for just one occupation alone. By using voice as an interface, employees will be able to reallocate many of the more mundane tasks to intelligent systems that can draft emails, conduct scheduling, etc., raising worker efficiency and productivity by allowing them to align their time with their talents. Voice as an interface is particularly suited to address these types of repetitive actions.

## Artificial Intelligence

Because these voice interface systems are powered by AI, they will become increasingly smarter at a faster rate than systems that simply use text and touch. The combination of voice, text, and images will help generate more effective intelligent voice interface systems. Because the artificial intelligence that powers these systems generally operates based off of large training samples of text, images, and data in isolation, significant amounts of data are required to teach these systems how to interact with humans in seemingly simple ways. By combining these three means of communication together in a single system, the application of transfer learning methods can generate significant improvements in reliability and effectiveness (Zhang 2019<sup>27</sup>).

Combine all this with other technological advances, like real-time language translation, and a variety of infrastructure developments that are giving more people access to the internet in the developing world and it's logical to conclude that voice has a huge advantage over touch as a human-to-computer interface.

## III. CENTRALIZED vs. DECENTRALIZED APPLICATIONS & PLATFORMS

### Problems With Centralization

Although many tools have emerged to help coordinate and democratize content distribution, they are still centralized apps owned by very large corporations that require content creators to transfer the ownership of their content and personal data to the platform. Moreover, each app lives in its own centralized world, making it time consuming and challenging to reach an audience across multiple platforms. These platforms come in the form of PWAs (progressive web apps) or downloadable apps for iOS and Android.<sup>28</sup> Other intelligent design systems have also emerged to help content creators with isolated tasks.<sup>29</sup>

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<sup>27</sup> Zhang, Lei. 2019. "Transfer Adaptation Learning: A Decade Survey." ArXiv. <https://arxiv.org/abs/1903.04687>

<sup>28</sup> These marketing platforms include: Buffer, Hootsuite, HubSpot, Lately, SproutSocial.

<sup>29</sup> These intelligent design systems include: Houndify, Amazon Alexa, Apple Siri, Google Assistant, Microsoft Cortana, Bixby.



## Security

Unfortunately, these centralized structures for creating, storing, and disseminating information have significant security vulnerabilities and are ripe for potential misuse. All PWAs or downloadable apps are all sourced on the same platform and susceptible to malicious attacks against a single entity (e.g., a DDOS attack). For example, if someone creates a video that is uploaded to Facebook, then the user has to not only insulate against risk on their own end, but also trust that Facebook will protect that video from people who want to steal their content and monetize it for themselves. While intuition would hold that the most productive and profitable companies are best suited to deal with security breaches because they have more resources, (Makridis and Liu 2020<sup>30</sup>) found the opposite: companies with greater cybersecurity vulnerabilities exhibit abnormal returns, highlighting the limitations of centralized governance.

Given the increase in data breaches (CEA 2019<sup>31</sup>), and the nearly 300 million Facebook users who had their contact information released through a breach, centralized security does not always succeed.<sup>32</sup> In fact, often these data breaches end up benefiting the very firms that experience them by raising their familiarity in the market (Makridis 2020). Moreover, even more sophisticated websites with two-factor authentication are susceptible to phishing scams whereby an email can come in with a hyperlink that is made to look like the genuine source. If the user is fooled, then the user would inadvertently disclose their sensitive information and 2FA code.

## Privacy

A related concern is that of privacy. By uploading a video to Facebook, the company uses the data gathered from the author and sells it to third-parties to generate ad revenue. To the extent users do not want advertising, or do not feel comfortable with the transfer of ownership to the company, these limitations in the current infrastructure create privacy concerns. Legitimate problems with the ownership of data have led to problematic policies, most notably the introduction of GDPR. These policies, however, are imperfect solutions: increasing evidence suggests that GDPR has led to a surge in compliance costs, a decline in technology-based and venture-based entrepreneurship, user experience, and even levels of trust (Chivot and Castro 2019<sup>33</sup>).

## Censorship

Setting aside flagrant examples of illicit activities, internet service providers (like AT&T, Comcast, Verizon) nonetheless have the ability to restrict access while social media sites censor content. For example, Twitter entered into public controversy after it restricted the ability for people to search several conservative leaders, including Republican Party chairwoman Ronna McDaniel, on the platform<sup>34</sup>. More recently, Facebook has entered

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<sup>30</sup> Makridis, Christos A., and Tim Liu. 2020. "Abnormal Returns and Dispersion in Cybersecurity Exposure." NOTE: This is a placeholder for Christos' SSRN working paper.

<sup>31</sup> CEA. 2019. "Economic Report of the President." White House Council of Economic Advisers.

<sup>32</sup> <https://www.techradar.com/news/millions-of-facebook-user-phone-numbers-leaked-online>

<sup>33</sup> Chivot, Eline and Daniel Castro. 2019. "What the Evidence Shows About the Impact of the GDPR After One Year." Information Technology and Innovation Foundation.

<sup>34</sup> <https://www.foxnews.com/tech/twitter-slammed-for-shadow-banning-prominent-republicans>



the spotlight for similar reasons, banning groups from organizing and protesting against state-specific measures related to the COVID-19 pandemic<sup>35</sup>. Moreover, YouTube has both restricted many conservative speakers from posting videos, including Dennis Prager who founded and runs Prager University, and has also potentially influenced the search results of others<sup>36</sup>. Joe Rogan has recently had Tim Pool on his podcast several times to discuss their experiences with censorship<sup>37</sup>.

## Currency

Ever since the establishment of the Federal Reserve in the United States, the government has had increased capabilities to print money without as much accountability or visibility by the public (Calomiris and Haber 2014<sup>38</sup>). In addition to altering the federal funds rate, allowing banks to borrow from each other overnight at a rate of nearly zero percent, the Federal Reserve can also buy long-term securities (Cheng, Skidmore and Wessel 2020<sup>39</sup>). For example, between March and June, the Federal Reserve expanded its portfolio from \$3.9 to \$6.1 trillion, which is roughly 30% of the entire U.S. GDP. It has also purchased corporate bonds, which can confound price signals for investors by putting the federal government's implicit support behind companies that may have weak fundamentals. Some may argue that desperate times call for desperate measures, but the reality is that the U.S. Federal Reserve, among others around the world, has increasingly behaved unilaterally, meaning that a single centralized decision can affect billions of people almost immediately.

While current technology giants invest billions into their data infrastructure to create privacy protections and reduce the risk of cyber attacks, the reality remains that the ownership of user-generated content transfers, at least in part, to the platform. Sometimes the downsides are more benign. In particular, many of these companies make a significant share of their overall revenue from the sale of user data to third-parties who can more effectively tailor ads for consumer products and services. However, an even larger concern is that these companies have full authority to censor content and ban creators from the platform (Mečinskis 2019<sup>40</sup>).

## Advantages of Decentralization

In contrast to the security risks associated with centralized technology architectures, which are especially susceptible to attacks given that security is constrained by the “weakest link,” there is now increasing evidence that decentralized blockchains have systematically better security outcomes. Moreover, there are ways of creating an infrastructure that stores decentralized apps so that the end user does not need to worry about security; Blockstack is one such platform (Mečinskis 2019<sup>41</sup>). A decentralized infrastructure offers three primary advantages.

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<sup>35</sup> <https://www.wsj.com/articles/facebook-curbs-organizing-of-lockdown-protests-11587419628> and

<https://www.theverge.com/2020/4/20/21228036/facebook-ban-event-protest-misinformation-government-social-distancing>

<sup>36</sup> <https://www.prageru.com/petition/youtube>

<sup>37</sup> <https://youtu.be/02ux1dKNPxo> and <https://youtu.be/DZCBRH0g3PO> and [https://youtu.be/Cs\\_mDplkUOY](https://youtu.be/Cs_mDplkUOY)

<sup>38</sup> Calomiris, Charles W. and Stephen H. Haber. 2014. *Fragile by Design: The Political Origins of Banking Crises and Scarce Credit* (The Princeton Economic History of the Western World Book 50). Princeton University Press.

<sup>39</sup> Cheng, Skidmore and Wessel. 2020. “What’s the Fed doing in response to the COVID-19 crisis? What more could it do?”

<https://www.brookings.edu/research/fed-response-to-covid19>

<sup>40</sup> Mečinskis, Tautvilas. 2019. “The Vision for a More Decentralized Web.” Hackernoon.

<sup>41</sup> Mečinskis, Tautvilas. 2019. “The Vision for a More Decentralized Web.” Hackernoon.



## Security

Because the platform is decentralized, any failure in the system would not halt transactions or prevent creators from accessing their own copy of the data. In particular, as long as participation in the system is easier than “cheating” the system, then people will participate, which makes it increasingly difficult to hack the system since a malicious actor would need to simultaneously hack the majority of nodes in a network. This resilience provides a cushion against the many malicious cyber attacks that currently plague publicly traded companies every day.

## Accountability

Individuals no longer own their data through physical servers; their ability to share and monetize content is tied to the decisions of the platform where the content is based. Centralized platforms are not held accountable to their community, particularly in light of the monopolistic competition in the tech sector. And, they force users to share content exclusively through their platform; there is no opportunity to share a Facebook or Instagram video simultaneously to YouTube, Twitter, or TikTok for example. Decentralized blockchain DLT empowers a Decentralized Autonomous Community (DAC) that is supported by a continuum of smart contracts. We believe that AI being held accountable to smart contracts on the blockchain is a much better alternative than AI being held accountable only to itself or to a small centralized community.

## Productivity

One of the biggest impediments towards creating strong incentives, whether in employee-employer or in business-to-business relationships, is the difficulty of measuring output. For example, if four employees work together to complete a task, how does the manager differentiate the contributions of each team employee? This inability to write “complete contracts” is one reason for organizational inertia and tension (Hart and Moore 1988<sup>42</sup>) and differences in the observability of output is one reason for the use of weaker incentive contracts (Lazear 1986<sup>43</sup>). Since decentralized blockchains allow content creators to transparently delineate and establish ownership over their content, there are not only clearer boundaries over each person’s contributions, but also stronger incentives for genuine collaboration and teamwork. And, since advances in technology have been linked with improvements in worker well-being, at least from 2008 to 2018, these gains in productivity may well also improve job quality (Makridis and Han 2020<sup>44</sup>).

By allowing for greater disintermediation of goods and services, the decentralized blockchain DLT can remove many of the traditional third-parties that increase risk across the supply chain. While decentralized blockchains also contain their own security challenges (Damti 2018<sup>45</sup>), they

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<sup>42</sup> Hart, Oliver and John Moore. 1988. "Incomplete Contracts and Renegotiation." *Econometrica* 56(4): pp. 755-785.

<sup>43</sup> Lazear, Edward P. 1986. "Salaries and Piece Rates." *Journal of Business* 90(5): pp. 405-431.

<sup>44</sup> Makridis, Christos and Joo Han. 2020. "Future of Work and Employee Empowerment: Evidence from a Decade of Technological Change." SSRN:

<https://ssrn.com/abstract=3518104>

<sup>45</sup> Damti, Itai. 2018. "The Dark Side of the Chain: Blockchain Viruses and Decentralized Autonomous Crime Organizations." Hackernoon.





provide more tools to facilitate governance from multiple channels. This would also have the added benefit of reducing the amount of time and money allocated towards compliance.

#### **IV. ADVANTAGES OF DECENTRALIZED VOICE FIRST APPLICATIONS**

Beyond the direct effects on convenience, efficiency, security, and privacy...the combination of voice as an interface and a decentralized blockchain DLT offers at least these four unique advantages. That is, the whole is greater than the sum of its parts.

##### **Advantage 1 - Enhance Ownership and Collaboration**

Research conducted in academia and the private sector shows that both encounter significant challenges arising from conflict relating to author ownership. While there is more collaboration among academics, more conflict and free riding tends to ensue, whereas, in the private sector, research is primarily kept internal, rather than shared with other stakeholders or potential partners (NRC 1999<sup>46</sup>). Given that collaboration with people outside of one's institutions is associated with even greater citations (Katz and Hicks 1997<sup>47</sup>; Franceschet and Costantini 2010<sup>48</sup>), information frictions to the resolution of ownership and collaboration create major costs. Moreover, the World Economic Forum has called for a move towards "super platforms" that allow organizations and users to collaborate more freely and identify contributors with like-minded ideas.<sup>49</sup> By embedding every piece of newly-produced content with an NFT when it is streamed, ownership of intellectual content is seamlessly monitored, which not only makes it easier to resolve conflict, but also deters conflict allowing for a new paradigm of collaboration.

##### **Advantage 2 - Improve Content Curation and Trust**

While the bulk of marketing comes in the form of text, audio/visual messaging is more effective because it is more experiential and memorable. By allowing creators to more easily record themselves and string together slices of different experiences through automated voice and image recognition, content curators can quickly assemble a collage of imagery, footage, and broadcast materials to tell better stories, ranging from marketing materials to scientific research and discovery. In an era with "deep fakes", the added feature of trust and convenience may play a major role in connecting with consumers and organizations. Live broadcasts are generating greater engagement as they are being consumed 8.1 times as much as pre-recorded broadcasts<sup>50</sup>. A voice interface will provide a much easier way for creators to do trusted live broadcasts.

##### **Advantage 3 - Develop New Sources of Work**

Although the emergence of labor market platforms (such as Upwork) have allowed people across the world to access new job opportunities, a substantial share of users with profiles are

<sup>46</sup> National Research Council (NRC). 1999. "Funding a Revolution: Government Support for Computing Research," Washington, DC: The National Academies Press.

<sup>47</sup> Katz, J. Sylvan and Diana Hicks. 1997. "How Much is a Collaboration Worth? A Calibrated Bibliometric Model." *Scientometrics* 40(3): pp. 541-554.

<sup>48</sup> Franceschet, Massimo and Antonio Costantini. 2010. "The Effect of Scholar Collaboration on Impact and Quality of Academic Papers." *Journal of Informatics* 4(4): pp. 540-553.

<sup>49</sup> <https://www.weforum.org/agenda/2019/01/how-collaboration-is-the-modern-company-s-secret-weapon>

<sup>50</sup> <https://blog.hubspot.com/marketing/facebook-live-vs-youtube>



inactive<sup>51</sup>. The reality is that many freelancers still struggle to find work and to acquire new skills through the work they take on. Transitioning to voice as an interface will address these challenges in at least two ways. First, it will provide a new source of work. Because some tasks that are completed on the decentralized blockchain will require a “proof of work” stage, new tasks will emerge that simply require a user’s time and cognitive capacities. Second, it will reduce the barriers to acquiring new skills. Because technology is often a psychological barrier for individuals who are not brought up with it, voice will serve as the greater equalizer of opportunity. This will also in turn open up opportunities in many new markets that have traditionally been closed to the developing world and other communities in the developed world.

## Advantage 4 - Create New Education Opportunities

One of the primary barriers associated with a move towards a skills-based framework for hiring and promoting people within organizations is the assessment of competency. For example, even within the realms of science, technology, engineering, art, and mathematics (STEAM) roughly 80% of employment requires at least a college degree<sup>52</sup>. Given that college attainment is increasingly becoming a noisy signal for quality (Valletta 2016<sup>53</sup>), and that the scale of equipping people with skills is growing (Crow and Dabars, 2015<sup>54</sup>), new pathways for learning over the lifecycle are required.

While the emergence of EdTech companies (such as Coursera and Udemy) offer some optimism, a wider set of educational options will not be fully realized until employers begin focusing on competency over traditional signals of ability, which are proxied through university rankings. By allowing content creators to signal their ownership of ideas and clearly communicate their skills on the decentralized blockchain, the new approach will provide the requisite data for employers to make data-driven decisions about the human capital needs of their organization. Although inferring competency is tough since each indicator is coarse, Emsi (2020<sup>55</sup>) has found that a skill cluster can serve as a heuristic for understanding an individual’s productivity and competency. In other words, an individual who signals that they know how to use Stata might be an imperfect signal of their data science capabilities, but if the individual can signal that they not only know to also use Python with expertise in PyTorch and NumPy, but also have completed an enumerated set of client projects involving these skills, then employers could have significantly greater confidence in their competency. This new approach provides a platform for collecting and signaling information on skills at scale. This will be easier to scale with a voice interface and more trustworthy with a decentralized approach.

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<sup>51</sup> <https://community.upwork.com/t5/Freelancers/How-many-active-freelancers-here-Upwork-with-unlocked-profiles/td-p/582917>

<sup>52</sup> Author calculations. This is obtained by taking data from the Occupational Network of Tasks (O\*NET) and the Occupational Employment Statistics from the Bureau of Labor Statistics and computing the fraction of workers who reside within occupations that require at least a college degree.

<sup>53</sup> Valletta, Robert G. 2016. “Recent Flattening in the Higher Education Wage Premium: Polarization, Skill Downgrading, or Both?” Education, Skills, and Technical Change: Implications for Future U.S. GDP Growth.

<sup>54</sup> Crow, Michael M. and William B. Dabars. 2015. “Designing the New American University”, Johns Hopkins University Press.

<sup>55</sup> Emsi. 2020. “A New Understanding of Pathways.” <https://www.economicmodeling.com/2020/02/20/skills-a-new-understanding-of-pathways/>



## V. **attn.live AS AN ILLUSTRATIVE EXAMPLE**

attn.live has built a "live podcasting" platform with a voice interface that allows its creators to stream audio in real time through any iOS, Android, or Windows (computer, tablet, smartphone, wearable) while also providing creators with one of a kind AITs (Attention and Influence Tokens). These prove ownership on the decentralized blockchain DLT and give creators the ability to trade, license or sell their content in an NFT (ERC-721 Non-Fungible Token) blockchain marketplace.

### **Voice as the Interface**

Voice technology is the interface to access, manage, and monetize archived content. Our content creators will be able to use a single device with just one piece of integrated software to do all of this seamlessly using their voice as the primary interface.

### **“Live Podcasting”**

attn.live content creators can stream audio as a “live podcast” that is distributed to multiple sources using only a single device.

### **Custom Home Device Channels**

At the launch of the creator’s attn.live account, a unique Amazon Skill, Google Action, Cortana Skill, Bixby Capsule, and Siri Shortcut will be created to cater to each voice platform. This will allow content consumers to simply make verbal requests of their home devices to “start attention live” and then “start (insert creators unique channel)”. The convenience and consolidation will directly empower content consumers to easily listen to the live stream without ever touching a screen or looking at a device.

### **Distribution**

Live podcasts are automatically distributed to smart home devices such as Amazon Alexa, Google Assistant, Samsung Bixby, Microsoft Cortana, SoundHound, Apple Siri; social media platforms such as Youtube, Facebook, Twitter, Instagram, TikTok; and podcast platforms such as Spotify, iTunes, Soundcloud.

### **Muxing**

Creation of video streams by automatically muxing user’s live podcast with still images or gifs.

### **Translation**

Provide (delayed) live audio translated content based on the end user’s preferences with AI.



### **Active Switching Service**

Content creators can continuously stream pre-recorded content on their specific channel 24/7 until the user is ready to “go live”. Once live, the pre-recorded content will pause and the live content will take precedence. Once the live stream ends, the pre-recorded content resumes. The creators have the ability to edit this stream.

### **Promotion**

Integration of artificial intelligence to automate the creation of promotional micro content - including but not limited to promoting the broadcast through social media, podcast platforms, email and/or SMS.

### **Competition**

Until now, this has required skilled media professionals patching together many different softwares with several hardware devices to provide these types of services.

### **Decentralization**

Furthermore, the content creation and distribution process is integrated into a decentralized blockchain adding unique coding to the content at the bit level in order to track and monetize each user’s unique content in a way that is 100% transparent and trustworthy.

### **NFT (ERC-721 Non-Fungible Tokens)**

This means that every new piece of content that is produced is automatically assigned an NFT (what attn.live calls “Attention and Influence Tokens”) that is distributed on a decentralized blockchain DLT.



**attn.live use case example:** Consider a politician, celebrity, or another influencer who wants to broadcast live content to their audience. Using attn.live, they can start streaming content and sending it out to all their social media channels simply with their voice. Following the live stream, they can interact with the intelligent system to curate the content further. Moreover, because their content is embedded with an NFT at the bit-level, they immediately hold intellectual ownership over the content and can license, sell, or trade it to a publisher, broadcast network, or directly to the consumer.

**attn.live use case alternate example:** Consider a person in a developing country (or even a rural community). Using attn.live, they could engage with content in their own language. In particular, videos that require searches using English characters would be opened up through the voice interface, granting them access to tools and educational content that was never accessible before. This could change the way they raise their children, how they garden and cook, and so on. Moreover, they could also create their own content and interact with the intelligent system to convert the content into the language of their choosing with clear delineation of their intellectual ownership, which could provide a stream of income.

## VI. CONCLUSION

With the advent of coronavirus and its permanent shock to the world economy, now more than ever the market wants a new technology infrastructure where people can create, communicate, and search for information by voice, rather than by touch. We believe that a “live podcasting” application is the ideal use case for bringing together both voice as an interface and decentralization through integration into a decentralized blockchain DLT where every unique piece of media content is embedded with an NFT.

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