

## The Sound of Creativity: Correlating brainwave & psychometric changes with workplace acoustics

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### I. EXTENDED ABSTRACT

The open office has been a central theme in contemporary workplaces, reasoned to provide flexibility, natural light, supervision, cost savings, transparency, democracy, and collaboration. While almost 70% of US workers occupying open plan or open seating settings (International Facility Management Association, 2010), this design strategy remains contentious (Kim & de Dear 2013). These settings may preclude privacy and concentration, evoke stress (Evans & Johnson 2000) and even influence attention, distraction and creative flow. Indeed, there are many physical features of the workplace that may influence the neural processes involved in creative and innovative activities.

This paper reports on findings from a controlled yet ecologically relevant study that investigates how sound may influence creativity. Creativity was assessed using psychometric tests and creative tasks that have been assessed and applied in peer-reviewed publications (The Cambridge Handbook of Creativity, 2013). Frontal lobe electroencephalographic (EEG) brainwaves were recorded while consenting participants completed alternate use tests, a creative product task, and post-test surveys in an office environment that was controlled to have no visual distractions and quiet control conditions. During the five test conditions, different recorded sound files were played to provide realistic yet repeatable sounds at levels measured in actual office environments. Tasks were scored according to the published protocols to reveal the impact on creative scores (originality, elaboration, flexibility and fluency) and were correlated with brainwave algorithms reported to reflect attention, mediation, and achieving 'the zone' when creative 'flow' occurs (Csikszentmihalyi, 2008). In addition, brainwave frequencies (alpha, beta, delta, gamma, and theta) were analyzed to understand the interaction between sound and creativity scores.

Initial findings show changes in creativity scores associated with different acoustic stimuli, and significant changes in alpha, beta, and gamma brainwave amplitudes during creative tasks versus inter-test intervals. These data suggest that face-to-face interaction, conversation and acoustic interruption may disrupt the the creative process. The experiment's progress and findings will add to the conversation of the impact and evolution of the open office workplace.

### 2. REFERENCES

- Csikszentmihalyi, Mihaly. Flow: the Psychology of Optimal Experience. New York: Harper Perennial, 2008.
- Evans, Gary W.; Johnson, (2000) Dana. Stress and open-office noise. Journal of Applied Psychology, Vol 85(5), Oct, 779-783.
- Kaufman, James C., and Robert J. Sternberg. The Cambridge Handbook of Creativity. Cambridge: Cambridge University Press, 2010.
- Kim, Jungsoo and de Dear, Richard. (2013) Workspace satisfaction: The privacy-communication trade-off in open-plan offices. Journal of Environmental Psychology. V 36, pp 18-26.

### 3. AUTHOR BIOS

**Eve Edelstein**, Fellow of the American Academy of Audiology, is Research Director of the Human Experience (HxLab), and the BioAcoustic Neuro Group (BANG) of the Gadget Lab at Perkins+Will. Dr. Edelstein is faculty and participates with the Center for Healthy Environments at the NewSchool of Architecture & Design in San Diego, and leads the Design Health CoLab, part of the AIA Design + Health Research Consortium. Eve works with ANFA and NSAD to develop the Neuroscience for Architecture curriculum. With the University of California, San Diego Eve created novel virtual visual and sonic simulations that synchronously measure the consequence of design on EEG and human outcomes. Eve's neurophysiological research and clinical practice applied novel intracellular, in-vivo, and clinical electrophysiologic techniques to diagnostic assessment of auditory and vestibular disorders of central and peripheral origin in adults and children. With degrees in neuroscience (Ph.D. Institute for Neurology, University College London), Anthropology (UC Berkeley) and Architecture (NewSchool of Architecture & Design), Eve now translates clinical and neuroscientific research into brain-based principles for design in all building types and scales, from rooms to regions, and including workplace, healthcare, educational, science and technology facilities.

Throughout his professional and academic careers, **Luke Lavery** has focused on psychological interaction and the exploitation of technology to create progressive environments and experiences. His design passion is performance—in both human and environmentally-sustainable terms. In "Immersive Environments," his thesis explored 'flow'—the trance when one is so mentally absorbed with the current activity that the boundary between environment and inhabitant becomes transparent—and how sound can blur the inhabitants with their surroundings. Awarded a Perkins+Will Innovation Incubator grant, Luke uses psychometric and EEG brainwave sensors to explore the impact of environmental features on creativity and flow in workplace and other built settings. Luke's award-winning theoretical work was featured in the 2013 American Institute of Architects Center for Emerging Professionals Annual Exhibition. Luke holds a BS degree in Architectural Studies from the University of Wisconsin-Milwaukee and a Master of Architecture from the University of Cincinnati.

**Richard Brink**, technology consultant, designer and leader, has over 20 years of experience in providing solutions for clients in various areas including technology design, project management and implementation. His specialties include Technology Visioning, Audio Visual Design, Systems Implementation, Room Acoustic Modeling, Speech Intelligibility, Speech Privacy Design and Troubleshooting, Mechanical Noise and Vibration control, Project Management and Contract Administration. Richard holds a BS degree in Audio Technology from the American University and MS degree in Engineering Acoustics from the University of Houston.