Active Sound Therapy

Targeting the Auditory, Cognitive, and Autonomic Drivers of Intrusive Tinnitus

By Sara Downs, Aud

Tinnitus isn't just an auditory phenomenon. Under certain conditions, it's a multisystem experience involving the auditory system, cognitive interpretations, and the autonomic nervous system's state of arousal. When tinnitus becomes intrusive, all three systems are involved. Active Sound Therapy (AST) is a novel approach that integrates three evidence-based interventions—customized sound therapy, cognitive behavioral reframing, and bottom-up breathwork—to address all three systems in a coordinated effort with specific timing.

Tinnitus as a Multisystem Experience

Intrusive tinnitus involves three interconnected systems:

The auditory system generates the tinnitus signal as a consequence of changes to pre-existing spontaneous neural activity that may increase the power, or produce abnormal synchrony across nerve fibers, in the auditory pathway.[1]

The cognitive system interprets the tinnitus sound. This involves one's beliefs about what the sound means, predictions about the progression of tinnitus, and catastrophic thoughts about its impact. Research has shown that cognitive processes shape emotional responses and that changing one's thoughts about tinnitus—easier said than done—may reduce tinnitus distress.[2]

The autonomic nervous system contributes one's physiological state and whether tinnitus is evaluated as threatening or safe. In other words, the sympathetic nervous system is your body's fight-or-flight response, heightening alertness to perceived threats, while the parasympathetic nervous system is your "rest-and-digest" state, promoting calm and allowing the brain to deprioritize signals like tinnitus (see chart on page 41). Sympathetic activation narrows attention to threats, making tinnitus intrusive, whereas parasympathetic engagement allows attention to broaden and tinnitus to fade from focus.[3]

These three systems interact continuously. The tinnitus signal, as with any other sound event, triggers cognitive interpretations, influences emotional state, shapes autonomic arousal, and affects attention to tinnitus, thus reinforcing the cycle. Interventions that fail to address the contributions of all three systems—for example, providing sound therapy without addressing a person's thoughts and autonomic state or doing the cognitive work without enriching the auditory system or shaping the physiological response—may not produce the clinical outcomes possible when multiple pathways are addressed together at key moments.

How the AST Protocol Developed: Consilience in Clinical Practice

AST emerged from twenty years of research, clinical observation, and

refinement in my clinic. In 2001, I was initially trained in Tinnitus Retraining Therapy (TRT) by Pawel and Margaret Jastreboff. TRT is effective, and substantial research supports it. However, achieving TRT's intended outcome—habituation—depends upon patient commitment and adherence to the program over 6–12 months. In clinical practice, these requirements can become roadblocks to patient improvement.

I recognized that the neurophysiological model presented by Pawel Jastreboff could serve as a springboard for a new approach to achieving habituation that simultaneously addressed the other systems involved in tinnitus distress.

Searching for additional tools to facilitate habituation led me to explore the fields of psychology, neuroscience, and functional medicine. A turning point came when I was certified in Mind-Body Medicine (MBM) at the Center for Mind-Body Medicine, where I was introduced to the work of Stephen Porges. The MBM curriculum included techniques for nervous system regulation and self-care that I realized could be integrated into audiology practice.

The MBM approach emphasizes experiential exercises, such as breathwork, body awareness practices, and somatic techniques, that help patients directly influence their autonomic nervous system state.

This moment of consilience, when different fields of science linked together to create a new approach, led to the development of AST. AST maintains TRT's neurophysiological foundation, integrates MBM's experiential exercises, coordinating them with specific timing, and includes audiologic intervention and sound therapy.

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The hypothesis is that by using breathwork and body awareness practices to shift the body's autonomic state while simultaneously providing counseling intended to demystify the tinnitus event along with sound therapy, we could help a patient's nervous system reclassify tinnitus as a nonthreatening signal, thereby facilitating faster habituation.

Integrating What We Know Works

AST integrates three approaches, each with a strong research foundation:

Customized sound therapy addresses hearing and tinnitus characteristics, as well as the patient's sound preferences.

Cognitive behavioral techniques address the cognitive system through education about neurophysiology, reframing unhelpful beliefs, and utilizing cognitive strategies. These approaches have the strongest research evidence for reducing tinnitus distress.[2]

Bottom-up breathwork and experiential exercises address the autonomic nervous system through slow diaphragmatic breathing with prolonged exhalation, body awareness practices, and other MBM techniques that directly activate parasympathetic pathways, increase heart rate variability, and reduce stress markers.[4]

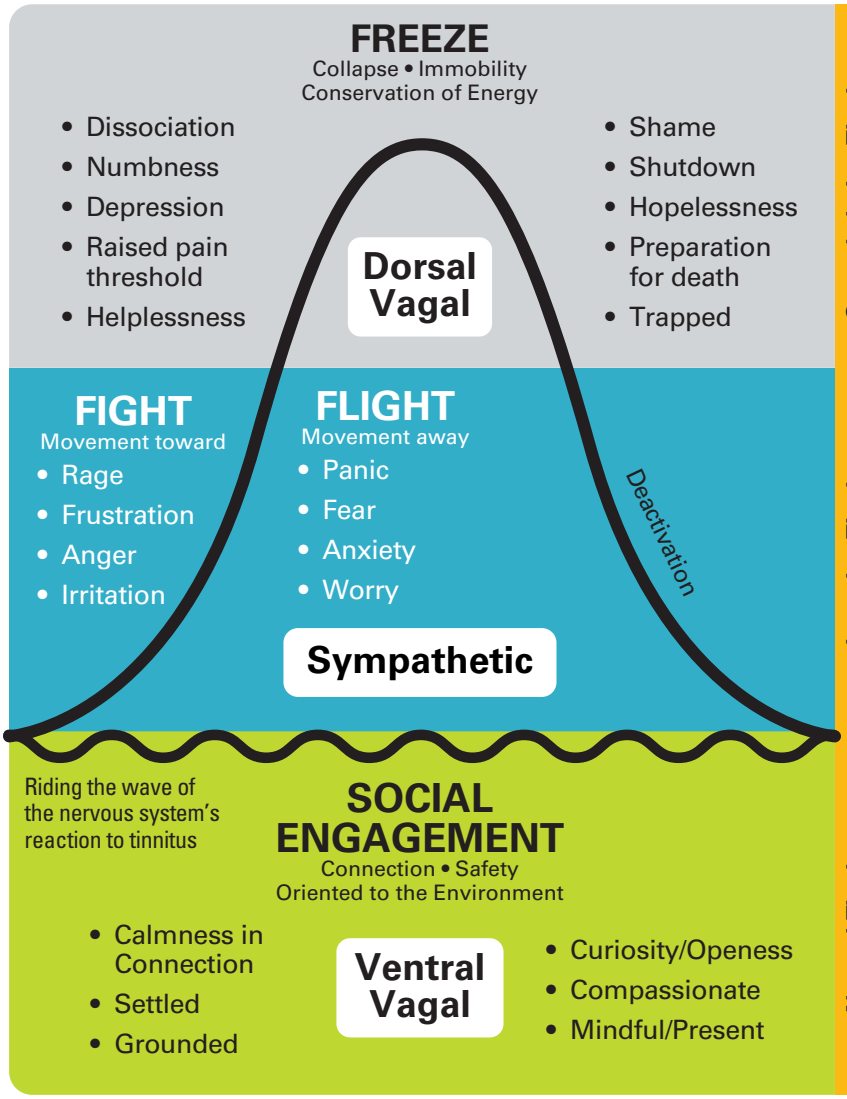
As a clinical audiologist, I find it important to make the point that for most people experiencing tinnitus, there is an underlying audiological condition. In these cases it is imperative that the underlying condition is addressed, most often with amplification that has been verified to stimulate the impacted areas of the auditory system.

Additionally, sound therapy programs in combination hearing devices should be customized to provide additional stimulation in the frequency region of tinnitus using sounds that the patient finds comforting and pleasant.

During a treatment session, minimum masking levels can serve as a guide to the type of sound presented and the level needed to achieve interaction with the tinnitus.

None of these therapies is new. The novelty lies in how they're combined and the timing of their application. Clinical observations over years of practice have revealed that when these three approaches are

The Polyvagal Pathways of Tinnitus



Overwhelming Tinnitus

Parasympathetic Nervous System
Dorsal Vagal Complex

Increases:
Fuel storage & insulin activity • Immobilization behavior (with fear)
Endorphins that help numb and raise the pain threshold
Conservation of metabolic resources

Decreases:
Heart rate • Blood pressure • Temperature • Muscle tone
Facial expressions & eye contact • Depth of breath • Social behavior
Attunement to human voice • Sexual responses • Immune response

Intrusive Tinnitus

Sympathetic Nervous System

Increases:
Blood pressure • Heart rate • Fuel availability • Adrenaline
Oxygen circulation to vital organs • Blood clotting • Pupil size
Dilation of bronchi • Defensive responses

Decreases:
Fuel storage • Insulin activity • Digestion • Salivation
Relational ability • Immune response

Neutral Tinnitus

Parasympathetic Nervous System
Ventral Vagal Complex

Increases:
Digestion • Intestinal motility • Resistance to infection
Immune response • Rest & recuperation • Health • Vitality
Circulation to non-vital organs (skin, extremeties)
Oxytocin (neuromodulator involved in social bonds that allows immobility without fear) • Ability to relate and connect • Movement in eyes and head turning • Vocal rhythm • Breath

Decreases:
Defensive responses

Adapted by Sara K. Downs, AuD, from: S. Porges, A. Wheeler, C. Sanders, R.J. Walker

Freeze (Dorsal Vagal—Parasympathetic) When tinnitus feels overwhelming, the nervous system may shut down into this state, which is marked by numbness, hopelessness, and disconnection. The sound feels inescapable.

Fight or flight (Sympathetic) Intrusive tinnitus can trigger this defensive state, fueling anxiety, irritability, and hypervigilance. The nervous system has classified the sound as a threat, focusing attention on it.

Social engagement (Ventral Vagal—Parasympathetic) This is the target state to enter when tinnitus becomes intrusive, though it is not a state to live in permanently. The goal of Active Sound Therapy is learning to recognize your body's signals indicating which state you're in, then taking active steps to shift. Breathwork—slow, diaphragmatic, with a prolonged exhale—is an effective tool for making that shift, moving the body out of defensive arousal. It is through repeated practice of noticing sympathetic activation and using breathwork and sound therapy to change the state in the moment that teaches the nervous system to reclassify tinnitus as non-threatening, and that is what allows habituation to occur.

What about the parasympathetic nervous system? The parasympathetic nervous system has two distinct branches that produce opposite experiences. The **dorsal vagal** branch (top of chart) is the older, primitive branch that facilitates shutdown and collapse. The **ventral vagal** branch (bottom) is the newer, more evolved branch that facilitates calm, connection, and safety. Both are technically "rest" states, but it's ventral vagal that supports healing and habituation. The chart can be thought as a ladder, with the goal of Active Sound Therapy helping a person spend more time at the bottom rung, where a person feels safe and socially engaged.

It should be noted that polyvagal theory, while widely applied in clinical and therapeutic settings, remains a subject of ongoing scientific debate, with some researchers questioning aspects of its neuroanatomical claims. It should thus be understood as a useful framework for thinking about nervous system states rather than a fully settled model.

coordinated and deployed at specific moments, such as when tinnitus becomes intrusive, habituation occurs more efficiently than when they're applied separately or on rigid schedules disconnected from patients' real-time experiences.

How the Nervous System Detects Safety and Threat

Neuroception is the nervous system's automatic, subconscious process of evaluating sensory signals as safe or as threatening. In the case of intrusive tinnitus, neuroception classifies the sound as dangerous, which drives vigilance and increases a person's distress, and both these responses impede habituation.

The concept of neuroception—the nervous system's preconscious process of scanning for safety or danger cues—is central to the AST protocol.[5] When neuroception detects danger, the body shifts into a defensive state, causing sympathetic activation, rapid shallow breathing, muscle tension, and narrowed attention fixated on the perceived threat. When it detects safety, parasympathetic pathways engage, allowing a relaxed body state, broadened flexible attention, and the fading of signals classified as safe without conscious effort.[6]

Habituation is the result of the nervous system learning that tinnitus is unimportant and safe to ignore. It is an active neurological process, not passive waiting.[7] The learning happens more readily when signals occur in contexts of physiological safety.

Porges emphasizes that visceral feedback fundamentally shapes neuroception: "Visceral states color our perception of objects and others."[3]

> ***"Habituation is the result of the nervous learning that tinnitus is unimportant and safe to ignore. It is an active neurological process, not passive waiting."***

Our internal bodily state influences how our nervous system classifies everything, including tinnitus. Physiological safety promotes neutral classification; defensive activation makes the same sound an urgent threat signal.

This explains why you can't simply think your way out of intrusive tinnitus. Cognitive understanding helps, but if your autonomic nervous system remains in defensive arousal, that physiological state overrides the ability to think oneself out of being distressed by tinnitus. The body's state is primary.

Bottom-Up Regulation Through MBM

MBM provides a toolkit of experiential exercises designed to directly influence the state of the autonomic nervous system. Slow, deep breathing with prolonged exhales directly stimulates the vagus nerve, which sends signals to activate parasympathetic pathways.[8] Research shows that the breathwork's effects can be measured as evidence of improved parasympathetic function.[9]

This process works regardless of thought. You can have anxious thoughts while diaphragmatic breathing shifts your physiology toward safety. This is bottom-up regulation, working directly with the body to influence the nervous system. Beyond affecting heart rate and stress hormones, breathing changes neural communication from the respiratory system to brain regions that regulate behavior, emotion, and cognition.[10]

The MBM approach emphasizes teaching patients these techniques experientially. In clinical practice, patients don't just hear about breathwork or read instructions. They practice during sessions until they can reliably shift into parasympathetic activation. They learn to recognize what it feels like in their body when the shift occurs. This hands-on training ensures patients have genuine capability, not just intellectual understanding.

Why Timing and Coordination Matter

AST's distinctiveness lies not just in providing a multi-faceted three-pronged intervention, but in deploying each intervention element at the right time, in a coordinated effort to address the three aforementioned tinnitus-related systems. The protocol trains the patient to use awareness of internal bodily signals, known as *interoception*, to identify when tinnitus shifts from background to intrusive. Shallow breathing, tense shoulders, and clenched jaw are

examples. These sensations signal neuroception is shifting toward threat and autonomic arousal is shifting toward a defensive state.

That moment is the cue to deploy the full AST protocol: Turn on customized sound therapy (activate the auditory system), engage in slow breathing with prolonged exhales (shift autonomic state), and draw on cognitive understanding (reframe the experience). The protocol addresses all three systems simultaneously, enriching the auditory environment while supporting the patient's sense of physiological safety and enhancing their cognitive understanding of tinnitus and the intervention process.

Clinical observations showed that specific timing matters greatly. When patients deployed the protocol at random times or on rigid schedules disconnected from their actual tinnitus experience, habituation occured more slowly. For example, at follow-up visits when patients had only deployed one or two of the methods, they often felt that only a small change or no change in their tinnitus response had occurred.

Most often the part they were omitting was the breathwork. When they learned to identify the moment tinnitus was becoming intrusive and intervened right then with the full protocol, including the bottom-up breathwork, their treatment outcomes progressed. Through repeated practice at these specific moments, the nervous system learns a different response: The tinnitus signal becomes neutral and no longer triggers a defensive arousal.

As one patient put it, "I really didn't think the breathing part mattered that much, so I just turned on the sound therapy when my tinnitus was bothering me. It helped at the moment, but I was still noticing it a lot. But after coming back and learning again how the breath part shifted the nervous system, I started doing it. Reluctantly. But that's when things really changed for me. I rarely notice my tinnitus now."

Patient-Directed Treatment

AST is deliberately patient directed. Evidence shows empowering patients to actively manage chronic conditions improves outcomes.[11] Patients learn to regulate their nervous system state, develop interoception, that knowing of when intervention is needed, and can deploy tools independently.

Empowering patients in this way addresses the feelings of lack of control that so many people report make tinnitus so distressing. Learning you have agency over your nervous system response, even if you can't control the signal directly, shifts your relationship with the problem.[12]

Facilitating Habituation

AST facilitates habituation by directly addressing the autonomic state that enables or prevents the body's perception of safety; it systematically creates conditions of physiological safety while tinnitus is present through breathwork-induced parasympathetic activation, enriched auditory input, and cognitive reframing.

This multisystem approach addresses the reality that tinnitus isn't just auditory. The auditory system generates the signal, the cognitive system interprets its meaning, and the autonomic nervous system evaluates the threat. All three systems need to be engaged for effective habituation.

My clinical observations have shown that patients using AST consistently report habituating to tinnitus more quickly than with other commonly used strategies. Last year, we had 50 practitioners complete AST training, and they are now offering it in their clinics. As more audiologists begin to implement AST, the protocol will be further refined and improved as we make clinical observations and share data through professional collaboration.

Over the past few years, I have been collecting clinical data about the outcomes of patients using AST in our clinic. Coauthor Marc Fagelson, PhD, and I are preparing a retrospective study that examines clinical data from patients who completed the AST protocol for submission. We look forward to sharing the outcomes and contributing to the growing body of evidence on multisystem approaches to tinnitus management.

Sara Downs, AuD, is an audiologist and president of the Hearing Wellness Center and Tinnitus Treatment Center, a multi-site practice in northern Minnesota. With more than two decades of specialized experience in tinnitus treatment, she also holds certification in Mind-Body Medicine, an integration that shapes her approach to patient care and informs the self-care practices she teaches to both patients and colleagues.

She is the developer of the Active Sound Therapy protocol and recently completed a retrospective study examining its efficacy. Dr. Downs served as Interim Executive Director of the American Tinnitus Association from 2023 to 2024 and continues to serve on its board of directors. Outside the clinic, she can be found working as a roadie and running sound for her son's band, or out on the trails, hiking or biking through the northern Minnesota woods.

Complete references can be found here.