

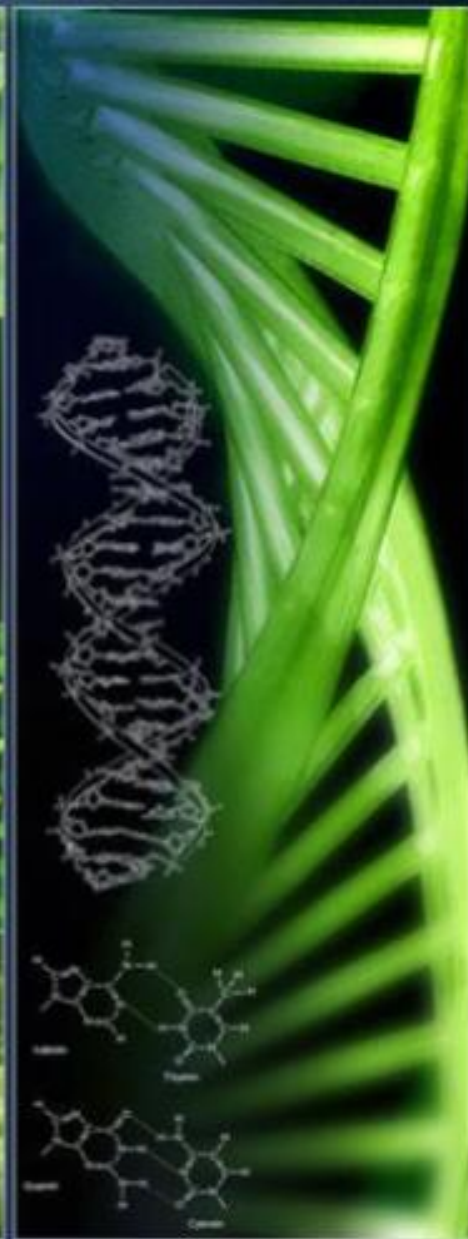
People , Nature and Architecture

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People Embrace Nature



SPIRALING STRUCTURE IN DOUBLE HELIX OF THE DNA, SOURCE OF LIFE AND DYNAMISM, SYMBOL OF HARMONY AND ULTIMATE BALANCE

VINCENT CALLEBAUT ARCHITECTURES
NEW 46, L'ESPANAY CONDORCQ, 14, AVENUE D'ALGER, 75008 PARIS

DNA SIMONE GREEN THOMAS



TO BUILD SIAMESE TOWERS INSPIRED BY THE SCULPTURE "LA CATHEDRALE" OF AUGUSTE RODIN, PARIS, 1909

VINCENT CALLEBAUT ARCHITECTURES
NEW 46, L'ESPANAY CONDORCQ, 14, AVENUE D'ALGER, 75008 PARIS

DNA SIMONE GREEN THOMAS

Frank Lloyd Wright Fallingwater

- Local sandstone
- Woodland
- Sounds of water
- Interior
Natural light and views out



Organic Architecture

Organic architecture promotes harmony between human habitation and the natural world through design. Sympathetic and integrated into its site so that buildings, furnishings, and surroundings become part of a unified, interrelated composition.



Fallingwater by Frank Lloyd Wright

Sensory Design

- **Falling Water exemplifies the importance of sensory design. Here natural light, sounds of water, views all combine with the materials and spaces to give the home dwellers an enriched sensory experience as the then owners (Kaufmanns) confirmed.**
- **We live through our senses after all.**

Evaluating the Sensory Experience

- Questionnaires
- Diaries
- Interviews and Self-expression via drawings, photos or narratives
- Wearables
- IEQ monitors

Biophilic Design Affects Learning

- Furthermore, classrooms that incorporate biophilic design principles result in **improved attendance, behaviour and focus and better educational outcomes**. The Gillis Gatersleben study in 2015 found that optimising exposure to natural light increased attendance by 3.5 days per year; the speed of learning by 20-26%; and test scores by 5-14%.

A

Kaitlyn Gillis

*

Birgitta Gatersleben

Department of Psychology, Faculty of Arts and Humans Sciences, University of Surrey, *

Buildings 2015, 5(3), 948-963; <https://doi.org/10.3390/buildings5030948>

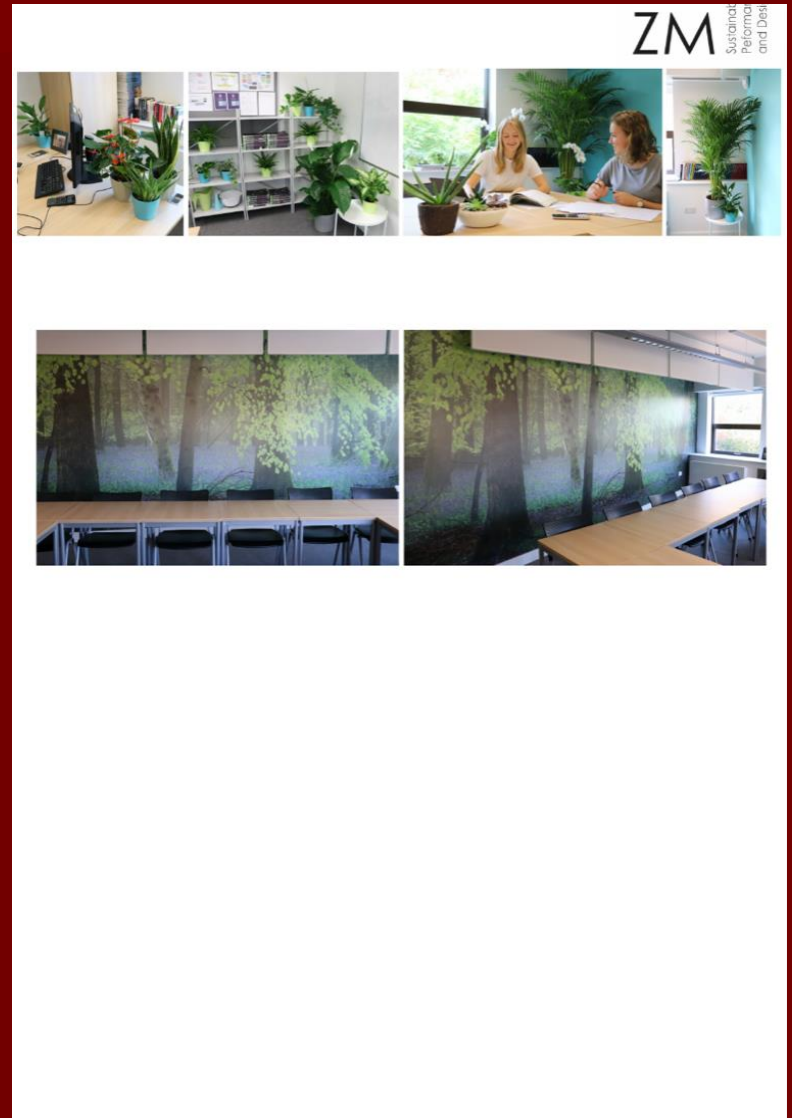
Review of Psychological Literature on the Health and Wellbeing Benefits of Biophilic Design

**Bowman and Clements-
Croome
found similar results in
Putney High School for Girls
in London**

Putney High School London

**RCZM Architects
Derek Clements-Croome
Putney High School pupils**

- **Pupils felt happier and more motivated in Biophilic Classrooms. The Flourish Model was a basis for the design.**
- **(Chapter 3 in Designing Buildings for People 2020)**



Research at PLP Architecture Offices in London

**Should we expect similar results in
offices as for schools?**

HUMAN SPACES:GLOBAL IMPACT OF BIOPHILIC DESIGN IN THE WORKPLACE

Those who work in environments with natural elements, such as greenery and sunlight report :

- **15% higher level of well-being**
- **6% higher level of productivity than those**
- **15% higher level of creativity than those with no connection to natural elements in the workplace**
- **WWW.HUMANSPACES.COM 2015 Cooper and Browning**

Publication:

BCO

British Council for Offices
April 2021



USE OF WEARABLES IN THE OFFICE

A review and examples in practice

Pilot Study

Use of Wearables in the Office, British Council for Offices, (2021)

https://www.bco.org.uk/Research/Publications/Use_of_Wearables_In_The_Office_-_A_review_and_examples_in_practice.aspx

TEAM

PLP
Architecture

Joyce
Chan-
Schoof

Derek
Clements-
Croome

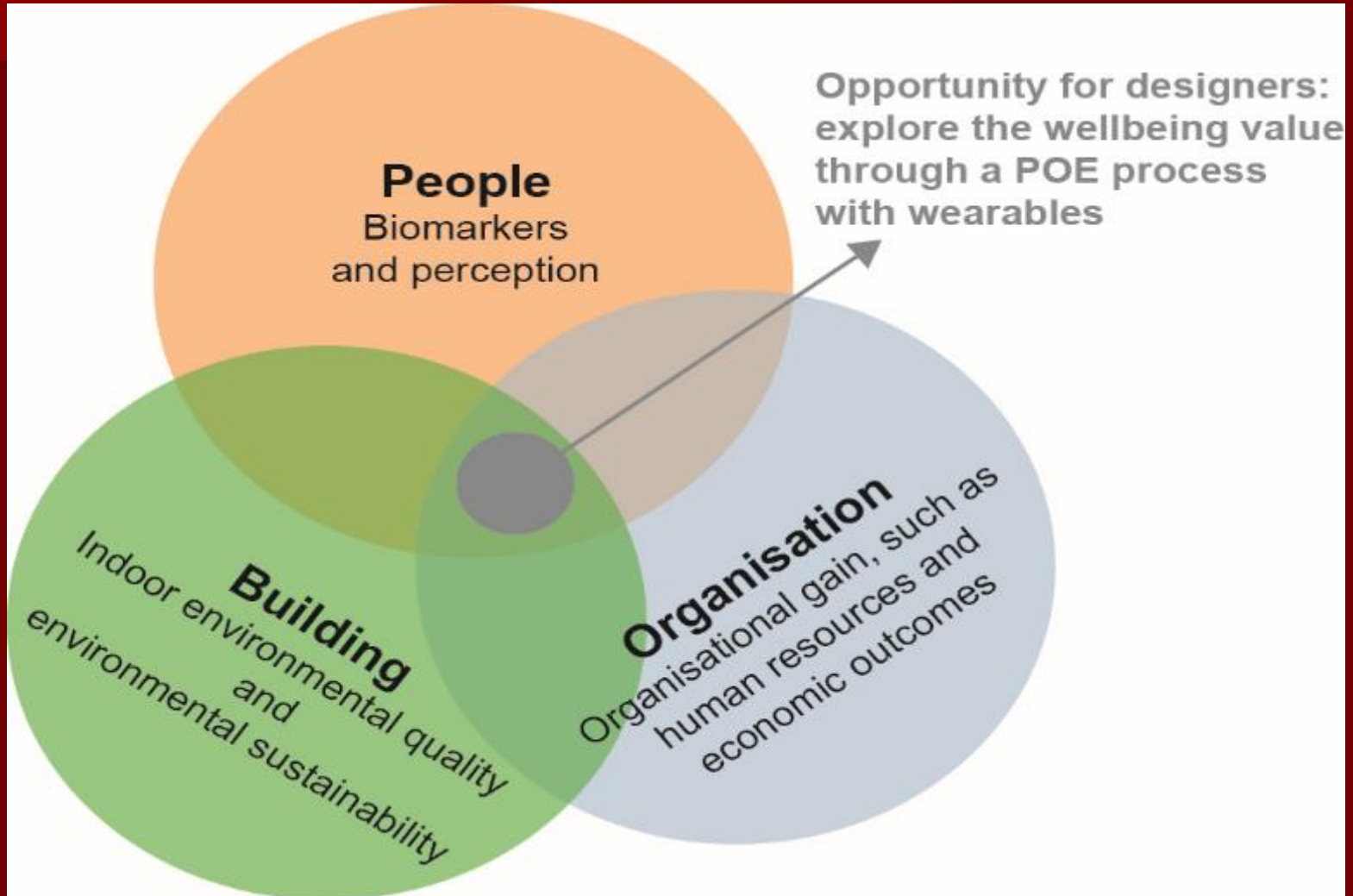
Biophilia
Specialists

THE ARCHITECTS POINT OF VIEW

- 1. Communicating the importance of design in health and wellbeing
- 1. Measuring the human
- 1. Empowering users
- 1. Guaranteeing performance



Integrated Approach



CONNECTED HEALTH

Body and Mind Interconnected

- Blood circulates oxygen
- Nervous system transmits signals
- Hormones effect emotional responses

All these can be assessed with wearable sensors and soon the immune system -- a defence against illness – will be easy to monitor too.

CURRENT MEASURES

- **Heartbeat patterns; activity levels**
- **Sleep quality**
- **Skin conductance; stress levels**
- **Blood oxygen; alertness**
- **Muscle tension and posture**
- **Brain rhythms; state of mind**
- **Diabetes is possible**
- **DNA wristband links to healthy food.**

WEARABLES

- **Worn as attachments**
- **Embedded in clothes**
- **Embedded in the body**

FUTURE MEASURES

- **Cholesterol**
- **Microbiome**
- **Immunity and antibodies**
- **Brain rhythms**

RESEARCH

- **Virus detection** with bio-optical sensors
- Surface skin patches
- Under-skin patches detect drugs in bloodstream
- E-glasses measure brain EEG and eye EOG

IN PRACTICE

- **POE**
- **Link with Augmented and Virtual Reality**
- **Need trusted data management systems with analytics**
- **Combine with robotics**

PILOT STUDY

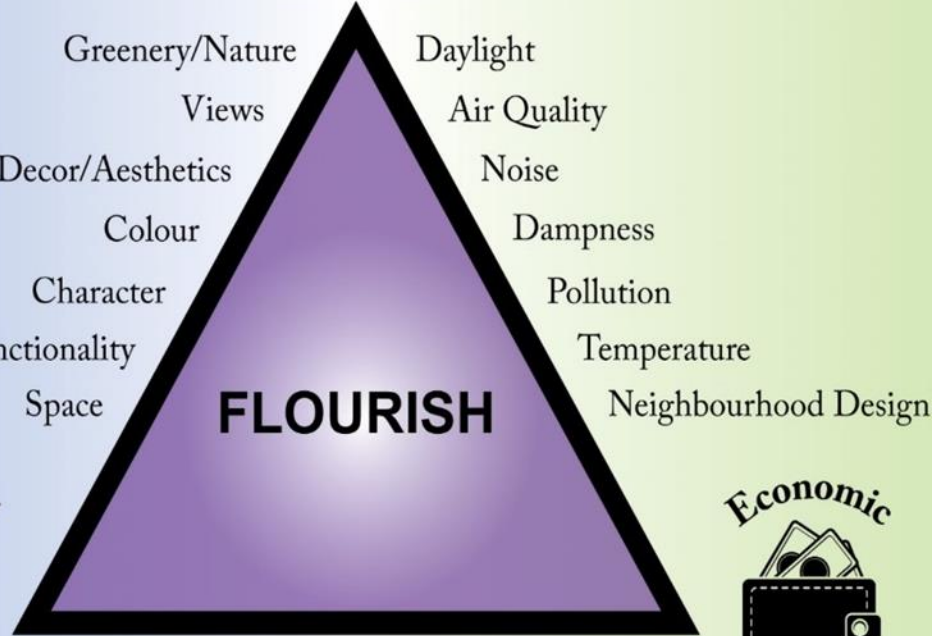
- **Use Fitbit Inspire 2 for heart ,sleep quality, activity levels, calories in-out and...**
- **for posture, Upright Go 2.**

QUALITATIVE

Physical



QUANTITATIVE



Perceptual



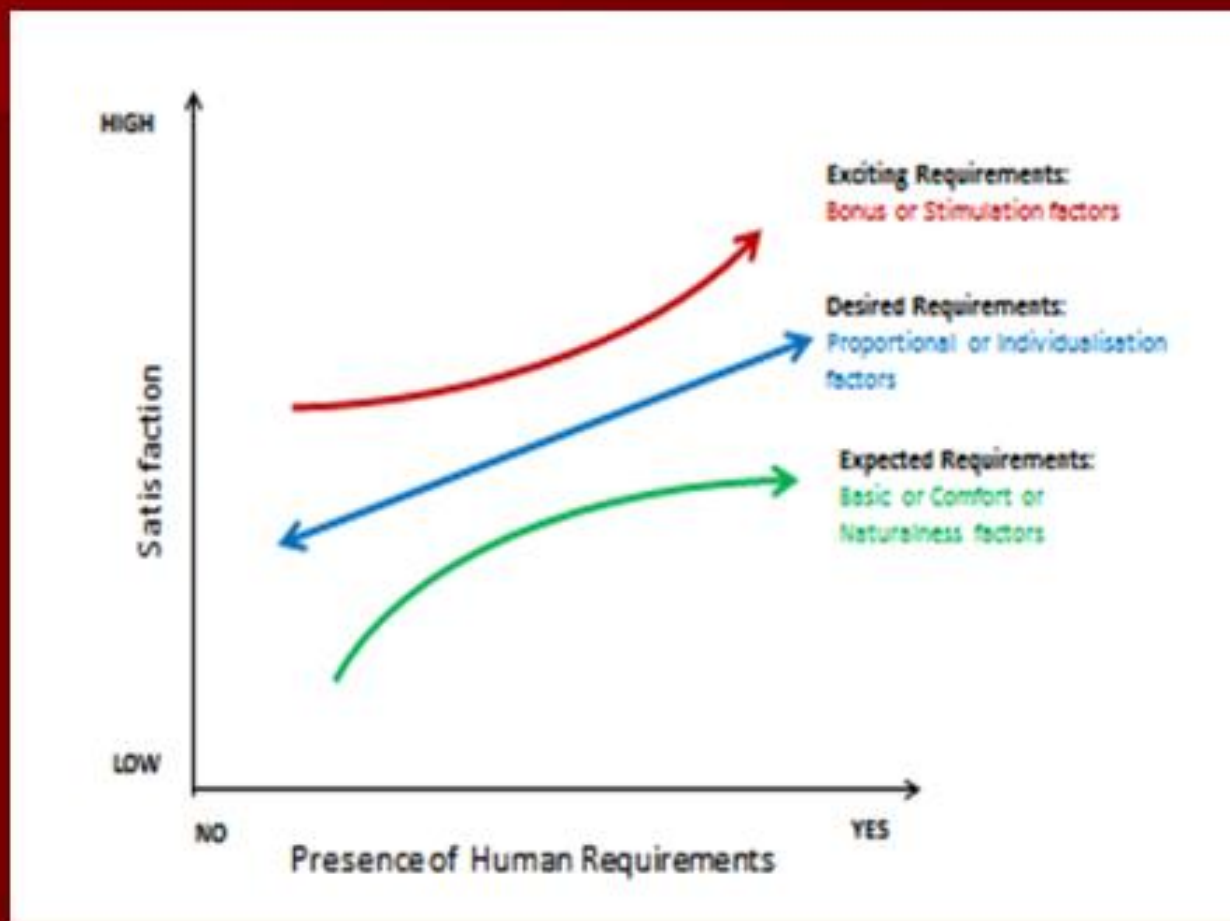
Economic



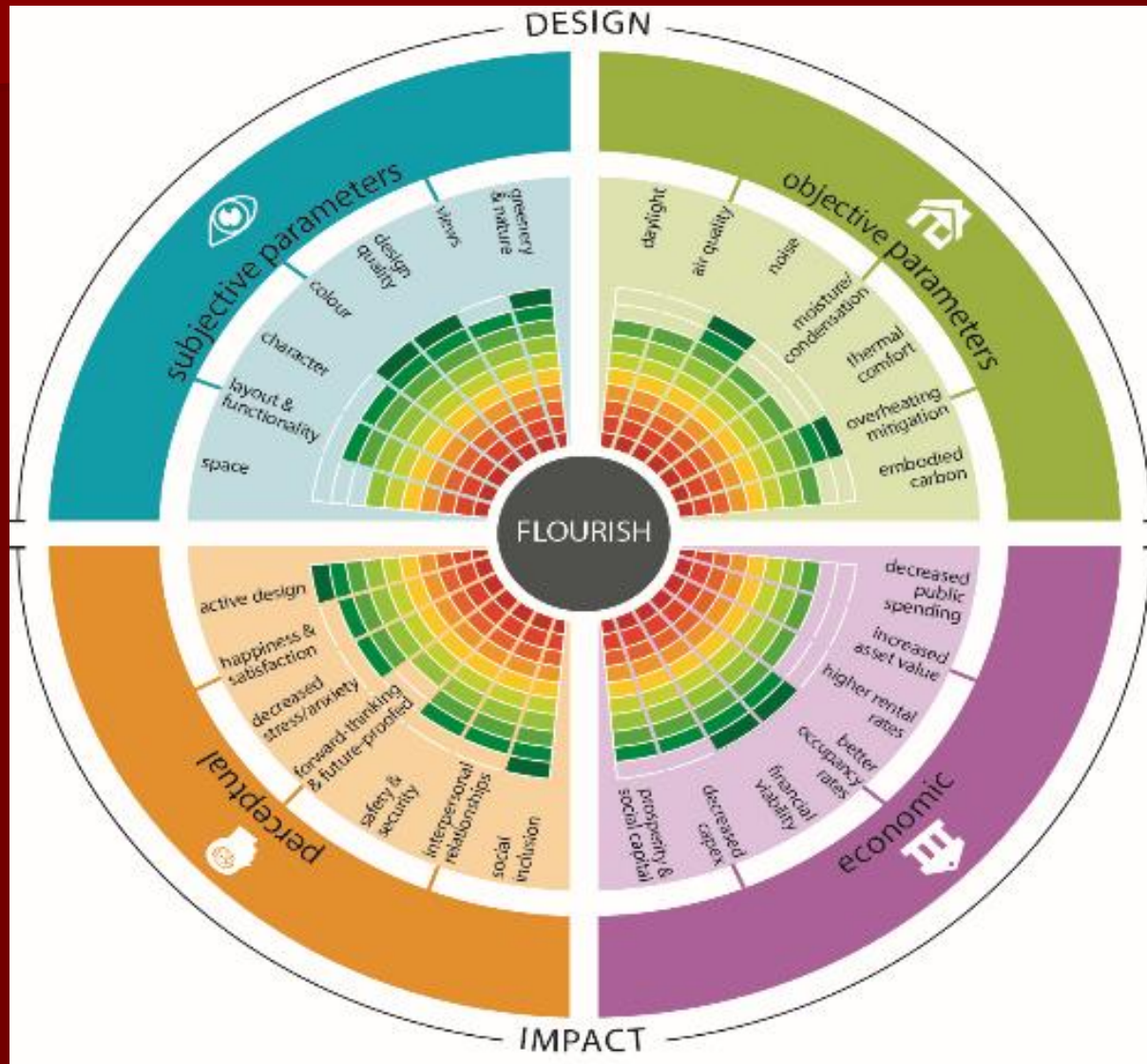
- Perceived Health and Well-being
- Happiness and Satisfaction
- Security
- Empowerment
- Achievement
- Relationships
- Community

- national* — Decreased Public Health Costs
(illness, injuries, therapies)
- developers* — Increased Asset Value/Sale Price
- landlords* — Higher Rental Rates
Better Occupancy Rates/Tenant Longevity
- occupants* — Productivity
Performance
Prosperity
Social Capital

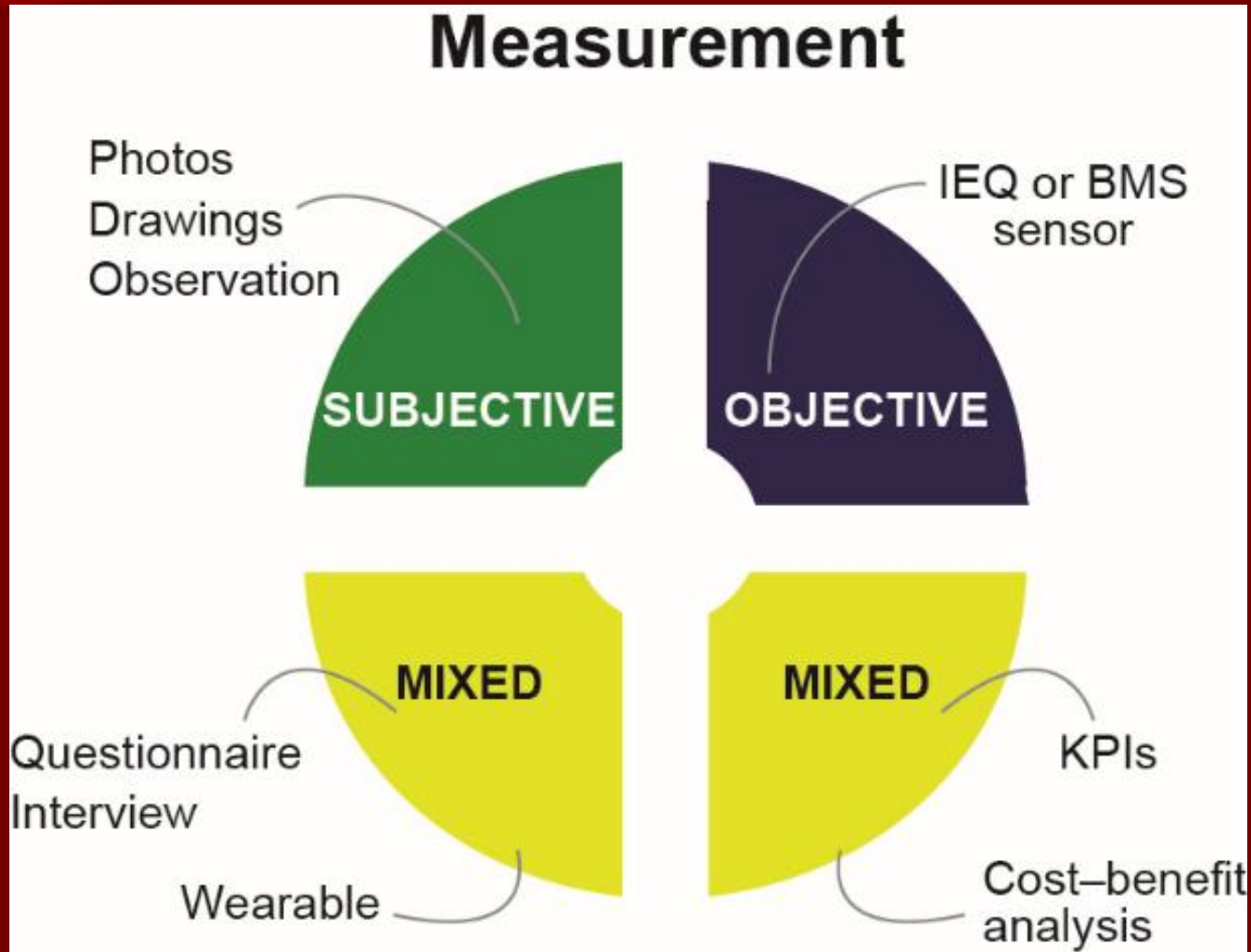
Beyond Environmental Comfort



FLOURISH MODEL (Clements-Croome 2020)



MEASUREMENT OF FLOURISH



QUALITATIVE DATA COLLECTION METHODS

- **Questionnaires** and **diary entries**, completed by participants each day or at several points throughout the day, can capture how participants are feeling.
- Questionnaires and diary entries can capture information such as:– **mood**– **activity**– **posture**– **caffeine and water intake**– **sleep quality**-**other stressors throughout the day (e.g. commute, meetings)**.
- Other methods for capturing the subjective elements of the study can include *interviews* and also participants *sketching the spaces* they are in or asking them to write about their experience.

OBJECTIVE MEASUREMENTS

- **Wearables assess physiological factors such as heart rate; skin conductance; sleep quality; calories; activity**
- **Traditional environmental monitoring of temperature; air quality and other parameters**

UPRIGHT GO2 SENSOR



UPRIGHT GO2



FITBIT INSPIRE 2



PHONE APP RECORDS DATA



MONITORS FOR PHYSICAL ENVIRONMENT



ASSESSING WELLBEING VALUE

Wellbeing/
social value

=

Number
of people

×

Value associated
with improvement

Hilson Moran –Manchester



- **BCO Report 2021
Use of Wearables
in the Office**
- **Company issue
wearables to their
employees**

Biophilic design = our connection with nature.

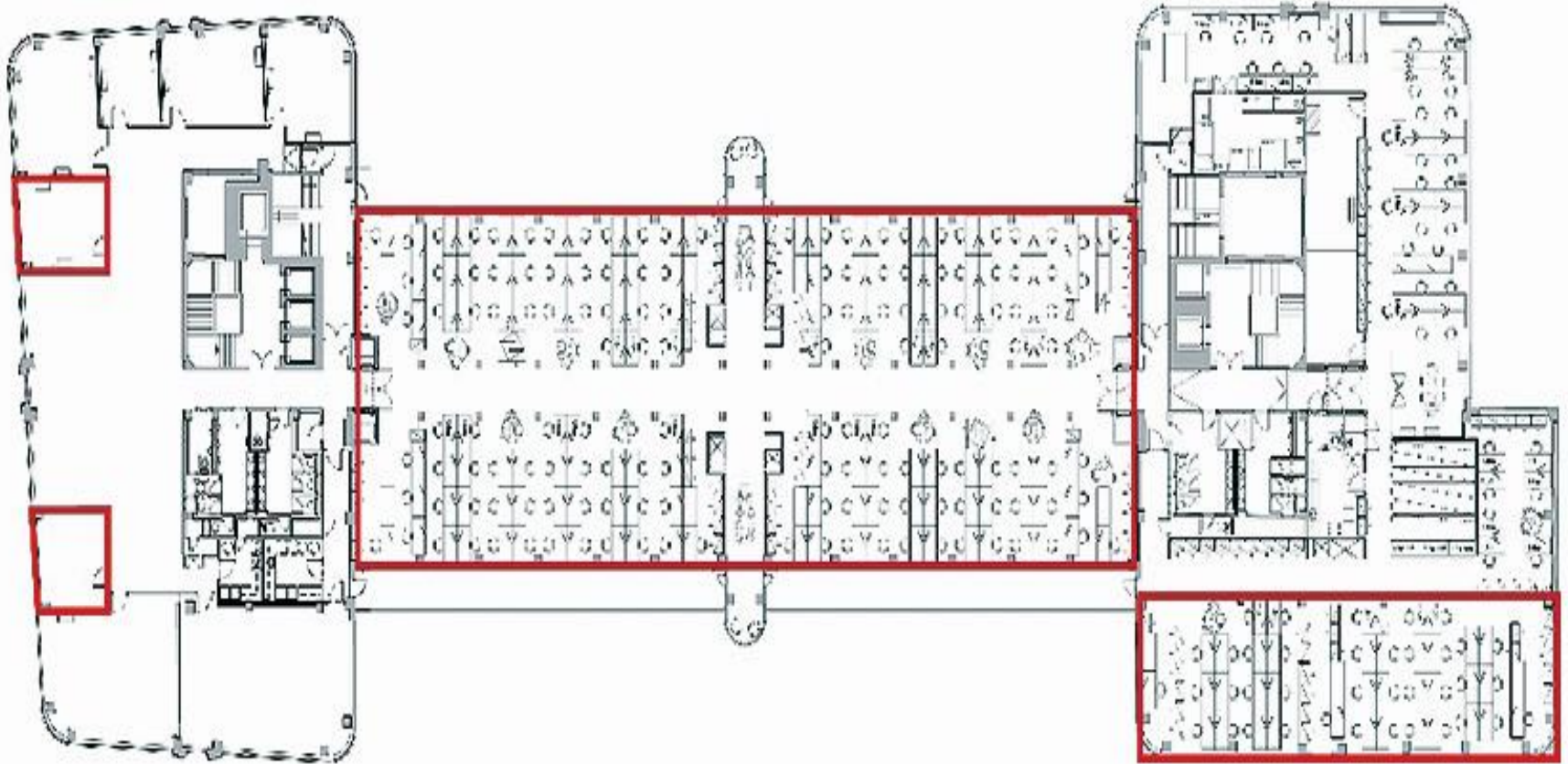
It has many variables, to what extent can designers objectively measure the effect of well-being that would inform decision-making? [Sub-RQ]



BIOPHILIC WORK PLACE



OFFICE FLOOR PLAN AT PLP Architecture



SETTINGS FOR RESEARCH



Design: Subjective Parameters



Designers' perspective

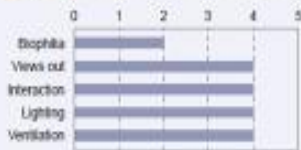


Figure 7
Scenario A - open-plan office

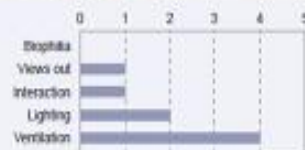


Figure 8
Scenario B - cubicle

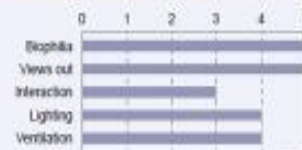


Figure 9
Scenario C - biophilic office

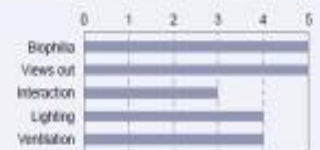


Figure 9
Scenario C - biophilic office

0- Poor
3- Average
5- Good

USERS COMMENTS



Impact: Perceptions



Building Users' perspective

Nice area of the office, with more green than other locations

Physically I feel very disconnected, however I do feel more digitally connected

Emotions

	Biophilic (P4)				Biophilic (P3)				Cubicle (P2)				Open Plan (P1)			
	Monday	Tue	Wed	Thu	Monday	Tue	Wed	Thu	Monday	Tue	Wed	Thu	Monday	Tue	Wed	Thu
Video (Morning)	Green	Green	Green	Green	Orange	Green	Green	Yellow	Yellow	Orange	Yellow	Yellow	Green	Orange	Green	Yellow
Video (Afternoon)	Green	Green	Green	Green	Green	Green	Orange	White	Red	Yellow	Yellow	Yellow	Green	Green	Green	Green

The wearables did not bother me at all, in contrary, I feel I paid more attention to my posture, amount of water drunk, exercising after work, etc., I could continue wearing them

There's too much light on the south side of the office

■ Positive
 ■ Neutral
 ■ Negative

FUTURE

Next Step



- Will create a well-considered biophilic workplace for a real-world study
- Will take advantage of smart technology
- Will involve the monetisation of environmental characteristics, it will aim to gain a deeper understanding of the value of good quality biophilic design.



PLP/ARCHITECTURE



Understanding The Brain Can Help Design Better Inclusive Spaces



WINDOW VIEWS

Transients
are important
and
wearables
can indicate
momentary
changes in
wellbeing.



Google Southlake Union

@nbbjdesign

Restorative
Zones

Comfortable
Furniture and
Lighting



West Coast Tech Headquarters

Restorative
Zones

Views to
Nature

Built into
Architecture



University Enterprise Zone

Choice

Pods or Open Work

Day light & Greenery



Floating City by Vincent Callebaut



CONCLUSIONS 1

- **The open-plan office and one of the biophilic scenarios have the most positive outcomes overall, and working from home also generated good wellbeing values when natural light and indoor plants were present.**
- **The cubicle scenario was an enclosed solitary workspace without views out and no greenery. Although this had no impact on the subject's physical activeness and posture, the data suggests that it negatively affected their moods and emotions.**
- **Perceived environmental conditions, such as aesthetics, access to light, thermal comfort and air quality, have a strong correlation with the level of valence and arousal (recorded twice a day). For example, the more satisfied the subject felt about the space, the more frequent positive emotions it attracted.**

CONCLUSIONS 2

Most of the participants improved their UPRIGHT GO 2 scores towards the end of the week. Some found that the device bothered them initially, but not later on. Thus it appears that some types of wearables require an adaptation period.

To summarise, it is technically feasible for designers to employ wearables in the POE process to collect snapshot or longitude data, but careful planning, including a trial period, and specific research questions to compare well-defined settings are the two most important considerations in the process.

CONCLUSIONS 3

- **Wearables help us to understand how people's physiological states vary with changing environments.**
- **We can compare differences between individuals.**
- **Steady state and transient conditions can be studied.**
- **This approach enables holistic perceptual studies to be made so giving a deeper meaning to human responses to their environment.**

Acknowledgements

- **BCO for financing the pilot study and printing the Report.**
- **PLP Architecture staff for their participation**
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- **Benholm Group for providing greenery**
- **Britni Stone of NBBJ for some case studies**