

A chair for getting fit and trim

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With the help of the personal trainer, residents of KogniHome can improve their endurance and strength – while sitting. Credit: CITEC/Bielefeld University

Getting fit and athletic – while sitting? Researchers at the Cluster of Excellence Cognitive Interaction Technology (CITEC) of Bielefeld University are developing an active chair as part of the KogniHome research project. At first glance, the chair looks just like another other reclining chair with a footrest you would find in a living room in front of the TV. But upon closer inspection, the chair is actually connected to a virtual avatar and has all manner of technical refinements.

The [chair](#) can be adjusted for each individual member of the family and can react to, for instance, a person's physical condition and the time of the day. The virtual avatar leads family members to perform fitness exercises in the chair, and in the future, this avatar will also give feedback on healthy posture. In addition to this, the chair will unobtrusively measure respiration and heart rate, allowing it to monitor all important physical parameters during exercise. This information will also be used for specific relaxation exercises done in the chair.

"The [personal trainer](#) can be used for relaxation but also as a comfortable reclining chair for watching TV, as it has all the functionality of a

normal chair," says Professor Dr. Thomas Schack, who heads the personal trainer subproject together with Dr. Ulrich Rückert for the Cluster of Innovation KogniHome. "The personal trainer can also assist the user in performing fitness exercises both correctly and in a way that is gentle on the joints. The trainer's program includes various yoga and fitness exercises, as well as instruction in strength building. "For the personal trainer, the researchers looked to the SonicChair, which was developed by Dr. Thomas Hermann with the Ambient Intelligence research group. Using an audio signal, the SonicChair alerts a worker when he or she has not changed their position in a long time. The chair measures a person's sitting position with sensors that are integrated into the surface of the seat.

The personal trainer can recognize each individual member of the family via Smartphone or Smartwatch. It assists elderly or physically challenged people to sit down or stand up by raising or lowering the chair. Depending on the user's preferences, it can automatically put up the recliner at 8pm, "knowing" that the person likes to watch TV at this time. It has integrated force sensors that measure how weight is distributed in the chair. Playful movement activities allow the back and stomach, for instance, to be strengthened. All exercises are led by a virtual avatar that appears on a display on the wall. The virtual coach also encourages exercise outside of the chair and thus enables exercise training within the apartment. With the help of the virtual personal trainer, all areas of the body can be effectively exercised. And as part of an individual training program, the personal trainer can be used together with the intelligent cooking assistant KogniChef to create a coordinated nutrition plan to best help the user reach his or her training goals.

"It is important to us that the coach does not intervene in the training in a domineering way, but rather assists and motivates the user. Accordingly, the virtual avatar does not force one to do the individual exercises or make strict rules, but points out when the user is overdoing or underdoing it,

and encourages him or her to give it their best – much like a human personal trainer. This coach helps overcome one's inner couch potato," explains Professor Schack. During the development phase of the various components of the smart, "thinking" apartment KogniHome, project partners are already taking into consideration the ethical, legal, social, and technical safety issues of these technologies. To this point, they are also planning a manifesto, which is being drafted as part of cross-sectional project ELSI, an acronym that stands for Ethical, Legal, and Social Implications.

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CITEC researchers are developing the personal trainer together with the family-owned companies Hella and Hettich. The automotive supplier Hella KGaA Hueck & Co from Lippstadt produces primarily automotive components and systems in the areas of lighting technology and electronics. "Assistive technologies for cars and apartments share many similarities. The human user is at the center of both, and the technology must serve their human user's needs and provide assistance in various activities. For the personal trainer, we are contributing our expertise in the technology for recording and measuring a driver's activity. This can be applied one-to-one to the chair," explains Dr. Michael Schilling, project leader in predevelopment at Hella. The Hettich corporate group from Kirchlengern in Ostwestfalen is one of the world's largest manufacturers of furniture fittings. The family-owned company is involved in all areas of KogniHome. The company Hettich is developing the mechanics for various movement functions and together with a partner is providing the chair, complete with embedded sensors and actuator devices. In addition to this, user studies with demonstrators are being conducted for which ethics applications are submitted in the framework of the ELSI project.

In the Cluster of Innovation KogniHome, 14 project partners from the region of Ostwestfalen-Lippe are working together through mid 2017 on a networked apartment that enhances the health, quality of life, and safety of family, singles, and senior citizens. The German Federal Ministry of Education and Research (BMBF) is funding the project over a period of three years with eight million Euro. KogniHome is led by CITEC, the Cluster of

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