THE END OF INFORMATION TECHNOLOGY

INTRODUCING HYPERSENSE & HUMAN TECHNOLOGY

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OVERVIEW

If we were to climb into a time machine and set the dial for ten years into the future, what might personal communications look like? Might you inhabit a soothing virtual reality where your conference call takes place in a simulated lakeside villa? Might you consult with a virtual doctor? Employ a "Guardian Avatar" to act autonomously on your behalf eliminating online drudgery and security concerns? Although no particular future is certain, the seeds of what is to come can always be found within the present reality, albeit often only in retrospect.

We at the Hypervoice Consortium have had the rare luxury of spending a year roaming widely over a change-swept landscape, to gather a diverse seed bank of clues to what the future holds. We have closely examined those seeds, asking ourselves a seemingly simple question:

WHAT MIGHT PERSONAL COMMUNICATIONS LOOK LIKE A DECADE FROM NOW?

The easy answer to the above question is a list of buzzword technologies, stuck together into a fantastical narrative about amazing features and functions. And indeed, there is an unfolding and impending technological leap that could bring those technologies into reality — much like the jump from horsepower to steam in the 19th century. Rather than being about muscle power, this coming leap is about reasoning power: Machines that can sense all our gestures, recognize them and respond to us.

Yet this kind of technology fortune-telling isn't our key finding. **The most important issues are tied to overwhelmingly human concerns.** Our findings prodded us to ask harder questions:

- How can these technologies service individual flourishing and collective *wellbeing*?
- What does it mean for us to engineer *feeling* states?
- How can we manage the *ethical* risks arising from power imbalances, such as when people feel no choice but to surrender their privacy?

The success of this report won't be in how precisely we foretell the future. Indeed, the future is malleable, and your act of reading this document will itself change it. **Our aspiration is to jointly imagine the most *desirable* future for personal communications, and to steer the world towards it.**

OUR JOURNEY

OUR INCEPTION & RESEARCH PROCESS

The Hypervoice Consortium was formed in 2012 as the result of a simple insight: Voice is a valuable data asset, and not merely ephemeral audio. This asset can be stored, contextualized, structured, indexed, and made searchable and actionable. Treating voice as an asset defines a new form of hypermedium, akin to the emergence of hypertext and the Web. Whereas hypertext is tied to a spatial metaphor (pages), hypervoice links events related in time (activity streams). Our mission ever since has been to explore this emerging space, and to promote the possibilities and pioneers to a wider audience.

Throughout 2014 the team at the Hypervoice Consortium has been researching both voice communications and its neighboring disciplines. We interviewed more than 30 technology visionaries, covering many fields: from professors of virtual reality to advocates for improved design for disability. Our written industry survey received 60 in-depth, expert responses. We also have sourced and organized more than 300 relevant articles, videos and presentations, which have provided us with a clear picture of the present reality and emerging near future.

Based upon our research, we have identified 250 ecosystem players across dozens of inter-related industry sectors. These ecosystem players consist of three types: established platforms, emerging services, and enabling ingredient players. *(For access to the full ecosystem report, please contact the Hypervoice Consortium via our website.)*

OUR WORLD VIEW (OUR BIASES)

As researchers, we came to this project with many decades of collective technology industry experience, which resulted in an unconscious bias. This bias manifested itself in the stalking horse version of the future that we offered to our research interviewees to provoke discussion. (This Future Voice Experience 2024 slide deck can be seen here.)

We discussed with them what the perfect conference call would look like, offering a menu of technological enhancements to today's services — pervasive sensors and wearables, new privacy and data search options, and improved efficiency driven by artificial intelligence and virtual assistants.

We found two big problems with our stalking horse. One, we weren't analyzing the human jobs to be done, human pain points, and opportunities for creating human meaning and value. Worse yet, our future scenario wasn't even all that far ahead of the curve! Interview after interview, we would find that our scenarios were, at most, three to five years out. Almost all

aspects were in late R&D or early commercialization. To deliver on a 10-year technology vision, we were going to have to get a whole lot less "practical", whilst also acknowledging that one thing doesn't change — namely us *humans*.
We have all been immersed in Information Technology, and this paradigm is unconsciously limiting us all. **The alternative paradigm is what we call *Human Technology* — elevating our *human* needs above those of technologies, systems or institutions.**

So now you know what this report is really about: Seeing the world of technology in a different, human-centric light.

A DANGEROUS PATH
Our research leads us to believe that if we continue along our present path, we will make a fundamental category error by processing human information (like voice) within the prevailing IT user paradigm. Our (possibly unwelcome) conclusion is that this leads us to a systems-centric dystopia. Companies like Apple, Google or Samsung may measure success in terms of user delight, but that delight is conditional on user subjugation to the data and identity platform owner. They want to own our voices, and as a society we can't let that happen.

In a true human-centric model, our identities are not bound to single platforms. Citizens are given real power over their data's collection, storage, use, and destruction. They are self-sovereign over their identity. By focusing on human needs instead of technologies, we reached our biggest single finding: a "Privacy Spring" revolution is coming. **We are moving beyond user *delight* as the benchmark for great application design, to human *freedom*.**

To summarize our journey, what matters are not the technologies per se, but the benefits they enable that make a qualitative difference in people's lives. This is especially true for those who are the weakest in society, who lack power by definition.

WE ARE OPTIMISTS
Although we are quick to call out a cataclysm when we spot its tale-tell signs, our worldview tends to have a technology positivist rather than dystopian slant. We feel this is justified by history. For instance, Professor Carlota Perez has written extensively about the golden eras for coal, electricity, oil and petrochemicals. Once the basic technologies have been invented and installed, the whole of society begins to reorganize around them. These fruits of technology then offer profound human benefit.

We are now at that place with the information revolution where the golden era is coming due. The trends for human development currently point towards a good future.

If we make the right ethical choices and tackle the right problems, the era of Human Technology will

gradually unlock our human potential. Each and every one of us will be helped to work and play in the most personally optimized way possible. However, navigating the hard choices that unlock this future must be done with great care and caution. Our future depends upon our vigilance.

REPORT OUTLINE

The rest of this report documents our journey from Information Technology to Human Technology. In doing so, we've deliberately left most of the insights and data we gleaned on the cutting-room floor. This is the bare "trunk" of our thesis, and those will be offered in future "branch" reports and publications.

In this summary report we cover:

- What is 'voice'? And how to make sense of it
- How voice leads the sensor revolution
- Our analysis: why Hypervoice leads to Hypersense
- The five pillars of Hypersense
- The wicked problem: persistence and power
- The dystopia: enslaved by senselessness
- The utopia: "blissful productivity"
- The next-generation browser: the Guardian Avatar
- How to get there? Science fiction or inevitable fact?
- Our future is still malleable: why you need to take privacy, power and identity seriously

We have also provided some appendices where we could not resist the urge to offer more data:

- Terminology (since we are describing untraveled technology lands)
- Our philosophy of futurism
- Our learnings from being Hypervoice pioneers that informed our conclusions

HOW TO MAKE SENSE OF 'VOICE'

PLEASE SPEAK CLEARLY AFTER THE DIAL TONE

Would you humor your narrator for a moment by reading aloud just one word, and doing it *mindfully*? Pay close attention to every aspect of the *feeling of saying* the word, rather than its meaning, which is not important.

Ready? Say the word: *ambulance*.

Go on. Say it out loud.

How did it *feel*? Did you experience a vibration in your jaw from the 'm' into your skull? What was it like for your lips, coming together to form the 'b'? The sibilance of the 's'? What else did you notice? How did your jawbone move and facial muscles work together in harmony? Did you sense any tension between being mindful of your body versus mental images of emergency response vehicles?

The point of this little game is to truly experience speaking as a profoundly *bodily* activity with all its associated *sensations*. No computers or digital electronics were involved. Yes, it is an obvious point to make, but one that turns out to be crucial to our whole understanding of the future of voice.

> **"THE HUMAN VOICE IS THE ORGAN OF THE SOUL."**
>
> — Henry Wadsworth Longfellow

VOICE IS SENSUAL, NOT SYMBOLIC

When we use the term 'voice', we usually aren't referring to this process of speaking (and hearing) as such, or even the air vibrating around us. What we usually mean is 'a digitized audio data type', together with the software applications that process that data. Yet that data has to come from not just somewhere, but *someone*. It was created from human bone, muscle and cartilage working together, in a unique and individual way.

The crucial observation is that the voice is sensual and the data machines ingest is a *sensed* data type: it comes via microphones that respond to these *bodily* actions.

Voice is *not* offered in symbolic form, as with a keyboard. We don't have a backspace key for voice to undo what we just said. This 'voice' bubbles from our unconscious into the world via a process that is invisible to us. Once we've said it, it's irreversible.

MAKING SENSE OF THE SENSUAL

Computers historically had difficulty making sense of such human audio data, so it has been an exception case in a big world of data processing. That is no longer true. Our machines are, at last, readily making sense of this information, meeting us on our terms, and joining us in conversation. Speech recognition and sentiment analysis are becoming mature technologies. We are becoming used to 'artificial' conversational voice through virtual assistants.

In summary, computer-processed voice belongs to an information sensing revolution, one that follows those of pure information transmission (e.g. telephony) and symbolic computation (e.g. most social media). For us to make progress in understanding the future of voice, we need to widen our scope to encompass this bigger picture.

HOW VOICE LEADS THE SENSOR REVOLUTION

We are in the midst of a communications revolution that is comparable to the advent of the personal computer or Internet. While the Internet of Things (IoT), smartphones, wearables and connected car are popular categories, they fail to do justice to the real underlying phenomenon. Instead, these categories provide false walls, and mask the larger story at work: **sensors are becoming ubiquitous.**

Thanks to the advent of virtual assistant technology like Siri, voice is now at the vanguard of a wide-ranging sensor and sense-making revolution. Since nearly all humans can talk, voice is the natural pioneer of the biosensor revolution. Voice is rapidly becoming a ubiquitous machine interface, which can be stored, structured, searched, and shared. This 'Hypervoice' technology is just coming into general consumer use, having gained a foothold in the contact center for a decade or more.

These sensors in turn drive a sense-making revolution that transforms computing and communications. Divisions between the virtual and physical world are shifting and dissolving. It portends a fundamentally new kind of relationship between us and the increasingly intelligent machines that serve us.

MACHINES VERSUS THE QUINTESSENTIALLY HUMAN

This shift sets up a trap: the risk is that we see these silicon-based 'humanless voice conversationalists' as the 'horseless carriages' of communications. This frames the future in terms of the past. A 'horseless carriage' is much more than just a self-propelling buggy without a horse: it ultimately results in freeways, suburbs, sprawl, strip malls, driving vacations, smog, obesity, gyms, and more. The automobile is not just an incremental first-order improvement on what went before: it has a transformational, higher-order effect on technology and society.

We barely have a vocabulary to describe the parallel phenomena for voice communications tied to machine intelligence, yet the shift is every bit as significant. Consider the history of computing. From punched cards, we advanced to typing symbolic text. Then the sensors in a mouse made it possible to point and click, so the desktop metaphor came alive. Yet we were still left precision-positioning mouse-clicks on bounded boxes and tiny icons. We adapted to the machines, as much as them to us.

Capacitive touch screens capture hand gestures, and these have given us a half-way house between our natural sensuality, and that which machines can make sense of. At the far extreme we have voice: an interface that is completely native to us, not to machines. We don't need to do

anything machine-centric at all to use it. It is the antithesis of where the digital revolution started.

A PAINFUL PARADIGM SHIFT

What happens when our voice conversations become supercharged by advanced sensing and sense-making technology? The promise is indeed amazing. Imagine machines that give us superhuman powers of detecting nuance or a misunderstanding. We might be prompted to end a call and re-schedule when a participant's physical or mental state is unsuited to the call's goals.

Yet in spite of all the industry hype and self-congratulatory noise making, it is too early to toast the sensor and sense-making party. Instead of heralding amazing wellbeing and productivity gains, this revolution is instead mired in the messy early part of the growth trajectory of a new paradigm.

There are going to be accidents, and we're going to be waving virtual red flags in the street in front of the 'humanless voice conversationalists' for a while to warn passers-by of their unexpected presence. We will need to figure out some new rules of the communications road as intelligent machines join us in our conversations.

WHY HYPERVOICE LEADS TO HYPERSENSE

By now, we hope you have grasped our first eureka moment: There is a potential category error about where voice is positioned in the technology cosmos. Voice does not belong in a ghetto with messaging, or anchored into a technology product category of unified communications. It certainly is not synonymous with telephony. **In short, voice is both the message and the medium.** However, voice is not the end of the journey.

One of our consequent insights, whose radical nature caused more than a little lost sleep, is that Hypervoice sets the stage for something far grander: Hypersense. This reframes the sensor world around sensed data and decision-making, rather than machine-centric artifacts and their physical connectivity.

Hypersense is best described as an adaptive learning system that mediates between the sensors and the human user. It takes all of the data incoming from those sensors (e.g. smartphone, wearables, connected car, IoT) as a linked activity stream in time. From this it produces either (a) a highly simplified decision matrix to an end user or, (b) trusted decisions made on behalf of its end user. In either case, the filtering and decision-making are unseen and unrecognized by the user.

By means of an analogy, Hypersense is like an augmented and highly accurate subconscious decision-making process for the human. It leverages what computers do best (i.e. brute force computation on massive data sets) to help humans strategize and navigate the world's increasing levels of complexity.

SMARTER MACHINES, OR SMARTER PEOPLE?

This parallels the evolution of hypertext, rather than just linked pages with a spatial metaphor, we have activity streams of sensed data. The hypertext Web includes machine learning as an integral element via search engines; the Hypsersense world has integral machine learning aimed at anticipatory decision-making. It also parallels and extends Hypervoice: it does what automatic speech recognition tied to virtual assistants do, but for any sensor type and reasoning problem. All hypermedia appear to share the same pattern: an advance in how data is inter-related, tied to advances in machine reasoning about those relationships.

What this Hypersense world portends is a different future that better serves humans. Until now, we have focused our efforts on Artificial Intelligence. This reduces our need for humans in the workforce, and focuses on making machines smart. We believe this unbalances our relationship with technology. **The Hypersense future speaks of a world of *Augmented Identity*, where humans adopt machine-assisted intelligence to redefine work by enhancing their capabilities.**

THE FIVE PILLARS OF HYPERSENSE

To make good on our intention of ethical use of sensor data to serve human wellbeing, we need enabling capabilities. We believe that the outcome of this sensor plus machine intelligence revolution will stand upon breakthroughs occurring within five key technology and market sectors:

1. **IDENTITY**
2. **PRESENCE**
3. **PRIVACY**
4. **COMMERCE**
5. **TRUST**

From an investor and/or corporate perspective, these five pillars represent market spaces that will go "from zero to one" — to quote Peter Thiel — within the next decade. If you are looking for the "new, new", then you will find the emerging players here. Our research has uncovered many of them. But given the pace of change, it's likely that the biggest players in these undiscovered markets have yet to be founded.

1. IDENTITY: THE MARKET FOR SELF-PROJECTION AND AMPLIFICATION

When we speak of identity, we must first recognize that it is a loaded and multi-faceted term. Here we are using the most simple, basic form of the concept: for our purposes, identity refers to the human at the end of the connection. How does that person choose to represent themselves online to others?

Today, we use very low-resolution avatars to conduct our business online and project our virtualized identity. A phone number is the degenerate avatar, akin to a single uniquely-colored pixel selected from billions of hues. Our Web avatars are mostly mute, two-dimensional representations of aspects of ourselves. For example, LinkedIn may provide my avatar for business, and Facebook my avatar for friends and family.

Within the next decade, the line that separates the embodied me from my avatar will begin to fade into oblivion. My personal avatar will be conversational: able to interact with (and

understand) both other machines and humans. It will engage without me being consciously aware of it happening. It will even start making decisions on my behalf, automating rote choices. Rather than being flat or a gray shadow of me, the avatar will become a lifelike, multi-dimensional *digital doppelganger* of me, with superhuman powers of memory and concentration.

Our avatar will become our exponentially better half.

Tomorrow's avatars will help us to manage the complexity of being online, since being online will be our default state. They will autonomously choose the right network connections, software protocols and applications. They will negotiate the best possible terms of service. These avatars will serve to present a simplified, human-optimized window into the online world. More and more, they will take the hard work of sense-making off of our plates.

This is a deep re-conceptualization of online identity. Today's "digital identity" is just a pseudonym: a placeholder record for the absent you. Tomorrow's "virtual identity" is an extension of you from the physical to the virtual domain, then back again. This electronic identity comes with your own virtualized knowledge and intelligence.

As radical as these conclusions may sound, much of the groundwork for avatar-human virtualization has already been done and patented. Although you may think back to Second Life and its shortcomings, "avatars 2.0" have broken out of their virtual environments and are meeting up with us in unexpected parts of our "real" lives.

One of our many proof points is the work of Geppetto Avatars. Currently focused on healthcare applications, the algorithms underneath are application agnostic and can work with any type of heuristic-based, human-AI interaction. Today, Geppetto Avatars is allowing home-based healthcare to be conducted via a friendly, personable avatar, who both gathers the information and dispenses advice. Although doctors are behind the scenes, this is not a mechanical turk application. The Avatar is reading cues from the human and adjusting how and when certain questions are asked. It is also conducting the patient interaction completely independent of the doctor's immediate involvement.

2. PRESENCE: THE MARKET FOR TRANSCENDING BODY PLACE AND TIME

The ordinary public uses "the Internet" to describe the general experience of being online, not the collection of routers and fiber optics that makes it happen. **Of all our radical findings, perhaps the most shocking is that "the Internet" as we know it is being transcended, and fast.**

Today, being online is something "out there": you experience it on a flat, 2D screen at an arm's length away (or slightly closer for those of us over 40). And yet, there are currently fewer than 100,000 people who are experiencing computing as an immersive virtual reality. Instead over

being “out there”, they are standing right smack in the middle of it.

Welcome to the metaverse!

The long-standing problem of “presence” is being solved for virtual reality. What that means is that you can where a head-mounted display and be able to navigate online virtual worlds as if you are standing in the middle of them. Turn your head, and your vision is perfectly aligned with what you anticipate being there.

These are still the early days of mass adoption of virtual reality, like how Pong and Breakout signaled mass adoption of computer games. But your brain’s visual cortex doesn’t know that! Even in the most low-resolution virtual environments, a creeping sense of “presence” can be felt.

To provide some historical context, the sense of “presence” is the most compelling form of human communication. A history spanning thousands of years tells us that it is also the one people will pay the most money for: purely informational or narrative communications don’t even come close. So what is it?

With presence, our minds and bodies are fooled into believing that we are experiencing a profoundly sensual sense of “the other” (usually a human). For instance, an original Vincent van Gogh painting is felt to embody “van Goghness” even though the painter is long dead. Likewise the sound or picture of your baby niece will trigger a sensual response in a way that a name or written story cannot.

In a digital environment, we typically achieve this feat of presence by simulating “being actually there” with the other person(s) via a process of “cognitive absorption”. Such presence technologies continue a long-term trend of ever-richer virtual worlds for us to inhabit. This began with telephony, which is an entry-level form of virtual reality. Telephony offers an audio-only replication of the presence of another person and place; both parties inhabit a shared “blind” virtual world.

The sensory experience we loosely refer to as “the Internet” is also a form of virtual space and, as such, will significantly advance within the next five to ten years. Today, we view the Web or mobile applications as an external experience. We have only a dim sense of being transported to another place by reading an article online, or skimming a Twitter feed while waiting in line. These are weak shadows of what is coming up in virtual environments.

We believe that two inventions from the last 5 years will remake how we see the world around us.

The first is the immersive virtual reality (VR) headset. Companies like Oculus Rift can create

simulated presence, replacing our physical surroundings. This presence is a profoundly sensual experience – one not so dissimilar from being on the famous Star Trek Holodeck.

The other invention is augmented reality via the smart eyeglass. Google Glass is the oft-quoted early prototype example, even if now discontinued. This overlays and modifies the sense of current presence, rather than replacing it. This technology is immature; it is reminiscent of all the clunky MP3 players before the iPod got the recipe right.

Both inventions are facets of the same phenomenon, which is to conjure the imaginings of the human mind into the real world. The physical and virtual cannot be separated in the world of sensors and sense-making.

With a VR headset, we "feel" the twists of the software-generated roller coaster, or the motion of an escalator. With immersive presence, it's no longer clear where physical reality ends and virtual reality begins. Within the next 18 months, at least seven headsets from various manufacturers will be in the market.

THE IMPORTANCE OF VIRTUAL WORLDS

MORE THAN 500 MILLION PEOPLE ARE ALREADY SPENDING A TOTAL OF 3 BILLION HOURS A WEEK IN VIRTUAL, GAMING WORLDS.

We will be doing ourselves a distinct disservice to think that VR belongs strictly to the gamers or geeks. These devices signal a profound break from the past: no longer is "being actually there" our highest aspiration. **Virtual worlds make it possible for our interactions to become "better than being there."**

For example, it is hard to imagine the future of telepresence without actually using "presence" as a feature. The big difference here is that we go from a table pushed up against a wall with a fake plant, to the environment being custom-made for each attendee's optimal thinking and collaboration space.

My simulated environment for a telepresence-based business meeting may show all my virtual colleagues gathered in a villa in Tuscany, while you may see us all fly fishing around you. My gestures to you may be amplified or attenuated in software to increase understanding. Representations of relevant social or business objects will be arranged around us, to be pointed at, discussed and shared.

This is not a new thing: 500 million people are already spending a total of 3 billion hours a week doing it in gaming worlds. The next generation of conference calls will likewise be about the

human perspective, highly tailored for the wellbeing and productivity of the individual. This experience is a far cry from the lowest common denominator world to which telepresence currently caters. Basic conference calls are set to go the way of the telegram and telex.

If you think that virtual and augmented reality are mainly going to impact the gaming industry, think again. Just as the iPad created a new category of computing, so will these devices. Facebook just created an onramp to mass adoption of the metaverse with its purchase of Oculous Rift. For the majority of people, Facebook will be the "AOL" of the metaverse. In essence, Facebook has positioned itself as an early winner in the platform player space. And with platforms, it can be a winner-takes-all market.

3. PRIVACY: THE MARKET FOR CONTROLLED SELF-DISCLOSURE

Today the rhetoric around privacy is hitting a crescendo. A group of vested interests are fueling the narrative that "privacy is dead" and sharing everything without controls is normal human behavior.

In contrast, our findings reveal that privacy as a market is about to emerge within the next three to five years. Far from dead, privacy is a requirement for freedom and survival, as ever more sensitive data is leeched from humans.

With presence, the feeling of technology being "out there" fades away. We will be inside our technology and will bring with us the expectations of the physical world. Yet if we were to visit a store in the real world like we do online, we would experience the equivalent of being strip-searched upon entry, and then stalked for years to come. We largely overlook this violation today because it is mostly invisible to us, and it happens in a way that we feel powerless to stop.

For instance, merely minutes prior to typing these very words, this author scrolled through the user agreement for voice memos on a state-of-the-art wearable smartwatch. My data is going to be stored and processed in ways that are non-negotiable if I am to use the device's functionality. What if I don't want my data to be stored in the USA, or sent to 'partners' without my knowing?

As a user-centric experience this could be seen as simple, pre-packed and perfectly arranged. It is totally convenient. If you were hired as a user experience guru, you would be able to publish a case study on this smartwatch's brilliant integrated design, and people would applaud you for it. But as a human experience, it represents digital barbarism. It leaves me, the individual, in a powerless position. This level of learned helplessness is typical of torture victims, not empowered individuals! It's inhumane.

With simulated presence, our deep human need to feel safe and secure kicks into high gear. We will begin demanding online rights similar to our physical life. **The way privacy on the Web works is incongruent to physical reality; this model won't last in presence-driven virtual worlds.**

As a result of these forces, a form of "Privacy Spring" is underway. We believe that the generational appeal of Snapchat and the EU's "Right to be Forgotten" legislation signal larger drivers at work that will help accelerate the market for digital decay. Ephemerality is a feature of life, not a bug, especially for sensor data. Personal concerns for privacy will drive us to insist on getting a virtual receipt when we hand over intimate data, and being able to audit its destruction as agreed. That is because sensory data is digital toxic waste when seen from a privacy point of view, and needs similarly severe environmental controls.

Savvy marketers and brands will start working towards privacy today, and not get caught flatfooted when the power shifts in the other direction. Our research tells us that people are drawing a firm line in the sand with recorded voice. There is a practical and ethical imperative to work with its sensed and intimate nature, and not just to treat it as just more symbolic data to be mined and processed.

4. COMMERCE: THE MARKET FOR TAILORED CUSTOMER EXPERIENCES

How we procure goods and services will radically shift over time, thanks to the advances in avatar technology, presence and privacy. Although both physical and virtual store experiences will continue to exist, their purpose will shift away from just transactions, and towards engagement and entertainment.

A great deal of commerce will become invisible to humans, as our avatars tackle the complexity of procuring goods and services in accordance with their human counterparts' ideal transaction (e.g., quality, speed, price). Send your avatar grocery shopping online. Don't do it yourself, it's way too boring.

There are several early examples of avatar commerce. The first is sophisticated recommendation engines. For example, Amazon's recommendation engine has a darn good idea what I am most likely to buy and when. The problem is that their recommendation engine works for Amazon, not me. Its goal is to trick me into purchasing items that I had no intention of buying when I came online. It's not too dissimilar to putting candy by the cash register in a physical store.

Now imagine how a recommendation engine may work if its sole intention was my health and wellbeing. A personal avatar recommendation would shop to ensure the best possible choice for me. Given its powerful computing resources, it wouldn't make emotional decisions or take short cuts. It would exhaustively research the best price, shipping options, return policies, and quality rating before executing a transaction. It would also do this anonymously so that Amazon cannot bug me with coupons and try to get me to override my avatar.

The second signal of the commerce avatar's viability is the ability to engage in anonymous commerce today with Bitcoin and other crypto currencies. **Although heaps have been written on Bitcoin and its competitors, few have connected it to the avatarization of ecommerce.**

By being able to conduct a secure digital version of a cash transaction, our future avatars will be able to effectively erase their commerce trail and protect their humans from the onslaught of cognitively-exhausting advertising. The blockchain technology can be used for tracking and auditing personal data as a currency.

The emergence of avatar technology holds the potential of breaking that power dynamic and puts the power back into the consumer's hands. The avatar will be trusted with all the information necessary to make the needed purchases by being in conversation with the household's smart appliances.

What the new world of virtual commerce unlocks is one that fundamentally reinterprets marketing and advertising. Ads move from being a human manipulation tactic to an algorithm designed to appeal to our avatars. As a result, much of our visual and auditory space is freed from the blinding and deafening messages associated with excessive commercial choice. The background chatter of messages between avatars and merchants may look more like high-frequency trading than the Web cookies of today.

The temptation for voice is to assume that future replacements for today's "1-800 style" customer service lines will be a modest incremental improvement. **It is possible, if not likely, that we will soon see a leapfrog that redefines the service experience.**

Serving customers in virtual worlds is a new skill. The jump is a little bit like how the early Web had personal home pages, but it took a decade for social media to truly emerge, and many brands have struggled with the change from a broadcast to conversational paradigm. Likewise, immersive systems redraw what is possible: today's phone call and Web are pale shadows of what we will see in ten years' time.

5. TRUST: THE MARKET FOR FREEDOM FROM FEAR

The final key to this future of contentment in virtual words is trust. We need to trust the avatar systems at least as well as we trust ourselves. That may seem like a far cry from where we are today, but it's closer to hand than it first appears.

Years ago, parents cried out when calculators were let into the classroom. Today, most of us rely on spreadsheets over our own ability to do complex math in our head. We have confidence in computers being available to perform this task for us, and feel safe letting our skills of long division decline from lack of practice. Similarly, today I trust Google Maps more than I trust my five senses, since my intuition as to where I am and which way to go is often wrong.

The baseline human algorithm for confidence in any system is simple. It is consistency over time. If an application (or an avatar for that matter) proves itself more reliable to perform a task or decision over time, then we cede that activity — particularly when we are feeling overwhelmed. The full reward of a trusted system comes when we can interact with confidence with parties with whom we have no track record of interaction.

WHAT DOES IT MEAN TO TRUST?

THIS ELEMENT OF TRUST CAN BE SEEN AS BEING ABOUT *ENGINEERING A HUMAN FEELING STATE.* AT ITS SIMPLEST, IT'S FREEDOM FROM FEAR AND ANXIETY.

This element of trust can be seen as being about *engineering a human feeling state*. At its simplest, it is a freedom from fear and anxiety. Many old banks had "trust" in their company name, and also named their products "trusts", because the fear of losing your money when handing it to a stranger was a very real one. If our higher ambition is to move us towards an idealized "blissful" state, then we must create machines that can predict the emotional, health, and ethical impact of choices we face. Voice is a part of this, since it is the data source that reveals so much about how we feel about the world and our emotional state.

THE WICKED PROBLEM: PERSISTENCE & POWER

There are many people alive today who were born before the invention of digital sensors and machine learning. At great cost it used to be possible to capture a few fleeting moments of sound or movement in analog form. Throughout the digital age, the norm has been for sensed data to remain uncaptured and ephemeral. Even today, our smartphones only remember an infinitesimal portion of what their sensors could capture.

With respect to voice, our cultural default is that when we talk, we don't wish to have our thoughts archived. If an idea is worth keeping, we make a typed note or send an email. But some conversations that feel ephemeral aren't. When we talk to our virtual assistants, those conversations are recorded and kept. How long and for what purpose is not clear. What is clear is that you *don't* have control of these recorded conversations.

Recently, the situation has become more complicated with the introduction of services like "Hey, Siri." This helpful app introduced with iOS 8 solves a real problem. If you are driving or not able to touch your phone, you can say "Hey Siri" and Siri will respond. The only catch is that Siri needs to be plugged in for this app to work. Why? Well, it takes a lot of battery power to keep your phone in continuous listening mode.

VOICE IS NOT SIMPLY DATA. VOICE CONTAINS OUR *IDENTITY*.

TREATING VOICE AS JUST MORE DATA TO BE COLLECTED, ARCHIVED AND THEN MONETIZED LATER IS INAPPROPRIATE AND UNACCEPTABLE. THAT IS WHY WE HAVE DECADES OF LAWS AND REGULATIONS THAT SPEAK DIRECTLY TO THIS VERY HUMAN CONCERN IN THE CONTEXT OF TELEPHONY. IT IS CONSIDERED UNETHICAL, IF NOT ILLEGAL, TO RECORD THE HUMAN VOICE ON A PHONE CALL WITHOUT EXPLICIT PERMISSION.

That's right. Your microphone is now always on and listening for that magic "Hey, Siri" moment. Now unlike human listening, this mode is not ephemeral. Siri is capturing everything that you are saying, even if it only remembers it for a few moments.

We have crossed an important, but nearly invisible, line.

Prior to the advent of virtual assistants, the vast majority of voice conversations were not recorded. We have customer service and regulated industries

recording our calls for “quality assurance,” “training” or “compliance” purposes. Maddening as it may be to not have a choice, we have soldiered on figuring it is only a small part of our total conversations.

That will soon no longer be true. Many more of our conversations are being recorded without our truly informed consent or choice. We are blundering forward using systems of control built for senseless data to managed sensed data. As such, it is time to make the problem set clear and explicit.

Voice is not simply data. Voice contains our *identity*.

Treating voice as just more data to be collected, archived and then monetized later is inappropriate and unacceptable. That is why we have decades of laws and regulations that speak directly to this very human concern in the context of telephony. It is considered unethical, if not illegal, to record the human voice on a phone call without explicit permission.

The advent of the virtual assistants is just the first wave of recorded and computer-processed voice. We are quickly leaving the realm of keyboard and mouse as our primary input technology to a world of voice I/O. In short, nearly all future applications will need to address the issue of recording human voice and how to handle it.

From a strategic perspective, there is some good news. Voice data is not yet being collected en masse. We have a rare chance to think proactively and begin putting programs in place to get us “ahead of the curve” on privacy.

There are two key challenges we face.

The first challenge is that today the sensor systems are mostly stupid: they are incapable of sufficiently meaningful decision-making on our behalf. We refer to this current dystopia as the *Senseless Computing* age. Senseless Computing is what happens when all these sensor-based devices, both old and new, require humans to either encode explicit fixed instructions/rules, and/or perform the role of sense-making (e.g. from a

SENSELESS COMPUTING: WHY SENSORS ARE REALLY NOT AS ‘SMART’ AS WE THINK

SENSELESS COMPUTING IS WHAT HAPPENS WHEN ALL THESE SENSOR-BASED DEVICES, BOTH OLD AND NEW, REQUIRE HUMANS TO EITHER ENCODE EXPLICIT FIXED INSTRUCTIONS/ RULES, AND/OR PERFORM THE ROLE OF SENSE-MAKING. WE ARE THEN LEFT IN THE LOOP OF HAVING TO INTERPRET THE SIGNAL AND TO MAKE A DECISION.

report or system notification). We are then left in the loop of having to interpret the signal and to make a decision.

Thus for the immediate future, humans will continue to be forced to both make sense of the captured data and also to make any resulting decisions. Therefore, our collective information overwhelm is likely to keep rising for the near future. In fact, it's likely to get much worse as every application you download to your smartphone splatters more of your (sensed) personal data over the Internet.

The second challenge is that there are serious imbalances of power over access to such sensor data that threaten our personhood and safety. What was clear from our research is that people are, quite rightfully, concerned about the privacy issues that such technology provokes. It slowly became apparent that to us the real issues were not about how to create clever features for personal communications applications. The grown-up conversation is about power, and hence privacy and identity.

THE DYSTOPIA: ENSLAVED BY SENSELESSNESS

One can be forgiven for believing that we live at the very apex of communication technology today. We have solved so many difficult problems. We have invented impossible machines, intelligent systems, self-healing fiber… Oh wait.

Before we let the marketing hype run amok and knock us unconscious, it's important to examine the end state. How do we *feel* about communication technology today? If you are like most of us, it's a love-hate relationship. It's like a bad high school romance where you're sorely tempted to key your sweetheart's car on a near daily basis.

> **"YET BE WELL ASSUR'D YOU PUT SHARP WEAPONS IN A MADMAN'S HANDS."**
>
> — Shakespeare

Today's senselessness is mostly a felt phenomenon of joyless interaction with technology, rather than an explicitly conscious experience. For instance, making sense of a recorded voice call is a painfully boring task, but we do it all the time.

The Internet of Things (IoT), wearables, connected cars and smart homes and cities are all categories that are just starting to heat up. Each adds ever-more sensors to our environment. These offer the promise of mass personalization of the physical world to our needs. **The price we will pay in the senseless paradigm is *information overwhelm*: a decision fatigue stemming from too many beeps demanding that you "make sense" of them.**

Tomorrow, all such sensors will be tied to machine intelligence and vast data sets. They will increasingly form part of a decision-making matrix. This is why Google, for example, sees itself as an AI company, not a search or advertising one. What kind of world will this result in?

For the pessimist, there is a large body of dystopian fiction to draw upon for inspiration. (See the *Terminator* trilogy for a classic reference of machines overtaking humankind.) These are cultural forewarnings should be taken seriously, since civilizations collapse when elites over-exploit human and natural resources. Allowing power inequalities to grow unchecked are just as dangerous in the realm of data as they are for money. The future we fear most is enslavement of individuals within a Matrix-like Information Technology paradigm.

THE UTOPIA: BLISSFUL PRODUCTIVITY

For the optimist, these systems will act for individual benefit and in our collective ethical interests. Sense-making machines will relieve us of cognitive load, just as steam and electricity have replaced muscle. This heralds a golden age of machines that can make better decisions on our behalf than we can make for ourselves: the rise of *Human Technology*.

A future is an end state. So the most practical question to ask of a prospective future is: **Will this end state benefit me the most?** Just in posing that question, it becomes clear just how deeply personal the future is. We want a future that benefits us, specifically.

DOES THIS SOUND TOO GOOD TO BE TRUE? IT'S NOT.

BLISSFUL PRODUCTIVITY IS DEFINED AS JOYFUL TOTAL IMMERSION IN PURSUIT OF A GOAL. WE FEEL BLISSFULLY PRODUCTIVE WHEN OUR DAY FALLS INTO PLACE AND WE ARE ABLE TACKLE HARD PROBLEMS EASILY. WE FEEL BLISSFULLY PRODUCTIVE WHEN WE ARE IN OUR "ZONE" AND ARE EXPERIENCING ACKNOWLEDGEMENT FOR A JOB WELL DONE.

In spite of the radical diversity of humanity, there are some common overlapping themes: we want to feel safe, be loved and contribute to humanity in some meaningful way. And thankfully, early on in our research process, we stumbled upon the end state that we believe serves the latter theme exceptionally well.

While studying the gamer community, we came across an idea that represents a joyful total immersion in pursuit of a goal. In a nutshell, gamers know what it feels like to have daily wins, and lots of them. Jane McGonigal, a well-known game researcher and advocate, explains this in her book *Reality Is Broken: Why Games Make Us Better and How They Can Change the World*. There is some deep human need here that those games tap into. She terms this emotional state "blissful productivity".

For non-gamers, we feel blissfully productive when our day falls into place and we are able tackle hard problems easily. We feel blissfully productive when we are in our "zone" and are experiencing acknowledgement for a job well done, even if it's self-congratulatory.

And with that, we had found the end state. Here was a future we could believe in.

What we see is that ultimately the gaming community is showing us the way to attain blissful productivity. It's an existence proof. Now that we know about it, our job is to manifest that feeling state, aided by emerging technology, in the wider context of work.

What most businesses want is increased productivity and less unforced employee turnover. What if a business could get both by creating a context for blissful productivity in the workplace? It's the ultimate employee perk. It's the ultimate corporate advantage.

From here, we need to ask: What are the conditions that people need in order to feel blissfully productive?

For many of us, we need protected, quiet time. Thinking time. We need the day's tasked prioritized and sorted. We need the burden of over-communication (hello inbox) to be radically reduced, if not eliminated. We need to have the myriad of simple, task-oriented decisions tackled without impacting our cognition. **We need things to stop beeping and alerting us, and start solving the underlying problem instead.**

The very good news is that we will have the technology capable of doing much of this within the next ten years. The open questions are: What will we need to trade to get here? How much control are we willing to concede to our devices and when?

THE NEXT-GENERATION BROWSER: THE GUARDIAN AVATAR

The promise of Hypersense lacks a critical aspect, one that unifies the five pillars of Identity, Presence, Privacy, Commerce and Trust.

The hypertext Web needs a browser to mediate between us and the websites that we visit. It brings together aspects of all the above. Likewise, this future Hypersensed environment needs a middleware agent to manage our sensitive data, network attachments and virtual relationships.

We call this next-generation browser the Guardian Avatar.

A NEW MEDIATION LAYER BETWEEN US AND MACHINES

Like a browser, the Guardian Avatar serves up requested content. Unlike a browser, the Guardian Avatar virtualizes our identity and personas so that it can navigate complex information landscapes: exchanges, protocols, and connections. It can independently take action on our behalf, such as to manage authentication; procure virtual services; communicate with others; and negotiate relationships and personal data exchange contracts (e.g. terms of use, data destruction policies).

Although it may seem like a turbo-charged virtual assistant at first glance, its primary job is to protect our *identity* and to keep us safe in a world where the dividing line between physical reality and virtual reality becomes blurred. It is the virtualized doppelganger of *you*. Since there is only one bodily you, and one synthesized and Hypersensed reality that you can experience, there is only a need for one Guardian Avatar per person; anything else represents a digital psychosis.

Why the distinction from virtual assistants? Over time virtual assistant applications will continue to improve and thus prove themselves better at doing most tasks than humans. However, as currently constructed the virtual assistants will hit a trust wall. As long as that intelligent entity is outside of my ultimate control, and serves a master other than me, then I cannot trust it enough to cede my identity to it. **Siri is an avatar of Apple, not you.** Who owns and controls "Google Now" is given away in its name.

When we trust our virtualized selves more than our biological selves to complete daily tasks and routines, the day of the Guardian Avatar will be in full swing. Think of it as the *enabler* for multiple perfected virtual assistants who can anticipate your every need and gently nudge us towards better outcomes.

BRING YOUR OWN IDENTITY (BYOID)

In several relevant ways, the advent of the Guardian Avatar will likely mirror the arrival of Bring Your Own Device (BYOD). Although Apple, Samsung and Google were very much responsible for providing the smartphones and devices, it is highly unlikely that any foresaw how BYOD would fundamentally change the hierarchical power structure within the enterprise. It is not an exaggeration to say that BYOD upended enterprises' ability to control devices on their networks and, accordingly, user behavior.

BYOD is the precursor to a much newer, and profoundly weirder, trend of Bring Your Own Identity (BYOID).

BYOID puts authentication back into the hands of the users through self-sovereign identity. Today enterprises like LinkedIn, Twitter and Facebook are acting as arbiters for the BYOID movement, promising the ease of Single Sign-On (SSO) to third part sites by leveraging their conferred credentials. BYOID opens the gates for startups, adjacent players and open source privacy movements to end-run the control aspirations of established players. **Only by controlling your own identity can you control how your data is used.**

For instance, in my earlier smartwatch example, my Guardian Avatar would negotiate on my behalf how and where my voice memo data is stored, and with whom it is shared.

This future is not without significant barriers, including key ethical and practical issues around privacy and security. To many, these barriers appear as intractable mountains today. From our perspective, we caution against discarding this future too quickly. Just as Bitcoin transformed our notion of currency, the Guardian Avatar promises to do this for identity. How it will occur remains an open question for debate.

HOW TO GET THERE?

SCIENCE FICTION OR INEVITABLE FACT?

When we began this project to explore the future of voice communications, we never expected to find ourselves investigating transhumanism, watching videos on the ecological role of fungi, or being mesmerized by Jason Silva videos on how we are becoming "psychedelic Prometheans". What we stumbled upon at first felt so uncomfortably strange it seemed more like science fiction than traditional industry market analysis. Indeed, the tradition of futurists overshooting what is actually possible, and ignoring real constraints, was constantly in the back of our minds.

Over time we came to understand and accept that digital technologies do run on exponential growth curves. We all struggle to imagine future virtual worlds that are only half a generation away. We too readily succumb to the "end-of-history illusion". When no longer constrained by atoms, but by imagination, progress can be startlingly fast and profound.

Look at the smartphone in your pocket, and compare that to science fiction of not long ago. McKinsey famously forecast in the 1980s that the cell phone subscriber market would be 800,000 in North America by 2000. That was less than 1% of the true figure. We are still on that growth curve, just shifted from phones to sensor devices. **The scale of change means only "incredible" scenarios are credible on a 10+ year timescale.**

What we have discussed here is only a small part of what we uncovered. Our original intent was to write a single findings report. This has become overwhelmed by the magnitude of the possibility space we have encountered. It is a task that needs to be broken up and spread out over a longer period, in order to do the matter justice.

OUR FUTURE IS STILL MALLEABLE

While it is fun to speculate about the future, we all live in the present. If you are reading this report, then you are part of a growing community of technologists and industry leaders who care passionately about the future. We have the collective power to accept or reject alternative futures.

Do you accept that power, privacy, and identity are the central issues around our Hypervoice and Hypersense future? If so, what does that mean for you, your organization, and our industry at large?

For each of us personally, we believe there is a professional imperative to be aware of the *Privacy by Design* movement. The seven principles match those being adopted into EU law. If

nothing else, you should take five minutes to read and understand these.

For our business organizations, executive management needs to ask important questions:

- What is the attitude of our suppliers and partners towards privacy?
- How do we currently handle the capture of customer conversation?
- How do we use that information specifically?
- Does our data destruction policy cover voice information?
- Do we give our customers a choice of having a conversation recorded and how it is used?

The last question is there to start a strategic conversation. In the future, more customer inquiries will originate online and will also use integrated voice or video using technologies like WebRTC. There is a window of opportunity to establish new expectations and patterns of behavior. Transparency and choice serve as ways to garner consumer trust, and allow your organization to be an early mover in the "privacy = mutual loyalty" world that is emerging.

Ultimately, the solutions to voice privacy will come from a combination of businesses investing in consumer trust and government regulations catching up with Silicon Valley's untamed appetite for personal data. We believe that the zeitgeist favors a "Privacy Spring" as citizens are becoming increasingly vocal about the personal toll of the recent data breaches and the resulting identity theft.

ON WHICH SIDE OF HISTORY DO YOU, YOUR ORGANIZATION AND YOUR GENERATION WISH TO BE?

On which side of history do you, your organization and your generation wish to be?
What is the vision of our communications future that you would most like to see accelerated?

We look forward to continuing to share more ideas with you, and engaging in discussion and debate around these questions.

EPILOGUE

Future visioning without action is an incredible waste of time and resources. And yet, it happens all the time. Teams come back from retreats all geared up and ready to implement, only to find themselves collapsing back into complacency of maximizing their existing business model. All the team's hard work has come to naught. How depressing.

But before we lose ourselves in the inevitability of it all, let's challenge the very idea that this has to happen. It doesn't.

Although there are many reasons for failure to execute, there are two common denominators amongst the winners: a sense of urgency and accountability. If you walk away from reading this report with one big idea that you wish to implement immediately, we couldn't be happier. In all likelihood, the idea was not ours but yours, written in the margins, inspired by your imagination and unique knowledge of your content.

"IF WE SHADOWS HAVE OFFENDED,
THINK BUT THIS, AND ALL IS MENDED,
THAT YOU HAVE BUT SLUMBERED HERE
WHILE THESE VISIONS DID APPEAR.
AND THIS WEAK AND IDLE THEME,
NO MORE YIELDING BUT A DREAM,
GENTLES, DO NOT REPREHEND:
IF YOU PARDON, WE WILL MEND:
AND, AS I AM AN HONEST PUCK,
IF WE HAVE UNEARNED LUCK
NOW TO 'SCAPE THE SERPENT'S TONGUE,
WE WILL MAKE AMENDS ERE LONG;
ELSE THE PUCK A LIAR CALL;
SO, GOOD NIGHT UNTO YOU ALL.
GIVE ME YOUR HANDS, IF WE BE FRIENDS,
AND ROBIN SHALL RESTORE AMENDS."

— William Shakespeare, A Midsummer Night's Dream

In short, you are the white knight you have been seeking.

If there is one take away from this report we wish you to have, it is this: **the future is yours for the making**. Futures are not simply determined by current events. It's far more complex than some deterministic fixed fate. But before you start sacrificing goats and wearing talismans, the future is not entirely random either.

The land of the visionaries lies directly at the crosshairs between what is most likely to stay the same (e.g. physics, the physical constraints of time and our bodies) and what is most likely to change (e.g. novel ideas that solve fundamentally uncomfortable

human problems that we have written off – largely – as unsolvable). And in spite of the halo around the term "visionaries" – we are not all optimists. Many of us see dark times ahead. But instead of viewing these dark times as inevitable, **a true visionary will fight to change the course of history.**

If you see the future you want, **you must do everything in your power to manifest it.** In our experience, a true visionary cannot help him or herself. But without the collaboration of larger innovative strategic partners, whether larger, established market players, financial institutions, or venture capital firms, few visionary ideas would ever see the light of day. Ideas, like all living entities, need nourishment and sustenance. But most importantly, ideas – like children – all start with a father and mother.

APPENDIX: OUR PHILOSOPHY OF FUTURISM

Thanks in large part to bigger-than-life gurus and pricey, overly-narrow industry reports, futurism has worked hard to earn its bad rap. That said, the best companies have a clear sightline on the future and work hard to align their products and services with that vision. The winners reach the finish line first because they know the course intuitively before driving it – not to mention the short cuts and the best vehicle for the terrain. And very, very rarely, there are winners who win by *changing the course and manifesting the future they most dearly want.*

> **"THE FUTURE IS ALREADY HERE, IT'S JUST NOT EVENLY DISTRIBUTED."**
>
> — William Gibson

If you are looking for an example of this most rare type of futurism in action, look no further than Apple. Steve Jobs famously distrusted experts, even his customers' opinions. He trusted his gut, his ability to see what was coming next. In turn, he was able to create new markets by breaking down false walls between industries – such as music and technology, or telephony and PDAs. Under his leadership, Apple became the world's most valuable company (in any industry) by mastering customer delight... without taking their opinions seriously.

Given the future's importance, it begs the question: What's the recipe behind a credible future vision?

To be clear, we believe that the best of these future visions are the product of visionaries, people with an uncanny knack for calling future trends precisely for decades and then putting those visions into action. Steve Jobs was not alone in his mastery of this skill. The people behind this project, both the interviewees and interviewers, have worked tirelessly for decades honing this capability.

Beyond collecting our information and drawing our inspiration from the articulated futures of our gifted visionaries, our approach to future is based upon seven key concepts:

1. "The future is already here, it's just not evenly distributed."
— William Gibson

Fundamentally, we believe that a future ungrounded in the events of today is unlikely to

manifest. The rate of change, particularly in communications, can leave us blindsided easily. Simply put, just because you haven't heard of it doesn't mean it doesn't exist somewhere, waiting to devour your business. In the course of our research, we found ourselves rendered speechless by technology innovation that exceeded our imagination. For example, the speed to market of virtual reality and the readiness of the massive, multigenerational market left us flatfooted early in the process. Facebook's $2B price tag for Oculus Rift may well seem like the steal of the century within the coming years.

2. Watch the haters.

"The most contentious question in business is whether success comes from luck or skill."
— Peter Thiel, Zero to One: Notes on Startups, or How to Build the Future

We agree with Peter Thiel that the success of great, truly disruptive businesses cannot be dismissed as simply luck. Table stakes of any venture-backed startup is exceptional talent and an impressive early product or prototype. Any credible (and grounded) entrepreneur will be quick to credit luck, but there is more to the story. If you are looking to bet on emerging technology, look for something exceptionally novel (e.g. Google = "search that works") and secretly valuable (e.g. in the 1990s, common wisdom held that search was a solved problem). The real breakaway success stories solve a problem, which up until the point they solved it remained unsolved and virtually unnoticed.

The key to calling the next big thing is to know what the emergent phenomena are that spring from the emerging technologies. When something is *genuinely* new, very few people can wrap their heads around it. Because it is so different, emerging technology frightens people at a core level. The result is the emerging tech is often ignored, ridiculed or gleefully assaulted by the so-called intelligentsia. An excellent example of the latter is the pundits' commentary on Google's acquisition of YouTube in 2006.

"THE MOST CONTENTIOUS QUESTION IN BUSINESS IS WHETHER SUCCESS COMES FROM LUCK OR SKILL."

— Peter Thiel, Zero to One: Notes on Startups, or How to Build the Future

3. Sometimes the naysayers win, but not in the long run. The naysayers' effect can generate a tremendous amount of drag on even the most vital innovation. For example, until the overwhelming success of the PDA market, no one wanted to admit to having bought the Apple Newton (author included). If an emerging technology is creating seismic backlash and critical guffaws, only the most contrarian tech adopter will buy early and proudly. From our perspective, the naysayer effect tells us that a given

product is likely a decade (or more) too early. If it's still uniquely novel and secretly valuable, its time will come. When Palmer Lucky cracked the code on simulating "presence" in an affordable virtual reality headset in 2012, the field of hardcore VR programmers had thinned out to maybe a few hundred people. It's hard to stay in a discipline, no matter how passionate you are, when everyone just shakes their head and says "Good luck with that."

4. "We predict too much for the next year and yet far too little for the next 10." — Neil Armstrong

The opposite of the naysayer effect is the amplifying effect of group enthusiasm. When people get excited about something, we tend to overestimate how fast it's going to occur. This results in the futurist's version of the Island of Misfit Toys. These ideas sound awesome and would make life so much more fun (e.g. jet packs and flying cars), but don't fit within the confines of our common reality (e.g. people suck at navigating 3 degrees of freedom, much less 4) and/or physics (e.g. …and we will be using what kind of battery to keep these things aloft?). Sadly, it's often the ideas we cherish the most that tend to languish on the island. But watch out when the seemingly "unsolvable problems" get solved. Thanks to Google's driverless vehicles and next-generation batteries, Santa's sleigh could be heading towards the island as we write.

"WE PREDICT TOO MUCH FOR THE NEXT YEAR AND YET FAR TOO LITTLE FOR THE NEXT 10."

— Neil Armstrong

5. It's about the data, stupid.
Although this may seem dumbfoundingly obvious, information is data that has been interpreted. Our guiding principle here is akin to the old coder's axiom: it's garbage in, garbage out. If the source data stinks, the interpretation will be rotten. Our approach to the future was to worry (a lot) about our source data. As such, all of our interviews were recorded and revisited repeatedly. Thanks to this particular procedure, for instance, we found that we heard what we wanted to hear on the first pass. It was only on subsequent *relistens* that we could get out of our own way and hear what was actually being said – whether we liked it or not. And not to put too fine a point on this, how many analysts do you know that record and relisten to interviews? (According to our spell checker, relisten is not even a word in the English language. That alone is awfully telling.)

6. A credible future is freaky as all get out.
Given the speed of change underway in the communications market today, what took thirty years to incubate is now happening in ten (or under). This apparent fast-forwarding of time is broadly known as the Law of Accelerating Returns, which Ray Kurzweil coined to explain how Moore's Law translates into our common reality and sense of timing. To imagine the impact, it

would be like experiencing the launch of the iPhone a mere 22 months after purchasing your first iPod, instead of the six years that it actually took. Would your brain be able to process that speed of change? Most likely not, and that's why a credible future vision must appear freaky. Your brain should not be able to make the cognitive leap. You are missing information.

7. Break out of the echo chamber.
Thanks in part to the nature of social media and our very human desire to have our ideas affirmed rather than challenged, collectively we live in an echo chamber. To ground a credible future vision, it is critical to seek out people with diverging thinking from your own. As an early mentor once put it, everyone needs a dark cloud to rain on his or her parade. Our vision was helped immeasurably by our ample supply of brilliant, dark clouds.

In summary, we took the challenge of constructing a ten-year vision seriously and approached it as an achievable, although an incredibly high-risk, venture. We have nothing at stake other than our reputations, which we've poured the last 20 years into cultivating. So, yes: we are mindful that political realities and inherited legacy technology could lay waste and/or delay many of the visions portrayed here. We are also painfully aware of the many lurking cognitive traps, which leads us to our next section.

APPENDIX: DEFINITION OF TERMS

Over the course of this summary, we have introduced a series of new and/or hotly contested terms. To help keep our intentions and the concepts themselves clear, we are providing a quick reference guide:

Hypertext – Text and images used as a dynamic, digital interface, which connect relevant and related ideas and concepts, within and across websites. Hypertext is what ultimately makes the current version of the Internet navigable by humans, since websites make information findable and sharable. The relationships are tied to a spatial metaphor of 'pages'. In the "Web 2.0" social media world, we added a temporal view with timelines and activity streams.

Hypervoice – Voice as an interface that is every bit as dynamic and persistent as hypertext. Its primary metaphor is temporal: what events (like taking notes) are tied to what is being said. Where hypertext set the stage for Web 1.0 and 2.0, Hypervoice is one vehicle for Web 3.0 – also known as the Semantic Web. When voice is the primary way you search, share or find things on the Internet (e.g., Siri), you are using Hypervoice as a navigational tool.

Hypersense – Eventually Hypervoice as an interface will be eclipsed. Although we will likely use a combination of Hypervoice and, to a far lesser extent, hypertext for navigation, a new means of navigation – such as sensed thought, micro-movement, and augmented decisioning – will change the way we access and navigate the Internet.

APPENDIX: CLUES FROM OUR JOURNEY

There were moments of insight about this Human Technology future that came as much from the process and journey as the sources of content and expertise we examined. Four in particular stand out:

Doing interviews. We would begin each conference call with "would you mind if we recorded this call for note-taking purposes?" This agreement itself was not captured, and the resulting data was stored entirely on our terms. The tool had inbuilt biases of power that were unexamined when it was conceived and built.

If voice was valuable data, how could its storage and use be negotiated in a consensual manner? How could we scale this "ask" without constantly nagging the participants for permission to record and use the data on every call?

Walking about. On our summer retreat, we would go for walks, during which we would attempt to capture our conversation by dialing into a conference bridge, and pinning a microphone to a fleece top that one of us would wear. When we had "aha!" moments, we'd fish out the iPhone to tag that moment in the Hypervoice conference tool. Since there was only one microphone, we'd only really capture half the conversation properly.

If voice is valuable data, how could many devices work together to capture it? Why couldn't we just ask our virtual assistant to note the important ideas and send them to us after?

Group diversity. The two founders of the Hypervoice Consortium are GenX through and through. We also brought on board two research assistants, who are Millennials. Between us we managed diversity of gender, generation, sexual orientation, disability, personality type and nationality. Three of these stood out: (1) One of the team with dyslexia is highly biased away from text to voice. (2) The younger members of the team valued freedom and privacy differently from the older members. (3) There was a clear divide between systematizing and empathetic personality types in how they experienced interacting with voice technology.

If voice was valuable data, what did it mean to satisfy our diverse individual needs and goals? What were the requirements when we wanted to interact, and have different preferences?

The refrigerator incident. "Beep!" What was that? OK, back to work... "Beep!" Oh darn it all! Did you hear that beep?

We were all on retreat sitting around the dining table, and there was this wretched beep every few minutes. It was maddening. The result was a 45-minute frantic search of the house. Where was it coming from? Outside? Upstairs? Laundry room? We narrowed it down to the kitchen. The cooker? The microwave? Eventually, we got it: the fridge door was ever-so-slightly ajar, triggering the beep. Who knew fridges talked?

As we calmed down from the irritation of the interruption, we realize that in the “sensorization” of everything we (humans) were the sense-making engine. We need to learn to translate the beeps. That’s fine when there are only a few beeps in your world. But as the world gets noisier, boy, that is not okay.

If voice was valuable data, what did it mean to relieve the user of the cognitive load of sense-making? How could we avoid the ‘tyranny of the beep’ (that afflicts environments like hospitals) when managing alerts and permissions?

That nasty “interruption” lead to a major finding – we live under the tyranny of the beep today. It’s so pervasive it’s almost unnoticeable and intolerable at the same time.

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