Making Sense of Sensors

All change begins with the ability to measure. For millennia, humans relied on our five senses to gauge the world around us in order to survive and thrive.

With increasingly sophisticated sensors—soon to number in the trillions—we’ll be able to expand perception far beyond our natural abilities. Ultrasound, infrared, night vision and positioning sensors will increase our vision and hearing. Chemical sensors will amplify our abilities to smell and taste. Mechanosensors will intensify what we feel.

But how much new sensor data do we need?
Experts predict there will be up to 100 trillion sensors by 2030. Image, speech, and voice recognition will advance to near 100% accuracy by 2025. The speed of analytics will grow thirty-fold by 2030, with 95% of queries answered in milliseconds. Sensors will be commonplace in the 111 million new cars and the 2 billion smartphones that will be purchased in 2020. The Internet of Everything market could grow to $14.4 trillion by 2022.

TINY ENGINES DRIVE THE DIGITAL REVOLUTION

Sensors drive everything from advances in robotics to self-diagnosing appliances, in form factors from wearables to gyroscopes to biochemical sensors.

The latest smartphones carry a magnetometer, barometer, thermometer, gyroscope, proximity sensor, accelerometer, and light sensor. In addition to expanding human senses, sensors will monitor machines, buildings, and living things to help us precisely understand our environment.

SENSORS WILL SERVE THREE PURPOSES:

The rules of exponential growth suggest sensors will be a thousand times more powerful in the next decade, providing:

1. Sensory extension
   Widening our perception and our experience of reality
   
   Types: voice and facial recognition, ultrasound and echolocation, infrared, 3d imaging, biochemical, color and ultraviolet, swarm
   Applications: medicine, science, exploration, data visualization, logistics, maintenance and repair, retail and shopping, art

2. Functional sensing
   Measuring parameters in humans, animals, machines, and infrastructure
   
   Types: ultrasound, infrared, biochemical, pathogen, torque and mechanosensors, smell, biodegradable
   Applications: healthcare, medicine, agriculture, maintenance, repair

3. Environmental scanning
   Gathering the data around us
   
   Types: voice and facial recognition, ultrasound and echolocation, infrared, 3D imaging, biochemical, pathogen, odor, biodegradable, swarm
   Applications: science, environmental management, public health and safety, agriculture and food/water management, energy production, logistics

UNDER OUR SKIN

Researchers are developing sensors to implant in or on humans, animals, and plants.

- Nano-engineers at the University of California, San Diego developed a temporary tattoo to enable non-invasive glucose testing.
- The FDA accepted an application for a digital drug-device that combines a pill for mental illness with an ingestible sensor.
- MIT scientists have introduced a “Band-Aid of the future” with temperature sensors, and tiny, drug-delivering reservoirs.

To incorporate sensors into operations and decision-making:

- Monitor advances in sensor technology, especially capabilities beyond what can be measured today
- Watch out for use cases in other industries that could transform your own business in unexpected ways.
- Look for ways that data from new types of sensors could optimize or eliminate traditional business processes.
- Open up innovation by inviting employees, business partners, and customers to develop sensor-driven innovation