NEW WORK ORDER

THE HUMAN FACTOR@WORK

ORGATEC

BIRGIT GEBHARDT
Trend Consulting

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HOW DO WE ACTUALLY WORK?

Smart environments will soon be supporting our work performance. But as long as we do not know what factors influence human intelligence, we'll stay stuck in machine-related standards.

Hendrik Hund
President of the Interior Business Association

During the coronavirus pandemic if not before, it became evident that "new work" and "agile working methods" are more than just buzzwords. It's time for us to seriously ask how smart technologies, spaces and their furnishings can support us as we engage in collaborative forms of work.

What is the essence of a human? What will we contribute to the connected world of work? Where do we have an advantage in our interaction with machines and the media, and in our cooperative work? Artificial intelligence (AI) is becoming ever smarter by imitating human models, but very few of us know what connections are being made in human brains and bodies while we are learning or working. For example, office workers would be astonished to hear that our brains are unable to make a purely rational decision. Why do we know so little about the processes that are typically human and the factors that influence them? How can we use the full spectrum of our skills in smart environments if we do not understand how it operates? Should we ask Alexa?

HOW DO PEOPLE, IN ALL THEIR COMPLEXITY, REALLY FUNCTION?

This study does not seek to examine a New Normal. Instead, it calls for a much smarter future world of work that focusses on human beings as individuals. We are starting out in the Anthropocene era, amid mixed realities, artificial intelligence and smart assistance systems. What if everything could speak, connect interests, take account of feelings and celebrate the individual? How differently would we learn and work?

In order to join this dialogue, we humans should be familiar with our operating language, our influencing factors and our soft skills. In the central section of this study we ask questions about ourselves as cognitive beings and marvel over our highly networked learning processes, sensory perception, and the interactions between our mental states and conditioning, and conclude that we are also predisposed to agility and smart networking.

Following up on this idea, we consider what a professional work environment should provide for people: an active support for their activities and capabilities that is so effective that it at least compensates for the commuting time to and from the workplace. And so perceptible as a multisensory "user experience" that the processes of working and learning, as well as the office itself, become a performance space. It should reflect our selves, our potential and the ways we can develop it. But it can do this only if we tell it to.

Oliver Frese
COO Koelnmesse GmbH

People need human contact. That applies not only to trade fairs but also to the world of work as a whole. The expansion of the world of work into digital space brings us new opportunities, but it also faces us with new challenges.

Photography: Rebecca Hoppé

THE AUTHOR

Birgit Gebhardt | Trend expert
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Birgit Gebhardt researches the future of work culture. She summarizes her findings, which are based on interviews with experts, consulting projects and travels, in the New Work Order studies. Her consulting for clients such as Swisscom Immobilien, Xing and Lufthansa is based on 12 years as a project manager at Trendbüro, of which she was managing director before founding her own company.

THE PUBLISHER

Interior Business Association
www.iba.online

The IBA is an association of the players who are shaping the new world of work. As a network, a platform, and the organizer of ORGATEC, the IBA supports the trends developing around the digital transformation, together with their implications for the design of office environments. The New Work Order studies that the IBA has published since 2012 offer one format of condensed trend analysis.

COVER ILLUSTRATION: DBL-DESIGN.DE

NETWORKING IS EMPOWERMENT

During the industrial era, human beings were one source of labour alongside machines. In the future, we will be sources of natural intelligence alongside AI. At least that's still a difference.

Of course we've organized work around human beings – always! If we hadn't, our work wouldn't have got done at all!" Honestly? No, not really. Ever since industrialization began, we have organized human work around machines and process management as well as along global value chains. We have given people protective clothing, tools, furniture and monitors so that they can use machines and computers for hours at a time and integrate human work into this system in the first place. That's the main reason why work has functioned – and why human beings have somehow functioned with it.

INDUSTRIAL CULTURE PUT PEOPLE INTO PROCESS STANDARDS – NETWORK LOGIC WILL ORGANIZE WORK AROUND THE INDIVIDUAL

But today, in the age of intelligent connectivity, the ubiquitous communication between people, machines and media is overriding our neatly drawn borders. It translates languages and connects knowledge; inspires business models that focus on the customer; develops cross-sector platforms for individual services; helps culture and commerce to meet in the "customer journey"; and calls on the business and scientific communities to focus on a more socially oriented and sustainable capacity for innovation.

Natural intelligence is being linked with artificial intelligence, contents with interests, talents with activities. As a result, it seems completely natural for old standardizing structures to disintegrate and be replaced by agility and diversity, and for organizations to reimagine themselves as learning organisms and gradually start to breathe again through their people and customers. The world of work will connect with people's living environment, and people will reorganize their spectrum of capabilities and action to include these and all other expanded realities.

WE WORK IN PHYSICAL AND COGNITIVE NETWORKS. THE WORLD OF WORK SHOULD SUPPORT THIS CONNECTION ABOVE ALL

If we regard our (inter-)personal learning, problem-solving and actions as our central activity in future, it will no longer be sufficient to adapt our workplaces to fulfil ergonomic requirements. Instead, brain waves and hormones, as well as metabolic and sensory stimuli, now also play a role in our ability to pay attention and to learn. Fruitful cooperation is based on social resonance, diversity and participation. Despite all pandemics, our senses require physical closeness in order to fully comprehend their surroundings. We are more enjoyably inspired in a mixed group than when we are sitting alone at home, and after physical activity or a walk in the midst of nature we achieve better results. We know these truths by now. And before we knew them, we could feel them. However, in the past this awareness was seldom implemented in the world of work.

Still in the wrong mode: For example, our mainly sedentary working posture is not appropriate to the increase in communication and interaction with others, nor does it provide suitable biophysical stimuli within our bodies.

Psychology as well as behavioural and brain research now confirm how strongly "soft" factors influence our ability to think and act. From the perspective of cognitive neurology, all of our decisions are supported by our individual world of experience and memory, which may reach back to our evolutionary memory. Biologists have demonstrated that our bodies continuously communicate with the external world, which in turn influences our metabolism and hormonal balance – and thus our (work) attitude, mood and emotions.

The crisis of the office is a crisis of human qualities. Most offices are purely business facilities rather than humane living environments.

Prof. Jan Teunen
Philosopher of culture, Burg Giebichenstein University of Art and Design, Halle/Saale

THE "SOFT FACTORS" ARE THE ESSENCE OF HUMAN BEINGS

If we ourselves knew more about these physiological factors, we could long have been working in ways that are much more healthy, motivated and productive. We could vary our working methods to fit specific tasks, direct natural influences in targeted ways, grant higher priority to physical activity and changes of perspective, and organize a sensory dialogue on our own. In any case, if the world of work is to regain its performance advantage in a smart and connected living environment, it will succeed only by means of these supposedly "soft" qualities and human influencing factors.

The skilled trades adapted the environment to how people work. For example, tailors didn't work at a table – they sat on it, as close to the light as possible. The best way to handle fabrics and folds was to hold them on their knees as they sat cross-legged. The brim of a tailor's hat protected him from glare and directed the light toward his handiwork. A place close to the big glass windows, which were expensive then, honoured the tailor's skill and enabled him to note fashions as people passed by. From their "established" workplaces in the middle of the shop, everyone shared in the contact with customers. Sitting cross-legged does become tiring, but a tailor's workshop shows more interaction between an individual's work and its surroundings than some office furnishings do.

De Kleermakerswerksplaats (The Tailor's Workshop)
Quiringh Gerritsz van Brekelenkam (1622–1668), Rijksmuseum, Amsterdam

NETWORKED INTELLIGENCE IS A PROMISE

Industrialization was a step forward for humankind; networked intelligence is a promise. What does this promise consist of, what are the misgivings about it, and how should we expand on this concept?

When the British computer scientist Sir Tim Berners-Lee invented the World Wide Web, he invented a network structure in which information is directed toward its recipient just as intelligently as it is in our human organism, in the world of animals, on the forest floor and in all living beings. Communication is the lifeblood that operates decentrally in every cell (almost autonomously) and simultaneously in a networked fashion (similarly to quantum computers). It always strives to maintain a balance between the vital overall structure (the stakeholders) and its connection with its environment, while expending as little energy as possible (a state that technology has not yet reached).

In theory, we could use this smart network structure and the implementation of AI to make an even greater gain for human development than we did with industrialization. It would enable us to solve supply shortages, dependencies, mass standards, the exploitation of resources and environmental problems. It would also help us arrange our activities at the individual, local and global levels in ways that are fact-based and context-related.

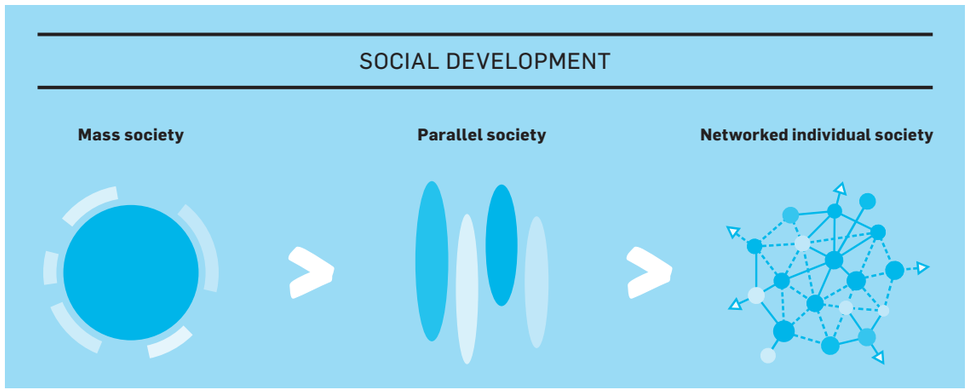
NOW IS THE TIME FOR NETWORKED AND INNOVATIVE THINKING!

Unfortunately, the transition between the old and the new logic is still shaped so that the most progressive pioneers of networking technology are basing their new business models on economic structures already considered to have been overcome. They try to own data, and they prioritize mass dimensions, monopolies and dependencies so that they can influence their market and control the public. "That's not really why I invented the Web," says Berners-Lee. However, he is obliged to conclude that the numerous free services we receive in exchange for our data are making it much more difficult to realize the decentralized business model that would create a direct link between supply and demand. It's really up to us to determine how remote-controlled or how people-focused we want our lives to be.

In September 2019 Facebook bought the previously unknown company CTRL-labs in New York for more than $500 million. The founders of this company investigated how people and machines can communicate with one another directly via brain waves.

ctrl-labs.com

The system logic of mass society favours the majority. Individuals who are not average tend to drift toward the margins, and that requires greater expenditures and special treatment. The principle of equal treatment permits neither the inclusion of people with disabilities nor the advancement of individuals. Today, technology is enabling individual recognition. Quirks and qualities can be recognized and supported, deficits compensated for. Everyone counts. We are experiencing the dissolution of the old logic and the transition to the new connectivity in the form of parallel societies in which visibility primarily functions within the group.



The development of industrial mass society (with marginal groups) into a networked individual society (in which inclusion would be possible for the first time). The parallel societies form the transition to the structural transformation.

From a trend researcher's perspective, we should not deal with the structural transformation at the superficial level. In other words, it would be better not to implement political protectionism or retroactively prop up data protection through bureaucratic measures. We should also stop trying to sell unfair "watering can" models (such as an unconditional basic income) as a lifesaver for society. The solutions we need for the structural challenges cannot be found in measures that were valid for the structures that have been replaced.

INDIVIDUALIZED INSTEAD OF STANDARD, AUTONOMOUS RATHER THAN ANONYMOUS

Instead, much more exciting possibilities are offered by social utopias that regard human beings not quantitatively as markets or machines but qualitatively, as individuals with all of their aptitudes, and call for an environment where individuals can pursue personal development. For example, only now would it be possible to implement aspects of educational reform (such as those of Maria Montessori) by means of individual feedback, adaptive surroundings and creative learning environments.

Above all, sharing (not saving!) individual data is central to enabling us to benefit at the individual level from the intelligence that surrounds us. This is the only way to support individual cognitive achievements and bridge physical limitations. It would make inclusion – and individual recognition – possible in the first place. There is a demand for more fundamental ideas on how to deal with our data DNA and for a better understanding of the necessity of interaction.

An interdisciplinary consortium of the Technical University of Munich (TUM), the Institute for Social Science Research (ISF) and the Ludwig-Maximilians-Universität München (LMU) is analysing the potential and the application scenarios of the concept of "inverse transparency". Together with Software AG in Darmstadt, the consortium is testing pilot solutions for the broad application of this concept.

inversetransparenz.de

EXAMPLE

INVERSE TRANSPARENCY

In a scientifically supported research project, Software AG in Darmstadt is testing participation-oriented approaches to increasing data sovereignty that offer more leeway and transparency for both the company and its employees.

DATA PROTECTION IS REACHING ITS LIMITS

In the digital world of work, everything is permeated by data – and in many cases this process is not noticed and happens "behind the backs" of the players. However, in practice the fear of misuse blocks intelligent use of the data. Traditional data protection is reaching its limits. Even within companies it is becoming increasingly difficult to decide in advance which data should be collected, used and linked.

INCLUDING THE EMPLOYEES

The Technical University of Munich is helping to develop a tool that can log the use of personal data and present it to the respective employee in aggregated form. At the level of occupational and organization science, the Institute for Social Science Research and the Ludwig-Maximilians-Universität München are investigating how this tool can be successfully implemented inside the company with the participation of employees, management and social partners.

Through this participation-oriented approach, the researchers hope to open up new scopes of action that harmonize the opportunities offered by digitalization – such as the optimization of work processes – with the fundamental right of individuals to informational self-determination.

EMPOWERMENT OF BOTH SIDES

Software AG is making its use of employee data transparent to the employees, and it is informing them about their rights of objection regarding their privacy. The research project is also asking the employees about intelligent scopes of data collection and allowing them to review and evaluate their own work areas and work processes so that they can draw conclusions for their cooperation or direct suggestions for improvement to the organization. The openness of both sides within this shared testing ground is meant to strengthen mutual trust and form a foundation for the fair handling of data.

EVERYTHING SPEAKS, RECOGNIZES, MIRRORS AND ASSISTS

Today we take a factual approach to things we previously felt: blood pressure, stress and fatigue. On the basis of our personal agenda, smart timekeepers are organizing our lives. How is this changing management and performance?

Fields of application are everywhere: Today cognitive analyses already accomplish far more than visual recognition, physical measurements, mechatronic movement or the medical measurement of vital functions.

Through our senses, our bodies continuously communicate with the world around them, anticipating, analysing and adapting. This generally happens without our knowledge, apparently automatically. Similarly, we can imagine smart sensors that in the future will mediate between human beings (or machines) and their immediate environment. In the area of merchandise management, vision and assistance systems are already counting, recognizing, measuring and testing. In autonomous driving, they are safeguarding proper distances. In sports medicine they support human movements, and in complex work processes they assign tasks to human beings.

SMART APPS NAVIGATE US THROUGH WORK AND LEISURE

The assistant looks for a place of work: Our sensory apps will probably mediate between the atmosphere and the intention to work, and if a certain workspace cannot be adapted or lacks appeal the apps will navigate us toward a more appropriate one.

If we now imagine this support in diverse areas as being networked and adapted to its respective context, it becomes evident that the world of work can no longer do without this digital support. And if we imagine this support in private areas as being networked and adapted to its respective context, it becomes evident that Alexa, Facebook and every Apple or smartwatch is already at the point of providing us with such services. Numerous points of contact register our activities individually, analyse and comment on our behaviour and will send augmented-reality overlays onto our glasses or contact lenses to propose routes and offers, give us instructions or warn us about dangers.

In these ways we too will use the advantages of smart assistance systems in order to make progress – in the work context as well as in our daily lives. At the personal level we will manage the blurring of the boundaries between work and leisure, link our continued professional training more strongly with our private interests, and in general take into our own assisted hands many of the processes related to our work and personal development for which our employers were previously responsible.

SMART ASSISTANCE PROVIDES US WITH INDIVIDUALIZED MANAGEMENT

Smart apps and AI-supported assistance systems will not only guide us through our daily lives but also act in the work context to take over significant aspects of individual leadership that we currently still expect from our supervisors. However, there is an increasing gap between employees' expectation of personal, differentiated and frequent feedback on the one hand and, on the other, the company's scheduling and legal framework. This gap makes it impossible for employed managers to satisfy the requirements of both sides.

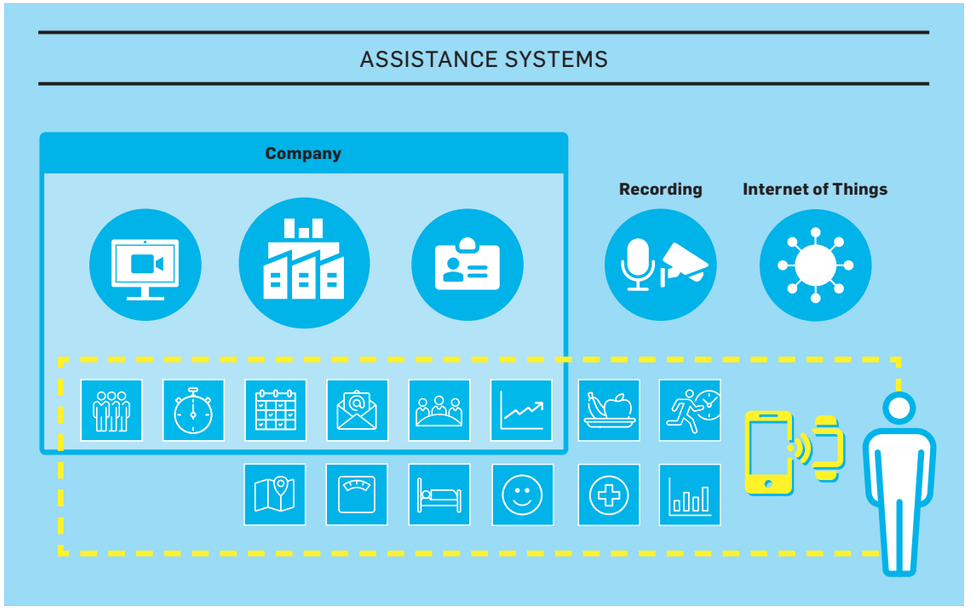
As a result, it is conceivable that – after some frictions regarding security and the revision of areas of responsibility – the apps from (probably) Google, Apple, Amazon or Facebook will also support us as we do our work at the office.

In view of the increasing flexibility of the place of work and the expectation that individuals should be able to deal with it, it seems absolutely necessary to consult egocentric assistance systems so that we can move around efficiently in these – and the virtual – worlds of work.

The fact-based mirroring of our actions helps us to realistically assess ourselves, can support our bargaining positions during negotiations, and motivates us to take on more individual responsibility and self-management.

Smart assistance systems make no distinction between work and leisure. Instead, they focus everything on the individual and his or her agenda. They navigate us through daily life, run errands, filter offers and analyse performance.

Due to employment law and data protection, the responsibility will be shifted from the company directly to the employees, who only share information if the sharing brings them an advantage.



Companies from the USA or China will be the ones that know the most about us via their numerous connected services and can optimally provide us with individualized assistance. This will be analogous to the way that software and internal communication run on Microsoft at the office. Smart connectivity, in contrast, is especially suitable for decentralized players, and the central storage of personal data would not even be necessary for their interaction, according to the inventor of the World Wide Web, Sir Tim Berners-Lee.

solid.mit.edu

OUTLOOK

INTELLIGENT ASSISTANCE

Pascal Bornet, who investigates the digital market in Singapore for McKinsey, believes that artificial intelligence will primarily provide people with support.

SMART ASSISTANCE SYSTEMS WILL ORGANIZE OUR DAILY LIVES

We can expect to see applications that we can use to monitor our daily work and optimize the workload. In ways that are similar to how we use a Fitbit or an Apple smartwatch, we can use AI to "measure" the pulse of our professional activities in order to make them healthier and more balanced – for example, by means of dashboards that analyse our daily activities and help us to improve them over time. In stressful situations, smart technology can also take work off our shoulders and communicate priorities or use mental training sessions to help us find a balance between professional and private life.

ARTIFICIAL INTELLIGENCE WILL INCREASE OUR PERFORMANCE CAPACITY

AI applications boost productivity by helping employees to focus on activities that generate more added value, less stress and a greater sense of fulfilment. In the future, assistance systems will act like a concierge or a wellness coach to offer us situation-related feedback in real time as well as individualized recommendations for self-adjustment. Time-consuming tasks in our spectrum of activities can be automated. We will receive smart support as we do research and conduct our projects. At the global level, communication can be optimized and planning can be synchronized by means of automated transcription.

Pascal Bornet
AI Lead at McKinsey Digital in Singapore & member of the AI for Tomorrow Council

LEADERS MUST MASTER THE "SKILL SET" OF THE FUTURE

What capabilities and skills should be developed for a world of work in which we human beings maintain our sovereignty?

The training program of a bank in Frankfurt now offers trend research workshops in order to sensitize the participants to networked thinking and enable them to evaluate developments on a broader basis. In view of the closures of bank branches and a disruptive fintech market, employers recognize the need to teach trainees a broader spectrum of skills.

The HR development unit of Energie AG Oberösterreich also wanted to find out what issues people will be focusing on in future. As part of this process, they extracted all the activities from the job descriptions in their unit. We then worked together to analyse how these activities might be changed by AI and smart communication. Which coordination tasks can be carried out directly or automatically? Where can transparency replace monitoring? Which decisions must still be made by which individuals, and to what extent must they be held responsible for these decisions? Which communications can be conducted technically via language bots, and for which ones should this be avoided?

The results of this analysis pointed to the need for a leaner process, more direct support via system intelligence, and more dynamic, short-term, content-related and transdisciplinary cooperation among employees. All in all, these are skills that enable us to maintain our sovereignty in spite of increasing complexity. In other words, they represent the acquisition of methods and skills that enable us to actively participate in a self-organized and networked manner and have an impact on something. In short, they expand the scope for human action and make us flexible in the face of change.

SMART SYSTEMS URGE US TO DEVELOP MORE HUMAN INTERFACES AND SKILLS

The Münchner Kreis, an association of business and science representatives, has developed a meta-paper about future-oriented skills on the basis of various studies of areas of competence. Whereas earlier studies of skills primarily connected areas of competence with digitalization, more recent studies tend to focus on the implications of digitalization for overall cooperation. The Münchner Kreis' meta-paper deals with the process of catching up with this development, and distinguishes between personal, team, and system-related skills, which it labels "Individual", "Team collaboration" and "Human/machine interaction" skills (see below). When measured against the comprehensively relevant "skill set", the proportion of digital interaction levels off at the one-third mark. After all, we shouldn't always be learning only how to adapt. Instead, we should develop greater curiosity about how we "function" as individuals – and how we cooperate with others.

Dr. Rahild Neuburger
LMU Munich School of Management and Managing Director of the MÜNCHNER KREIS

"The diversity of the emerging forms of work calls for a diversity of skills that range from personal to social skills, human/machine interaction skills and process, solution and strategic skills. The goal is not only to enable individuals to operate in a networked world of work but also, and especially, to enable them to develop and design creative solutions for the challenges we face, whether it's at the corporate or the global level."

A meta-analysis of future-oriented skills, developed by the Münchner Kreis, 2019. Participation and structure: Birgit Gebhardt

HUMAN SKILLS AND AREAS OF COMPETENCE

	Individual	Team collaboration	Human/machine interaction
Cognitive	Individual responsibility Self-direction Self-organization Orientation skills Critical thinking Focusing Decisiveness Maturity Learning skills Self-motivation Self-awareness Mindfulness Self-reflection Resilience	Communication Networking initiative Capacity for teamwork Dealing with complexity Active listening Analytic skills Prioritizing Negotiating skills Emotional intelligence Tolerance Intercultural competence Empathy Ability to deal with conflict Assertiveness	Media competence Digital mindset Digital competence System competence Interaction skills Information management Assessment competence Professional expertise Monitoring Openness Ability to make distinctions Translation skills Programming skills Data sovereignty
Operational	Specialized knowledge Structured thinking Resource management Response capability	Methodological skills Organizational skills Management of expertise Agile collaboration	STEM skills Controlling skills Project management Capacity to act
Creative	CIP mindset/understanding Lateral thinking Openness/curiosity Imagination/creativity	Awareness of problems Cognitive transfer capacity Transdisciplinary approach Improvisation	Opportunity assessment Sensitivity to context Connected thinking Zest for experimentation
Strategic	Visionary thinking Target orientation Flexibility Entrepreneurial mindset	Dealing with uncertainty Results orientation Anticipatory mindset Stakeholder inclusion	Holistic perspective Customer orientation Capacity to adapt Networking

HYPOTHESIS

PROMOTING SKILLS DEVELOPMENT

The personnel management company of Energie AG Oberösterreich operates on the assumption that skills development will become the central task of leadership.

CONTINUOUSLY ADAPTING SKILLS

At our company, about half of the skills that are regarded as "relevant to the future" have changed within the last five years. For example, in 2015 we wanted to train individuals to reduce complexity. In 2020, we are convinced that the complexity of systems must be recognized and that dealing appropriately with this complexity is an essential future-oriented skill. We need to keep up this process of continuous adjustment.

LEADERSHIP THAT SUPPORTS AUTONOMY

With regard to leadership, an assessment of the skills of the future has clearly shown that the central task of leadership is to challenge and encourage the employees for whom he or she is responsible. It's also essential for leaders to serve as models of clearly defined values and goals, encounter employees at eye level, delegate responsibility, back up employees and give them support. At the employee level, methodological skills, especially the skills of self-organization, collaboration and media competence, are becoming increasingly important in order to enable the use of intelligent systems that support communication.

ADAPTING THE WORK ENVIRONMENT

New requirements for people also give rise to changed requirements for the workplace. This basically means offering a venue for collaboration as well as an environment where individuals can withdraw and concentrate on solo working. In future, both kinds of activities will be carried out not only on the company premises but also in virtual space. In future, office buildings must offer diverse spaces and a modern infrastructure for innovation processes, knowledge sharing and learning experiences – across department borders as well – because in all of these areas especially, personal contacts are crucial for top quality.

Johannes Michael Blätterbinder
Managing Director, Personalmanagement GmbH of Energie AG Oberösterreich

Birgit Pieringer
MBA, Team Leader Personnel and Management Development, Personalmanagement GmbH of Energie AG Oberösterreich

HOW DO PEOPLE FUNCTION?

Our intellectual capabilities range from creative openness to tunnel vision. To exercise these capabilities, our brain activates various neural oscillations. Can these brainwaves be consciously controlled?

Now just concentrate for once!" All of us are familiar with this reprimand, which people get when they find it hard to pay attention as required. But a lot more is happening in our control centre than simply flicking a switch on or off. The "various states of consciousness" that psychologists talk about have now been confirmed by neurological research that involves measuring diverse brainwave frequencies (see right).

Five frequency bands span the spectrum from healthy deep sleep (delta waves) to highly concentrated focusing (gamma waves). The interplay of these five frequencies is an important factor in the healthy management of our capacity for work. But we could do even more in this area: if we knew how to activate these frequencies in a targeted way, we could put ourselves into the work mode we want.

In the past we have mostly used only the beta range for our work. In this energy-conserving phase of cognition between 12 and 40 hertz, we assimilate information in a targeted way, conduct complex conversations, analyse and learn. To be in this phase, we only have to be awake – for which we've used coffee, tea and energy drinks until now.

Two new methods act directly on our brainwave frequencies in an effort to address a broader range of states of cognition. This makes sense, because in future we should also use brain frequencies that – like the creative generation of ideas – lie beneath the state of wakefulness in the daydream range of the alpha waves. Or those – such as the highly concentrated focusing – in the brilliant gamma mode above 40 hertz.

BRAINWAVE FREQUENCIES
Delta (0–4 Hz): Deep sleep; promotes regeneration and healing processes
Theta (4–8 Hz): Dream state; facilitates insight, consolidates memories
Alpha (8–12 Hz): Daydreams; undirected linkages, reduction of cortisol
Beta (12–40 Hz): Waking state; active perception, sharpened focus
Gamma (40+ Hz): Highest stage of concentration; tunnel vision, enhanced performance

Brain frequencies stimulated via binaural beats (binaural in Latin = with both ears) should be in the range 0 and 40 hertz and address the five states of consciousness ranging from delta to gamma. The light dome supports these effects using colours: violet (reputedly for transformation), green (calming), light blue (refreshing) or dark blue (relaxation and balance).

The "Somadome" pod in the Wellness Center, Adobe headquarters, Adobe Inc., San Jose, California

» **We were one of the first companies to offer** a "binaural beats" armchair in our Wellness Center. For me personally, the sessions have provided beneficial relaxation during stressful workdays. Afterwards, I felt refreshed and was able to be productive for the rest of the day.

Lacey Arslan
Workplace Experience Designer (2013–2019) at Adobe

The binaural method tries to generate brainwaves by means of sounds. In binaural beats, sounds of slightly different frequencies are directed at the right and the left ear. The brain balances them out to register a sensory impression in the intermediate frequency range. The "Somadome" meditation pod (see opposite page) uses this automatic process in the attempt to evoke the five states of consciousness. The full spectrum of effects has not been scientifically proven, but sound waves have demonstrated their effectiveness in meditation and trance states for centuries.

Neurofeedback is a new method of activating the more alert states of consciousness in particular. By using this method, the individual learns, while thinking, which brainwaves can be stimulated and how. It's a skill people should acquire, and not just for work.

EXPERTISE

NEUROFEEDBACK – TRAIN TO LEARN

The brainboost company helps people recognize subconscious brain processes and consciously attain desired states of concentration. How does this work?

WHAT IS NEUROFEEDBACK?
Neurofeedback is a subgroup of biofeedback, in which the trainee receives real-time feedback data about his or her bodily functions (such as breathing and heartbeat). In neurofeedback (NFB), brain activities are reported back to the subject and trained.

HOW DO YOU RECOGNIZE BRAIN ACTIVITIES?
The brain works in diverse frequency bands under different conditions, such as concentration or stress. These frequencies can be measured by electroencephalogram (EEG) monitoring. Brainwaves depend on an individual's state of mind. Research has demonstrated the correspondence between specific frequency bands and states of mind. In training sessions, we only reward the desired frequency bands.

WHAT HAPPENS TO THE SUBJECTS?
Electrodes are attached externally to various points on the scalp in order to measure electrical activity within different areas of the brain. The active frequencies are shown on a monitor.

DO SUBJECTS KNOW HOW THEY ARE THINKING?
Basically, yes – but only in the second step of the process. First, they find out by means of a playful interaction when they are moving toward a certain brain activity. We connect this brain activity with something, such as the movement or standstill of a toy Carrera racing car on a track in front of the test subject. By the end of the process, the test subjects can move the car only through their activated brainwaves.

WHAT IS YOUR PERFORMANCE FOCUS?
Here you have a choice between three states: firstly, concentration and focusing; secondly, a flow state and creativity; and thirdly, relaxation, self-regulation, self-reflection and serenity.

HOW DOES NEUROFEEDBACK (NFB) ENHANCE CONCENTRATION AND FOCUSING?
In this process, the subject practices blocking out internal and external distractions in order to reach a state of maximum concentration. Here NFB helps the brain to, for example, consciously reach a focused state, boost alertness, alleviate fears such as anxiety before tests or competitions, and boost performance.

HOW DOES IT WORK FOR FLOW OR CREATIVITY?
Here NFB improves the brain's ability to make decisions and helps individuals quickly switch from thought to action. This reinforces or increases self-confidence, opens up the brain to inspiration and promotes creativity.

HOW ABOUT SELF-REGULATION AND SERENITY?
NFB enables the brain to recognize nervousness, doubt or negative thoughts and to take specific countermeasures. The trainee learns how to detect distractions early on and improves his or her ability to suppress them and remove mental blockades.

SO THE TRAINEES IMPLICITLY LEARN HOW TO CONTROL THEIR BRAINS?
Yes. Neurofeedback consists of the brain's unconscious learning and the subject's consciously learned self-awareness and self-controlling. Successful learning takes place via implicit learning – just like in learning to ride a bicycle, the desired behaviours are rewarded by positive experiences. The same thing happens with regard to the desired phases of concentration or relaxation. As a result, the subjects can move toward these states more often and internalize them permanently. The great advantage of this brain training method is that the trainer can objectively follow the brain activities on the monitor and adapt or support the training process accordingly.

Dr. Philipp Heiler
Doctor, founder and Managing Director of brainboost

Matthias Donner
Head of Corporate Solutions, brainboost

brainboost combines medical experience with exercises supported by sports science, psychological insights and modern management methods. The team headed by the doctor Philipp Heiler and the entrepreneur Matthias Donner has taken medical neurofeedback – which has been successfully used for self-monitoring in cases of epilepsy and ADD/ADHD since the 1970s – and translated it into training for performance enhancement.

brainboost.de

CONDITIONED BY OUR ANCESTORS

Selective pattern recognition, which is stored in our evolutionary memory, still controls our behaviour. In the world of our ancestors, it was essential for their survival. How significant might it be for the world of work?

The sense of security with which we move through the world is something we have inherited thanks to our ancestors' thousands of years of learning experiences. On the basis of their survival skills, signals, patterns and codes for recognizing certain "if – then" processes are embedded in our evolutionary memory. Our intuition still follows this programme. If we want to assess a situation, our brain looks for familiar characteristics and runs a comparison. For this purpose, our information pool includes what we ourselves have learned as well as genetically inherited experiences. In other words, lifelong learning is something we already have as a survival strategy. It's an asset that can be constantly upgraded. In the dense jungle, our ancestors needed to see only a section of a tiger's skin to intuitively seek a retreat. In our civilized environment, we rear back from moving cars and sharp edges. Our brains need to perceive only one detail in order to warn us – and that gives us precious lead time to react. Our senses focus on the "relevant set" of patterns that are crucial to our survival. Our sense of hearing is trained to perceive the frequency range of voices, and our sense of vision is focused on the spectrum of visible light so that we can perceive our surroundings. Nature operates efficiently – but for human beings feelings, not calculation, come into play.

If speed and customer orientation count, our brains should be well-equipped to perform the corresponding tasks. And we have objective customer data to counteract our subconscious self-referential tendencies.

EVOLUTIONARY MEMORY: EMOTIONAL EFFICIENCY

Emotions already filter the spectrum of our perception. Our emotions influence our decisions, drive our actions and direct our focus according to the information that our evolutionary history has previously registered as positive or negative.

This also applies to our assessment of our physical surroundings. Anthropologists, psychologists and researchers of evolution support the theory of "prospect and refuge", according to which people prefer landscape formations that are closed behind their backs (cliffs, slopes and walls) and permit them to have a wide overview of what is in front of them. Even today, in urban squares or in restaurants we tend to choose these protected spots with a view. As a result, every office renovation that took away the walls behind the workers' backs or placed employees in four-walled glass cubicles ran counter to our human nature. In many cases, such renovations even negated the original aim of the change: employees were expected to self-organize, but they were deprived of the overview this requires.

Conversely, our physical surroundings also have an impact on our brains. According to neurologists, specialized cells in the hippocampus region adapt to the geometry and the arrangement of the spaces in which we grow up or spend a large part of our lives. In this way the brain conserves the energy it needs for orientation and consolidates in us a "normal image" of a given situation. In other words, a familiar constructed framework thus makes it easier for us to categorize the activity carried out within it. Accordingly, in order for us to conduct a variety of activities, the configuration would have to change in ways that match the image recorded in our brains. Unfortunately, our "normal images" of work are still overly dominated by images of industrialization. Consequently, patterns and motifs from our evolutionary history could help us to block out the past 200 years and inspire us to create a more natural world of work. In this way the brain conserves the energy it needs for orientation and consolidates in us a "normal image" of a given situation.

Our constant process of making self-referential comparisons is the result of our evolutionary history. The "bubble formation" that we accuse the social media mechanisms of promoting is due to our search for harmony within a group. Today, it is less life-threatening for us to be open to new experiences and meet new people than it was for our ancestors – and it is our only opportunity to break out of our own limitations.

Artificial intelligence functions in a very similar way. It too looks for specific characteristics and similarities. However, it forgets nothing, can draw its knowledge from diverse datasets, and can also benefit from the learning of other connected systems.

Artificial intelligence functions very differently. It objectively analyses each situation on the basis of the available data and rates it according to the specifications programmed by a human being. Because it is free of emotions, it can serve us as a corrective in the areas of analysis and evaluation. At the same time, it can "take a stand" and try by means of emotional intelligence to detect our feelings and take them into account.

EXPERTISE

METAPHORICAL SPACES

What does cognitive neuroscience (brain research and experimental psychology) know about people's perceptions, preferences and behaviour? And what can be derived from this for the design and territory of the office?

WHAT EVOLUTIONARY FINDINGS ARE IMPORTANT FOR THE DESIGN OF HUMAN-CENTRED OFFICES?
I think that the principles of "prospect and refuge" can be transferred very naturally to environments for learning and working. It stands to reason that we are going to find our best performance when we feel supported, secure and comfortable. Being placed into the middle of a large open space (for example) is going to mitigate against that. Though there are lots of pragmatic reasons for the general failure of the open office (noise and distraction, for example), I think this is another such reason. In any environment, we feel, work, learn and behave best in circumstances that resonate with the human condition.

THE THEORY OF PROSPECT AND REFUGE SEEMS TO RANGE FROM BASIC HUNTER-GATHER HERITAGE UP TO ANCIENT ASIAN RULES OF HARMONY.
I think that ancient practices like Feng Shui and also Vastu probably had a part of their origins in an intuitive understanding of the relationship between biology – what it means to be a human animal – and the organization of spaces.

IS OUR SENSE OF HARMONY A RESULT OF OUR PRIMEVAL STRUGGLE FOR SURVIVAL?
I think that what the ancients might have called a "harmony" is deeply rooted, biological and measurable. I think the mistake some people make is to see these ancient practices as being mystical. I think that for the most part they are grounded in sensible pragmatics.

IN THE OFFICE, MANY OF US MEET BOTH: STRUGGLE AND HARMONY. ISN'T THIS TENSION ALSO OUR MOTOR FOR GETTING ENGAGED?
This is a very interesting balance – the one between struggle and harmony. The sociologist Richard Sennett talks about what he calls "friction." Though he's talking about urban scale rather than an office interior, the idea is easily translatable. Sennett refers to friction as what happens when human actors are in a setting which affords lots of flexibility (so it doesn't have all of the vitality programmed out of it) all sorts of interesting, non-linear, unpredictable things can happen. Sometimes in offices, we talk about serendipity – for example when we say that good office designs encourage incidental, unplanned, but fascinating creative exchanges between workers. I think these are all ways of looking at the same thing. So I don't think that the most important task of an office design is to soothe us into quiescence and complacency. I think we need some of that balance as retreat, but the places of friction or serendipity are, if anything, more important. Those are the places where the sparks fly.

NATURE HAS A RECOVERING INFLUENCE ON US. BUT HOW ABOUT PRODUCTIVITY? WE ARE NOT VERY PRODUCTIVE DURING IMMERSION IN NATURE, BUT RATHER AFTERWARDS?
You are right that there is not very good evidence that immersion in nature does not necessarily lead to increased performance in the conventional sense, but there is abundant evidence that we can use nature to promote recovery from cognitive depletion. Spending a few minutes in a natural setting can reverse the mental fatigue brought about by hard focus on a task. So the question for office design is how to implement affordances for those kinds of restorative breaks. This could mean devoting an area of an office solely to such restorative interludes, but the challenge might be demonstrating to those who run the company that their investment would pay them back. It's no fun to have to always bring things back to money rather than to just consider the well-being of the worker, but realistically we normally have to do both.

OUR BRAIN IS VERY GOOD AT RECOGNIZING PATTERNS AND PLACES. DO YOU THINK WE SHOULD USE MORE SUCH METAPHORS FOR LEARNING?
I would say generally that spatial metaphors are very powerful for human beings and the underlying brain hardware for processing space is accordingly abundant and extremely sophisticated. I think it possible that as our understanding of areas like the PPA, the hippocampus, the rest of the medial temporal lobe, for example, progresses, we will think of new ways to tap into this to advance principles for effective learning. But in a way we've known about such things for a very long time. Over 2,000 years ago, Cicero described the method of loci as a mnemonic device in which he suggested explicitly that the way to memorize material is to place it into a spatial framework. We still teach this, even to elementary school students, because it works pretty well.

AND WHAT WOULD BE YOUR CONSULTANCY FOR MORE HUMAN OFFICE SPACES?
I would say that the most important thing is to not treat human beings as though they are nothing more than brains in vats. We are embodied, we are organic, we are drawn to things that have always been good for us (nature) and repelled by things that are dangerous (sharp edges). We are adapted for living in groups – which doesn't just mean that we are social but also that we are territorial!

Prof. Colin G. Ellard *is a cognitive neuroscientist at the Canadian University of Waterloo and the director of its Urban Realities Laboratory. He is a member of the advisory committee for the Academy of Neuroscience for Architecture.*

Ellard works at the intersection of urban and architectural design and experimental psychology. He has developed a novel set of methods by which the human response to the built environment can be measured using a toolkit consisting of both traditional psychological methods and sensor-based measurements of physiology and brain function.

OUR LONGING FOR EXPERIENCES IN NATURE

We don't just like nature for aesthetic, recreational or leisure-related reasons. We are part of it, and even if we've forgotten that, our bodies and minds still interact with it, for our own good.

Wooden skyscrapers, vertical gardens, a rainforest in an airport terminal: technology no longer celebrates itself but instead offers space for natural processes and phenomena. Initially the aim was to save energy and costs, but in the future that has already begun another aim is to noticeably increase people's quality of stay.

This rethinking is taking place while metropolitan areas, traffic and communication swell in parallel with our personal levels of psychological stress. Humans can withstand all sorts of stress and still perform at high levels under pressure, but constant stress damages us physically and mentally. Since we continue to live with megacities, mobility and constant communication, it is important to know what kind of environment is good for us.

Biophilia – another word for our joy in living things – became anchored in us in the course of evolution. If you wanted to bring biophilia into the world of work and interiors, this could include the experiences that arise during a walk in a natural environment. For example, there would be mostly green plants in different growth phases (such as rolled-up and spread-out fern leaves) to underline the vitality of nature. We feel attracted by the complex aesthetics of such feathery leaf formats in multiple variations. Studies show that even images of green plants lower blood pressure and reduce stress in humans.

But nature also stimulates, for example by the change in light throughout the day. Natural daylight (including the sun's warming rays) is best because it provides a broad spectrum of colours. The daylight colours synchronize our internal clock and create a secure feeling of time orientation, while the sun's rays tickle your attention. A similar effect is created by shimmering surface reflections resembling water or cloud movements, such as those created artificially on the conference room ceiling of the Fraunhofer IAO.

A purely functional working environment is not good for people. It does not communicate with them and they cannot relate to it. Even people who do not directly suffer from such a situation will, in the medium term, lose qualities such as performance, creativity and enthusiasm. None of these can prosper in a working environment that has ossified into dead space.

Prof. Jan Teunen
Philosopher of culture, Burg Giebichenstein University of Art and Design, Halle/Saale

NATURE STIMULATES OUR SENSES AND THESE IN TURN STIMULATE US.

Changing floor coverings, ramps, views from several perspectives, varying ceiling heights, and room geometries subliminally ask us to take different positions and expose ourselves to changing sensory stimuli. These sensory stimuli are the motor for our physical and cognitive functions, which range from metabolic processes to the release of hormones and increase our receptivity to the here and now. Providing such stimuli in a targeted manner makes our work more pleasant and productive.

The effects of the 14 biophelial patterns (see table) have all been proven by studies. (International references are to the original table Terrapin Bright Green).

The world of work has, quite rightly from the viewpoint of scientific aesthetics, defended itself against an influx of potted plants brought from home. Scientists are now calling on people to give more space for the human desire to experience nature.

Addresses all of our evolutionary preferences: The natural oasis at Changi Airport in Singapore is both an attraction and a place to relax. If you consider how much retail space the more than 1,000 trees and 100,000 bushes occupy, investing in green oases now even seems possible on commercial grounds. Singapore, which is increasingly turning into a garden city – partly thanks to highly networked data analyses – is a role model for mobility, security, quality of experience and sustainability.

Rain Vortex by Safdie Architects in the Jewel Complex at Changi Airport is the world's largest indoor waterfall, fed by rainwater.

Photography: Tim Hursely

BIOPHILIC PARAMETERS AND THEIR IMPACT ON HUMAN BEINGS

	14 patterns	Stress reduction	Cognitive performance	Emotion, mood, preference
Nature in the space	Visual connection with nature	– Blood pressure and heart rate	+ Mental engagement/ attentiveness	+ Attitude, satisfaction
	Non-visual connection with nature	– Systolic blood pressure and stress hormones	+ Cognitive performance	+ Mental health and tranquillity
	Non-rhythmic sensory stimuli	+ Heart rate, sympathetic nervous system	+ Attention and exploration	
	Thermal and airflow variability	+ Comfort, well-being, productivity	+ Concentration	+ Perception of temporal and spatial pleasure
	Presence of water	– Heart rate, blood pressure + Feeling of tranquillity	+ Concentration, memory, responsiveness	+ Positive emotions, addressed preferences
	Dynamic and diffuse light	+ Circadian rhythm, visual comfort		
	Connection with natural systems			+ Health responses; environmental perception
Natural analogues	Biomorphic forms and patterns			+ Observed view preference
	Material connection with nature		– Diastolic blood pressure + Creative performance	+ Comfort
	Complexity and order	+ Perception – Physiological stress		+ Observed view preference
Nature of the space	Prospect	– Stress	– Boredom, irritation, fatigue	+ Comfort, perceived safety
	Refuge		+ Concentration, attentiveness, perceived safety	
	Mystery			+ Strong pleasure response
	Risk/peril			+ Strong dopamine or pleasure responses

+ Improves – Lowers/reduces

The key biophilic patterns to which the human organism responds.
A catalogue of the natural elements and their positive impact on human beings. You can find the international research sources that demonstrate their effectiveness in the original table published by Terrapin Bright Green.

Terrapin Bright Green, 2014
14 Patterns of Biophilic Design Improving Health & Well-Being in the Built Environment.

www.terrapinbrightgreen.com/report/14-patterns/

SENSEO, ERGO SUM

Given that sensors are now responding with high sensitivity to people, how do we react to our own senses? How do they influence us and what effect does this have?

Our senses are always active. Addressing the five senses is generally considered to be a reliable way of transferring information even if other modes of access are blocked.

We come into contact with the world – and the world with us – via our senses. It all begins with a feeling, a noise, a smell or a texture, which leads only a fraction of a second later to an assessment of the overall situation. To create this overall impression, all of the sensory stimuli from our environment and from inside our bodies that we consciously and unconsciously experience are integrated into information.

WE LOCATE OURSELVES WITHIN A SITUATION BY MEANS OF THE CONGRUENCE BETWEEN OUR SENSORY PERCEPTIONS, OUR ASSOCIATIONS AND OUR EMOTIONS

On the one hand, these items of information are compared with each other in order to obtain as complete a perception of the situation as possible. Inconsistencies such as the loss of synchronization of sound and image can reveal an illusion. A delay of as little as 80 milliseconds enables us to recognize that a scene is not real but artificial.

A comparison is also made via associations or memories so that a new perception is linked with stored experiences. Although the depth of experience of a human being is limited compared to the networked learning of artificial intelligence, it enables us to recognize causalities for a comparatively minimal expenditure of energy whenever doing so offers an intelligent added value for a given context.

The third comparison of external perceptions that our brain makes is a reaction to our emotional and physical mental state, to which the external situation should correspond as far as possible. In this way, our health, emotions and moods affect the spectrum of incoming perceptions. The natural automation of these egocentric filters is for our own protection and benefit. Our brains intensify those environmental impressions that we will probably need to cope with in the situation we face.

Vision just happens to be the most efficient way of acquiring knowledge. This is perhaps one reason why so large a part of our brains, amounting to perhaps one quarter of the total, is devoted to vision. Moreover, there are certain kinds of knowledge, such as the colour of a surface or the expression on a face, that can only be acquired through it.

Prof. Semir Zeki
Neurobiologist, founder of the Institute of Neuroaesthetics, University College London

The emotions we feel shape what we see. We do not learn the world passively through our external senses – we receive and experience the world differently depending on our emotions.

Psychologist Dr. Erika Siegel
University of California, San Francisco, in: Psychological Science, 2/18

OUR PERCEPTION CREATES SPACES

1 The perception space is constructed by a person's sensory impressions in a given situation through interactions with the environment. The perception space is created by the participating sensory impressions, whose interaction can differ greatly, for example, when a blind person has to compensate for the lack of visual perception using other senses.
Our brains do not simply create perception spaces out of local impressions, because temporal or activity-based impressions also create perception spaces. They reflect the world in the manner that a person perceives or can perceive it at that particular moment.

2 The conceptual space builds on the physical-sensory perception space through the addition of the components memory and perspective. It supplements the perception spaces with previous experiences, creates conceptions of the context of our actions and thus lays the foundation for continued trust in the future. To ensure that the conceptual space does not demand too much or too little of our own scope for action, it has to adjust itself to major changes in the perception of the world, as is shown by changed brain structures. Using digital navigation systems weakens the biological network behind our sense of orientation while expanding our conceptual space.

3 The action space (also the interaction space) is created within the conceptual space. In a sense, it describes the active playing field, in which an individual can move with his or her perceptions and conceptions.

4 The effect space expands an individual's action space by the addition of the components of the impact and the influence on other action spaces. Within the conceptual space, the effect space delineates the range of possibilities that enable us to overcome our physical limitations and increase self-effectiveness by means of smart tools and digital media, for example.

Such sensory, emotional and associative responsiveness would actually be important for classrooms and work spaces – after all, no other space more clearly formulates the intention to fulfil our natural urge for development, experience and learning.

So what could be more sensible than to transfer this empathic creativity to the design of the room in order to enable us to experience the sensory, emotional, associative and pleasurable parameters that we long for inside? The feel-good trend that more strongly addresses sensory perceptions and thus expresses appreciation is in keeping with this inner desire to feel welcome and in good hands no matter in what state we are in. Visually, this feel-good trend uses patterns that do not fit with the neutrally standardized office image (ideally, it does this without using elements from another set of clichés, such as that of the living room). In this way, it stimulates our associations further and encourages us to create our own new office image.

THE ATMOSPHERE DETERMINES THE QUALITY OF OUR EXPERIENCE

Human-centric lighting (HCL) research, which coordinates the effect of light with the interactions in our environment, has achieved a technological breakthrough with regard to light, which is the key means of creating atmosphere. Technology has succeeded in using white LEDs to recreate the natural visible light spectrum and simulate it chronologically throughout the day in building interiors (Nobel Prize in Physics 2014). From a biological standpoint, the discovery of melanopsin photoreceptors in the human retina (2002) explains how the body clock is adjusted in tune with the colour of daylight and the angle of the incident light. This enables us to use lighting not only for the purposes of illumination and decoration but also biodynamically to influence human perception, support our sleep-wake cycle, and accommodate our sense of well-being.

Numerous studies that report on improved comparative figures regarding sleep and basic mood also calculate how much energy our brains had to invest in order to endure or compensate for the previously inadequate lighting standards. For example, recent attempts to boost employees' productivity by using a large share of blue light for a longer length of time than would normally be the case only resulted in temporary improvements to concentration. In fact, the number of people on sick leave even rose after a short period of time. Playing tricks on our internal operating system can backfire. Taking into account biodynamic factors that correspond to our capabilities is a more promising approach.

Activity patterns in the brain show that there is a connection between processing and storage, which links the things we perceive with a large number of associations.

Prof. Rainer Bösel
German-Austrian neuroscientist and psychologist, professor emeritus, International Psychoanalytic University Berlin

RGB LEDs can simulate the visible spectrum of sunlight in building interiors. The illustration shows how the changes in the colour of light should change with the time of day so that it optimally harmonizes with the exterior and our biorhythm. The colour temperature scale ranges from less than 3,300 Kelvin for warm white to over 5,300 K for cold white.

Photography: Zumtobel

EXPERTISE

HOW PERCEPTION SPACES BECOME SCOPES FOR ACTION

All of our perceptions give us a spatial and temporal concept of our existence in the environment. But the question is: How do we create this conceptual space?

Prof. Axel Buether *conducts research at the University of Wuppertal in the areas of visual perception, design and communication with a focus on the way colours, light and space affect human beings.*

Photography: Martin Jepp

» **The HOW (something affects us) is more important for the assessment of one's surroundings than the WHAT.** Whereas the "what stream" leads to semantic memory, the "how/where stream" activates the behavioural conditions and interrelationships of actions that are linked to the event in the procedural memory.

WHAT DOES SPACE MEAN FOR OUR SENSES?
Our perception does not create spaces like building a bridge. Instead, our conception of space and the world results from our interaction with the environment. It's similar to the way we understand language by asking questions and receiving answers. I look at the world with my eyes and the environment answers my questions, not only because I see something but also because my other senses (smell, touch etc.) explore it along with my sight. In this way, we actively construct the world with all of our senses and link these impressions together to create experiences.

WHERE IS THIS PERCEPTION SPACE?
Constructivists would say that it's all in your head! However, I think rather like a semiotician. For me, the space of this interview situation is a discussion space that is created by you listening and me speaking. It becomes richer the more intensively we engage in a dialogue and it is limited to the duration of the interview. This is the perception space that our brains generate. It's first constructed by our visual focus, which provides us with the picture.

HOW DOES A PERCEPTION SPACE DIFFER FROM A CONCEPTUAL SPACE?
A conceptual space is the remembered perception space. It aggregates our scope for action from the various perception spaces. If a perception dimension is lost, as with blindness, we have to learn to explore the world with our remaining senses. This is hindered if we remember how it used to look. Our conceptual space must adapt to our new perception of the world, and this, in turn, also changes the brain structure.

CAN I EXPAND MY CONCEPTUAL SPACE?
Yes, because the conceptual space can be explored via multiple senses. In this way, I can expand my vision, for example by talking about the image. Conversely, I can graphically supplement the language space by means of a model such as a diagram. The interactions between the sensory spaces exist within the conceptual space and can reinforce impressions. This is also accomplished by digital media, which have already become a fixed part of our conceptual space. If I took away your smartphone it would be as if I had blindfolded you. I now consider smartphones to be an extension of our sensory perception.

HOW DOES THIS CHANGE OUR LEARNING?
The environment is part of our memory storage system; it's basically an outsourced memory. Something as minor as a pattern or a smell enables us to remember its importance for us. This can also be extended to digital tools: I no longer have to remember the way because my navigation system does this for me. The need to remember something decreases because we can access everything in our immediate surroundings. As a result, my students no longer have to memorize anything and instead are given much more complex tasks that they have to solve by accessing knowledge. They would never have been able to achieve this level of complexity before!

DO I SEPARATE THE REAL FROM THE VIRTUAL IN MY CONCEPTUAL SPACE – OR DO I EXPERIENCE EVERYTHING AS IF I WERE USING DRUGS?
The whole way we perceive the world is actually similar to a psychedelic experience because we perceive everything subjectively. This perception of the world goes away when we close our eyes. Our belief that the world really is as we experience it is nonsense because there is no such thing as an objective world. Everyone who dies takes their entire world with them, and every newborn has to discover his or her own world. To do that, we have to learn to practically comprehend space as (inter)action space and be capable of interacting with it. It makes no difference where the information for this comes from or whether it is really or virtually generated.

HOW CAN I TRUST A SPACE?
By gaining an impression of it. In most cases, this is primarily a visual impression, an image that I make of a situation. But often I am unable to objectively test a situation – the "what" – and therefore only make a decision about the "how" indicators and on the basis of my feelings whether I'm in good hands. My intentions also play a role. Take a car, for example: If I step proudly into a dynamically styled automobile but then get stuck in traffic, this context destroys the whole impression. The space has to generate a true sensory experience, not merely an illusionary one. I want to succeed in my intention here.

DO CERTAIN COLOURS AFFECT HOW WE WORK?
No, to think that would be a mistake. There is no specific colour that will always work well for us when we work or relax. Although light and colours can be used to generate atmospheres that tend to be more stimulating or relaxing, it would be wrong to press people into such categories. We have to create tailored solutions that take into account the respective people, intention and place.

SPATIAL PERCEPTION IS A PROCESS OF APPROPRIATION

"Spatial perception is based on the principle of probability, a fact that can be well observed in the learning process of children. The use of objects and the discovery of our possibilities of interaction let us develop action routines. That's why we hardly notice that our spatial perception is a process of appropriation," says the media researcher, perception psychologist and architect Professor Axel Buether. "Space is like a language system that tells us what the objects it brings together mean, how we should behave and what our scope for action is" (see the interview opposite).

Because we pragmatically use information from the real and virtual worlds as we envisage our scope for action, the physical environment has to catch up. On the one hand, networked sensors and cameras provide it with a kind of "software skin", which enables our digital assistance systems to scan the surroundings for us in a more objective, fact-based and large-scale manner. In this way, we can individually recognize what they have to offer for our current, future or past situations. On the other, our physical environment should concentrate more on physical-emotional qualities and captivate us with its truthfulness via multiple senses.

An individually and communally experienced multisensory perception provides us with a learning advantage that we can only experience together and at the same moment. Locally, we feel not only our actions in their actual context but also dynamics within the group – their reflections, their motivations and their delight in experiment, which in turn encourage every member of the group to participate.

HYPOTHESIS

SHAPING SENSATIONS

Which perceptions can be shaped as intended sensations?

CHARGING PLACES OF LEARNING AND WORK WITH POSITIVE EMOTIONS

Because people inevitably connect especially happy or terrible moments with the place in which they happened, employees might be able to "inaugurate" their workrooms by staging a beautiful and moving experience. If the dominant impression of a place is charged with positive associations, future stressful moments could be weakened in their effect on employees.

VIEWING POSSIBLE SOLUTIONS IN A DIFFERENT LIGHT REQUIRES A NEW START

A functional magnetic resonance imaging (fMRI) scan demonstrated that our "photic memory" takes into account the colour of the light at the time of an action and that we find it harder to continue with a task if the colour of the light has changed. This implies that we should complete tasks in line with the natural change in the colour of light and not to interrupt our work so frequently. Conversely, a clear change in the colour of light might help us to leave chosen paths in order to be able to literally see things "in a different light". What's more, our biorhythms make us most productive at noon, when the colour of the light is brightest. So why do we go for lunch at this time?

LIGHTING IN ACCORDANCE WITH ONE'S MOOD AND PERSONALITY

Human-centric lighting can be controlled in line with the time of day in order to generate preferred lighting moods according to the respective situation. Target group-specific lighting moods already exist for retail environments. In the same way that such lighting emphasizes aspects of the product range and accommodates personal preferences, it could be used by employees to personalize their workplaces or increase their motivation for an intended task.

LOOKING AHEAD, SECURING ONE'S BACK

The prospect-refuge theory is in a one-to-one correspondence with the orientation of our senses. While we are very good at seeing and hearing whatever is in our field of vision, we can only imprecisely perceive what happens behind us. To prevent this subconscious anxiety, seats should be arranged in such a way that the sitter's back is protected by a visual and acoustic barrier.

Our "photic memory" remembers the colour of the light at the time of the action. Test subjects who were to continue an ongoing cognitive task after a one-hour break were less able to continue with this work if the colour of the light was much different to what it was before.

A functional MRI study conducted by the Cyclotron Research Center of the University of Liège and the Department of Chronobiology at the INSERM Institute for Brain Research in Bron, France

THE I AS THE NAVEL OF THE WORLD

Navigation systems lay the world at everyone's feet.
Optimized image worlds outshine our conceptual spaces.
What can we learn from the user-centric approach?

Self-organization, self-management, self-learning skills, self-motivation, self-marketing, individual responsibility... due to the digital transformation, the individualization trend has now finally reached the world of work. These self-centred skills are meant to help people make a larger personal contribution and individually find the best way of doing things.

Digital services have already adapted to this trend. As a result, each user experience focuses on the specific user and his or her context. The expectations that people will have of the working environment in future will probably be similar to the way every digital map creates the world centred on the user's location.

The criteria of success are shifting from "performance" to "experience". (...) For the new middle class in particular, the main thing is now how one experiences life, how it "feels".

Prof. Andreas Reckwitz
Sociologist. "Für eine Kultur der emotionalen Abkühlung", FAS, No. 47, 24 November 2019

THE POSSIBILITIES WILL BE LAID AT THE USERS' FEET, WITH THE GUIDE RAILS FOR TARGET ACHIEVEMENT INCLUDED IN THE OFFER

How could personal identification with the workplace be created in daily life? How could the set of methods for target achievement be translated at the individual level? How could each person's conceptual space be expanded? The question of how we want to work is thrown back at us. We are at liberty to try out how these guide rails work and how they might look – and how creatively we use the media to extend our own conceptual space.

We exchange images. Our knowledge of others – and with it our continuous confirmation of our trust in them – is actually increasing. The question is how we can use these technical possibilities in a targeted manner so that we can get into actual, analogue and personal touch with people with whom we have no previous connection. We view this as a digitalization opportunity that has not yet been exploited.

Jan Wetzel
Sociologist. Excerpted from: Julia Schaaf: "Wir müssen zu einem Wir werden", FAZ, 9 March 2020

Since the introduction of Instagram, observational learning actually means "imitation".

Prof. Albert Bandura OC
Canadian psychologist who developed the concept of self-efficacy and social cognitive theory, Stanford University, USA

We already use the medium that is most effective for expanding our conceptual spaces: images. Most people are very visual in nature and orient themselves primarily on the basis of facial expressions, patterns, motifs and image impressions. Images root themselves firmly in our minds and shape our conceptual space, as we, unfortunately, also know from the images of the old world of work. That's why we need new images, images that excite us – and precisely why we like to go exploring on Instagram and other such websites.

Role models have turned into influencers and thus have slid down to our level. Everything inspires and imitates. Copying also benefits from the fact that physical translation reinforces the sensory experience. Psychologically, selfies are suitable for identification because the individual – in effect observed from outside – recognizes himself or herself in the midst of the action and over-inflates his or her role as the protagonist. We have therefore intuitively understood how we can appropriate our surroundings and impress ourselves with images.

SELFIES SHOW US WHAT THE OFFICE WORLD STILL NEEDS TO LEARN: INDIVIDUALS MUST BE GIVEN THEIR EFFECT SPACE

We used to believe what we saw. We now know better. We optimize our environments as well as ourselves and use illusion for our benefit in enactments. We are shaping our own conceptual space. What's interesting is that we, in a sense, implicitly learn twice in mixed realities. On the one hand, we do so by trying out unimagined possibilities and saving the effects, and, on the other, by our ability to observe ourselves during this learning process and trace developments. While the first is a push that enables us to exceed limits that were previously thought impossible to reach, the other factor reinforces our understanding of the way things are and our faith in our ability to translate it. This certainly is not a bad way to train oneself to learn self-management and self-learning skills!

Boosting one's intelligence is firstly a matter of mindset. According to Carol Dweck, a psychologist at Stanford University, USA, intellectual ability is also a question of one's self-image. As a result, stereotypes such as the idea that girls are less gifted than boys when it comes to mathematics strongly influence how well female students perform in corresponding tests.

Prof. Carol S. Dweck
Psychologist, Professor of Psychology, Stanford University

HYPOTHESIS

CONVINCING ONESELF

The motto "I won't believe it until I see it myself" is a workable approach, because the linking of seeing and experience leads to conviction.

WE PUT EVERYTHING INTO RELATION

Thanks to our mirror neurons and socialization in early childhood, we can recognize and understand people's emotions by their facial expressions. According to the neurologist Prof. Joachim Bauer, these me-you networks enables "us to some degree to experience ourselves the way others see us and vice versa". As a result, we innately tend to meet other people's expectations or to imitate other individuals. Both of these approaches help us to not lose our bearings. Sometimes we are influencers, sometimes followers – imitation also means learning by implication.

OBSERVING ONESELF AS ONE LEARNS

Every YouTube tutorial combines the features of seeing and understanding. The learning process would be even more successful if one were to perform the task oneself and be filmed in doing so.

Seeing oneself as capable of learning not only reinforces one's memory, it also shows us that one was able to master the task. The confidence we gain in this way (plus the instructions) will probably motivate us to continue to practice the task.

A FOLLOWER'S DREAM ATMOSPHERE

Could I be accompanied by my favourite lighting mood in the same way as my music accompanies me through my headphones? Would it be possible for my environment to provide various atmospheres just for me depending on my intended task? Or will it soon be possible to use a few commands or gestures to turn any space into a workroom, an inspiring backdrop, or a music room? Will I then concur with the sociologist Niklas Luhmann, who postulates that the medium is not just the message but also puts me into the intended mood?

Interactions between sensory spaces can reinforce impressions. In this context, it's helpful if people can use mnemonics to depict experiences in a perception space (e.g. by means of a camera), thus articulate processes, and offer them again for reception in the form of a video.

Prof. Axel Buether
Didactics of Visual Communication, University of Wuppertal

SPACE BECOMES A STAGE AND EMPOWERS THE PERFORMERS

Physical reality or imaginary spaces? Selective perception or fooled senses? When our experiences are enriched by additional dimensions, does this also expand our learning spectrum?

Experiences in mixed realities as well as in the spatial continuum between archaic physicality and incredible sensations force us to re-explore the conception and significance of space. There is no such thing as "the single space". It never existed, because every individual has always experienced it differently. The existence of such a "single space" will be even less feasible in the future, due to superimposed information.

We begin to understand a space by interacting with it, which causes the space to take shape. The perception space then becomes a conceptual space, from which arises our action space, out of which we in turn create our effect space. With regard to perception psychology, the architectural space is the backdrop before which we act. This backdrop can stimulate or support us. However, it can also leave us cold. The latter would a lost opportunity – not only for the "experience society", but also for the world of work.

At some point in the 2020s we will get breakthrough augmented-reality glasses that will redefine our relationship with technology.

Marc Zuckerberg
Founder and CEO of Facebook

FROM THE CONCEPTUAL SPACE TO THE SENSATION SPACE

The only limit left is in our imagination. In the real world, any shape can now be built or printed and clever storytelling allows us to generate any type of emotional involvement. Here too, digital simulations augment and overlap the spatial structures, use the built environment as three-dimensional image carriers, and will play smart cities like stages.

The dialogue of surfaces has begun. The physical environment is expanding its boundaries and range of offers through spectacular impressions, augmented realities, smart sensors and social feedback.

A force of nature that is seemingly caught in the Wave aquarium
The LCD screen that is wrapped around a façade in Seoul, South Korea, simulates a wave breaking in the building.

dstrict.com

If a façade is complex and interesting, it affects people in a positive way – negatively if it is simple and monotonous.

Prof. Colin G. Ellard
Neuroscientist at the University of Waterloo in Canada and Director of the Urban Realities Laboratory

We thus have the tools and opportunities, but do we also have ideas about how we will use the converted space and for which learning experiences we would like to shape it?

It might be helpful if we approached this question with the wide-open eyes of a child. How do our children experience this new world? Which learning environments are they using for themselves?

GOING BACK TO THE CHILD EXPLORER MODE

Children practice creativity and collaboration in games such as Minecraft Earth, where kids of all ages and different interests construct their own buildings, walk through other players' structures, modify constructions, learn know-how, and are proudly part of a community that can create worlds. We similarly use digital twins to simulate planned buildings. As is the case with the plans for the Siemensstadt in Berlin, we can walk through the virtual terrain and depict changes and their consequences for any discipline.

Children learn how to bake on YouTube and send pictures of their cakes to their grandmothers. Video tutorials also help us to make repairs ourselves, while augmented reality overlays may allow us to dispense with workmen in the future. But how do children shape their physical environment? They continue to build caves out of chairs and blankets, hide within them, and feel cosy there in the same way as we attach additional value to our homes, furnish them in a way that appeals to the senses, and are now even pursuing the feel-good trend in the office.

NO MATTER WHETHER IT'S ACTUALLY BUILT OR IMAGINED, THE SPACE ALWAYS SERVES AS THE FRAMEWORK

The pendulum swings in both directions. On the one hand, we are thrilled by new insights and worlds of experience, while, on the other, we look for support in certainties. Space is our enabler, mediator and transformer.

Although our skills, activities and methods are changing, and vary depending on the task, we should also be able to shape the framework if we know the contents, the action and the effect that it is supposed to generate.

Workrooms that are supposed to support us in the purpose of our work must be designed as part of our user experience. Offices' advantages are clear. A dive into the environment with all five senses can only take place on location. In this way, the Instagram generation, which is motivated by visual attractions, can also find its toolkit and work platform for curated self-awareness in the office.

Architecture influences human cognition, experience and behaviour by allowing, facilitating, requiring, impeding or preventing various perceptions, thoughts, emotions and acts.

Prof. Daniel R. Montello
Professor at the Department of Geography and the Department of Psychological & Brain Sciences, University of California in Santa Barbara

There is no clear-cut line dividing interiors from exteriors. In every exterior that we move through, we obtain support and orientation from the interior spaces that we create for ourselves and in which we recreate the cave that used to house us.

Dr. Wolfram Ette,
literary scholar, paraphrasing the religious philosopher Klaus Heinrich; in: "Baumeister, Moderne Seelenräume", 2/2019, 116th Volume

CHANGED PERCEPTION OF QUALITIES

NEW POSSIBILITIES		RENEWED APPRECIATION
Facts	>	Emotions
Relation to context	>	Reference to oneself
Remote presence	>	Physicality
Simulation	>	Authenticity
Contemporaneousness	>	Originality
Shapability	>	Naturalness
Recognition	>	Privacy

THE OPTIMAL EFFECT SPACE

If work is supposed to encourage us to unfold our potential in a more natural way, where would the potentials for an optimal spatial effect on this development be located?

The challenge for understanding space is to understand the context. The context provides the framework through which people understand the significance of architectural structures.

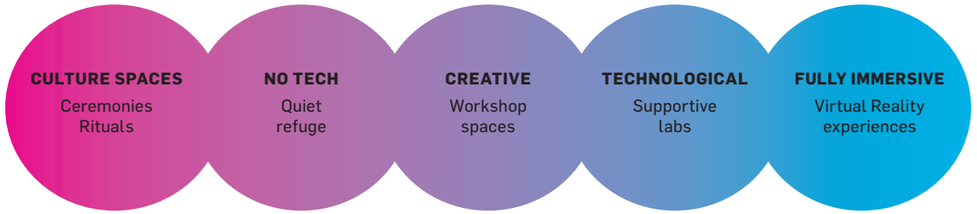
Prof. Daniel R. Montello
Professor at the Department of Geography and the Department of Psychological & Brain Sciences, University of California in Santa Barbara

First off, it should be an environment that more strongly accommodates our biological, sensory and emotional needs. As we determined using the example of the colour spectrum of daylight, our previous working environment has in no way harmonized with our biorhythms. As a result, the focus on health and well-being is by no means a nice-to-have trend, but a key factor that particularly pays off in stressful times of crisis. Moreover, our conscious sensory axis can be controlled by means of design, architecture and aesthetics. On the one hand, we ourselves are beings who interact with spatial form and allow ourselves to be influenced by our surroundings. On the other, we are shapers who can appropriate the world for ourselves.

OUR STRIVING TO APPROPRIATE AND MARK AREAS IS A RITUAL FOR MAKING A PLACE USEFUL FOR OUR OWN PURPOSES

The fact that we are predisposed to social as well as territorial behaviour (which Colin Ellard talks about on page 15) points to additional cognitive-emotional interactions that we look for in spaces. This provides us with three pointers for office design.

First, we need a place for our conception of work (see "conceptual space"). As visually predisposed beings, people remember an event's context more easily by means of the location where it transpired. When we have very emotional experiences, our brains even store the place inseparably with the memory. This means that new working methods also require us to have new images for our minds. Because our interaction space in particular is currently expanding on the playful and virtual level, might we be able to take the images from these new worlds?



THE SURROUNDINGS ACCORDING TO INTENTION

The graphic shows a variety of characteristics that range from physical-cultural spaces to fully immersive spaces. That's because not every job requires the full range or the same range of digital equipment. What matters is an atmospheric distinction, which also provides psychological support for the intention behind the work. Possibilities for individual adaptation would also be desirable in each case.

Does the flight altitude of one's thoughts correlate with the height of the ceiling?
Together with Rui Juliet Zhu, the psychologist Joan Meyers-Levy established that rooms with high ceilings tended to encourage people to engage in abstract thinking. Instead of focusing on specific details, the test subjects found it easier to relate facts and objects with one another. The scientists think this broader view of looking at things is associated with the great height of the rooms.

Prof. Joan Meyers-Levy
Psychologist and professor for Marketing at the University of Minnesota Twin Cities. Together with **Rui Juliet Zhu**, *she authored the study "The influence of ceiling height", 8/2007*

Office design will become increasingly diverse. We hope that offices will get a more individualized profile in the years ahead.

Hendrik Hund
President of the Interior Business Association in: "OFFICE PIONEERS. Ausblicke auf das Büro 2030", Robert Nehring (ed.), PRIMA VIER Nehring Verlag GmbH, 10/2020

Secondly, conversely we can anchor our thoughts to specific locations. Cicero connected his thoughts with the Forum Romanum (see page 15), which he walked through in his mind and where he placed his arguments. This shows that architecture can also be used for our conceptualizations, so that we can order our thoughts. Our inner search for structure also speaks for the retention of a readable architecture (and against "womb forms").

Thirdly, the actual core element of our territorial predisposition is that we want to appropriate, own and occupy spaces. This is often a dilemma in view of flexible room occupancy and a clean desk policy. However, when employees recognize that their area of activity is not limited to a screen workstation, but that the entire office building is at their disposal, they might be reconciled to their situation by the newly gained diversity and spaciousness.

FROM WORKROOMS TO INTERACTION SPACES

It is important that the increase in methods and opportunities for interactions also lead to an increase in associations and rituals that fit with a company's culture and its team spirit. This definitely does not mean embellishment but rather a visual comprehension of a situation, which is also a form of appropriation.

EXAMPLE

HUMAN-CENTRIC DESIGN

At Adobe, Lacey Arslan's job title was "Workplace Experience Designer". Her holistic understanding of design could not been better described.

A HOLISTIC IDEA OF WELLBEING

Besides Adobe's Wellness Center covering a whole floor with various offerings for fitness, training and therapies (including the Somadome sensory room, see page 12), Adobe has ergonomic workstations, an onsite dietician, access to meditation apps, and healthy lunch, beverage and snack options. The holistic thinking about wellbeing also embraces the quality of architecture and design. So, wherever possible, the built environment is made of healthy, natural materials (we specify low or no VOC paint products and try to avoid synthetic materials) and for our ancillary furniture we choose local sources and have a preference for handcrafted objects.

COMBINING SENSORY AND CONVENIENCE OFFERS TO ENHANCE THE WORKING SPIRIT

To enable both working and wellbeing, we integrated a small video conference room into the Wellbeing Center to give our colleagues the convenience of moving directly from a meeting with their trainer to a meeting with their team. Quite similar are the little greenhouse conference rooms between the restaurant area and the roof terrace. They are amongst the most frequently reserved conference rooms due to their proximity to a basic human essential: food. Convenient too is the fact that these rooms eliminate the hassle of carrying your lunch across campus for a team lunch meeting.

DIFFERENTIATING SPACE AND ITS USAGE VISUALLY, ACOUSTICALLY, HAPTICALLY

As every office floor is accessed from elevators, we designed entry areas to feel like small lobbies which facilitate meeting with people and provide a sound buffer from the elevator lobby. In San Jose every office floor has transitions between the spaces to signal to the brain a change in atmosphere. From the office space to the break room the flooring changes from carpet to hard surfaces with playful overhead acoustical panels. They have the most access to natural light, and they're stocked with various types of seating that is optimal for gatherings and collaborating.

DESIGN CAN SUPPORT THE WORKING SPIRIT AND EMPLOYEE PERFORMANCE

I believe, and I've seen, that when employees gain a sense of ownership of their office space through a creative contribution they also gain personal pride, feel more at home, and become a part of something bigger which transcends into more positive work and work relationships.

Lacey Arslan
Multidisciplinary designer, and Workplace Experience Designer (2013–19) at Adobe, San Jose USA

Lacey's role was to ensure that Adobe's brand and culture were reflected at its Headquarters and in every office around the world.

I've had the most interesting and inspiring conversations with fellow employees over coffee, over lunch. People love to share what they are passionate about, including their work environment. That anecdotal feedback, as well as research from Adobe's internal workplace intelligence team, has been the impetus of innovative new spaces.

ARE WE GOING TO THE OFFICE JUST FOR FUN NOW?

If we choose our environment in line with our aims and agendas, and if working from home becomes well-established for undisturbed working, will the office become a "corporate culture community" space?

No other form of dialogue is as motivating and as fruitful as physical cooperation in one place. That's because it's the only form of dialogue that stimulates all the senses, enables the participants to become completely attuned to one another, and creates the cohesion that is crucial to making progress.

Actively enjoying working at the office doesn't seem so far-fetched when the tendency is towards spending just a few days a week there. The trend toward working from home enables many people to work undisturbed and receive updates, but it's counterproductive in terms of emotional cohesion and fruitful transdisciplinary cooperation. Sharing a coffee break in front of a computer screen will never be as good as meeting at a café. Similarly, the work steps for which close cooperation within a team are required should be carried out in one place, together with everyone involved and with all of one's senses activated.

WE NEED A WHOLE CULTURAL CENTRE TO SHOW WHAT AN OFFICE OF THE FUTURE COULD BE

If employees prefer to spend more time working at home, the office is either not providing the excitement of human cooperation or not conveying it. It's true that until now offices have not taken full advantage of the sensory/emotional or the cognitive/didactic potential of a contemporary learning environment. That is a fatal deficit during an era of change, when people need, more than ever before, to be taken by the hand and have their curiosity aroused about what lies ahead – and about their own potential. Where could we look in order to find out how people's zest for creative encounters – both interactive and content-oriented – could be stimulated? I would go looking for the right motivations and examples in a village community and in a cultural centre.

Why a cultural centre? Because it's a place where very diverse people meet in order to find out more about the things that connect them. Because a cultural centre presents opportunities that are curated in terms of their themes and didactic value, invites people to participate in many different kinds of interaction and learning, and has something for everyone. And because when we are inspired in this way we seek out our tasks on our own, meet kindred spirits there, initiate conversations about a topic, an observation or an attempt to try things out, and thus learn from one another. Creative workshops and performances, stages and presentations enrich our days. The reading room of the centre's library also offers space where individuals can quietly retreat and focus intensely on the work at hand. Time in the centre is structured by pauses for dining, playing games together, making music, moving around or relaxing outdoors.

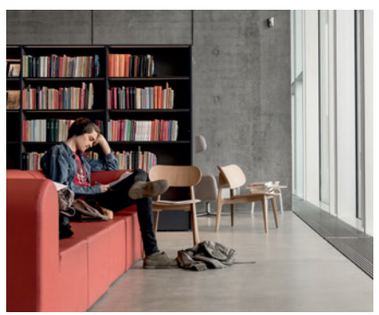
The cultural centre provides the motifs that offer us new images and patterns of behaviour for new learning and working worlds – and it uses adroit didactic methods to mediate between individual egos and a sense of community.

AND WE NEED AN ENTIRE VILLAGE TO SHOW WHAT AN OFFICE OF THE FUTURE COULD BE

Why? Because in a village everyone knows that their own goal can only be reached in cooperation with the others, and that they all contribute their know-how to the community. Because a village encourages people to develop their talents and specializations within a larger context. And because it deals sustainably with natural resources and the seasons, masters crises through resilience, and cooperatively creates and defends something lasting.

If everyone is only communicating virtually, there are no longer any casual encounters. Besides, it will always be difficult for new employees to become part of a team if they are only meeting their fellow team members virtually. Values and team spirit are transmitted more easily through physical contact.

Hendrik Hund
President of the Interior Business Association



The cultural centre as a model: Various types of spatially curated meeting can be seen in this building in Århus, Denmark. The areas along the ramp and the windows, as well as in the galleries, are mainly used for working. Art and performances, workshops, gaming zones, restaurant areas and spaces for movement, as well as a library with a reading room, inspire the users.

"Dokk1", Schmidt Hammer Lassen Architects

Photography: Adam Mørk

The village as a model: The International School in Ikast-Brande, Denmark was expanded by adding halls for sports and contemplation, offices for work, rooms for learning, shops and community areas. The diverse uses of the building can be seen in its cubature and felt through the choice of materials. "The Heart" is a vibrant meeting place for schoolchildren, teachers and community members.

"The Heart", C. F. Møller Architects

Photography: Adam Mørk

THE OFFICE OF THE FUTURE SUPPORTS ITS USERS

Corporate real estate management is still oriented according to data on employee numbers, occupancy, frequency of use and energy consumption. Quantity instead of quality. When will the end users' interests count?

The key priorities for office buildings are flexibility and efficiency. The clients want these qualities, as do the users. However, these qualities mean rather different things for the clients and their business customers on the one hand and for the people who will work in the building on the other. In terms of the building itself, the aim is to build in ways that are as standardized and compact as possible so that the investment is worthwhile. Today the introduction of open spaces and desk sharing offers maximum flexibility and efficiency.

But in terms of efficiency, the final users expect to have an environment that supports their activities and their capabilities – and enables them to work so effectively at the office that at least their commuting time is worthwhile.

IF THE USERS' EFFICIENCY COULD BE INCREASED BY TEN PERCENT, WOULD IT PAY OFF TO CONSTRUCT A MORE EXPENSIVE BUILDING?

This question was asked by Jöri Engel, the CEO of Swisscom Immobilien AG, at several workshops in which we considered what an office of the future should achieve and how that would change corporate real estate management. Every glitch in the system led us back to the people working there. Engel pointed out that in many cases office designs based on organizational charts turned out to be faulty. For one thing, many people don't work together with the colleagues in their team but instead with people from other departments. Furthermore, the emphasis was on room features based purely on typical tasks and roles. This seemed to be a plausible approach in objective terms, but it was not always right for individuals, because not all knowledge workers are lawyers, bookkeepers sometimes work from home, and "HR consultants want to work in the organizations they serve rather than in an HR office," according to Engel. Planning needs more dialogue and is oriented toward people and processes rather than a "one size fits all" approach.

>> We bear responsibility for creating spaces that are effective – not just attractive.

Jöri Engel
CEO Swisscom Immobilien AG

OUTLOOK

INDIVIDUALIZED ADDED VALUE

The office must demonstrate its "performance benefit" for individuals.

DIVERSITY IN SPATIAL DESIGN

Supporting individual employees' work agendas is known as "activity-based adaption". In order to noticeably boost their own performance, individuals will be able to use additional levers to adjust the atmosphere.

INTERFACES WITH PRIVATE APPS

Employees will be able to use their own "performance monitoring" devices, which should function inside the office as well. If the users release their anonymized data, spaces can be planned in line with needs.

EXPERTISE

FOCUS ON USER EFFICIENCY

What does an office property have to provide in future? Jöri Engel talks about the new tasks of corporate real estate management (CREM) at Swisscom Immobilien AG

IN SEVERAL WORKSHOPS, WE'VE COME CLOSER TO A VISION OF THE FUTURE OF THE OFFICE. WHAT IS THE MAIN INSIGHT YOU'VE GAINED?
From the users' perspective, an office is a lever or a tool to support and rate their own performance. The concept of "function" is far more important than overly motivated office planners' and real estate managers' drive to design and self-realize. We ought to step back a bit and spend more time observing in order to find out what elements are helpful for the users. In the learning environments we visited, students use (only) the solutions that offer them the greatest added value because of their particular function. As a result, "voluntary test subjects" are very good indicators of how well a space serves them.

WHAT NEW REQUIREMENTS DOES THE WORLD OF WORK WITHIN THE OFFICE NEED TO FULFIL?
The main goal is to get a clear vision of what can and will benefit the company. So you can stipulate that the office must be a site of collective know-how, networking and creativity, and that it is embedded in the organization as such. The fusion of work and private life is a fact. Some employees deal with this better than others. A company is responsible for offering both groups the support they need, and for creating a "home port" or a "campfire" where people meet, work, initiate things and feel that they are part of a whole and part of something big.

WHAT TASKS MUST AN OFFICE FULFIL WHEN EMBEDDED IN A SMART CITY?
Digital services will focus more strongly on user efficiency and less on operational processes. So the question for us is: How can we design our employees' daily work as efficiently as possible? And which – digital – solutions can help us do that?

IF APPS REFLECT PERFORMANCE, WHAT WILL THE OFFICE NO LONGER HAVE TO DO?
The office can no longer afford to be static or take dogmatic approaches, such as "role/function/task A presupposes room concept A. And B presupposes B."

WHAT SHOULD THE OFFICE PROVIDE MORE OF?
The "humanization" of the workplace must be possible. Person A selects room program B for task C. It all begins with the individual's preferences, because that's exactly when his or her performance is best.

HOW IS THE PROPORTION OF PERSONALLY SPECIFIC COMPUTER WORKPLACES DEVELOPING?
I see that about 50 percent of the people in my environment appreciate their personal workplaces and the other 50 percent are voluntarily giving up a fixed workplace in favour of an ergonomically high-quality non-personalized work opportunity. What both groups have in common is the demand for functionality, ergonomics and flexibility. Both groups' requirements can be planned and implemented.

WHAT LESSONS HAVE EMPLOYEES LEARNED FROM THE INCREASED FLEXIBILITY?
The flexible design of daily work is very responsive to the employees and their individuality. Highly functional spaces and room structures for teamwork are considered much more important than individual workplaces. We need more team/project/theme rooms where people work together on something and where the knowledge that has been gained is depicted in the room and can be referred to later.

HOW CAN CREM STRENGTHEN EMPLOYEES' SENSE OF BELONGING AND IDENTIFICATION WITH THEIR COMPANY?
In addition to themes related to the brand such as CI/CD, we've created the concept of "white spaces" in order to also strongly embed these topics in house. These "white spaces" cover about ten percent of the total area allotted to a department, and they can be designed individually and without any limits by the team working there. Some teams have built self-designed furniture at the weekends, and others have taken the furniture they need from the company's in-house furniture storehouse in order to fulfil their wish for individuality. The best aspect of this approach is that it increases the employees' identification with their place of work and decreases their desire to restructure the other areas.

HOW DO YOU THINK OFFICES COULD BE MORE CLOSELY ADAPTED TO THE PEOPLE IN THEM?
I'm focusing on two challenges that are facing workspace design. For one thing, I'm looking for ways to take into account the individuality of each person – the user typology – in their requirements regarding their own workplaces, while still creating an economically acceptable standard. For another, I want to establish clarity (and provide information) about CREM's responsibility to establish the comprehensively ergonomic workstation as the primary place of work in the office, because we don't know the long-term consequences of working at secondary places of work. If we simply compare the daily results of the step counters and Fitbit bracelets from during the lockdown with those of the time before, I get worried about whether we can offer the right support for people's health and well-being at secondary places of work.

Jöri Engel
CEO of Swisscom Immobilien AG and President of CoreNet Global in Central Europe

Engel has been the CEO of Swisscom Immobilien AG since 2013, and as the Head of Corporate Real Estate Management he is responsible for Swisscom's approximately 1,000 properties. The close connection with Swisscom AG and with the workforce as a whole thus offers both broad and differentiated insights into the transformation of the ways we work and their spatial requirements. Among the ITC companies, Swisscom tried out desk sharing (2006) and agile work methods as well as its own new concepts very early on and adapted them to its own purposes.

>> There may be roles, functions or tasks that influence the design of the world of work, but these are only a small number of the factors involved. Various types of people, characteristics and individuals must also be provided for so that their full potential can be realized.

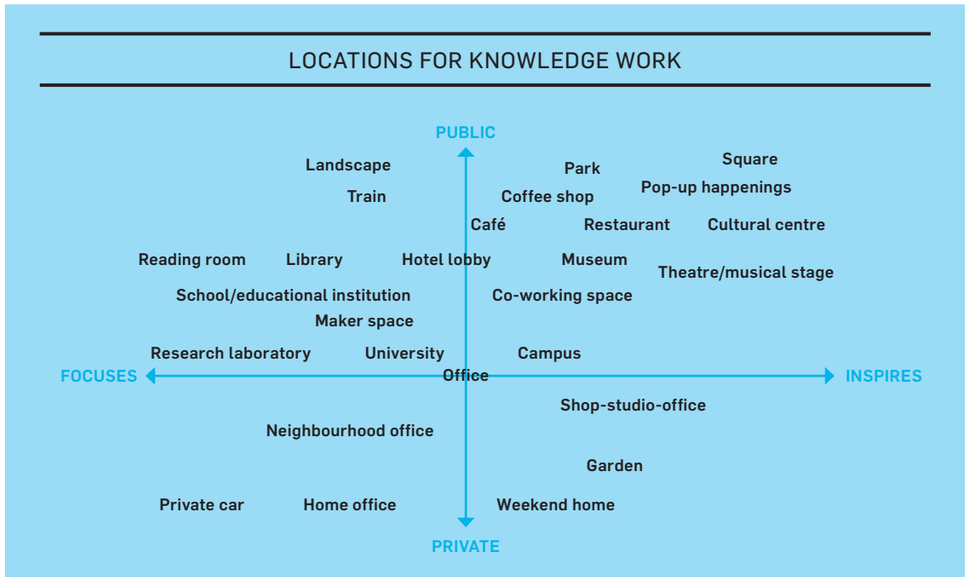
NEW KNOWLEDGE BIOTOPES

Urban spaces stimulate people through multiple senses. Many urban attractions are basically places where people meet and learn. We can draw on their diversity to form images that lead to a broader concept of knowledge work.

The astonishing thing about the structural transformation is that the solutions to the major challenges are popping up along with them, everywhere and immediately. The smart city connects production with supply, work with living at home and culture with consumption – and it communicates its offers in transdisciplinary ways, as knowledge work should be carried out. The city's diversity and changeability holds the vibrancy that gets people moving. Cities have always been sources of inspiration and drivers of development. In the increasingly interwoven worlds of work and leisure, cities will continue to motivate us to develop a new concept of work and will point us toward the human longings that also involve natural and rural environments because of their qualities.

URBAN CULTURE WORKS WITH EXPERIENTIAL SPACES

Hybrid spaces that are good for working are emerging in the midst of the environments where we live. Meeting places that also offer products for consumption are expanding to include not only cafés but also cultural sites, natural landscapes and passenger compartments. Cultural centres, libraries, museums, science centres, laboratories, studios and workshops are opening up for a public that wants to learn and work. Once we are working without keyboards – by means of voice control and augmented reality – we will become even more bustling. Co-working was the first sign that daily work also needs variety. Conversely, embedding our work within the urban lifestyle, with accidental meetings and a more informal design, has loosened up functional office standards. In places where decorative design has been successfully transformed into an atmosphere where people feel comfortable both emotionally and the functionally, observers have noted a gain in productivity. This shows that people can be brought into a productive frame of mind. The identity of the office thus depends on whether dedicated workspaces have a professional advantage. What will they promise for learning and capability? The answer must be:



The diversity of urban opportunities can support the many facets of knowledge work. This "tag cloud" extends vertically between private (below) and public access points (above). Horizontally, it begins on the left at retreat areas where people can focus and expands rightwards toward vibrant surroundings that inspire our knowledge work. Although the locations where work feels like work differ from one individual to the next, the graphic points out the qualitative spectrum of available locations.

SUPPORT FOR HUMAN PERFORMANCE

As human beings, we register sensory stimuli, patterns and surroundings more or less consciously as we perform our activities, we ought to design our spatial impressions more deliberately. This means creating more spatial variety with regard to the specific activity being carried out and the way the place of work expands into its urban surroundings. Especially as people are expanding their repertoires of activities and methods and looking for new imaginative spaces where they can implement them.

More flexibility for the individual. Initially the time demands of the world of work "invaded" private life, but now family and leisure environments are making demands on the world of offices. The boundaries are becoming negotiable, and rules are becoming the differentiating factors.

INTEGRATING PARTS OF THE LIVING ENVIRONMENT INTO THE WORLD OF WORK AND EXPANDING THE PLAYING FIELD OUTWARDS

The specific place of work is being chosen on the basis of the planned activity, the people involved and the atmosphere.

This could be the planning challenge for office designers, who must decide on behalf of each user (and his or her needs) how many options can be offered within the office itself. That's because the users will discover individually in a wide variety of places what kind of atmosphere they need in order to concentrate or cohere creatively, which people they want to meet in person and where or when the virtual is sufficient for them.

The city wins – and the office as a learning environment wins along with it, because if the digital cloud is surrounding us like an intelligent skin, only the physical location can make us humans aware of the difference. Cities hold the promise of diverse locations for productive cooperation – learning environments that are effective in the sensory, cognitive and cultural dimensions.

» **There are places that are formed in the very founding of society,** which are something like counter-sites or heterotopias – a kind of effectively enacted utopia in which the real sites that can be found within the culture are simultaneously represented, contested, and inverted.

Michel Foucault
Philosopher, sociologist, psychologist. "Of Other Spaces", 1967

OUTLOOK

HOW IMPORTANT ARE PEOPLE TO US?

At present, the future is not looking rosy. A structural transformation of our economy and society is not a walk in the park. How seriously are we taking our future?

THE DYSTOPIA:
There is reason to fear that the trend toward working from home will be used during the post-coronavirus recession to outsource some of the workforce and downsize office facilities. We must assume that this will affect low-wage workers and areas where the work will be automated in the foreseeable future. The remaining offices would only be available to the more qualified and sought-after talents. In the competition with other attractive workplaces, the office would count on decorative design instead of a more humane user performance.

THE UTOPIA:
We have an opportunity to redefine the significance that work has for us as human beings. An awareness of what each individual can contribute and in what kind of environment this will succeed most fruitfully. Offices will regain their unique professional status by providing physical evidence of how well the workforce learns and performs in the office environment. Smart environments support human performance everywhere, but multi-sensory learning environments generate a knowledge advantage that can only be experienced here.

METHODOLOGY & IMPRINT

The fourth NEW WORK ORDER study was conducted by trend expert Birgit Gebhardt on behalf of the Interior Business Association (IBA) and ORGATEC, the leading international trade fair for modern working worlds.

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