The New Built Environment: Health, Well-Being, and Productivity

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Definition: "Built Environment"

- Man-made structures, features, and facilities viewed collectively as an environment in which people live and work.

- Buildings: the shell and everything inside the shell that a person perceives as part of their work environment

- Note: emphasis is on what is "baked-in" rather than "discretionary"
  - A floor plan that encourages physical movement vs. an in-house gym

Setting the Stage

- The impact of physical and psychological environments on health and well-being is inseparable.

- Both the physical and psychosocial aspects of work are addressed here.

- Presentation theme: *Health and well-being are more than removing bad things—it is also increasing good things.*

- Scope of our attention is the entire organization and how all the parts work together to support worker health and well-being.

Interdisciplinary Center for Healthy Workplaces (ICHW) Model of Worker Health and Well-Being
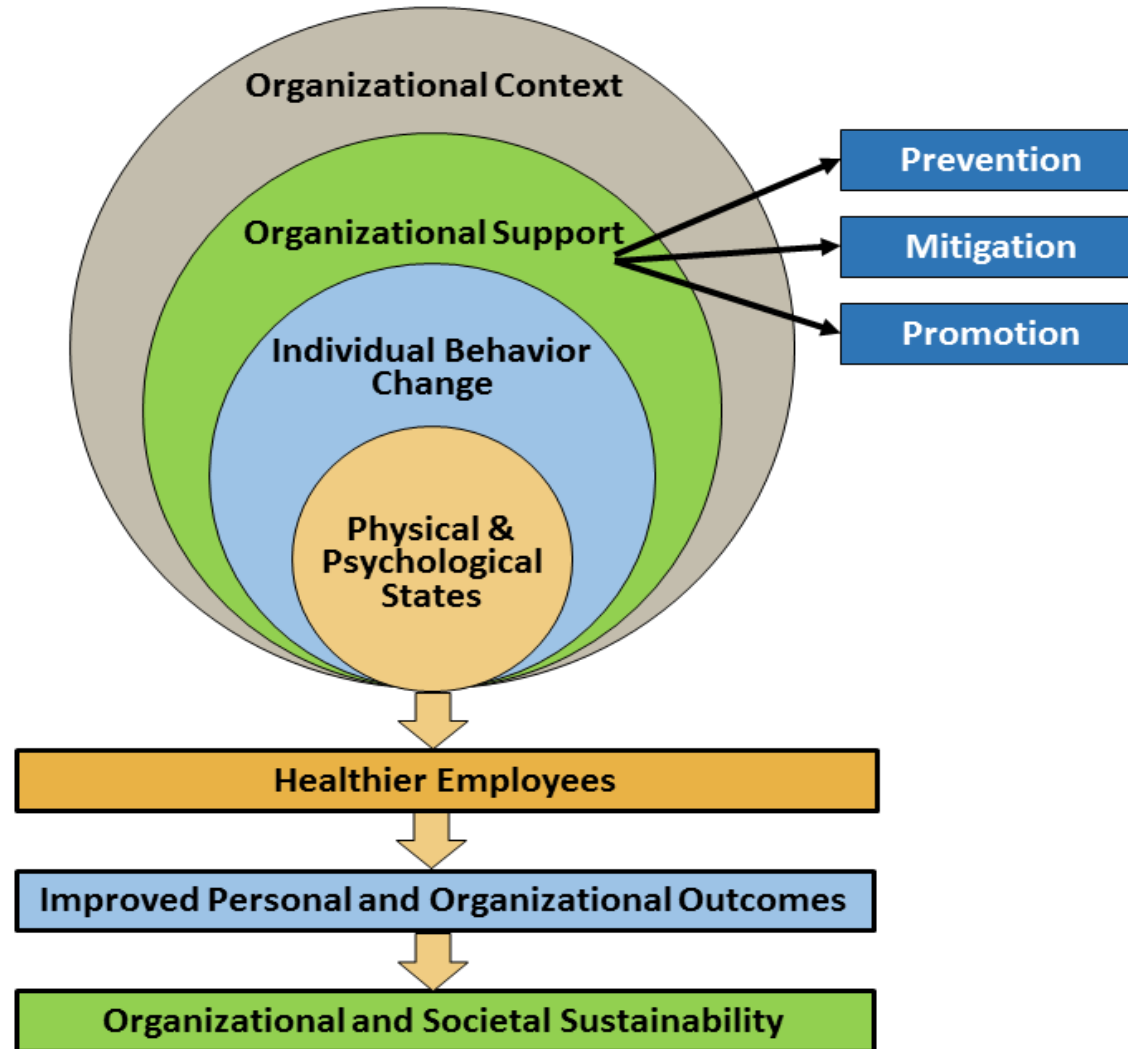
Implications

- A wide range of built environment elements can be examined and improved.

- Need to design and operate workplaces that remove the "bad factors" and increase the "good factors."

- The environments workers experience are interconnected and simultaneously affect worker health and well-being.

- "One and done" is not enough.

- Model applies to all work types including gig work and remote working.

Bottomline: What do we need to address?

Physical Bad Factors

- Toxic chemicals
- Airborne pathogens
- Muscular strain
- Repetitive motion
- Prolonged lack of movement

- Excessive noise
- Noxious smells
- Poor lighting
- Physical hazards
- Physical discomfort
- Toxic/contaminating people

What do we need to address?

Psychological Bad Factors

- Overwork
- Lack of control
- Unfairness
- Unpredictability
- Precarity
- Distraction

- Stagnation
- Isolation
- Tedium
- Impediments
- Incivility
- Values conflicts
- Invisibility

Physical and Psychological Good Factors

- Autonomy
- Belonging
- Competence/Accomplishment
- Fairness
- Meaning/Purpose
- Physical and psychological Safety
- Positive emotions

"Less Bad, More Good"

Outcome	Regulatory Factors	Target
Sleep	Light hitting receptors on the retina, releasing glutamate in the brain	Melatonin
Sensorimotor & cognitive processing	Stimulation of sensorimotor and cognitive areas of the cortex	Acetylcholine
Pleasure, desire, social engagement	Experience of positive valence factors which stimulate rewarding and reinforcing behaviors	Dopamine
Memory, judgment, decision-making	Stimulation of the hippocampus, amygdala, neocortex, and prefrontal cortex	Acetylcholine, Glutamate, Epinephrine, Opioid peptides
Affiliation, attachment, & communication	Stimulation of the hypothalamus which increases eye contact, trust, social support, and interpretation of facial expressions	Oxytocin
Fear, anxiety, frustration, & loss	*Experience of negative valence factors which trigger sympathetic nervous system resulting in stress responses, mood disorders, immune dysfunction, dementia risk*	*Cortisol Epinephrine*

The Built Environment Targets: Physical Elements

- Indoor environmental quality (IEQ)
- Lighting
- Colors
- Windows, Views
- Workspace layout/Floor plans
- Furnishings
- Biophilia

IEQ

Ventilation

- Maximum exchange between inside and outside air.
- UV germicidal irradiation (UVGI) using LEDs for disinfection within the ventilation

Humidity

- Moisture and relative humidity held to 30-60% to reduce spread of molds and biological contaminants

Temperature

- Automatic temperature adjustment as occupancy changes in building locations.
- Individual local control of temperature wherever possible.

Noise

- Soundproofing material on ceilings, walls, partitions
- Internal walls finished to the ceiling and floor
- Noise cancelling devices (soundwave disruptors)
- Layered sound (white noise, nature sounds)

IEQ

Air Quality
- New materials with low chemical and biological emissions (PFAs, PFCs, VOCs)
- Green Building construction guidelines regarding air filtration, radon-resistant construction, enhanced ventilation systems, an low-emitting products
- Scents for purpose: lemon (cognitive performance), rosemary & sage (memory), cinnamon (creative thinking)

Acoustic and Visual Privacy
- Enclosed booths (Orange Box)
- Glass barrier change (opaque, darken)
- Private offices

- Smart Buildings
  - Digital infrastructure to collect and aggregate operational data, connectivity to analyze/learn/share data, optimize for building occupants
  - Application of artificial intelligence and machine learning through surveillance and optimization

Circadian System Lighting

- Daylighting preferred
- Indoor (artificial) lighting
  - Mimic the cycle of the solar day (full spectrum) to maintain circadian entrainment
  - Dynamic spectra or change in light output
    - Daytime: High amounts of Circadian Stimulus (CS) during the morning (high short-wavelength content— "cooler" light toward blue range)
    - Afternoon: Incrementally decreasing amount of CS as day progresses (lower longer-wavelength content— "warmer" light toward yellow/orange range)
    - Evening: Little or no amount of CS (lights dimmed to minimum or out)
  - CoeLux (simulated daylight from "skylight")

Daylighting Simulation: CoeLux

Colors

- Match colors with desired emotion & purpose

- Saturation: how true color is to original color
  - Add opposite colors to lower saturation
  - Low saturation has grey tone

- Brightness: how light the color is
  - Add white to make brighter
  - High brightness has a lot of white mixed in

- Hue: broad names of colors associated with wavelengths

Applications

- Calm, relaxing effect
  - Light sage green
  - Bedrooms, offices, waiting rooms, doctor offices
- Concentration, knowledge work
  - Light sage green, light smoky-blue
  - Offices, work spaces
- Cognitive performance generally, creativity
  - Greens in general, light sage green best
  - Studios, R&D
- Socializing
  - Light orange, smoky-orange
  - Break rooms, lunch rooms, coffee bars

- Optimism (women)
  - Pink
  - Breast cancer treatment centers
- Danger awareness
  - Red
  - Emergency equipment, danger zones
- Examinations
  - Light dove grey
  - Exam rooms

Windows, Views

Furnishings

- Increase postural variation and movement

- Activity-based design

- Personalization

- Workstation aligns with work activity needs
  - Privacy
  - Ergonomic fit
  - Changes in posture
  - Physical movement
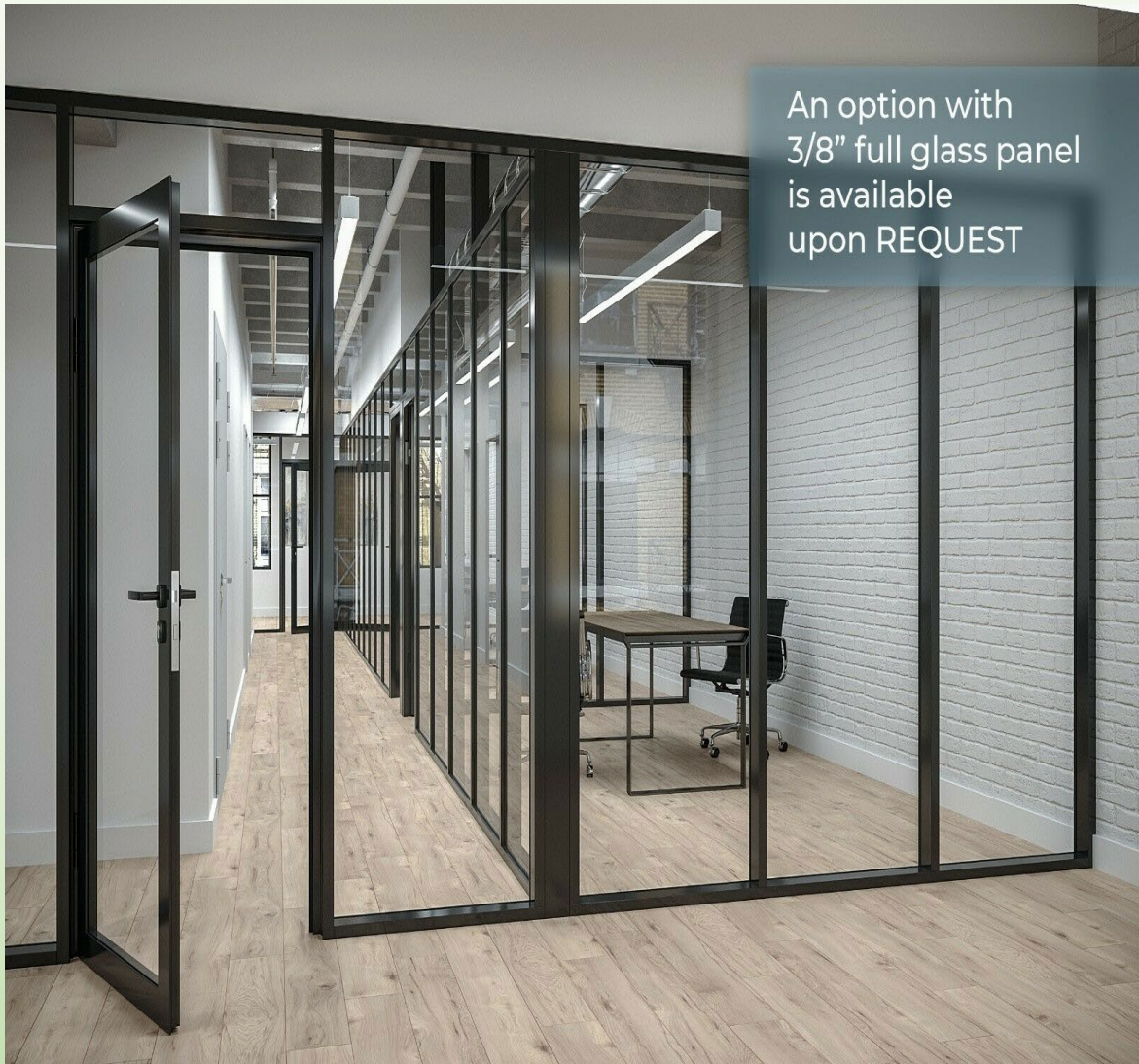 - Sitting in anatomically correct and comfortable position for short periods

Capisco chair

Bike-assisted exercise workstation

Focal Upright

An option with
3/8" full glass panel
is available
upon REQUEST

Private Offices

Phone Booth

**Microsoft Has Built Treehouses For Its Employees Where They Can Conduct Meetings**

OCTOBER 16, 2017 OFFICECHAI TEAM (OFFICECHAI.COM)

Biophilia

- <u>Definition</u>: Introduction into buildings design elements that were present in natural environments where humans felt comfortable early in our history.

- <u>Biophilic design</u>: Full range of sensory experience, gentle movement, natural materials and plants, natural shapes and forms, natural colors, animal motifs, water, curved pathways, views and vistas, spaciousness, warm light, prospect and refuge
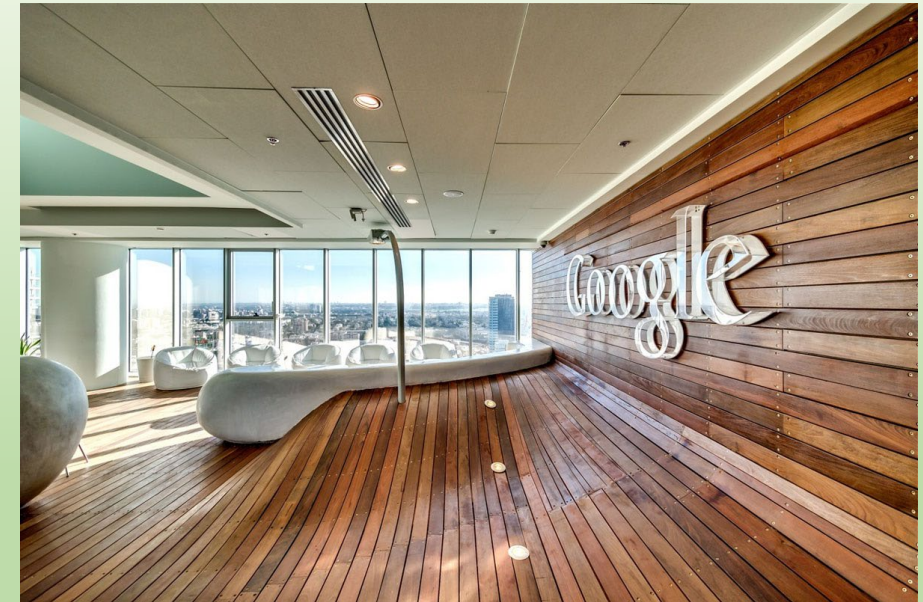
Living Wall
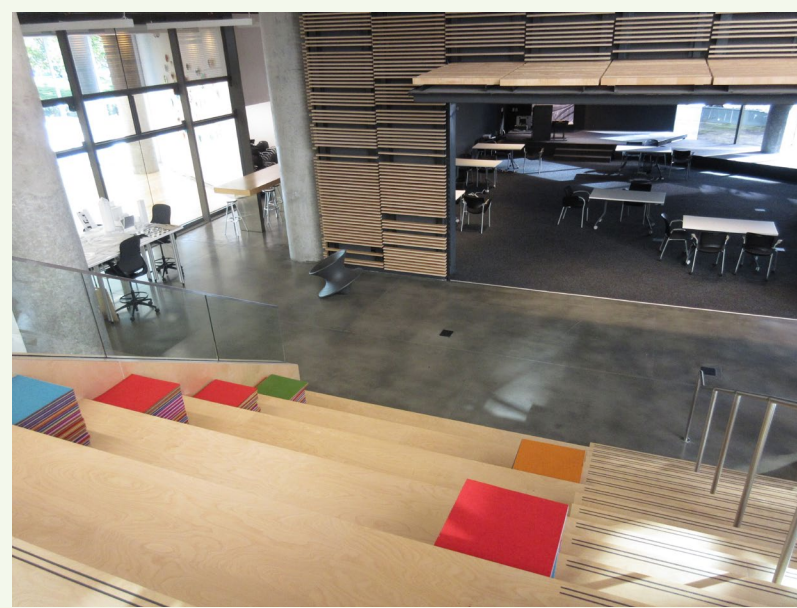
Open stairway

Prospect and Refuge

Google, Tel Aviv

Oliver Health
Design

The Built Environment Targets: Psychosocial Elements

- Work demand
- Control over work demand
- **Recognition & rewards**
- Compensation
- **Social connection**
- **Fair treatment**
- Work/Family balance
- Benefits: Leaves, Health insurance
- Management support
- **Organizational culture**
- **Resources**

Burnout (Maslach & Leiter)

- The co-occurrence of cynicism, emotional exhaustion, and inefficacy
- Six burnout predictors/risk factors:
  - Workload
  - **Control**
  - **Reward**
  - **Community**
  - **Fairness**
  - **Values**
- Built environment interventions:
  - Identify opportunities to **expand autonomy and choice**.
  - Create **work environment that supports tasks-at-hand**.
  - Create **spaces and actively support cognitive refreshment**.
  - **Use relaxing colors (green), warm light, and biophilic design** to support emotional refreshment and positive emotions.
  - Use **daylight** (or artificial daylight) to provide the physiological effects that support physiological systems.
  - Design floor plans that **maximize efficiency** to lower workload but also **encourage movement**.
  - Create designs to **foster social communities** through spatial layouts, and provide opportunities for positive tactile experiences.

Brittalny Newman for The New York Times

Questions?

Thank you.

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Built to Thrive: How to Build the Best Workplaces for Health, Well-Being, and Productivity. ICHW, September 2019.