



Keith Kirkland

Keith Kirkland is a designer, engineer, futurist, and haptics enthusiast that is deeply excited about bringing the use of touch in product design and movement learning. He is a serial entrepreneur inspired by the intersection of touch, equitable business models and wearable tech. His goal is to create impact-driven products with tactile experiences that scale. He is currently the Leonard Pryor Fellow at the Kansas City Art Institute. His work has been recognized by the Pratt's Rowena Reed-Kostellow Award, SXSW, The Smithsonian, TED, Dropbox, Google, Verizon, The Yokohama Government, Perkins School for the Blind, Unilever, Bauhaus, The Cerebral Palsy Alliance Research Foundation, EY, and the MET Museum.

The Future is Touch

A Call for Haptics in Education

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The word HAPTIC means "of or relating to the sense of touch."

I learned this life-changing word at the ripe elder age of 33, during the final year of my third degree-granting program at the Master's level. I was with the director of the Digital Arts and Humanities Research Center at Pratt Institute, Henry Yoo, along with about 12 other members whose work ranged the gamut between art, music, design, and tech.

We had just witnessed a haptic product demonstration. A company had figured out a way to "pan" the sense of touch, much like audio engineer span sound from one ear to the other. By independently adjusting the balance, or maximum volume in the left and right ear, they could create the illusion of sound in space. Similarly, this technique created a sense of spatiality through the skin. And I had never before experienced anything like it!

Imagine holding two ends of a string taut between each hand with your eyes closed. Now, envision a large vibrating bead capable of sliding back and forth on the string, akin to an old counting abacus. Imagine being able to discern precisely where the vibrating bead is spatially, solely by feeling the variation in vibration intensity channeled through each hand holding the

string. With remarkable clarity, one could understand exactly where the vibrating bead is located.

Feeling is Believing

When it was my turn, I was nothing short of astonished. I found it mind-blowing that I could feel the vibrating bead's location so accurately; it almost felt like I could "see" it moving. However, there was one glaring detail: there was no vibrating bead at all. The two vibrating motors generating the sensation were not even physically connected to each other; they were independently held in each hand. The haptic illusion of panning touch felt so insanely real that I walked out of that room a changed person. It had never dawned on me that illusions so common in vision and sound could be possible in touch, and that realization completely altered the direction of my life. When I got home, I turned to my most wordiest of friends and asked them, "Hey, do you know

"When I got home, I turned to my most wordiest of friends and asked them, "Hey, do you know what 'haptic' means?" To my utter shock, almost no one had ever heard of the word. "Like 'optic' is for eyes, 'haptic' is for skin," I'd say." Their eyes would widen in understanding, "Ah!", and then we would move on with the conversation. But I never moved on.

Haptic means Touch

I have been repeating this sentence for a decade. For millions of people, I was the one who first introduced them to *that* word. I wondered how a word so closely related to something as basic as touch could be unknown to so many people, including myself. As an exercise in building empathy, imagine having to explain the word "vision" to almost every person you meet, even though they use their eyes and sight every day. It was an ego boost to feel so

cutting-edge, but it also felt like this cutting edge had been experienced by other senses long ago. I started to ponder why haptics felt like such a mind-blowing concept, both to myself and to others.

To understand the root of the haptic story, I started to make historical connections through thought experiments. Touch has historically been treated as the lowest of the five senses. As a result, we have had less research spending on the development of technologies that take advantage of touch.

In contrast, over the last millennium, the greatest scientific heavy weights were making massive contributions in thinking power to the study of sight, and secondarily, of sound. Greats like Pythagoras, Aristotle, Plato, DaVinci, Newton and Goethe all made significant contributions in the study of vision and color. Aristotle, who wrote the first theory of color, also ranked the 5 senses in a hierarchy. His theory on color would dominate popular thinking for almost 2000 years, until the work of Sir Isaac Newton.

"Aristotle's classical hierarchy of the **senses** deems "sight" the highest of the **senses**, followed in order by hearing, smell, **taste**, and **touch** (Jutte 61).

Philosophers have privileged the "distance" **senses** such as sight and hearing over the "bodily" sense of TOUCH due to notions that distance from the object perceived yields objectivity, which in turn might lead to knowledge. And proximity to the object perceived yields subjectivity, which implies the risk of self-indulgence (Korsmeyer 361). This sense hierarchy is not uncontested. Theorists have argued

that “ This sense hierarchy is not uncontested. Theorists have argued that this hierarchy is not a universal "given," but a social construct influenced by philosophy, human evolution, and technological progress (Jutte 61).” (Source: University of Chicago 2004)

Society had built a social, and technological, construct around the senses that promoted the sense of seeing and hearing over the other senses. When paired with the dominance of the religious doctrines of the time and the way they emphasize the removal of touch as necessary to remove temptation, human touch was seen as both sin, in connection to intimacy and sex, and subjective, in connection with understanding knowledge. Finally, the world of science and religion had a common belief. And those impacts would ultimately affect how the scientific community would view, explore and invest in the sense of touch for thousands of years to come.

The Story of Wear Works

In 2014, the same year I was having my mind-blown with the concept of haptic illusions, I also was working on my master thesis. After a few years working in fashion for companies like Calvin Klein and Coach, I decided I wanted to use design in a way that would help forward humanity. After 3 years of being away from fashion, I had deeply missed it. My new pathway, wearable technology, enables the combining of all of my previous skills and interest into one beautiful cohesive ball. And I used my thesis as a way of bridging the gap.

I wanted to build a suit that would allow a person to download Kung fu. But there was one problem, I had no idea of how to communicate movement without an instructor being in the room.

Initially, I thought about using audio. One day as I was hunched over in my chair, my roommate, without saying a word, gently put the index finger from one hand on the front of my right shoulder and the thumb from the other hand into my spine near my lower back. Instantly, I sat up straight. In one gentle gesture, they had communicated how to fix my bad posture. In that moment, I realized that if I had haptic motors where they had placed each finger, and motion captured at a to know my current and optimal posture, I could replicate that experience without a movement teacher needing to be in the room.

Upon completing my thesis, I decided to continue this work. I partnered with some classmates, and we started [WearWorks](#). Our first product, [HapticNav](#) and [Wayband](#), was a free haptic navigation app and optional haptic wrist band that gently guided users to their destination without the need for any visual or audio feedback. In 2017, we assisted the first blind person in running the NYC marathon without being tethered to a sighted guide.

Over the next 9 years, I had the chance to meet with the “Who is Who” of the visually impaired community. I worked with major blind organizations around the world, including the US, The UK, Sweden and Romania. I met leaders of major blind organizations like Lighthouse Guild, Helen Keller National Center, American Federation for the Blind and National Federation of Blind. I’ve worked with poets, Paralympians, entrepreneurs and musicians who were visually impaired. I even had the privilege of being invited to support as an advisory board member for the [Howe Innovation Center](#) at Perkins School for the Blind, the largest school for blind people in the United States. As I was spreading my message of touch as the 3rd lane to access the “digit

superhighway”, I found a deeply receptive audience. “From the age of 0-5, 85% of the learning information we consume is visual.” (Source: [Blind Spot](#))

As we built the company, a realization dawned on me. We were telling the story of a potential multibillion-dollar touch industry. When we were able to capture and distribute hearing and sight media, it created entire new world economies and ecosystems that today are valued at over \$100 billion. The haptic market got its roots in the gaming industry. The global gaming market, valued at \$245 billion, is nearly three times larger than the film and music industries combined. Furthermore, it is projected to grow to \$645 billion in just the next six years. Pair that with the 745 million people globally living with severe visual or hearing impairments, and the future of touch interfaces feels not only imminent, but also essential.

Haptics: Becoming a \$100 Billion Industry

As a founder, you have to envision a future that doesn't exist. The current global haptics market was valued at \$4 billion in 2023. As a founder focused on the future, I began contemplating: What major shifts would we need to prepare for as the haptics industry approaches \$100 billion? Standardizations across haptic platforms, privacy and ethics issues related to collecting haptic data and physiological responses, and user interface developments for non-technical users who want to use haptics without the deep technical expertise, are just a few.

But for me, one thing stood out as the BIGGEST challenge. There are too few pipelines to develop and nurture haptic talent, and the ones that are available usually start at the Ph.D. or Master's level.

I was pitching a dream of a billion-dollar haptic enterprise and quickly realized that if we ever got that big, we would have a massive staffing shortage. Further more, since [the average Ph.D. salary in the US is over \\$100,000](#), it means that staffing a haptic company could be prohibitively expensive, especially for a startup.

The Future Follows Research Spending

In 2023 at SXSW, I walked on to a stage. Not as a pitch contestant, though I was one the year prior. This time I was the opening act for the Pitch Awards. In a moment of creative expansion, I wrote a rap song with the goal of educating people about the meaning and benefits of haptics. This was the only song I have ever written, and SXSW was the first time I had ever performed. I would go on to perform this song at scientific-based conferences around the world.

"Haptics (We have a Vision)" by Keithius, Sonic P., & The Source Academy Kid

"We have a vision, Of a world that doesn't need vision. Elevating touch to the level of, Sight and Sound and that is our mission. Research spending, Today is access tomorrow for all of our children. Look at the spending!"

Why does an [Oculus Quest 2 VR headset](#) only cost \$199, yet a [Braille key board](#) cost \$2,700? My overly simplified hypothesis: We spent more research funding figuring out how to make VR headsets less expensive because there was a big potential for a payout for the team that could pull it off, and we, as a society, haven't seen that same potential (until recently) in pursuing assistive tech.

I once read an article that I can no longer find. In the article, there was a graph highlighting the spending on research over the

last 100 years for each of the 5 senses. There is no surprise that vision-based research topics and projects receive more than half of the total funding spent on all the senses combined over the last 100 years. Hearing-based research was a very distant second. And for other senses of touch, smell, and taste, compared to vision, spending was almost negligible.

"Seeing is believing, (yup) most went to vision. Second was sound and pretty far distant. For a hundred years, Money only spent on two senses! Isn't that senseless!?"

The Bose Corporation specializes in sound. Their company motto, "Better sound through research", is not just a statement. There was a famous conversation between Dr. Amar Bose, the CEO and founder of Bose, and the head of the noise reduction division, who would later become Bose's president. "Dr. Bose, do you know how much we have spent? Over \$50 million [and 15 years developing noise-canceling]?" he said. **Dr. Bose's response was classic.** "\$50 million! If this were a publicly traded company, I would have been fired years ago." Ultimately, Bose would go on to dominate the sound industry, building category-defining products using the very technology that they previously sunk millions into exploring, through research.

A Call for More Haptics Education in Undergrad

Where we spend our research dollars determines the future. Research is often a personal journey. Many researchers are researching things or subjects for which they have developed a personal interest in or a connection. Often their interest comes from an exposure during their personal lives or early academic journeys. By the time most soon-to-be researchers are selecting

their Ph.D. focus, they have already developed a clear interest in their topic of choice.

Human-Computer Interaction (HCI) is the closest thing we currently have to a degree in Haptics. The first challenge is that it is usually offered at the Ph.D. and Master's levels of education, making it inaccessible for undergraduates and non-college students. The second challenge is that haptics is often just a small focus of the total Human Computer Interaction program. Contrast that with the time I spent in design school studying color and color theory. We spent years learning how the eye and brain process color information, how texture and material can change the appearance of color, and how the psychology of color and its impacts on human perception, can affect usability and user preferences.

I earned the word HAPTIC at the age 33 ,and it changed my career path. But not many people would be willing to change their path so late in their careers. All of a sudden, the answer seemed simple. We need to introduce students, aka future researchers, to the concept of haptics earlier in their academic careers.

I knew what an artist was when I was 6 years old. That is how I became an artist. I knew what an engineer was when I was 12 years old. That is how I became an engineer. I learned about shoe design when I was 24. That is how I became a handbag and shoe designer. I learned what an industrial designer was when I was 27 years old. That is how I became an industrial designer. I learned what the word HAPTIC meant when I was 33 years old. That is how I became a Haptic Designer.

A Serendipitous Opportunity

As I was realizing the challenges of building a pipeline of Haptic Designers, I started to make plans for creating a 4-year degree program that would teach haptic design. Most of the other 5 senses have a 4-degree of study at the undergraduate level surrounding it. Culinary arts, music performance and theory, graphic design, and visual arts. For touch, the closest proxies are massage, performing arts, and physical therapy.

Haptics101: Design for the Sense of Touch@KCAI

Now, I am a visiting lecturer and artist fellow at the Kansas City Art Institute. As [the Leonard Pryor Fellow for Accessibility](#), I have been given a unique opportunity to bring accessibility awareness to the greater student, staff, and faculty body. I have also been given the chance to create a new class based in social practice.

Haptics 101 was conceptualized to bring non-technical majors exposure to the concepts of haptic technology. We explore haptics through several modalities to give an overall understanding of how to understand and use touch to create unique and embodied user experiences.

Haptics have a strong connection to writing. Most authors know what haptic means because they are using haptic words to create realism and analogy :I had a ROUGH day .That salesman was so SLIMY. She has the WEIGHT of the world on her shoulders. So we start students with a study of haptic words, with the aim of having them select 3 words and build an analog haptic object that embodies the 3 haptic words that were chosen.

In the second project, a responsive haptic experience, we teach the students basic coding for Arduino to build physical computing capabilities. Students all start with the same input sensor, in this case, a magnetometer, gyroscope, and accelerometer, and create a unique motion-based haptic experience.

For the final project, the students use haptics to solve a real-world problem. They will start with a person and a problem. They build a solution that uses any sensor as input, paired with a haptic output, to create an experience for the user that solves their problem using the sense of touch. Students are allowed to explore a range of sensors as inputs, while being restricted to the output being in haptics.

What Does the Future Hold for Haptic Design Education?

I believe that touch can become the 3rd lane into the digital superhighway. Touch is a more accessible lane, and it will allow the offloading of information that previously needed to be communicated with visuals and audio. My hope is that by inspiring the next generation of Haptic Designers and giving them access to the tools I discovered so much later in life, that we can begin to build awareness and interest in developing more touch-based research to forward the industry.

We have all seen the impact of the “curb cut effect”, a term that has been used to show how developing solutions for people with accessibility needs actually gives everyone a better experience. Closed captions, audio books, virtual voice assistants, and yes, curb cuts, have had outsized impacts on people without disabilities. “A rising tide raises all ships.”

Beyond accessibility, the tapestry of touch is deeply woven into our human experience. In a terrible real-life study, newborns who were orphaned and not touched, died. Nurses soon realized that by spending just a little time touching them, they could improve their mortality rates dramatically. Touch is foundational to life. And it's time we put the dogma of touch implication aside and stopped being so afraid of exploring the most important sense we have as humans.