

Buildings, Brains and Behaviour

Towards an affective neuroscience of architecture:

The Hedonic Impact of Sustainable Work Environments on Occupant Well-being

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The recent alignment of architecture, neuroscience and psychology has recast our understanding of how building design influences people's states of mind. Testable scientific hypotheses open up new avenues for the synthesis of these disparate fields of inquiry. This study draws upon some of the latest research that seeks to understand how hedonic states of pleasure are connected to eudaimonic assessments of meaningfulness within the built environments in which we work and live. Integrating these theoretical perspectives affords an opportunity to hypothesize that 'green' buildings could enrich human experience by promoting psychological and social engagement (eudaimonia) while providing healthier indoor environments that enhance the well-being of its occupants (hedonia). This paper provides evidence to support the intuition that an architecture that sustains the well-being of its occupants will be valued and endure.

Introduction

Across the globe today, forward-looking organizations² are directing significant capital resources to the development of new green-rated, sustainable workplaces. In addition to the objective of reducing environmental footprint, a key imperative is the ability to tap into a vast reservoir of human potential by promoting and sustaining the health and well-being of people through exceptional indoor environmental quality (IEQ). In pursuing the latter, the investment goes beyond the building per se to include the introduction of major 'change' initiatives aimed at preparing employees to work more effectively in open, flexible, team and activity-based work settings. Moreover, in the midst of all this, they are radically restructur-

“Change the environment,
change the brain,
change the behaviour.”

Fred Gage, PhD, neuroscientist
Salk Institute for Biological Studies

ing the way work is being done in their organizations. Hence, this investment also seeks to facilitate more effective adaptation to restructuring.

However, the extent to which these new types of green workplaces are affecting the psychological well-being of their occupants (for example, sustained well-being, and greater adaptability) is unknown. There is a dearth of empirical evidence linking the physical features of sustainable work environments to positive social, psychological, behavioural, or neurological outcomes. While work has been directed to the relationship between environment and psychological states (though not to date, on green buildings) less is known on its influence on brain functions. In this paper, we argue that new discoveries in the neurosciences can help us bridge conceptually, the gap that exists between our understanding of the relationship between the built environment and the social and psychological experience of those who are required to work there.

The Neuroscience of Architecture and Well-Being

New research emerging out of the neurosciences is challenging our preconceived notions about how the physical environment affects our sense of well-being. Dr. Fred Gage was part of a group of

scientists that discovered ‘neurogenesis’ or, the process whereby new neural connections are regenerated across the life span through active immersion in enriched physical environments (von Praag, Kempermann, & Gage, 2000). Studies such as these offer ample evidence to support improved brain functions through environmental activity, stimulation and enrichment. If we compare an ‘enriched’ lab rat cage with Camenzind Evolution Architects’ playful, neuro-design of the new Google headquarters in Zurich, we can visualize a similarity to the contemporary workplace.



Fig. 1: Environmental Enrichment – Lab Rat Cage + Google, Zurich

How we feel and act in built environments can be tied to variations in the physical features of those environments. A recent study identified people’s preferences for curvilinear versus rectilinear surfaces and space (Vartanian et al., 2013). More recently, the same research team studied the effects of ceiling height and perceived enclosure, or openness, on aesthetic judgments and approach-avoidance behavior (Vartanian et al., 2015). These studies are exploring the neuroscientific basis of architecture and design.

For example, people’s sense of place and the ability to navigate are two of the most fundamental brain functions. The Nobel prize-winning research of O’Keefe, Moser & Moser (2014) identified ‘grid’ and ‘place’ cells in the human brain that give us our sense of place and serve as a kind of compass and spatial positioning system to help orientate us as we navigate our way through the built and natural environment.

An important contribution to providing evidence-based support for this comes from not relying on subjective self-report data alone. Psychologists and neuroscientists today are employing functional mag-

netic resonance imaging (fMRI) technologies to pinpoint the brain’s hedonic hotspots stimulated by pleasant associations with our surroundings through our senses, thoughts and tasks (Berridge & Kringelbach, 2010). Neurological evidence can play a pivotal role in demonstrating the efficacy of design approaches.

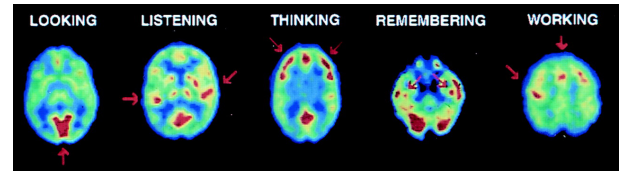


Fig. 2: Hedonic Hotspots. Looking at pleasant sights, listening to pleasant sounds, thinking pleasant thoughts, remembering pleasant memories, working on pleasant tasks (flow)

We can easily imagine all of our hedonic hotspots firing simultaneously if we suddenly found ourselves in a place like Paley Park in New York City. This “oasis of well-being” was highlighted in William H. Whyte’s 1980 book and film: “The Social Life of Small Urban Spaces”. Engagement in an environment high in natural features stimulates the parasympathetic nervous system in ways that counter the stress-related “flight or fight” response to promote a sense of well-being while reducing the risk of stress-related immunological health issues.

These features reveal a biophilic sensitivity to the brain’s pleasure and reward centers. A high (6.1m) waterfall and retention pool provide a backdrop to this pocket park masking the sounds of East 53rd Street. A canopy of trees with green walls, planters, flowers, moveable tables, chairs, bench seating and natural surfaces sets one’s mind at ease. A wonderful aspect and orientation (sun, light and a vendor) and you have many of the positive ingredients necessary for a visitor to achieve a eudaimonic state of neuro-psychological well-being.



Fig. 3: An Oasis of Well-being – Paley Park - New York City – Zion and Breen, 1967.

Investigations such as these are the first conscious steps of a discipline conceived in the boundary blurring union of architecture, neuroscience and psychology.

The Neural Basis of Affect and Design

People attribute meaning to the places in which they live and work. This is captured in how people develop a psychological sense of place attachment (the emotional bond between person and place) and place identity (the relationship between lifestyle preferences and environmental opportunities). The study of meaning is fundamental to understanding the relationship between people and place. John Dewey stated in *The Pattern of Inquiry* (1938, p.330), that: “only those things of the environment that are taken as having connection with and bearing upon this life, enter into the meaning system”.

A place's influence on our behaviour is mediated by our brain's interpretation of it. Through a series of cognitive, affective and conative processes, environmental information is used to construct an internal representation of our physical surroundings which, once developed, guides how we interact with elements in that environment. The great pragmatist and one of the founders of modern psychology, William James in his *Principles of Psychology* (1890), put it this way: “Minds inhabit environments which act on them and on which they in turn react” (1890, vol.1, p6). The following figure illuminates his insight and provides an experimental framework for this affective inquiry.

Similarly, the circumplex model is used to explore the neural basis of affect. The circumplex model proposes that affective states arise from two fundamental neurophysiological systems, one related to valence (along a pleasant-unpleasant continuum) and the other to the level of arousal or alertness (Posner, Russell, & Peterson, 2005). People's affective meanings and interpretations can be analyzed through their placement onto this two-dimensional, bipolar plane. (Russell, 1980).

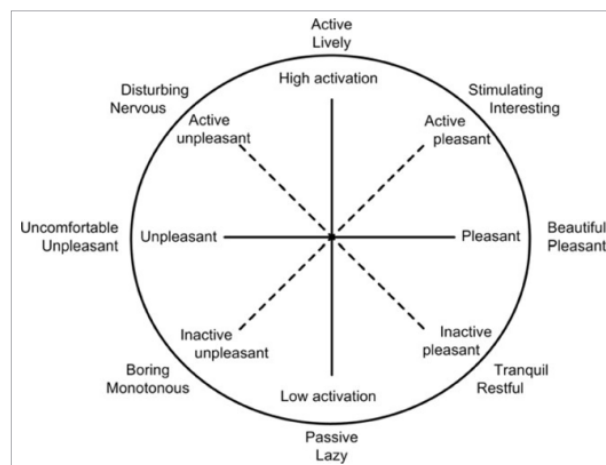


Fig. 5: A Circumplex Model of Affect (Russell, 1980)

We hypothesize that a zone of optimal well-being and peak human performance will be found in those workplaces that exhibit high positive affect and optimum levels of arousal. A variation of Wundt's curve illustrates this.

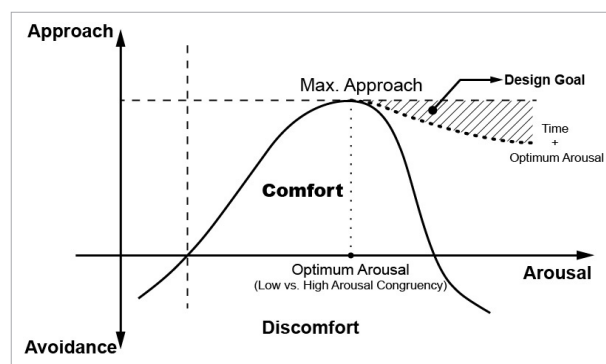


Fig. 6: Hypothetical curve relating maximum approach (high positive affect) with optimum arousal (derived from Wundt, 1874 and Berlyne, 1967, 1973)

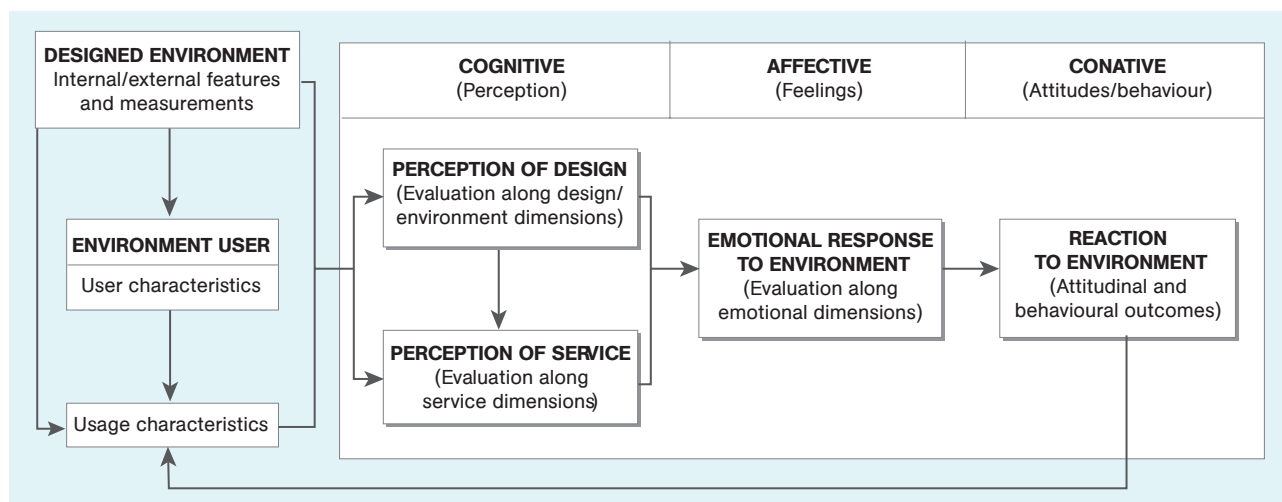


Fig. 4: The Environment-Response Model (after Bitner, 1992).



Fig. 7: The Docklands (Melbourne, Australia)

Subjective well-being (SWB) consists of three parts, namely: the presence of positive affect (PA); the absence of negative affect (NA); and, satisfaction with life in general (Diener, Biswas-Diener, & Tamir, 2004). The focus henceforth will be on the first.

Context/Case Studies

In this paper, we will examine the positive affect that the physical features of green workplaces have on the well-being of occupants in three (3) recently occupied, Green Star rated, premium-grade, commercial office buildings located in the Docklands in the City of Melbourne, Victoria, Australia.

The opportunity to observe the physical changes occurring across three new sustainable work environments provides a distinct vantage point from which to view the evolution of the green workplace. Each of these case studies has been recognized as an exemplar of sustainable workplace design earning world-class, Green Star and NABERS ratings. These two (voluntary) Australian ratings systems are used to assess sustainable design and environmental performance (Green Star) and the ongoing operational and energy efficiency (NABERS) of new office fitouts in green buildings:

- **The Green Building Council of Australia (GBCA),** Green Star, www.gbca.org.au
- **The National Australian Built Environment Rating System, NABERS,** www.nabers.gov.au

A brief overview of each case study site is provided below to set the stage for this inquiry.



Case Study 1 (CS1)

This global company is a leading service provider of information communication technology (ICT) solutions supporting a broad range of industries and enterprises across Australia and New Zealand. Their tenancy is located in a Green Star (Office Interiors V1.1) 6 star Green Star rated building in Melbourne's Docklands. The building was certified and occupied in 2009 and comprises 3 levels totalling 4,518 m² of premium-grade office space housing approximately 350 staff. The tenancy also achieved a 5 Star NABERS rating for energy efficiency.

Case Study 2 (CS2):

The firm, based in Australia and South Africa with a worldwide office network, offers engineering, design, planning, project management and specialized technical services for public and private sector clients. In late 2012, the firm moved into its new, 6 star Green Star rated building in Melbourne's Docklands. The firm's tenancy in the building included the fit-out of some 9,800 m² of premium office space accommodating nearly 700 staff over the top five levels all interconnected by a central open, communicating stair.

Case Study 3 (CS3):

The company is a major private health insurer in Australia. The insurer has recently occupied nearly 46,500 m² of space across 9 levels of their new 'organic' open structure located in Melbourne's Docklands. The facility has achieved a 6-star Green Star rating and a five-star NABERS rating. The building will consolidate and house approximately 1,500 staff from six different locations. The relocation of all staff to the new building was completed in October 2014.

These case studies provide an opportunity to explore some of the latest thinking in sustainable workplace design.

Methods, Findings and Results

This inquiry takes a pragmatic stance utilizing mixed methods to study subjective well-being in green workplaces. Tools of inquiry included semi-focused interviews, building walkabouts, observations, analysis of documents, photographs and floor plans, and the use of an 'online' building use survey administered both pre and post-occupancy (CS3). Data from the three case study sites have been combined and are being presented collectively from the research database.

Document Analysis

We will begin by reviewing some of the key business, cultural, and design strategies employed in the creation of these new workplaces informed by the interviews, and a review of design briefs, corporate communications, press and media releases.

Business and Cultural Themes/Drivers:

The following business and cultural strategies were used to guide the design of these new green workplaces (CS1, 2, 3).

- Reflect a commitment to innovation and sustainability.
- Align work environment with business strategy and brand.
- Provide staff amenities that maximize health and well-being.
- Enhance staff satisfaction and reduce stress.
- Foster collaboration and teamwork.
- Promote casual encounters and informal interactions.
- Encourage movement, flexibility and freedom of choice.
- Provide smart technologies/mobile tools to support flexible work.
- Empower staff to choose where and how they need to work.
- Increase employee engagement.
- Improve staff performance and productivity.
- Reduce sick leave and absenteeism.
- Reduce operating and real estate costs.
- Create a culture that attracts and retains staff.

Design Themes/Drivers:

These are some of the key strategies identified by architects and engineers involved in the design of these green workplaces (CS, 2, 3).

- Reduce the environmental (carbon) footprint.
- Deploy energy-efficient solutions throughout.
- Take advantage of daylight and external view.
- Achieve 'exceptional' indoor environmental quality (IEQ).
- Optimise natural ventilation with perimeter operable windows.
- Provide effective and efficient lighting and controls.
- Provide some personal control of comfort conditions.
- Enhance acoustic performance with extensive sound isolation solutions.
- Specify sustainable materials, furnishings, fixtures, and finishes.
- Reinforce the culture and brand attributes.
- Create an environment that supports new ways of working.

"We are committed to growing a sustainable business and this starts with making a concerted effort to ensure our own offices respond to the challenges that the world faces such as climate change and resource constraints."

Visual Analysis

A typical floor plan from each of the case studies will be examined to capture the not-so-subtle evolution of the ‘open plan’ concept across our research horizon (2009–2014).

If we ignore the building core elements (elevators, fire stairs, mechanical/electrical rooms, toilets, janitor

closets, and so on) we see that nearly 80% of the ‘lettable’ floor area is comprised of high-density, standardized workstations in an open plan environment. Full height, floor-to-ceiling partitions are used sparingly to enclose private conferencing, meeting and training rooms for acoustical privacy. The following interior photographs give you a sense of the openness.



Fig. 9: Typical Floor Plan – Case Study 1 (2009).



Fig. 12: Office Interior, CS1.

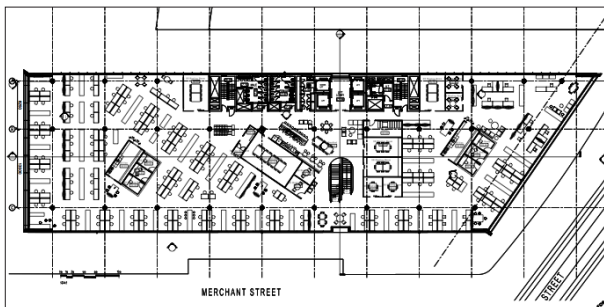


Fig. 10: Typical Floor Plan – Case Study 2 (2012).



Fig. 13: Office Interior, CS2.

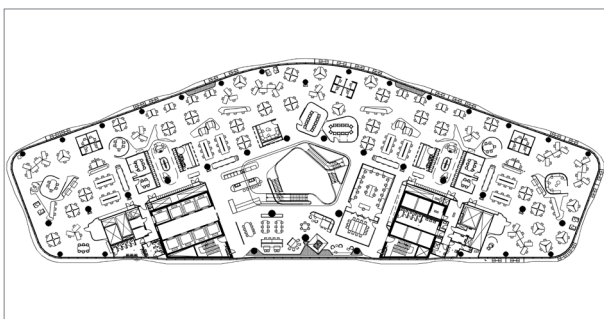


Fig. 11: Typical Floor Plan – Case Study 3 (2014).



Fig. 14: Office Interior, CS3

Below is a listing of the major physical changes observed and identified from the examination of the floor plans.

- Fewer enclosed spaces and floor-to-ceiling partitions.
- Mass-standardization of all workstations, one size fits all (CS1,2).
- Lowered height of all vertical work panels to create more openness visually across the floorplate – see fig. 12,13,14.
- Reductions in the amount of dedicated floor space per person (CS1,2,3).
- Reductions in the amount of personal workspace (less work surface, bins, shelves, files and storage space (CS1,2).
- Elimination of the enclosed, private office (CS2,3).
- Elimination of the dedicated, personal workspace (CS3).
- introduction of lockers, hot-desking, work-points and neighborhoods, in lieu of allocated workspace (CS1,2,3)
- introduction of internal, open, intercommunicating stairs (CS2,3) – see fig. 16, 17.

can be managed more effectively and economically, resulting in less space but better utilized.

These may be reflective of a larger, more global shift taking place in the nature of work and the changing character of the workplace. These new buildings are seen as ‘agents of change’ and space is perceived as a tool to deliver measurable business results.

Qualitative: Semi-structured interviews

Twelve interviews were held at each of the three case study sites with volunteers representing a broad cross-section of staff in terms of age, gender, tenure and management responsibility. Interviews were audio-recorded, later transcribed, and then migrated into NVivo software for qualitative analysis. The following begins to capture some of the patterns and themes emerging from the interview data.

To express their own personal sense of well-being in their new work-places, individuals often compared their previous work setting to their new work environment. For example:

“The difference between our old office and here?

It’s like chalk and cheese, it really is.”

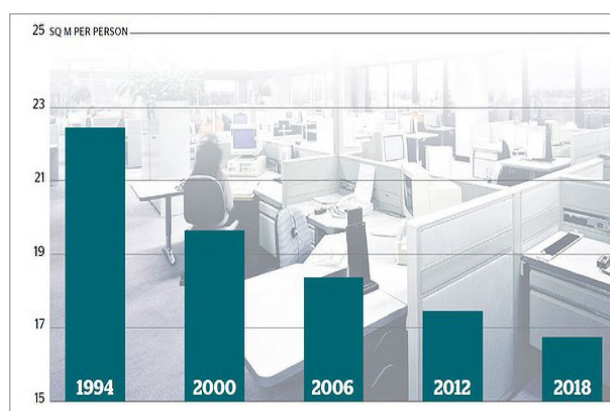


Fig. 15: Allocated Floor Space per Person (sq. m.).

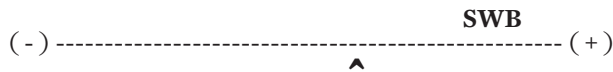
A dramatic reshaping of these sustainable workplaces is observed across this time frame. Overall, these transformations result in higher building density with the associated reductions in dedicated floor space per person.

There is a growing recognition among many organizations that their workplace is a physical asset that

Individuals used simple affective terms to compare the attributes of the old with the new. The following themes were identified from our collective data:

REFLECTIONS: of the old (-)	PERCEPTIONS: of the new (+)
dull	modern
dirty	clean
tired	comfortable
cramped	flexible
oppressive	light
appalling	airy
ineffective	fresh
cheaply constructed	vibrant
messy	healthy
suffering	impressive
embarrassing	proud

If we place these affective attributes into our circumplex model, we could picture them clustering at each end of the horizontal axis which begins to capture a general valence of subjective well-being in these new green workplaces.



Positive Affects (PA)

The following features were identified by individuals as those from which they derived the most positive affect from their new work environment:

- Healthier, with fresher air and lots of natural lighting.
- More comfortable, with better temperature control seasonally.
- More active, with energy (buzz), vitality, and healthy amenities.
- More green, with recycling, green walls, and interior plant-scaping.
- More open, with daylighting and panoramic views.
- More flexible, with the ability to work in different settings.
- More mobile, but only if the right technology and tools are provided.
- More collaborative, with a nice mix of team and small group spaces.
- More egalitarian, where everyone is treated the same.
- More informal, with places for casual interactions.
- More meeting spaces, with variety of room types, sizes, and technical support.
- More paperless, with less physical storage and better e-archives.

If success is measured by positive affect, then these organizations are reaping some significant rewards for their commitment to creating healthier and more sustainable workplaces. This from a senior manager (CS2):

"If you are feeling good and you like your space then that's likely to have the greatest correlation to productivity."

The positive affects are not only related to the employee's work environment, but also the broader dissemination of the ethos of the organization to the wider community. The workplace communicates this in three ways: by the image it presents to the public; the message it conveys to clients; and the identity that staff attribute to it. A senior executive (CS2) described it this way:

"I think the initial impression when you walk into reception on level 8, that this is a forward-thinking company, a company that has its eye on the future, and that is reflected through the design of the building."

Thus, the ethos (or brand) of an organization is reflected in the design of its workplace.

New Ways of Working

The evidence suggests that we are witnessing a period of dramatic change in the physical layout and design of these new green workplaces. New tools, technologies, and new ways of working are radically transforming the workplace. Office work is increasingly mobile and being done in wide variety of physical settings obscuring the line between work and home.

Open Plan Work Environments

The open plan office has emerged as the stereotypical place of work for the post-industrial age with over 70% of workers occupying some form of open plan office at the turn of the century (Hodgkinson & Ford, 2011). The open plan office has become the dominant choice of workplace strategies allowing greater numbers of employees to be accommodated (Becker, 2004).

Open plan work environments are not only seen to be efficient, spatially and environmentally, they are also seen to offer opportunities for greater social

interaction and collaboration in the workplace. In particular, communal stairs have become central design features of these new ‘enriched’ work environments.

The open, intercommunicating stairs were seen to be one of the most positive building features mentioned by many of the interviewees (CS2, CS3). These stairs create a more visible connection between floors giving people the opportunity to move more freely through the building without using the lifts or the fire stairs. It opens up numerous opportunities for encounters and interaction.

Nevertheless, the open, ‘social’ environment of these new higher density office environments have created the potential for more noise, distractions, and interruptions (DeMarco & Lister, 1987). While some people really like the ‘buzz’ of an active, open, noisy workplace, for most people, it is a constant source of irritation and a disruption of their work, flow, and well-being. Many staff recounted adaptations they

made to function more effectively in their new open plan work environment. Oddly enough, it was the younger staff who expressed their frustrations most adamantly.

“The biggest impact on me personally with the open plan environment, is that I find it very difficult to concentrate on a piece of work for any length of time. I can be easily distracted. So, it’s a balance between quiet, productive work in a very active, open and collaborative environment.”

Another statement from a young new employee (CS1):

“You have to get used to an open environment. It’s an attitude one has to acquire – being able to shut things out.”

And, while people need many types of spaces and places available to them for work, those set aside for quiet, concentrated and hence, more productive work may be the most important of all (Cain, 2012). Studies have shown that organizations can improve staff productivity (Leaman & Bordass, 2005) and enhance well-being by designing quieter office environments (Bloom et al., 2011).

The short history of the open plan office (Saval, 2014), reveals an industry built around ‘standardization’. In our observations of two of the open plan environments (CS1, CS2), we saw how this has created a workplace filled with workstations of the same basic size and configuration.

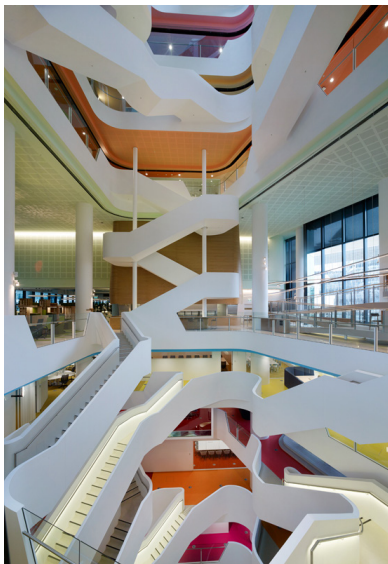


Fig. 16: Intercommunicating Stair, CS3.

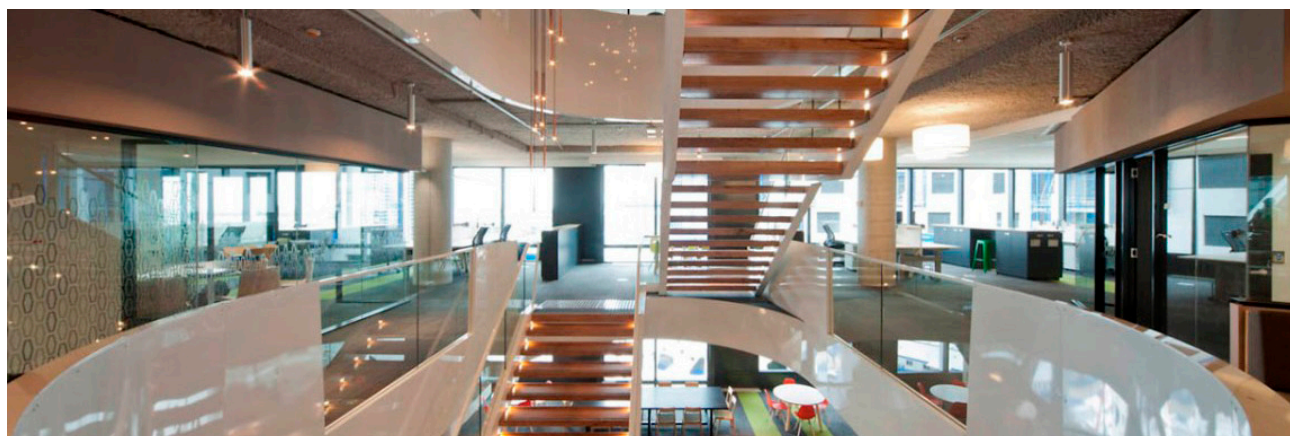


Fig. 17: Intercommunicating Stair, CS2.

This serves two primary functions:

- **Flexibility** – the ability to freely move people and teams around
- **Equality** – one size fits all, everyone is treated the same

This egalitarian philosophy revealed itself in the following quote from a business manager (CS1):

“The space is for the most part pretty flexible. All the workstations are about the same size so it’s easier to move people around internally.”

Nevertheless, ‘perceived’ status endures as determined by a person’s physical location in an open plan work environment. For example, those nearest the windows (and in control of a bank of shades/blinds) are referred to as the ‘window people’. Or, those staking out executive claims over an open triangulated corner of a floorplate are referred to as the ‘corner people’. The physical trappings of status may have vanished, but the spatial ones have not.

Activity-Based Work (ABW)

From these initial case studies, we are beginning to discern a theme best characterized by Dale and Burrell (2008) as the ‘disappearing workplace’. The stasis of having an office, a workstation, or even a permanent desk is being swept away by many organizations (Dale & Burrell, 2008). Workers are expected to be mobile, to work in multiple physical settings including the home (Felstead, Jewson, & Waters, 2005).

Work is also occurring in ‘non-places’ such as the train, plane, car, or the café (Auge, 1995). Our final case study takes this novel approach to work mobility to a whole other level.

Case Study 3 has embraced the activity-based work concept and has radically restructured the way work is being accomplished across the organization. In the new ABW workplace, staff are provided a locker (for personal belongings) and assigned to a floor and a neighborhood where they are, for the most part, free to move around and ‘follow their work’. A variety of work spaces (referred to as ‘workpoints’) are provided in lieu of a dedicated workspace.

Six months in, people are responding positively to the change. The following figures show positive responses to five variables by employees across all seven levels of the new building from a post-move survey completed in April 2015 (822 responses, 48% of staff).

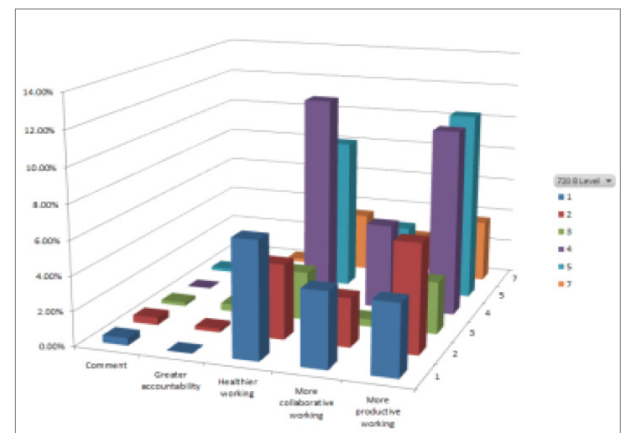


Fig. 18: Positive Post-Move Responses – To Healthier, More Collaborative, and More Productive Working.

Positive Change							
Count of 720 B Level	Column Labels						
Row Labels	1	2	3	4	5	7	Grand Total
Comment	0.43%	0.43%	0.22%	0.00%	0.22%	0.65%	1.94%
Greater accountability	0.00%	0.22%	0.43%	0.86%	0.43%	0.22%	2.16%
Healthier working	6.70%	4.32%	2.81%	12.10%	8.86%	3.46%	38.23%
More collaborative working	4.32%	2.81%	0.43%	4.97%	3.89%	2.38%	18.79%
More productive working	4.10%	6.26%	3.02%	10.80%	11.02%	3.67%	38.88%
Grand Total	15.55%	14.04%	6.91%	28.73%	24.41%	#####	100.00%

Fig. 19: Positive Change Data by Floor Level

Many are thriving:

"I mean the ability to choose where you want to work is so empowering and liberating."

"People have said that they would never go back to the old way of working where they were stuck at one desk and couldn't move around."

A few are not:

"Some people keep going back to the same desk every day. They want that bit of familiarity. They aren't adapting very well."

"So we say, 'it's OK mate.'"

"I have some mixed feelings about whether I'm happier – I think it's the space. So everyone is saying, where is my workspace?"

And, from these early post move surveys two interesting issues have surfaced:

The first being the issue of 'camping' whereby staff leave personal work items at a 'workpoint' as a way to place a 'hold' on it. Camping is defined in the organization as 'not following your work'. With neighborhood densities targeted at 80 percent (available workpoints occupied), this practice decreases workpoint availability, increases crowding, and creates tension amongst staff. Camping also seriously hampers spatial flexibility (a key ABW variable) and leaves employees hunting for a limited number of available workpoints in or around their neighborhoods or floors.

The other issue, with important implications for today's team-based business cultures, has to do with people's connection to their team and to their team leader. In both instances, staff are feeling less connected in the new ABW work environment, at least initially. As one senior manager said, "we

need to get our heads around teamwork in non-allocated workspace".

ABW represents a clear break with the past and a paradigmatic shift in the reciprocal relationship that used to exist between people and their places of work. Employees are now responsible for temporarily seizing parts of a fleeting and fluid workspace, but are also expected to work more effectively.

Further, employees need to be findable and locatable. One of the more interesting technologies designed to support this new ABW work environment is the Serraview system. Harkening back to Bentham's panopticon, this system allows one to physically locate, in real-time, any employee, anywhere across the workplace. One staff member referred to it as, "stalk and talk".

Quantitative: BUS pre and post-move data

At Case Study 3, we utilized the 'online' BUS Occupant Survey³ administered both pre and post occupancy and were able to explore 58 different study variables related to people's perceptions of their existing and new work setting.

This brief summary and analysis of pre and post-move data focuses on only two study variables namely: perceived health and, perceived productivity.

These two self-reported measures of well-being give us a sense of staff perceptions just before they moved from their existing workplace and soon after they relocated to their new, and dramatically different, activity-based work setting.

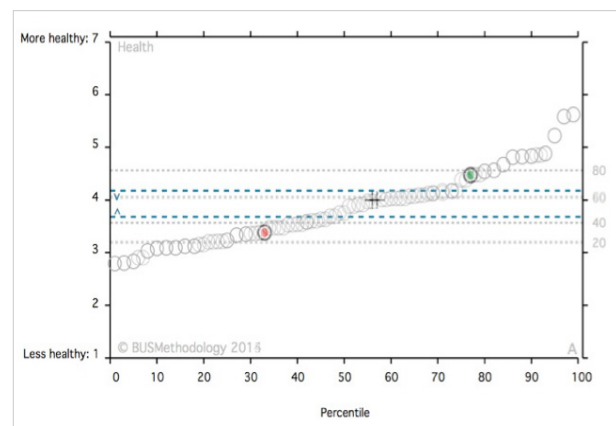


Fig. 20: Perceived Health
pre (left, red) and post* (green, right).

* Post-move data is drawn from a small representative sample of staff

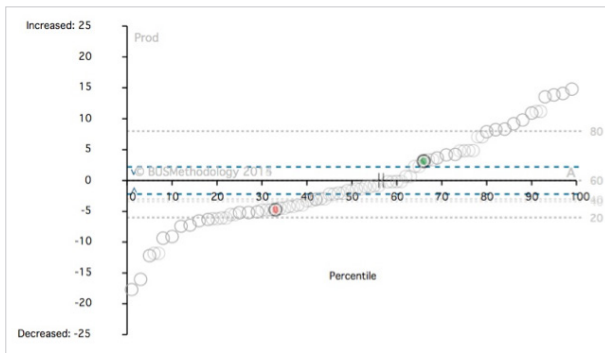


Fig. 21: Perceived Productivity
pre (left, red), and post* (green, right).

* Post-move data is drawn from a small representative sample of staff

Again, from these charts, we can see a positive shift occurring in people's perceptions of health and productivity as exhibited three months before and six months after the move to the new workplace.

From these initial analyses of quantitative data, we have seen a spike of positive employee responses to different aspects of the new ABW work setting and a modest, but positive shift in staff perceptions. While it's too early to draw inferences of sustained levels of well-being, it is worth noting that early success and positive affects can help fine-tune the ABW work environment,

Conclusions

This paper has explored the relationship between the transforming work environment and perceived well-being of occupants. The three case studies illustrated here are representative of global shifts towards more dynamic, flexible and 'activity-based' work environments. These 'enriched' environments engage both hedonic states of pleasure and eudaimonic assessments of meaningfulness. Descriptors of positive affect include notions of perceived comfort, vitality and a more 'relaxed' work environment combined with recognition of the communal, egalitarian and flexible workplace afforded by such environments, as well as a sense of pride in the 'green' business identity that they promote.

Preliminary pre and post occupancy data from the third case study supports the position that such enriched environments enhance occupant wellbeing. However, given the relatively recent occupation of the new building and the tendency for data to be skewed towards positive outcomes in such studies, these results cannot be taken as definitive proof of enhanced wellbeing. It is evident from the qualita-

tive study that some individuals more readily adapt and thrive in these new workplaces, while others seek more stable and calm environments. Strategies such as 'camping' are employed as a strategy to secure more stable or desirable positions within the fluid workspace, while residual spatial hierarchies endure in the occupation of the privileged 'edge spaces'.

Ultimately, these buildings will be judged by how well they sustain the well-being of their occupants over time. We know all too well the human costs of working in negative, pathogenic environments, or so-called, 'sick' buildings. Yet, very little is currently known about the positive affects associated with working in these new green, salutogenic workplaces, or 'well' buildings. This research is an attempt to remedy that. The results suggest that our evaluation of how the physical features of sustainable workplaces affect the psychological well-being of occupants is both timely and within reach. A neural basis for design could lead to a *regenerative* architecture with sustainability and well-being an integral part. *Buildings that you can't get ill in, but in fact, make you feel better for being in them*⁴. □

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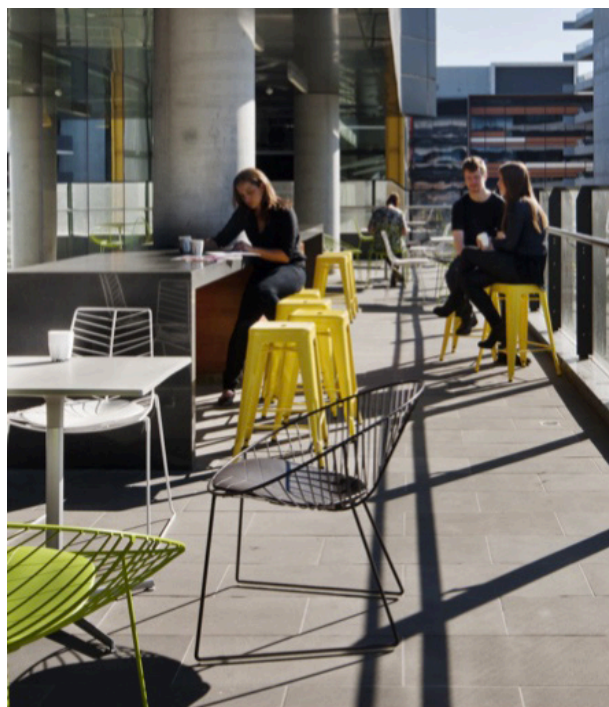
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Credits

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Sources

Figure 1

Google Switzerland GmbH – Combined Photography of Building 100 & 110 (Picasa).

Figure 2

PET Scans – Office of Biological and Environmental Research (BER), Medical Sciences Division, US Dept. Of Energy (DOE).

Figure 3

Paley Park, NYC – Creative Commons, Flickr photograph by Dave M Barb.

Figure 7

Aerial Photo, The Docklands, Melbourne – photo by Dianna Snapes, used with permission.

Figure 15

Allocated Space per Person – Research and Forecast Report, Second Half 2014, CBD Office, Colliers International.

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