

# TACTILE SOUND 101

## Clark Synthesis Tactile Sound™

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### Chapter One: Introduction To Tactile Sound

*A Proven Entertainment Product Class*

**R**emember the scene in the original Jurassic Park, when all the Land Rovers sputtered and stalled during the park tour? The rain was drumming hard on the roofs of the vehicles and tension began to rise. Slowly, the camera zoomed onto the surface of a still glass of water, and the surface began to ripple. Here, Spielberg was trying to give the sense of something big about to happen. Because he was unable to shake the theater floor, he used the next best thing; a visual effect of water rippling.

However, suppose he could shake the entire theater floor, and shake it the way a 20-ton, stomping T-Rex would. That would raise a few goose bumps, would it not? Well, maybe the local theater can't do it, but you can by installing Clark Synthesis Tactile Transducers in your home.

Tactile Transducers are electromechanical devices designed to drive large surfaces, such as seats and floors. These are powerful devices, intentionally installed and calibrated to subtly add the tactile sense that is missing from music and movie soundtracks. The result is nothing short of engrossing. Anyone who has experienced tactile sound will tell you that it adds another dimension to home entertainment.

Tactile sound reproduction has a solid basis in psychophysiological research and is used extensively in military and other applications. Clark Synthesis is the first and only company to bring the excitement of Full Range, Full Fidelity, Full Contact Audio Tactile Sound to the home entertainment industry.

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### Chapter Two: The Psychophysiology of Sound

*How We Process "Sound"*

**M**any people conceptualize "sound" as the perception our brain produces when auditory energy travels through air and stimulates our ears. This is reinforced by the audio/video industry, as the industry's standard sound reproduction device, loudspeakers, do just that. Loudspeakers are designed to push air molecules closest to the drivers, creating longitudinal waves that eventually reach our ears. The result is what we call "sound."

However, this is a one-dimensional way to look at our perception of sound, because the phenomenon of sound involves many more facets. In fact, there are several other pathways that acoustic energy travels through that reinforce our perception of sound, even though it does not enter our ears the standard way—through our ear canals.

To better understand the physiology of sound, let's take a look at the launching of a space shuttle mission. If a man and his son watch a liftoff, the sonic impact of this event on our observers involves two distinct pathways and a variety of psychophysiological mechanisms. First, let's examine the event itself. When the space shuttle's engines are initially ignited, a tremendous blast occurs at the launch site. The enormous energy released travels through the earth and is transferred to our two observers via the ground they stand on. This energy is felt almost immediately, because sound waves travel rapidly through solid media. Next, after several seconds, the actual sound of the shuttle reaches our observers in a thundering roar. By this time, both father and son have goose bumps covering their entire bodies due to the overlapping of five different perceptual phenomena.

## **The Five Pathways To Perceiving Sound**

In the following section, you will see the five ways pulsations can be perceived in the human body in the auditory frequency range. Each of these sensory pathways has a different mechanism, but all of them can reinforce the sounds that come in through our ears. The general term adopted for these additional four pathways is "tactile sound."

### **1. Hearing via Air Transmission**

The standard way we perceive acoustic energy is through our ears. The mechanism is simple. Vibrating air molecules enter the ear canal and push against the eardrum. This energy is transmitted to the Cochlea through the inner ear bones. The Cochlea is a fluid-filled sense organ in which small hairs, Cilia, convert mechanical vibrations into the perception of sound.

### **2. Feeling via Deep Tissue Movement**

The ground vibrating almost imperceptibly beneath our space shuttle observers is stimulating nerve endings in deep tissues and muscle mass. This sense is called "kinesthetic." It comes from the Greek word *kinos*, which means, "to move." These kinesthetic sensations are the gut feelings that occur when powerful objects excite the ground near us.

### **3. Feeling via Skeletal Joint Movement**

The ground vibrating beneath our observers is also stimulating nerve endings in skeletal joints and deep tissues. This sense is called "haptic." It comes from the Greek word *haptain*, which means, "to touch."

### **4. Feeling via Tactile Stimulation**

The ground moving beneath our friends is also stimulating nerve endings just under the outer layer of skin. This sense should be familiar to you; it is your sense of touch. Ordinarily, the sense of touch does not come into effect with acoustic events except in situations where excessively loud noises are produced. It also comes into effect for musicians who hold their instruments close to their bodies when playing.

### **5. Feeling via Bone Conduction**

The Cochlea, the sense organ that takes the mechanical movements of acoustic energy and translates them into nerve impulses, is firmly encased in the skull bone. This bony protection allows a secondary pathway for sound waves to reach the Cochlea; directly through the bone mass itself. The phenomenon of bone conduction is well known and has been exploited by many people. For example, in cases of structural hearing loss where the eardrum or inner ears bones are damaged beyond repair, various companies manufacture bone conducting "hearing aids." These devices clamp onto the back of the ear, or are actually implanted into the skull, to directly stimulate the Cochlea via local bone conduction

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## **Chapter Three: Tactile Sound Applications**

*So, Now I Know How My Body Processes Sound, How Does That Relate to Transducers?*

**T**his final section provides you with an overview of how tactile sound transducers work and in what type of applications they can be used.

### **General Overview**

Tactile sound reproduction can be utilized for many purposes. Of primary interest is the addition of tactile frequencies to the production of recorded music and movie soundtracks, which provides dramatic effects. Participants often refer to the experience as being thoroughly engaging, and describe a feeling "that encompasses a sixth sense." That sixth sense is the increased realism obtained when tactile cues are added to conventional air-transmitted sounds.

### **What Musicians Have To Say About Tactile Sound**

One of the earliest groups to embrace the use of tactile sound transducers were musicians. To understand why, let's look at the physical mechanisms at work during a violinist's performance, for example:

When you listen to the recording of a violinist, you are attempting to recreate the exact perceptions the instrumentalist felt during the live performance. It may surprise you to realize that what you experience and what the violinist experiences are two very different things. Here's why: when a violinist performs, he/she is

drawing a slightly abrasive set of strings (the bow) across a set of finely tuned strings. This excites the strings, which resonate, and we hear these vibrations through our ears. However, consider our performer, who also feels these sounds. This feeling is direct in the fullest sense of the word, from the chin piece directly into the violinist's body. The three main sensation mechanisms for the musician are:

1. Through the ears via air-transmission.
2. Through the skin via tactile sound reception.
3. Through the Cochlea via bone conduction.

In short, musicians experience music quite differently while playing than we do as passive listeners. That is why when musicians hear music being reproduced with tactile sound transducers they're usually ecstatic! In fact, professional musicians have taken the transducer technology on the road to save their hearing, lighten the load, push their performance, and improve their sound for the audience. Used with in-ear monitors, tactile monitoring can replace up to four 18-inch subs in a folded horn design. Many drummers say they play better and the roadies have a lot less to load and tear down without the massive sub cabinet.

As an example of how transducers can impact someone who makes music his/her life, consider this anecdote that was relayed to us at Clark Synthesis. During a reception, a conductor for the Denver Symphony Orchestra stepped onto a cedar deck that was playing a Bach orchestral piece via Clark Synthesis transducers. After several minutes, he exclaimed that he had never heard orchestral music reproduced so clearly and with such feeling. He exclaimed that he could hear and feel each instrument individually. Soon, he was sprawled out on the deck with his eyes closed and a grin on his face.

Musicians do, indeed have a different frame of reference. If you want to experience a performance the way musicians do, all that is required is a Tactile Sound Transducer installed properly in the listening environment.

### **Home Theater**

The Clark Tactile Sound Transducer (TST) is essentially a special loudspeaker driver designed to vibrate a large, heavy structure—such as a chair or a floor—instead of a small, light speaker diaphragm. TSTs are not designed to replace conventional speakers and subwoofers, but to supplement them. A Clark Synthesis TST is a full-range device (in contrast to ordinary "bass shakers") and it supplements conventional home theater speakers and subwoofers in two ways: first, it delivers physical vibrations that you both feel and hear through bone conduction; and second, it forms what amounts to a very large speaker, wherein the resonant structure to which it is attached actually generates audible sound. We have found that some people who install a TST in a chair or couch for use with movies, video games, or music prefer to limit its range to the lower frequencies; that is, vibrations you mainly feel, rather than hear. This can be achieved by using a low-pass filter on the signal, or supplying the TST with the LFE/Sub (Low Frequency Effects) channel of a surround-sound signal (see the Clark Synthesis Tactile Sound installation manual for more details).

It must be noted, however, that allowing higher frequencies in the mix improves the intelligibility of movie dialog, and clarity in general. Indeed, this is one of the principal benefits of bone conduction. The trade-off, however, is that occasionally you will hear voices in a mono-soundtrack or an off camera scene coming from the seat of your chair! Should this occur, try adjusting the volume of the TST's amplifier and the low-pass filter setting until an acceptable balance is achieved. Another easy way to fine-tune this is to use an equalizer to filter out the imposing frequencies. An equalizer added to the system allows wide bandwidth effect experience compared to a crossover. (Note that "chair sound" is not an issue when you wear headphones. In fact, this is an especially great way to experience video games.)

### **Automobiles**

Adding TSTs to your car can assist in lifting the sound stage to head height and clearly define center stage imaging. The TST can bring out details that standard speakers cannot produce. With the use of tactile sound, the hearing paths improve the in-car experience like no other component can. ***If you plan to install a TST in your car, Clark Synthesis highly recommends that you contact a car audio installation specialist.***

### **Platforms, Risers, Stages, and Decks**

When TSTs are used beneath floors, stages, or wood decks, full-range reproduction is desirable. This is because the TSTs are being used both to generate tactile sensations and to supply audible sound via the coupling surface that supplements the main speakers. A popular application for the All-Weather TSTs is to use them to reproduce music by attaching them to wood decks.

## **Military Simulation**

The original environment for tactile sound transducers was in military simulators, where they are used to generate motion cues and simulation soundtracks. These low-frequency cues are necessary to impart realism into flight and tank simulators. At the same time, the TSTs produced the full range sound of the actual craft to increase its realism.

## **Theme and Amusement Parks**

Theme and amusement parks use hundreds of tactile transducers in conventional rides and simulation rides. Clark Synthesis Tactile Sound Transducers are one of the favorite building blocks as the parks design new attractions.

## **Other Home Applications**

Along with use in home theater applications, TSTs have been designed for use in swimming pools, hot tubs, and spas. Based on the same transducers technology, these applications deliver amazingly clear sound by activating water, fiberglass, and wood.

## **Special Needs Populations**

These devices are one of the only ways the profoundly deaf can experience external sounds. Tactile transducers have been used under Wenger portable stage floors (risers) at concerts for the hearing impaired, and many participants have described the results as "a miracle."

## **Here is a general list of applications for Clark Synthesis Tactile Sound Transducers:**

- Home Theater
- Pools and Underwater Sound (Aquasonic speaker line)
- Commercial Theater
- Studio and Stage Instrument Monitoring for Musicians
- Virtual Reality and Gaming
- Flight and Warfare Simulators
- Spas and Hot Tubs
- Theme and Amusement Parks
- Automotive Sound
- Outdoor Decks
- Hearing Impaired and People With Special Needs

## **One Final Note: Know What You Are Buying**

### **There Is a Difference Between Shakers and Tactile Sound Transducers**

Great confusion has been generated regarding the difference between Tactile Sound Transducers and shakers. The difference is simply a factor of bandwidth and fidelity.

Clark Synthesis manufactures the world's only Tactile Sound Transducers that deliver high output, full fidelity, full bandwidth sound. From this product line we developed the term Full Contact Audio. Tactile Sound Transducers make complete use of the four ways tactile sound is perceived, and can also be used audibly to achieve all five paths of sound perception.

On the other hand, shakers manufactured by other companies, by design, have limited bandwidth and lack fidelity, which reduces the quality of the experience. By using shakers, the perception and intelligibility of a soundtrack is greatly compromised. Also, the shaker's lack of fidelity in sound enhancement applications, such as home theater and sound monitoring by musicians, makes them the less desirable choice for those applications.