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Measuring the open office and its Baukultur

Conference : Getting the measure *Baukultur* – pour un espace de vie de qualité
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Parallel session 2: Workscapes

During the *Measuring the Quality of Baukultur* conference, I spoke about two themes: A) a study my advisor and I did on the transition to open offices and B) the power of new technology in measuring Baukultur. In our research on the open office, we show one of the new forms of technology – sensors.

Understanding the impact of open offices

In the study, "The Impact of the 'Open' Workspace on Human Collaboration," my advisor Ethan Bernstein and I asked the question: what is the effect on communication of going from a "closed" office design to one that is "open" and characterised by fewer spatial boundaries? To answer this question, we looked at employee communication as two offices transitioned from cubicles to an open office. In particular, we used sociometric badges, which track in-person interaction, and email as data sources. Contrary to conventional wisdom surrounding open architecture, the amount of face-to-face interaction actually decreased significantly after the move – about 70% – with an associated increase in electronic interaction. In short, rather than promoting face-to-face collaboration, open architecture appeared to create a human response to social withdrawal from coworkers and interact instead over email.

This paper, to our knowledge, is the first to use sensor technology to track the change in face-to-face behaviour before and after the transition to an open office. As stated above, we used "sociometric badges" to quantify this in-person communication. In our paper, we described the sociometric badges in the following way.

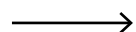
To capture a full, data-rich picture of interaction patterns both before and after the boundaries were removed, participants were asked to wear a sensor, known as a sociometric badge, that recorded, in great detail, their F2F [Face-to-Face] interactions: an infrared (IR) sensor captured whom they were facing (by making contact with the other person's IR sensor), microphones captured whether they were talking or listening (but not what was said), an accelerometer captured body movement and posture, and a Bluetooth sensor captured spatial location. All sensors recorded time-stamped data in 10 ms intervals. Based on prior research using these sociometric badges, an F2F interaction was recorded when three conditions were met: two or more badges (i) were facing each other (with uninterrupted infrared line-of-sight), (ii) detected alternating speaking, and (iii) were within 10 m of each other. This F2F data was combined with email and IM data for the same time periods, collected from the company's servers, to create a full picture of these professionals' interactions before and after the redesign.

As we found, after transitioning from a closed to an open office, communication patterns changed. As we explained in the article, face-to-face communication went down and electronic communication increased.

Our two empirical field studies were consistent in their answer: open, unbounded offices reduce F2F interaction with a magnitude, in these contexts, of about 70%. Electronic interaction takes up at least some of the slack, increasing by roughly 20% to 50% (as measured by 'To:' received email).

Many companies transition to open architecture to increase collaboration. However, as we found in our results, this type of design may cause the opposite effect.

Many organisations, like our two field sites, transform their office architectures into open spaces with the intention of creating more F2F interaction and thus a more vibrant work environment. What they often get – as captured by a steady stream of news articles professing the death of the open office – is an open expanse of



proximal employees choosing to isolate themselves as best they can (e.g. by wearing large headphones) while appearing to be as busy as possible (since everyone can see them). Recent studies and earlier research have investigated the self-reported dissatisfaction of employees in open offices, but to our knowledge we are the first to empirically study the direct behavioural impact of open office space on the volume of F2F and electronic interaction. Our results support three cautionary tales.

In particular, our results support three cautionary tales about open offices. The first is that open architecture does not always promote open interaction.

Transitions to open office architecture do not necessarily promote open interaction. Consistent with the fundamental human desire for privacy and prior evidence that privacy may increase productivity, when office architecture makes everyone more observable or 'transparent', it can dampen F2F interaction, as employees find other strategies to preserve their privacy; for example, by choosing a different channel through which to communicate. Rather than have an F2F interaction in front of a large audience of peers, an employee might look around, see that a particular person is at his or her desk, and send an email.

The second is that a transition to an open office may impact collective intelligence. In effect, because of decreased collaboration and over-stimulation, the group is less able to process information.

The second caution relates to the impact of a transition to open office architecture on collective intelligence... While the earliest work assumed open spaces would promote collective intelligence among humans, our findings support more recent work that has begun to suggest otherwise. Kao & Couzin, in modelling the presence of multiple cues and the possibility of observing them, find that intermediate (rather than maximal) levels of cues produce higher levels of collective intelligence. We see a close relationship between our finding that open, 'transparent' offices may be overstimulating and thus decrease organisational productivity and Kao & Couzin's demonstration that finitely bounded, and often small, group size maximizes decision accuracy in complex, realistic environments.

Finally, the third caution is that the transition to open architecture can affect in-person and electronic communication differently.

The third caution is that transitions to open office architecture can have different effects on different channels of interaction. In our studies, openness decreased F2F interaction with an associated increase in email interaction. In the digital age, employees can choose from multiple channels of interaction and a change in office architecture may affect that choice.

How new types of data can "measure" Baukultur

Beyond the results of the study, I hope that the study's methodology will provoke new ideas to measure Baukultur. In particular, we tried to measure collaboration in the office by looking at quantitative communication data. Though communication and collaboration are not identical concepts – one could be talking without saying much of anything! – we move closer to measuring collaboration by seeing how people interact.

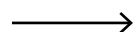
What's exciting about future work on Baukultur is that with the advances in data collection and analysis, there will be new ways to measure how people experience a space.

Sidebar: what is the big data revolution?

The "big data revolution" at its core describes three interrelated, but separate phenomena: the growing abundance of data, advances in data analytics and new forms of data collection.

Rich, abundant, novel data

As Andrew McAfee and Erik Brynjolfsson described in their HBR piece "[Big Data: The Management Revolution](#)," data is easier to capture than ever before. Consider retailing: previously, companies could only track preferences if individuals opted-in to their award system. Now, however, companies like Amazon monitor millions of transactions daily. The data they get from these transactions allow them to give personalised recommendations to potential shoppers in a way that traditional retailers never could.



Advance in data analytics

Once you have the data, what do you do with it? Over the past 15 years, the sheer amount of data has forced us to develop new techniques for statistical analysis. In particular, these new techniques are helping us unlock the value of underused data. For example, neural networks are helping advance the field of image recognition, voice identification and even video analysis.

New forms of data collection

Much of the data collected in the past 15 years has been completely novel. Data on the internet is one clear example of a new form of data collecting. Online dating companies like OkCupid have used data they've collected to help match individuals based upon compatibility. Data analysis like this was impossible previously in large part because this source of data didn't exist.

But, these new forms of data exist far beyond the Internet. Take the example of Google Nest. Google Nest's thermostat tracks temperature, carbon monoxide levels and electricity. The thermostat is also connected to Wifi, which allows it to learn your patterns and update its internal temperature automatically. Google Nest represents "the Internet of things," a transition to have every item we interact with collect data.

Most recently, however, "the Internet of things" has been competing with a different type of data collection: "the Internet of people." The MIT media labs, birthplace of the sociometric badges and Humanyze, have helped pioneer this new field. Professor Sandy Pentland directs the Human Dynamics Laboratory at MIT. His work has used cell phone data, online trading platforms, and recently sociometric badges to quantify individual interactions. Below, we'll profile a few technologies that will help measure how people interact and experience a place.

Three new technologies to measure people's experience in a space

The big data revolution has taken us a step closer to answering the original question of the conference "How to measure Baukultur." By measuring people's experiences and interactions inside a place, we come closer to measuring the elusive concept of Baukultur.

In particular, I see three types of technology as being critical for this work.

1. Sensor technology

Sensors can be an effective way to measure how people move and interact with a new space. As we showed in our study on office transitions, you can even use sensors to track how people's communication patterns change.

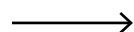
Researchers have been using sensor-based technology to track people's interactions for over a decade. [Researchers in the MIT Media Lab](#) have used the sensors in our phones to track how people move through spaces, how diseases spread, and even whether a person shows depressive symptoms.

In a recent [HBR article](#) on the open office, my co-author Ethan Bernstein and Humanyze President Ben Warner argued that sensors are becoming ubiquitous.

Sensors are all the rage. Sensors in chairs measure how long workers are at their desks. Sensors in the floor measure when and how they move. Sensors in RFID badges and smartphones track where they go. Sensors (in the form of video cameras) track whom they are with. Panasonic has added Wifi sensors to lighting systems, which can monitor face-to-face interactions across entire buildings and workplaces.

2. Machine learning and video data

Another technology that will help measure interactions is machine learning. In particular, by using certain types of machine learning algorithms, such as neural networks, we can train computers to identify individuals in video data. This will allow architects, designers and developers to understand how people flow through spaces.



Take the example of a public square. Many public spaces around the world are already recorded using CCTV cameras for security reasons. Officials looking to improve public spaces, like parks, could use machine learning techniques to quickly identify the number of people in a park, the hot spots at different times of day, and the ways people are interacting with public works.

Of course, privacy is a big concern when using digital data. However, there are ways to ensure privacy, such that system operators cannot identify individual people. Instead, the operators would only have access to high-level data of how groups move and interact in a space.

3. Virtual reality

Finally, virtual reality (VR) serves as an exciting area to prototype and experiment with new spaces. One of the difficulties of design is that it is hard to predict people's reactions to new spaces. That's why developers will often create "model spaces" for potential tenants to experience an apartment before buying.

As VR develops, it will become easier for designers and architects to get immediate feedback on their designs. Just like how Internet companies can do A/B testing with certain features, designers of public spaces will be able to experiment with how people react to changes in the environment.

The bottom line: new data can help measure and legitimise Baukultur

Though Baukultur is an elusive concept, technology can help us quantify it. With the above technologies, we can show how people move through space, how they react to it, and how often they interact inside it.

Of course, **technology is not a panacea** and the reality is that it would be a mistake to apply it in every situation. Still, these types of data can be a tool to legitimise the concept of Baukultur. By showing that we can measure people's different experiences in different environments, it will become easier for designers to convince cities and developers to invest in high-quality spaces.