Binaural Coordination: Making the Connection

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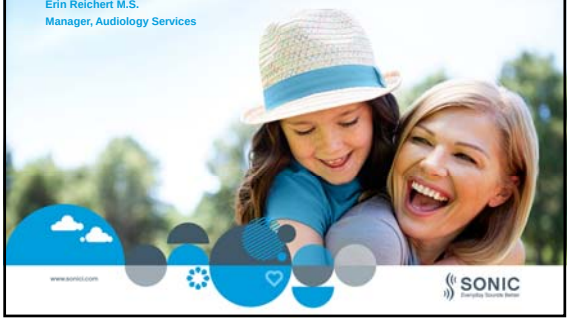


Why Does It Matter?

With Binaural Coordination, independent functionalities merge to create a single, unified and natural listening experience

Learning Outcomes

- **After this course, you will be able to**
  - Describe what Binaural Coordination means in terms of Sonic's Product Offering
  - Describe the functionality of Environment Classification, Non-Telephone Ear Control, and Binaural Synchronization
  - Summarize what products at Sonic offer Binaural Coordination

The Dynamic Environment

Ever Changing World

- Imagine the listening environments YOU have been in, just today
- These moments make up the very spectrum of human communication and interaction

The Normal Hearing Ear

- Healthy Cochlea
  - Controls variations in amplitude by amplifying low-level and compressing high level sounds
  - Tonotopic arrangement of inner and outer hair cells maintain frequency contrast of speech
- Healthy Brain
  - Psychoacoustic properties of time and level differences between ears determine spatial separation and location of sound sources

Uh Oh…

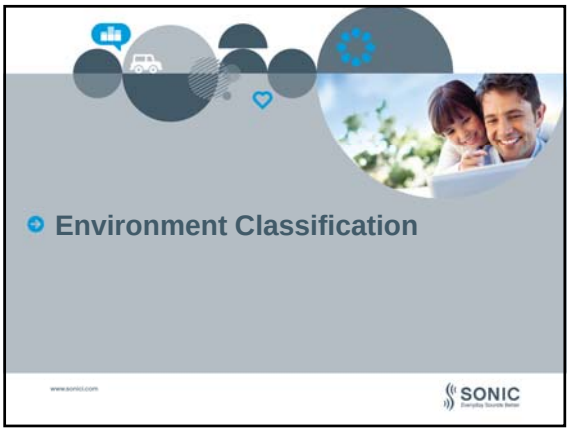
- **Remember the ever changing dynamic world?**
  - Introduce hearing loss
    - Loudness
    - Speech Discrimination
    - Background Noise
    - Sound Localization
- **Major disadvantage without amplification**

Limits of Amplification

- **Processing capabilities**
- **Burdened by having to make manual adjustments**
  - What program is my instrument in?
  - Drats, wind…now what?
  - Did I turn up my right more than my left?

The Sonic Solution

- **Simplicity – 4S Foundation**
  - Focus on a solution that makes it simple to wear Sonic instruments.
- **The Environment Classification algorithm analyzes all acoustic signals to provide the best adaptive response for all situations**



Environment Classification

What is Environment Classification?

- **Method of acoustic signal analysis that recognizes complex patterns**
- **Temporal and Spectral Characteristics**
  - Detect
  - Measure
  - Classify

…IN JUST 300 milliseconds!

What is Evaluated?

Detection	What This Tells Us
Periodicity	Identifies the harmonics found in speech, music, or other signals like wind
Modulation Rate	Is speech present or absent
Signal-to-Noise Ratio	Establishes how much noise exists
Interaural Time Differences	Variations in sound pressure level arriving at each microphone
Interaural Level Differences	Variations in sound pressure level arriving at each microphone

The Result

- After the source is analyzed, the algorithm organizes the scene into one of five possible categories for the instrument to respond

1. Speech in Noise
2. Speech in Quiet
3. Noise Only
4. Quiet Only
5. Wind

Time to Coordinate

- Prioritization and synchronization of environmentally classified categories occur between both instruments
- If both instruments detect different environments, the highest priority environment dominates and synchronize to the dominant environment

The Universal Environment

- Speech is king
- Speech in Noise is the highest priority giving an extra 'hands-free' advantage
  - Speech in Quiet
  - Noise Only
  - Quiet Only
- Wind is excluded as it is managed separately between ears

Further Optimization

- **Adaptive and Hybrid Directionality**
  - Fade between the most advantageous polar plots necessary for the situation
- **Speech Priority Noise Reduction**
  - Attenuates background noise, only as much as needed, to restore listening comfort

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Gain Settings Optimized

Category	Optimized Gain Setting
Speech in Noise	Compression of speech-related input is decreased to maximize phonemic cues in noise
Speech in Quiet	Amplification of speech-related input is increased to accentuate conversation with less listening effort
Noise Only	Amplification of loud inputs is reduced for greater comfort in noise when speech is not present
Quiet Only	Amplification of soft inputs is reduced for a transparent sound in quiet
Wind	Low-frequency amplification is reduced only for the affected side; the opposite side remains unaffected

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The Essentials

- **Sonic's Digital Signal Processor provides the computation power needed for a robust, fast acting and accurate system**
- **Wireless Technology of Binaural Coordination**
  - Information is exchanged at a net rate of 120,000 bits/second
- **Allows extremely rapid detection and synchronization of classified settings between ears**

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In a Nutshell

- **The Result?**
  - A full 360(degree) binaural optimization of the auditory environment
- **The Benefit?**
  - A hands-free, unified auditory experience for the listener in dynamic environments
- **The Value**
  - A happy, smiling patient who loves their hassle free hearing instrument

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Non-Telephone Ear Control

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Simple and Effortless

- **Listening on the telephone presents challenges for hearing instrument wearers, especially in noisy situations (Kochkin, 2005)**
- **Improved system with introduction of Auto Telephone**
  - What happens when it's noisy?

How It Works

Simplicity at its best

1. Auto Telephone active in instrument
2. User places phone with adequate magnetic field near the instrument
3. Magnetic switch in instrument engages the Auto Telephone Program
4. With Binaural Coordination active, the non-telephone ear responds simultaneously as it's configured in EXPRESS*fit*

Configuration Options

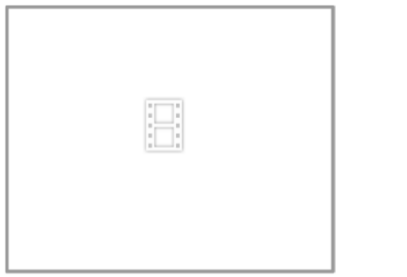
Configuration	Non-telephone Ear Behavior
0 dB	No change occurs to the non-telephone ear during phone use
-6 dB	Amplification of the non-telephone ear is attenuated by 6 dB
Mute	Amplification of the non-telephone ear is silenced completely

Suggestions for Use

Configuration	Best Setting For
0 dB	Patients who are not distracted by background noise during phone use
-6 dB	Patients who are slightly bothered by background noise during phone use, but still want to retain some auditory awareness of the environment while on the phone
Mute	Patients who are disturbed by environmental noises while using the phone

Versatility at its Finest

- **Most flexible way to hear on the phone**
- **Is not side dependent**
  - Can switch between ears during 1 single phone call
- **Easy to configure via EXPRESS*fit***
- **Very positive patient response**



Binaural Synchronization

Two Ears Working as One

- **Wireless feature that coordinates manual changes on the ear or via accessory**
  - Program Button
  - Volume Control
  - Push Button Mute
- **Works via carrier frequency of 3.84 MHz**
- **Occurs simultaneously**

Configurable Controls

Local Control	Binaurally Synchronized Behavior
Program Button	A short press of the program button made on one instrument results in the same program change for both instruments
Volume Control	An increase or decrease of the volume control made on one instrument results in an equal volume change in the other instrument
Push Button Mute	A long press of the program button on one instrument simultaneously mutes both instruments
Accessory (RC-P or SoundGate)	An adjustment (VC, Program Button or Mute) ensures that adjustments occur in both ears, simultaneously

Simplicity & Accuracy

- **Hassle free**
  - Adjustments can be made to either instrument
    - Important for dexterity issues
  - Guarantees accuracy between ears
    - Programs always match from side to side
    - Volume levels evenly raise and lower from side to side
- **Benefit**
  - Streamlined, accurate operation of controls

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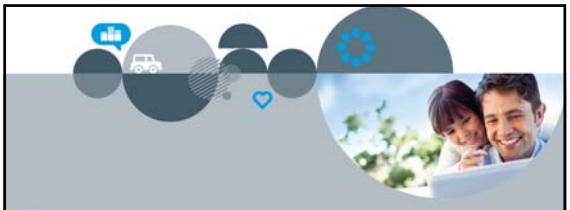

EXPRESS*fit* with Ease

With Sonic's commitment to Simplicity, the selection of Binaural Coordination is simple and straight-forward

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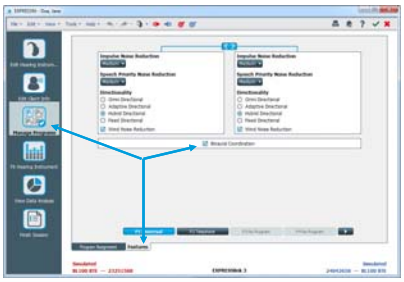
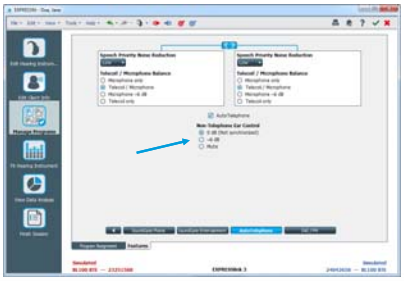
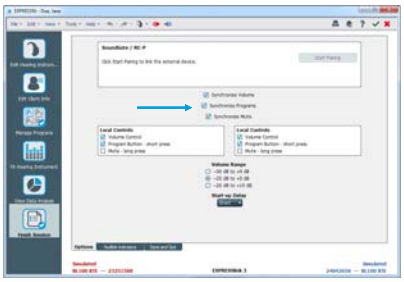
Binaural Coordination

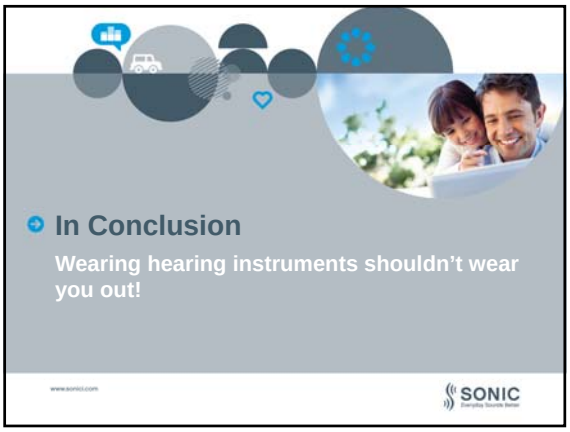


Non-Telephone Ear Control



Binaural Synchronization





In Conclusion

Wearing hearing instruments shouldn't wear you out!

With Binaural Coordination…

- **Dynamic listening environments are stabilized with Environment Classification**
- **Telephone use becomes effortless with Non-Telephone Ear Control**
- **Manual volume and program changes are minimized with Binaural Synchronization**

Thank You

- **Sonic Spotlight Binaural Coordination: Making the Connection Author, Tara Helbling**

Final Comments

- Thank you so much for attending today's session on Binaural Coordination: Making the Connection
- Any Questions?
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