



The calm after the storm

Audi acoustics experts hunt down noises in the car interior, and silence them with a special haptic coating. An acoustic test drive into the realm of onomatopoeia. Text: Michael Thiem



Audi uses Wörwag anti-squeak coatings in the car interior. Go on a journey of discovery – touch to find it.

Phooh. That's how it starts. Two minutes later, it is more of a phooohh. And as every second goes by, more Os are added. What you sense changes rapidly – like the temperature in the interior of the Audi Q5. In the motionless air, your palms turn moist and your pulse rises. It's hot. And it's going to get hotter fast. You know the feeling, when it's a sunny 25°C and you don't wind down the car windows. It is quiet. But it's hardly relaxing! The air conditioning is off. The fan is off. No radio. Just your own pulse – and the first beads of sweat. The aim of this unusual test drive at Audi's Ingolstadt test track is to detect noises and to find their causes: creaking leather, vibrating plastic parts, or metal rubbing. Sounds that can easily steal a new car owner's joy. Once found, the noises can be eliminated – with, among other things, the help of a special haptic coating that enhances the interior while also making it more resistant to wear. Thanks to the haptic coating, 10 to 15 percent of noises in the vehicle's interior can be eliminated.

Eavesdropping

Günter Klos hears everything. He works in the Total Vehicle Quality Control as head of "Watertightness and Noises". This makes him Audi's "reference ears". Internally, they refer to this department as the "rustle and click team". Every time 47-year-old Günter gets into a car, it's time for onomatopoeia – a term that school kids learn by the age of 13, but soon forget. We recognize it most as the description of the sound effects in comics. Onomatopoeia is painting sound with letters. Like "bumpabumpabumpa" when a ball bounces down the stairs. Or "grmpf" when Donald Duck is annoyed again. As Klos says, "The Eskimos have a hundred words for snow; we have our own vocabulary for noises in the interior of a vehicle."

Audi has had this department for more than 25 years, and it has a clear mission: To carefully listen to the sounds in the vehicle's interior. Klos and his team of eight start work long before there is anything to hear. Almost three years before production begins, the experts monitor the development process and study the digital models, plans, and computer simu-

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lations. They "hear" with their eyes. "We go through all the metal tight spots with the designers," says Klos. "We know, for example, that during coating, liquids won't flow properly if the distance between two metal plates is less than two millimeters." So later, this can lead to cracking noises. Welding points are also studied early on in the development process, because in the worst case, there may be rubbing at these spots later. "Creeeek, creeeek, buzzz, whirrr," are some of the onomatopoeic sounds Klos uses to summarize the acoustic perceptions. "We have a checklist that we go through meticulously," says Klos, who sees himself more as a detective than as an engineer. "Actually, we are technicians. We just wear casual clothing instead of ties. This is because sometimes we have to literally crawl into the vehicles. It can get sweaty. So we often need a fresh change of clothes." It can take days of perspiration to isolate a specific noise. Metal sounds are particularly challenging and hard to identify. On one Audi A7, they even had to cut open a side panel. The source of the metallic cracking sound was finally traced to an absorber bearing. An isolated incident, which you could say is routine in this job – new challenges are the norm.

Once the first prototypes and pre-production vehicles are ready to roll, they hit the road. Tenacity and physical fitness are essential for the acoustic test drives. One guy is at the wheel, and his colleague might be in the back seat or



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completed his Wörwag training as a coatings lab technician in 1982. Today he is a market manager responsible for automotive interior coatings worldwide. "My job is particularly nice because the look and the quality of our soft coatings make life more enjoyable."

the trunk with a flashlight in one hand and a stethoscope in the other. "Once we had someone perched on the fender with the hood open!" They are listening for where it squeaks, buzzes, or crunches. Every sound is recorded using Audi's established expressions. The whole team knows immediately what is being discussed. They speak the same sound language.

The acoustics experts travel the world 130 days of the year. Every week they cover around 5,000 kilometers. The climate is an all but constant companion – where they go, it is always extremely cold or extremely hot. This is because temperature has a huge impact on the sounds in the vehicle's interior. Materials expand in the heat. Leathers and plastics become brittle when it is very cold. Klos explains, "The warmer, the cracklier." All sounds are neatly listed and scored. A score of 1 means the driver needs to pull over and investigate, while a score of 10 means there is no issue and things can continue on. With a score of 5 on the Audi acoustic rating system, it is assumed that a critical customer will take the car into the repair shop and complain.

Once a year there is a special acoustic test drive with the entire model range. Audi has been doing that for 20 years. All the models are driven a punishing 10,000 kilometers on some very bad roads. Then Klos and his team are invited to do a sound check because Audi wants all their cars to be free of irritating noises, not only when they are brand new but also after years on the road. The critical points are the armrests, central console, door trims, and door handles. Klos is on the alert whenever two plastic parts are clipped together. A central console consists of about 200 parts. Over the years they will develop a small amount of play, which leads to squeaks, creaks, and crunches. In order to take the right precautions, Audi conducted a special study with different coatings – and opted for Wörwag's anti-squeak paint. "Compared with the alternatives, the results were significantly better," says Klos.

During pre-production testing of an Audi A3, 175 noises were identified and documented. To find the sources of the noises and prevent their recurrence in later production models,

the acoustic experts put the vehicle on a "hydro-pulse" system. Four computer-controlled hydraulic cylinders make the car move rapidly up and down, setting up vibrations at all the frequencies that require investigation. "This is a tool that allows us to get the whole vehicle vibrating in any way we want to," says Klos, inviting us to join in on the fun. Did you have a good breakfast? How much can you take?

The frequency begins to rise steadily. Your knee whacks the central console and your breakfast bun collides with your stomach walls. "We set the frequency so that we can constantly hear a certain noise. Then we can track it more easily," says Klos. Watch your head! The passenger's hand slaps against the window pane. The car keeps swinging back and forth, skipping and hopping. The frequency increases, a seat belt buckle starts buzzing like a swarm of bees. The rear shelf rattles, the armrest creaks, and the visor whimpers. By now the message is very clear: To hear it, you have to feel it. It is obviously an extreme laboratory scenario; no road in the world could treat a car this badly. Klos recalls a situation a while back where the zipper on the first aid pack started buzzing. The problem was solved by swapping the zipper for a cord tie. As Klos says, "It only takes one or two sounds to spoil a car's impression of high quality."

Quality assurance includes testing the sound system, since the interiors of many vehicles are increasingly becoming mobile concert halls. This is why Klos has a special sound CD with extremely low and super-high frequencies. When you're testing the frequency range from 447 hertz down to 35 hertz, you feel it in your stomach – like being in the first row at a Metallica concert. The sonorous bass of David Munyon's "Four Wild Horses" would be totally ruined by any buzzes or rattles. To test this, the volume is turned up to a predefined level. Klos himself drives an Audi A6. Sometimes he even stops to track down an unusual noise, much to the chagrin of his wife. It's a rare exception for him to put up with unusual sounds in his car. Like Latin American reggae. "Ah! – that must be my son's CD," he laughs. ■

WET-ON-WET METHOD

Helpful and high-quality

Automobile manufacturers have been successfully manufacturing using the wet-on-wet method developed by Wörwag since 2006. Without oven-drying, a water-based haptic coat is applied five to seven minutes after the first coating has been applied. This coat has a dampening effect and positively enhances the interior acoustics. The composition complies with the common interior specifications of premium manufacturers for use on materials such as ABS, PC/ABS and PC. Basically, any component made of one of these materials can be coated.

Audi uses the haptic coating R6483 H. The principle of the wet-on-wet coating with a suitable top coat is also used by BMW. Other manufacturers are planning to introduce this concept in their production lines.