

Savoring Coffee on Tiptoe

Novicos works with Miele to develop fully automatic coffee machines with a particularly pleasant sound

Hamburg. Christiane Gillner likes to drink coffee to wake up in the morning. While the the rich brew makes its way through the stainless steel filter at 15 bar, she likes to think about the day ahead. Neither she nor the other 80% of Germans who thirst for coffee in the morning need the noise of a machine.

Jutta Tembaak drives to the office in Gütersloh every morning at half past six. Tembaak is a development engineer and project manager for fully automatic coffee machines at Miele. Over the past two years in particular, the long-established German company from Gütersloh has surprised everyone with extraordinary growth figures in this product segment.

The appliance manufacturer knows its customers and knows that fully automatic coffee machines are at their peak in the morning when people are at home in peace and quiet. This is when people are most sensitive to the volume and sound character of kitchen appliances. This is why Tembaak has been promoting the topic of acoustics in its area of responsibility for years and has launched a comprehensive acoustic project for fully automatic coffee machines in 2022.

Acoustics: not espresso, but lungo

"I see acoustics as just as sustainable as the service life of our devices. It doesn't help us to have selected machines acoustically optimized on the outside if we have to start from scratch every time we change series," explains Tembaak.

To the Point

- Miele is working intensively on the acoustics of its new fully automatic coffee machines.
- Novicos provided support with a transfer path analysis for a holistic understanding of the acoustic relationships.
- Results and solutions were presented visually and acoustically in a
- VR environment
- The physical prototype confirmed the results of the simulation



"I want to solve the problem of acoustics in coffee machines once and for all. We need to know all the acoustic processes in the machine and understand the interdependencies. Neither a design engineer can do this in an ongoing process, nor a design service provider with a lens on a project. We needed a partner with an eye for the big picture and an acoustic expertise that I can trust even in the deepest waters. For us, that's Novicos."

With a team of four under the direction of Dr. Sören Keuchel, Novicos set out to explore the acoustic processes and interactions of Miele's fully automatic coffee machines.

The hidden heavyweight

Christiane Gillner, a physicist at Novicos, was enthusiastic about the project. In front of her stood the dismantled coffee machine - in pieces, but fully functional. "We keep the machine alive and measure it while running," says Gillner. "This is the only way we can separate the sound paths and study the influence of individual modules on the system. The aim was to obtain real measurement data and optimize it acoustically using simulations."

"The most exciting thing is when we are in pursuit of an acoustic heavyweight," says Gillner, describing the highlight of her experiments. In the simulations of the structure-borne sound path, the team had identified vibrations that behaved atypically and did not match the known modules. "We wouldn't have got anywhere with vibration measurements. That's why we did a blocking force measurement." And there it was. The big surprise.

A fully automatic coffee machine consists of a handful of elements that generate acoustic stimuli and are therefore wellknown culprits for acousticians. Novicos discovered that something was missing from this hit list of the top five sources of noise from coffee machines. They added a module whose role is determined solely by physical interactions and which had previously been completely ignored. "I was surprised and delighted at the same time," says Tembaak. "This is exactly why we did the right thing by publishing the project in its entirety. It is more efficient and effective to do it once than to test it ourselves for 20 years".

Putting words into action

The hybrid simulation and measurement project was so successful that the company's other decision-makers had to experience the surprise with their ears - and their hearts. Novicos generated virtual sound files, incorporating all the acoustic improvements the team had developed. The result could be experienced through VR glasses in a virtual kitchen, using a standard machine - and a modified one.

"The silence that followed the presentation of our results was impressive," recalls Gillner. After this memorable meeting, the project was expanded. The results were to be verified with a physical prototype. Novicos built and measured the prototype to compare the results with the simulation. Both, customer Tembaak and service provider Gillner are satisfied: "The deviations ... »The most exciting thing is when we have an acoustic heavyweight on the track« ...



Blocked Forces Measurement of the Grinding Mechanism



Partial-section vibro-acoustic FEM model



were small and in the expected places. They confirmed the result in all important points."

Tembaak sums up the joint success of the project: "Thanks to the results, we now know once and for all what is really possible. In fact, we now even have an acoustic map for our fully automatic coffee machines. The fact that the prototype confirms the results of the simulations and measurements confirms my confidence." "The new findings from the project have the potential to fundamentally change the way we look at the design of fully automatic coffee machines," says customer Miele. But it's not just the big projects that fascinate Christiane Gillner. "If you work hard, every project can be a surprise." That's what drives us. Christiane Gillner smiles and warms her hands on her cup of brown gold.

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VR environment with experiential simulation and measurement data



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