

OCTOBER 2020



**PRIMER: INNOVATION ROUNDTABLE**  
FRONTIER TECH - VOICE AI

COLUMBIA INNOVATION ROUNDTABLE  
LIMITED | INTERACTIVE | OFF-THE-RECORD | NON-SOLICITATION



**Credit: SoundWaves**  
Soundwaves artwork by Sebastian Eriksson

**Columbia Innovation Roundtable** cordially invites you to

## **STAY RELEVANT | ACCESS THE FUTURE**

Join a select group of executives and investors as together we explore industries in the midst of disruption and renewal. Be empowered.

### **THEME: BEYOND ALEXA – FUNDING THE FUTURE OF VOICE AI**

*“Give Every Man Thine Ear, But Few Thy Voice.”*

– William Shakespeare, English Playwright (1564 – 1616)

The above quote from Shakespeare’s *Hamlet* is fatherly advice given before the journey to an unknown place, a foreign land. The advent of widespread 5G technology, advances in speech recognition accuracy (99%+), growing awareness of ethics and implicit bias of technology makes the VoiceTech infrastructure is thrusting us all to “an unknown place”. As VoiceTech continues to grow rapidly, few industry participants are listening to the implications and potential second/ third order effects of this new tech layer. Rather the drum-beat of Voice-AI enabled ecosystems grows louder. VoiceTech pushes us all further into an exciting, murky world of biological mechanics and AI psychology stretching not only bandwidth but also privacy boundaries. With an estimated \$1.57 billion in global Voice AI startup funding in 2019 and lofty market size estimates topping \$1 trillion by 2025, without question: VoiceTech is booming.

## (1) How Does Sound Work in a Human?

Voice is arguably the ultimate “user interface” amongst human beings. Facilitating communication, feelings, transactions, trust and more. The mechanics of voice and hearing and interpretation with amplification and are remarkable.

The brain acts a filter. The auditory cortex, the brain's listening center, can decode and amplify one voice over others -- at lightning-fast speeds.

The sound waves are gathered by the outer ear and sent down the ear canal to the eardrum. The sound waves cause the eardrum to vibrate, which sets the three tiny bones in the middle ear into motion. The motion of the bones causes the fluid in the inner ear or cochlea to move.

Sound is a vibration that propagates as a mechanical wave under pressure, traveling through a medium such as air or water.

Frequency is the number of sound vibrations per second, measured in Herz (Hz). Decibels (dB) is a

measure of volume – the amplitude, or pressure, of the sound wave. A normal speaking voice is about 60 dB, while a shotgun blast might be 140 dB. Ultrasound is sound waves with frequencies higher than the upper audible limit of human hearing, above 20 kilohertz. Whereas infrasonic sound waves are below the lower limit of human hearing, below 20 Hz.

When we hear, sound waves travel from the outer ear, through the middle ear into the inner ear where the vibrations stimulate thousands of tiny hair cells. The tiny hair cells in our inner ear send electrical signals to the auditory nerve which is connected to the auditory center of the brain where the electrical impulses are perceived by the brain as sound.

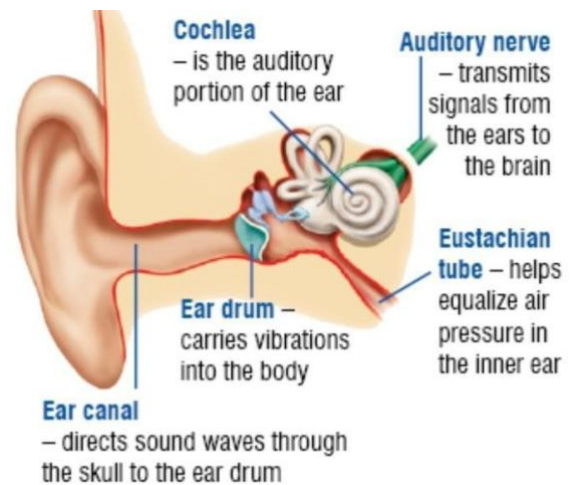


Image: Human Ear's Internal Mechanics



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The brain translates the impulses into sounds that we know and understand. Physical reception of sound is limited by our own ears. Normal range for humans is between 20 and 20,000 Hz. There are over 7,000 languages in the world and 23 languages cover 50% of the global population. With nuances, contexts, intonation, the human brain, with its voice and listening apparatus, does a remarkable job of processing information – a feat machines are closing on but still have some ways to go before achieving parity.

## (2) What is NLP – Natural Language Processing?

As the interface between a user and the product or service, voice technology (voicetech) has the potential to dramatically improve the way we interact with the products. According to Hidden under the proliferation of text-based chatbots, the limitless potential of artificial intelligence (AI), and the continued efforts to improve natural language processing (NLP), is the stoic voicetech – it quietly combines the progress of many foundational technologies. Natural Language Processing (NLP) is the technology used to aid computers to understand the human's natural language. NLP is a branch of artificial intelligence that deals with the interaction between computers and humans using the natural language. Most NLP techniques rely on machine learning to derive meaning from human languages.

Most basic processes would have the following simplified steps:

1. A human talks to the machine
2. The machine captures the audio
3. Audio to text conversion takes place
4. Processing of the text's data
5. Data to audio conversion takes place
6. The machine responds to the human by playing the audio file



Image Credit: Amazon Echo's Internal Mechanics



NLP is the driving force behind virtual assistants such as: Google’s OK Google; Apple’s Siri; Microsoft’s Cortana; and Amazon’s Alexa. NLP entails applying algorithms to identify and extract the natural language rules such that the unstructured language data is converted into a form that computers can understand. The ambiguity and imprecise characteristics of the natural languages are what make NLP difficult for machines to implement. However, VoiceTech is advancing and its contextual awareness has improved; the accuracy has increased and its ability to derive the meaning grown significantly.

### (3) How Massive Could VoiceTech for the Economy, Market and Customers?

The value of the VoiceTech economy has seen some projections top \$1 trillion by 2025. Companies like Amazon, Google, Apple, Microsoft, and Samsung are investing billions into VoiceTech. Scientific advancements from Thomas Edison’s 1877 phonograph to Google’s gains in word accuracy, from 80% in 2013 to 95% in 2017 have been significant. Similarly, according to a report by OMERS Ventures, consumer adoption has also risen sharply with 112 million Americans using a voice assistant monthly in 2019, up from 80 million two years earlier in 2017.

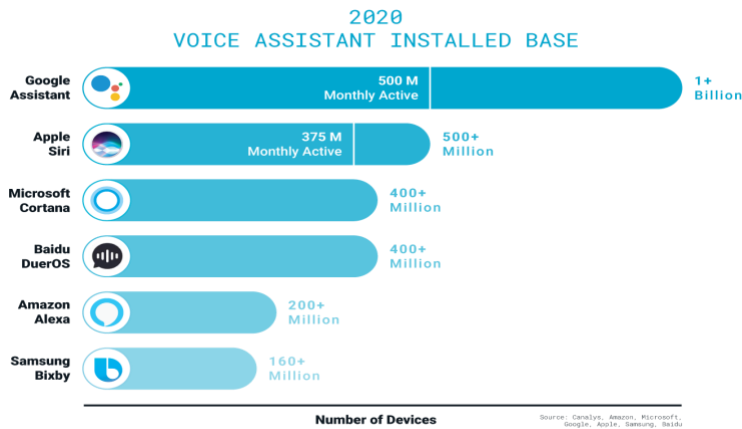


Image Credit: Techcrunch

VC investments in the voice space have continued to grow at a frenzied pace. According to Mangrove Capital, global funding for voice technology startups was \$581 million in 2018 and will grow to \$1.57 billion in 2019. Notable transactions include startup Clubhouse, voice-based

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social media app, received a \$100 million valuation with only 5,000 beta users earlier this year in May 2020. Amazon's Echo Auto announcement in November 2019 and its subsequent 1 million pre-orders also signal tremendous demand for VoiceTech beyond the home. Apple's release of Siri OS this year 2020 also is seen as a huge catalyst for further VC investments in VoiceTech space.

### **Conclusion – Closing Thoughts**

Will voice be a transformational change to the user experience, one that even replaces the keyboard as some investors have touted? Or will it be mired in regulatory and consumer criticism over privacy concerns? Big technology companies like Amazon and Google open-source their NLP or make their technology stacks available at low cost would further proliferate VoiceTech.

Voice has the potential to be will be the next major platform with mass adoption and may even replace the keyboard in the next decade. There is rising concern among U.S. adults about privacy and smart speakers even when you include smart speaker owners. In January 2019, the combined “moderately concerned” and “very concerned” cohort totaled 46%. One year later that figure was 53%.

The key question: Will Big Tech listen to these privacy & data concerns, “giving every man their ear”? Or will the consumers blissfully enjoy the magical convenience of this emerging VoiceTech platform designed by a few?



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## NOTABLE CORPORATE INNOVATION: AMAZON ALEXA VOICE ASSISTANT AND ECOSYSTEM

### Amazon Alexa and the Ecosystem <https://developer.amazon.com/en-US/alexa>

Alexa is the voice-controlled Amazon assistant that turns words into actions. Alexa (whose name is partly inspired by the legendary Library of Alexandria in Egypt) is the voice platform that powers Amazon's Echo speakers, including the standard Echo (2019 version), the little Echo Dot, the video-enabled Echo Show and Echo Spot smart displays, and a bunch of compatible speakers (and other things), some from other manufacturers. Alexa speakers include built-in microphones, so they can listen to your commands and then send a recording of them to Amazon's cloud services, where the recording is analyzed and the appropriate response is triggered. That process usually takes only a couple of seconds.

Alexa already works with more than 20,000 smart-home devices representing more than 3,500 brands. Her voice emanates from more than 150 third-party gadgets, including headphones, security systems, and automobiles.

### Alexa Product Integration

The number of devices with Alexa built-in more than doubled in 2018. There are now more than 150 different products available with Alexa built-in, from headphones and PCs to cars and smart home devices. Device makers announced more new Alexa products at CES 2019, including the Lenovo Smart Tab and new devices from brands like First Alert, Jabra, JBL, Kohler, LG, and Razer.

### Alexa Gets Smarter

Alexa is getting even smarter. The Alexa Skills Store now offers more than 80,000 skills and Alexa customers can now access Apple Music's library of 50 million songs on their Echo devices. Alexa also answers more questions with the help of customers through Alexa Answers; knows more about math and science with the addition of a new knowledge resource, Wolfram Alpha; helps customers get more done with location-based reminders and routines; connects people across the world with the launch of Skype; and more.

### Alexa Scientific Developments

Amazon made new scientific advancements with Alexa, including a new unsupervised self-learning system that detects the defects in Alexa's understanding and automatically recovers from these errors, helping Alexa learn at a faster pace. Amazon also introduced a new text-to-speech system, which uses a generative neural network and produces more natural speech, paving the way for Alexa and other services to adopt different speaking styles based on different contexts.





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**NOTABLE CORPORATE INNOVATION: ALEXA CVC FUND AND PLATFORM**

**Amazon Alexa Fund Platform** <https://developer.amazon.com/en-US/alexa/alexa-startups/alexa-fund>

Founded in 2015, Amazon Alexa Fund is the corporate venture capital arm of Amazon that is based in Seattle, Washington. The firm prefers to invest in artificial intelligence, enterprise, healthcare, internet of things, frontier tech, robotics and voice technology sectors.

The Alexa Fund is part of the company's effort to identify more Alexa-showcasing companies and products around the world. It isn't just a fund. It's come to comprise three parts—a VC-style investment arm, an accelerator, and a university fellowship program. You can think of these as different ways of reaching innovators and entrepreneurs at various stages, from training to ideation to execution as a real company.

**The Alexa Fund**

The Alexa Fund provides up to \$200 million in venture capital funding to fuel voice technology innovation. The Fund believes experiences designed around the human voice will fundamentally improve the way people use technology.

With a team of 6 professionals, the Alexa Fund has made 95 investments with 13 exits since its launch in 2015. According to *Pitchbook*, its current portfolio of 70 companies.

**The Alexa Next Stage Accelerator**

Amazon and Techstars currently have seven companies participating in Alexa Next Stage, its voice tech startup program originally called Alexa Accelerator.

Amazon earlier this year said it would revamp the program to focus on later-stage companies. Launched in 2017, the Alexa Accelerator supported 27 early-stage startups in three cohorts over the past three years.

**The Alexa Fellowship**

The Alexa Fellowship inspires and enables the next generation of curious minds to invent the next big thing in conversational AI. The Graduate Fellowship supports PhD and post-doctoral students specializing in conversational AI at select universities. The Innovation Fellowship empowers technology entrepreneurship faculty members to help student entrepreneurs innovate with voice interfaces.



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**FEATURED FIRM: AMAZON (NASDAQ: AMZN)**

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Amazon.com Inc. (AMZN), the world's largest online retailer, is growing rapidly in a broad range of businesses under founder and CEO Jeff Bezos, including its core e-commerce operations, cloud services, digital advertising, groceries, and prescription drugs. It also sells products such as the Alexa personal assistant and ecosystem, and movies and television shows through its Amazon Prime Video platform. Amazon's rivals include Walmart Inc. (WMT) and Alibaba Group Holdings (BABA).

The Company's products include merchandise and content that it purchases for resale from vendors and those offered by third-party sellers. It also manufactures and sells electronic devices.

Amazon divides its business into three segments: North America, International, and AWS. The first two of these segments, North America and International, refer to geographical breakdowns of Amazon's retail business. They generate revenue from retail sales in North America and the rest of the world, as well as from subscriptions and export sales for those areas. Retail can further be broken down into online stores, comprising the bulk of sales, and physical stores.

**North America**

Amazon's North America segment dominates its net sales, accounting for \$55.4 billion in Q2 2020 and operating income of \$2.1 billion. This is about 62% of the company's net sales for the quarter. North America was Amazon's fastest growing sector for the quarter.

Aside from retail, the other primary source of revenue for North America is subscriptions, including Amazon Prime, which offers unlimited free shipping, and unlimited streaming of movies, TV shows, and more.

**International**

There is one Amazon segment that has not thrived in recent years: the International business. This segment consists of Amazon's retail business for consumer products and subscriptions for internationally-focused online stores. It also includes export sales from those stores, but not those from North America-focused online stores. Amazon has lost money in each of the last 3 years in its International segment. However, in Q2 2020, the segment posted an operating profit of \$345 million compared to an operating loss of \$601 million for the year-ago quarter. Net sales for the International segment grew 38.5% to \$22.7 billion, comprising about 25% of the company's total net sales.



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### **Amazon Web Services (AWS)**

Amazon Web Services (AWS), launched in 2006, provides services to businesses, government agencies and academic institutions to store information and deliver content. Amazon says AWS provides an "infrastructure platform in the cloud," for a variety of "solutions" such as hosting applications and websites, providing enterprise IT, and content delivery.

Amazon controlled more than a third of the cloud market in 2018, more than twice its next closest competitor. AWS competes mainly with Microsoft Corp.'s (MSFT) Azure, and Alphabet Inc.'s (GOOGL) Google Cloud.

In 2019, AMZN generated \$280.522 billion in annual revenue. Currently, the AMZN market cap is approximately \$1.72 trillion and the company has a headcount of roughly 800,000 full-time and part-time employees.



**BIOGRAPHY OF SPEAKER: ZAIN A. GULAMALI, HEAD OF AMAZON ALEXA FUND  
and DIRECTOR OF WORLDWIDE CORPORATE DEVELOPMENT**



Zain A. Gulamali manages the Amazon Alexa Fund, Amazon’s \$200 Million venture capital fund investing in artificial intelligence, enterprise, healthcare, IoT and connected devices, robotics, voice technology, and more. Zain has led the Alexa Fund’s investments in Tact, Greenlight Financial Technology, June Oven, Owlet Baby Care, Mojio, Embodied, Rachio, and TrackR. He was also responsible for establishing the Alexa Accelerator in partnership with Techstars, now running its 2nd

class. Zain is also part of the broader Corporate Development team at Amazon. Prior to Amazon, he worked in mobile gaming (Pocket Gems), private equity (Warburg Pincus and Monitor Clipper Partners), and investment banking (Goldman Sachs). Zain is a graduate of the Stanford Graduate School of Business and the Massachusetts Institute of Technology (MIT).



## SCHEDULE:

- 6:00 – 6:05 pm Meeting Ground Rules (Welcome Remarks)
- 6:05 - 6:15 pm Introductions
- 6:15 - 7:10 pm Presentation & Open Discussion - (Roundtable Discussion)
- 7:10 - 7:15 pm Concluding Statements - (Closing Remarks)
- 7:15 – 7:30 pm << Coffee Break>>
- 7:30 – 9:00 pm Private Virtual Reception & 1-on-1 Networking

## OUR PURPOSE:

### >> Stay Relevant.

- How can you invest in promising voice technology startups? How will you prepare your company, business model and workforce for privacy & data safeguards for a new platform: VoiceTech? With potential elevated UX/UI experiences enabled by VoiceTech, are your products and services ready to meet new customer expectations? Our speaker is tackling these questions at one of the world's largest and most influential technology companies: Amazon.

### >> Access the Future.

- A world where it is voice-first, not mobile-first, what skills and roles will be needed? Which platform and Voice Assistant will customers choose – will there be one dominant VoiceTech platform overall or will there be multiple winners by specific use-cases? Where will liability rest for loss of data or incursions of privacy? The future of VoiceTech is promising and will make AI a bit more human.

## OUR PARTICIPANTS:

Columbia Innovation Roundtable – an independent affiliate of the Columbia University Alumni Club – invites you to experience our distinctive innovation-focused, private, invitation-only executive roundtables. Join us for a stimulating discussion on **Frontier Tech: Voice AI.**



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## OUR SHARED VALUES:

- **Limited** - Each roundtable is unique and limited to a total of less than 25 invited members
- **Interactive** - Active participation by each member enhances our collective perspective
- **Off-the-Record** - All discussions are strictly off-the-record and confidential
- **Non-Solicitation** - No solicitation or investment pitches are permitted

## EVENT DETAILS:



### Columbia Innovation Roundtable

**Address:**

Zoom Virtual Link

(Shared privately 24 hours before the event)

**Date:**

Thursday, October 15, 2020

**Theme:**

Voice AI: Beyond Alexa – Funding the Future of Voice AI

To request an invitation, please email  
[oa2142@Columbia.edu](mailto:oa2142@Columbia.edu)