# Acoustics in innovative office environments

## Basis and aims

The way office work is organised plays a pivotal role in today's information-based economy. The demands placed on knowledge work and workers are steadily increasing – and high productivity, outstanding quality, flexibility, mobility, and adaptability are now key. To meet these challenges, companies require outstanding office and organizational infrastructures – in other words, they need offices that ideally support effective work processes, and provide an attractive environment for employees. This is best achieved by means of adaptable office structures designed to foster communication.

Work is becoming increasingly flexible, and the importance of communication and collaboration is on the rise. Against this background, office environments are undergoing major changes. Small-scale (one- or two-person) cellular offices are steadily giving way to open-plan architectures. Team and group offices (for 8-20 employees) are now becoming increasingly common in central Europe. As a result, the European market – formerly dominated by cellular offices – is coming to resemble the Anglo-American model, characterized by considerably more open designs.

In recent years, an innovative and completely new form has developed alongside established basic designs – the flexible office. In spaces of this kind, workers are no longer tied to a particular workstation. Desks, other furnishings, and all technical resources are shared – and can be used by any employee on a daily or even hourly basis. This allows users to flexibly utilise the scenarios and environment that best suit the task at hand.

## Office acoustics

There are two aspects to creating the right acoustics in open-plan and semi-open-plan environments (for example, team offices). On the one hand, noise levels have to be reduced through the deployment of sound absorbers. These typically include ceiling and wall coverings (which cannot always be used with thermally activated concrete ceilings, or with transparent outer and inner walls), as well as flooring.

On the other hand, in extensively sound-dampened open-plan offices, efficient acoustic screens are necessary to prevent noise from carrying over large distances. The effectiveness of elements used for this purpose (for example, partitions, cupboards) depends their height and width, as well as on how well they join together, and their surface absorbency.

Recent psychological and psychoacoustic findings have corrected the previously assumed correlations between ambient noise and productivity – in some cases, turning received opinion on its head. For people affected by noise, the key factor is not how loud a particular sound is, but its information content. For example, spoken language (such as background conversation) has a demonstrable and significant impact on cognitive performance, even at very low volumes. By contrast, noises with low information content, have little influence, even at high volumes.

Office acoustics also have to take into account today's need to tailor spaces to different tasks – through rapid repurposing for communication (for example, discussions), concentration (for example, creative work), or confidentiality. To provide the diverse – at times, almost diametrically opposed – acoustic conditions required in today's offices, the relevant elements and fittings must be as adaptable as possible.

The growing demand for flexible offices and working environments, the increasing pace of modern work, and the constantly changing conditions in which people have to work, pose seemingly formidable challenges when it comes to ensuring the right acoustics. Moving or setting up elements takes effort, and users therefore tend to shy away from these tasks. Intelligent systems, which automatically adjust to rapidly changing user requirements, are not yet ready for the market.

In light of the foregoing, office-wide sound absorption is an important step toward creating the right acoustics. In most offices – above all, those with state-of-the-art ceilings – the floor is the largest continuous surface available for noise-reduction measures. When it comes to acoustics, office carpeting has advantages over hard surfaces, such as stone flooring, tiles, PVC, parquet or laminate.

In contrast to most other types of flooring, textile floor coverings are highly sound absorbent. Carpets are considered porous sound absorbers, and are particularly good at soaking up sound in the high-frequency range (up to over 50% in the 2,000 to 4,000 Hz range). One of the great strengths of carpeting is its ability to prevent echoes, especially in large spaces (open-plan and team offices).

In addition to their dampening effect, textile floor coverings help prevent footfall noise – and when this does arise, they help absorb it. While flooring materials with a harder, more rigid surface propagate footfalls, textile floor coverings virtually stop them occurring. Particularly dense, deep-pile carpeting reduces sounds of this kind by up to 40 dB, and even flat-woven carpets can achieve a reduction of some 20 dB.

## Perception and feelings of well-being at the office

Work-environment design is extremely important for the creation of innovative, high-quality offices. Good design fosters employees' sense of well-being and motivation – two factors that are key to staff productivity. Because flooring has a major influence on the working environment (especially in large offices), it has a particularly important role to play. Studies into soft success factors, conducted within the scope of the Office 21, have shown, among other things, that textile surfaces have a strong positive influence on people's sense of well-being, and meet with high employee acceptance. This research has extensively documented the attractiveness of textile surfaces in office environments. The distinct advantages of carpeting are its multi-dimensional appeal, in terms of design quality, acoustics, and indoor climate. For example, people perceive carpeted rooms as being up to three degrees centigrade warmer, which in turn can contribute to a greater sense of well-being. What's more, unlike solid flooring, carpets can temporarily bind microscopic dust and allergens, reducing associated risks – and making carpeting particularly suitable for allergy sufferers and asthmatics.

New types of fibre, in conjunction with innovative manufacturing techniques, enable completely new kinds of patterns, and colour and material combinations. This creates interesting opportunities for new designs, and a variety of new possibilities when it comes to tailoring environments to individual requirements.

## Further reading


BAUER, W.: Innovationen für die Büroarbeit. In: Leonardi, N. (Hrsg.): BRT Architekten – Office Buildings. Bologna: The Plan. Art & Architecture Editions, 2004, pp. 36-39.

BUNDESANSTALT FÜR ARBEITSSCHUTZ UND ARBEITSMEDIZIN (Hrsg.):Akustische Gestaltung von Bildschirmarbeitsplätzen, Dortmund, 2003

KERN, P.; BAUER, W.: Das Büro der Zukunft – Innovative Bürogestaltung. In: Mensch & Büro A+A 2005 spezial, pp. 23-24

LANDAU, K. (Hrsg.): Good Practice – Ergonomie und Arbeitsgestaltung. ergonomia Verlag, Stuttgart, 2003

LORENZ, D.: Akustik – Optik – Klima. Büro Spezial, 2003 No.3, pp. 6-9.

PROBST, W.: Akustische Gestaltung von Bildschirmarbeitsplätzen in Büros. Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (Hrsg.), Dortmund: 2004.

SPATH, D.; KERN, P. (Hrsg.): Office 21. Zukunftsoffensive OFFICE 21 – Mehr Leistung in innovativen Arbeitswelten. Egmont vgs, Cologne, Stuttgart, 2003

SUST, Ch . A./ LAZARUS, H.: Bildschirmarbeit und Geräusche, Schriftenreihe der Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, Dortmund, Berlin (Wirtschaftsverlag NW), 2003.

VERWALTUNGS-BERUFSGENOSSENSCHAFT (Hrsg.): Büroarbeit – gesund und erfolgreich – Praxishilfen für die Gestaltung. Schriftenreihe Prävention SP2.12 (BGI 5001), March 2005.


## Authors


Dr. Wilhelm Bauer and Stefan Rief

Fraunhofer Institute for Industrial Engineering (IAO)

Nobelstrasse 12 *((bitte ss – nicht ß: wird als B gelesen))*

70569 Stuttgart

Germany


December 2006