

## ACOUSTIC ADVANCES

Three years ago, we took a holistic look at the growing importance and understanding of frequencies and vibrations (See Frequencies & Vibrations – June, 2010) – in health and wellness, in the workplace and in the global consumer marketplace. At the time, we considered all of the multi-sensory (e.g., sound, light and haptics) application possibilities related to frequencies and vibrations. We found then that scientific research was bearing out what was once considered to be a more “fringe” field of endeavor. Since then there has been considerable and rapid development within the specific field of sound and acoustics. A combination of cutting-edge research, new consumer-facing technologies, and other innovatively engineered solutions suggest that we are entering an acoustic age that will impact the future of a great many things.

### Therapeutic Properties of Sound

There is a growing movement to harness therapeutic properties of sound in health and wellness. Meditation, including the sound and vibrations of chanting, has long been considered therapeutic in spiritual circles. Now, science is proving out that meditative chanting can boost the activity of genes that promote good health. Boosted genes improve cellular energy efficiency, increase insulin production and prevent the breakdown of caps on chromosomes that help prevent cells from wearing out and aging. Similarly, clusters of genes that become less active are those involved in chronic inflammation, which can lead to high blood pressure and heart disease. Studies among those who regularly meditate suggest changes could be long term (494-0713).

### The Next Frontier of Therapeutic Sound Apps

With a greater understanding of how to leverage sound’s therapeutic properties, developers, artists and scientists alike have collaborated to create innovative apps and experiences:

- **Healing Environments:** Music pioneer Brian Eno has designed two innovative “healing environments” that will test the therapeutic properties of ambient sound. Each was created to provide a serene atmosphere with restorative effects for hospital patients (404-0613).
- **BioAid:** Researchers have developed an algorithm that could transform smartphones into novel hearing aids. Like similar software that harnesses and perfects ambient noise, BioAid uses the smartphone’s internal processing power to amplify too-quiet noises and diminish too-loud ones. This trick essentially mimics the biological processes that occur in a healthy ear to deliver clearer, more comprehensible sound to the hearing impaired (404-0613).
- **Reclaim Sound:** “Reclaim sound,” conceived of by hearing-impaired artist Christine Sun Kim, investigates the physicality of sound by translating noise into kinetic phenomena in order to experience it through its visual and bodily effects – such as sound vibrations, a visceral, internal way for the deaf to process sound stimuli (404-0613).



## **Sound & Language**

The very nature of sound – as it pertains to spoken language – can affect early childhood development. And the impact of technology is increasingly apparent. Linguists wonder whether the time adults spend on mobile devices might affect the way children actually learn language. Research shows that children make greater linguistic strides when adults talk with them than when they are merely in the presence of language or when adults talk to them. Children’s language abilities and eventual academic success are linked to the volume of words they are exposed to early on. The quality, not just quantity, of exposure matters. Studies have also found that babies whose moms interact with them in sync with their babbling began to vocalize more, with more complex sounds, and articulate more accurately than other babies (475-0713).

And not only does the sound of language affect development, it can be an important diagnostic tool for development. Different pitches and acoustic features of a baby’s cry could reveal developmental disorders or neurological issues that change the way a baby’s vocal cords function. For example, a distinct, high-pitched cry – called “cri du chat” – is caused by a genetic anomaly similar to Down syndrome. And since people with autism can produce atypical or unusual sounds, vocalizations might help detect autism during infancy (492-0713). A better understanding of the sounds that babies make could equate to several years’ gain in the diagnosis and treatment of potentially-debilitating disorders.

## **Decoding the “Sound” of Speech**

Several emerging applications have to do with the reproduction or interpretation of the sound of language – using other sensory cues. For example, using a high-speed camera pointed at the throat, scientists can decipher a person’s words without relying on a microphone. By snapping thousands of images per second, researchers recorded every movement of neck skin that accompanied sounds originating in someone’s voice box. A computer program then turned the recorded skin vibrations into sound waves. Next, the researchers want to focus the camera on a person’s cheeks to look for more skin areas that move during speech (468-0713).

Applying this type of technology more playfully into the marketing realm, a Dutch coffee company introduced a novel vending machine with facial recognition technology. The machine includes a mechanical barista that dispenses free cups of coffee to anyone who is determined to be yawning in front of the machine (600-0813).

## **And Even In Nature...**

Developments in the sound of language are also affecting the natural environment. Some experts warn that mobile apps that mimic bird calls are too real. Concerned that birds may misinterpret the sounds as coming from other birds and respond to them inappropriately, some experts call the apps harmful. In England, The Wildlife and Countryside Act made it an offense to intentionally disturb nesting birds. Brownsea Island has now put up signs warning visitors about using the apps (476-0713). Clearly, marine animals and possibly even bees can be adversely affected by the sounds, vibrations and frequencies that humans intentionally or accidentally use. The effect of sound on animal and plant life will continue to be an important area of study.



### **Other Emerging Sound Applications:**

- **Acoustic Levitation:** A new acoustic levitation technique uses frequencies above 20 kHz, the upper limit of human hearing. This new technique has several potential applications, and there are few limitations in the length or size of objects that can be levitated. Acoustic levitation could, for example, be used to evaporate biopharmaceutical solutions without having them crystallize – thus allowing the body to absorb them more efficiently (583-0313).
- **Mapping of Physical Spaces:** A new algorithm that sorts through echoes to develop an accurate map of a room’s dimensions may lead to better sound quality for teleconferences and online gaming. Researchers next hope to explore whether adding more microphones could enable mapping not only oddly shaped rooms but the furniture inside. In the near future, people may be able to map a room with their mobile devices (464-0713).
- **Perfect Sound Wave Reflection?** A new type of mirror that reflects light perfectly has been constructed. The mirror could find its way into powerful lasers and other optic technology. At least in theory, researchers say, variations of this mirror should be able to perfectly reflect sound waves and even water waves (585-0813).

### **Implications:**

#### **Advancements in Health, Healthcare & Wellness**

The practical benefits of sound waves and vibrations on human (as well as animal and plant) wellness are becoming clearly established. We know, for example, that sound waves – along with other types of vibratory energy – can actually affect the crystalline structure of water. And since water is so fundamental, not only in our surrounding environment, but also within our bodies, the beneficial utilization of sound therapy will be a major growth area of the near future. What are now prototype ambient sound chambers in hospitals could soon become the norm in healthcare facilities. Advanced sound application will also likely be more interwoven into the design and service menus of spas, wellness facilities and extended-stay “spa-spitals.” And will ambient sound chambers serve as the next iteration of corporate napping/sleep stations? Will managers recommend – or even mandate – the use of sound chambers among their employees? What effect could this have on productivity and motivation? Formally licensed *sound therapists* could represent a newly emerging profession – similar to the homeopathic practitioners, aromatherapists and alternative medicine specialists (e.g., acupuncturists) of yesterday and today.

#### **Advancements in the Architecture & Design of Built Environments**

Going forward, acoustic science will have a far greater impact on the design of the built environment than ever before. No longer only the purview of specialized functional structures (e.g., concert halls and other performance venues), we are likely to see considerable growth in the utilization of acoustic science in the workplace and in our homes. Increased productivity, harmony, satisfaction and happiness – as well as decreased physical and mental stress – are all realistic outcomes of this acoustic renaissance in design. Will entire buildings – either commercial or residential – be “sounded?” If so, what would that mean? Similar to today’s LEED (Leadership in Energy and Environmental Design) certifications, will there be a formal accreditation system for built structures that conform to the most beneficial acoustic standards?



### **Noise Segmentation**

As populations age, sound becomes an increasingly important factor in well-being and comfort. Retailers, restaurants, airport lounges and other public spaces featuring loud music risk losing well-to-do older customers who find the noise disturbing. New York City's proposed new taxis will have somewhat muted horns as part of an effort to improve quality of life on streets with a growing older population. Businesses of all kinds will face growing demands for a less strident environment, especially considering the aging of populations throughout most of the developed world. This is counterbalanced by the reality that many younger consumers demand more dynamic environments – and technologies – that pepper them with sensory (including auditory) engagement. This wide disparity in acceptance of, and appetite for, environmental noise could lead to one of the more interesting market segmentations of the future.

### **Sound & Auditory Biomimicry**

Engineers, in a sense tinkering with evolution, have long tried to shortcut and imitate the adaptations of other species in order to enhance human capabilities. For example, engineers – inspired by the compound eyes of certain ants, beetles and flies – have developed a digital camera that, thanks to 180 tiny lenses, is capable of panoramic views. Such cameras might soon equip tiny flying robots that could scour a disaster site for survivors or conduct other aerial surveillance (*410-0613*). If this sort of biomimicry is possible in the visual realm, then we can also expect it in the auditory realm. Engineers are likely already close to at least better approximating the more acute auditory machinery of bats, owls, pigeons, dolphins, cats or elephants. Will such applications generally be for novelty? Or will they heighten human ability?

### **The Future of Augmented Reality (AR)**

As an extension of the above, we could see the development of many more consumer-facing apps that enhance human hearing – or at least heighten the acuity of our perception of sound cues in the surrounding environment. Consider the way that early-stage augmented reality (AR) applications (e.g., Google Glass) and other wearable technologies (See **Techno-Fashion** – September, 2013) are already giving us enhanced, almost *super-human*-like abilities to process and respond to stimuli in our environment. The privacy implications are profound, when we might, for example, be better equipped to listen into others' conversations.

### **The Impacts of Mobile Technology**

Digital and mobile technologies are profoundly impacting language development in children, as well as stasis in the natural environment. This is especially true because mobile penetration is quickly approaching global ubiquity, even in the poorest markets. As acoustic science continues to evolve, it will be important to recognize and respect the impact of these technologies, while also being mindful to mitigate the potentially adverse side-effects.

