

UCL + CIBSE + CIB

# SMART BUILDINGS

**GUEST LECTURE**

27 January 2023

EUR ING Dr Matthew Marson MEng (Hons) CEng IntPE(UK) FIMechE FRSA



EUR ING Dr

# MATTHEW MARSON

MEng (Hons) CEng IntPE(UK) FIMechE FRSA

## **MANAGING DIRECTOR, JLL TECHNOLOGIES**

Smart Buildings PhD

MEng Structural Engineering + Architecture

Head of Smart Places, WSP

Connected Spaces Lead, Accenture

Board & Fellow at the Institution of Mechanical Engineers

Royal Academy of Engineers Young Engineer of the Year 2022

IMechE Young Visionary

Fellow of the RSA

Co-author, Encyclopaedia of Sustainable Technologies





**SMART BUILDINGS DESIGN**

Twentytwo Bishopsgate, London



**SMART AIRPORT**

Red Sea Airport, Kingdom of Saudi Arabia



**4IR CITY**  
NEOM

نيوم NEOM



**DIGITAL HUB DESIGN**

Santander, UK



**SMART CAMPUS**  
University of Glasgow



**CONNECTED HOSPITAL**

National Children's Hospital



**WORLD'S MOST CONNECTED BUILDING**

Dublin



**SMART WORKPLACE**  
Morgan Stanley



**DATA MONETISATION STRATEGY**

14<sup>th</sup> at Irving, New York



**SMART ASSESSMENT**

Soho Place, London

# THE VALUE OF A SMART PLACE IS DERIVED BY THREE PRIMARY VALUE LEVERS

sustainability.

space.

sapiens.



# THROUGH THE LAST DECADE, THE PERTINENT VALUE LEVER HAS CHANGED

2010  
2011  
2012  
2013  
2014  
2015  
2016  
2017  
2018  
2019  
2020



sustainability.

space.

sapiens.

1 Environmental Sustainability Principles for the Real Estate Industry

2 [Document thumbnail]

3 [Document thumbnail]

4 [Document thumbnail: Research Roadmap for Intelligent and Responsive Buildings]

5 [Document thumbnail: Towards Creating Buildings]

6 [Document thumbnail: Use of an innovative building]

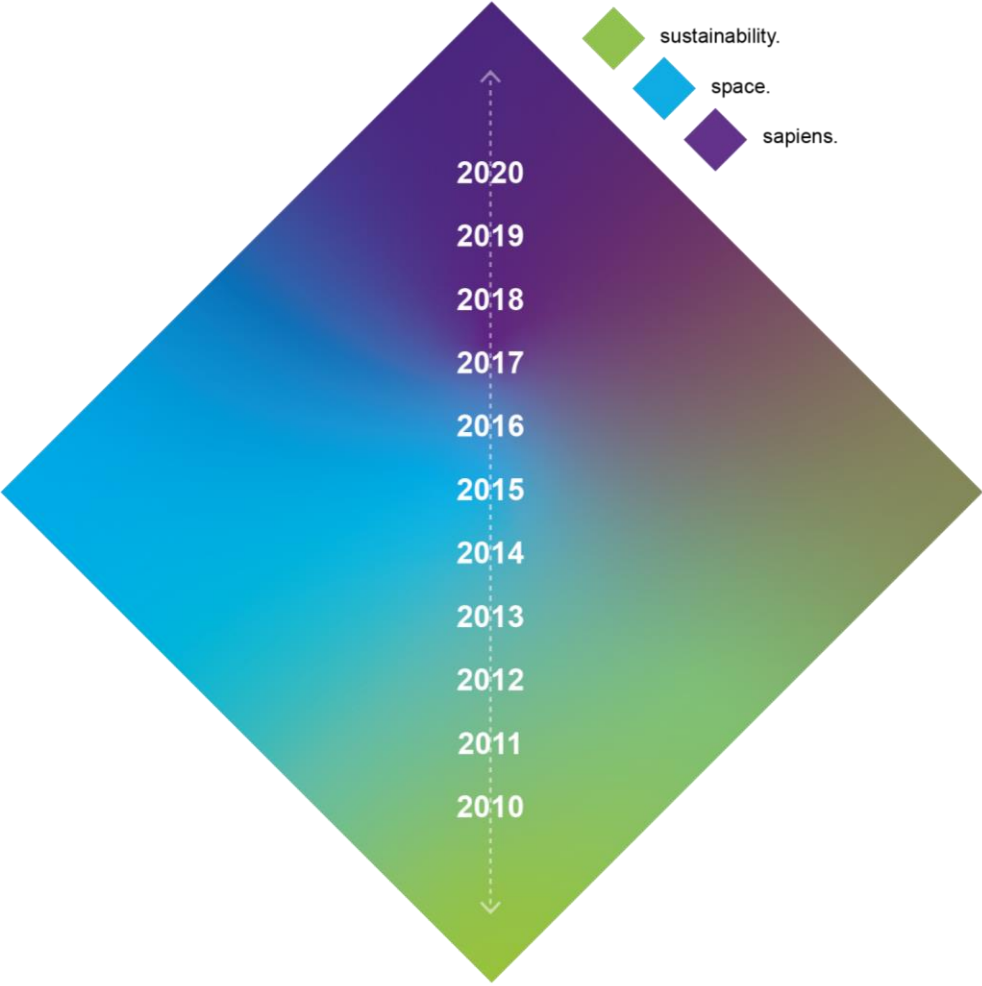
7 [Document thumbnail: Smart buildings]

8 [Video player: Smart Thinking]

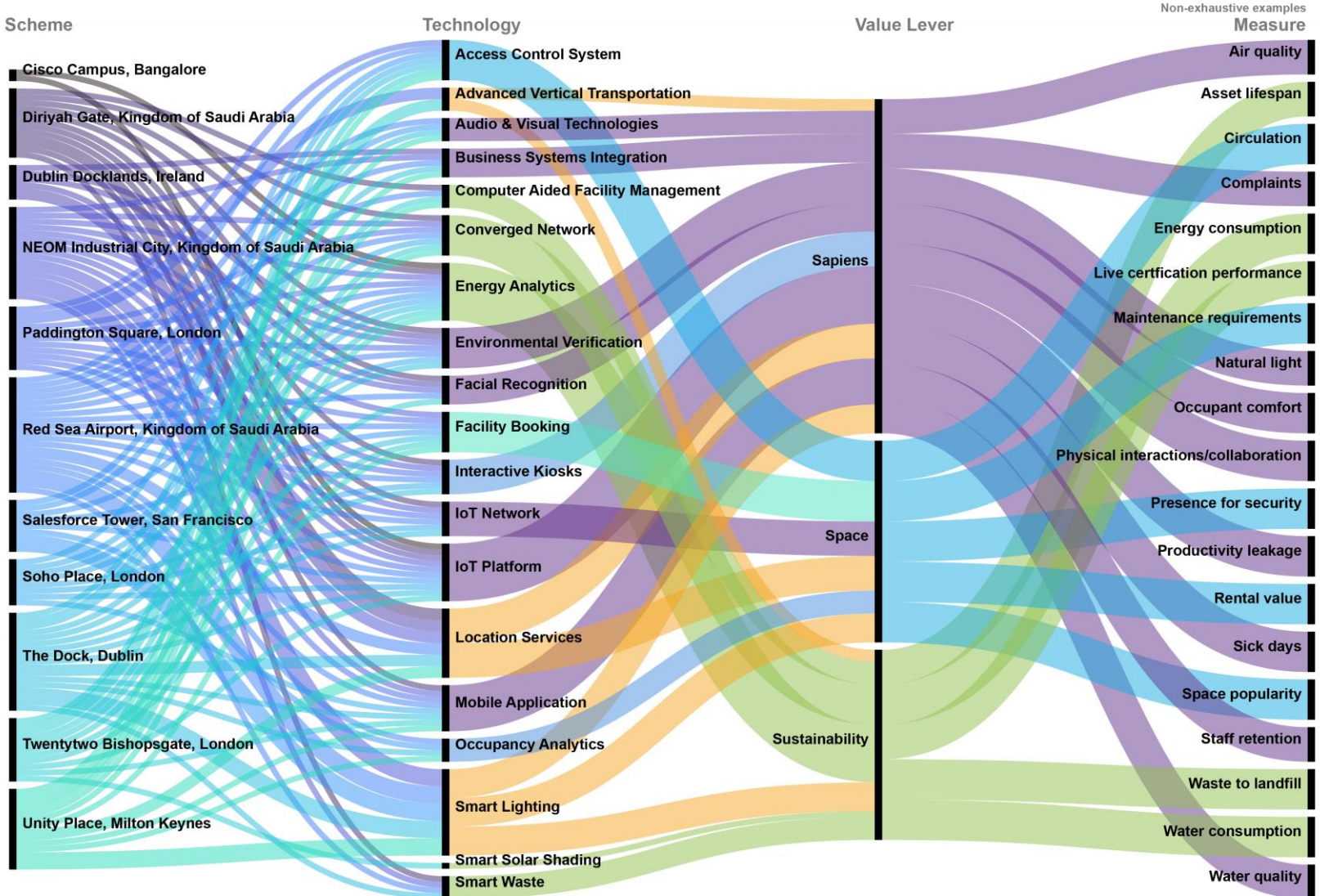
38 [Document thumbnail]



# THROUGH THE LAST DECADE, THE PERTINENT VALUE LEVER HAS CHANGED



# THROUGH THE LAST DECADE, THE PERTINENT VALUE LEVER HAS CHANGED



# THE VALUE OF A SMART PLACE IS DERIVED BY THREE PRIMARY VALUE LEVERS

sustainability.

space.

sapiens.

# **SIZING THE ISSUE**

when it comes to operating our buildings

## 2050 EU BUILDING STOCK

**25%**  
to make

**75%**  
here today

## GLOBAL CO<sub>2</sub> EMISSIONS

**40%**  
comes from  
buildings



**160**

kWh/m<sup>2</sup>.year

average today



**110**

kWh/m<sup>2</sup>.year

best-in-class today

**160**

kWh/m<sup>2</sup>.year

average today

**55**

kWh/m<sup>2</sup>.year

for nzc

**110**

kWh/m<sup>2</sup>.year

best-in-class today



**105**

kWh/m<sup>2</sup>.year

to reduce

**55**

kWh/m<sup>2</sup>.year

for nzc

**110**

kWh/m<sup>2</sup>.year

best-in-class today

40%

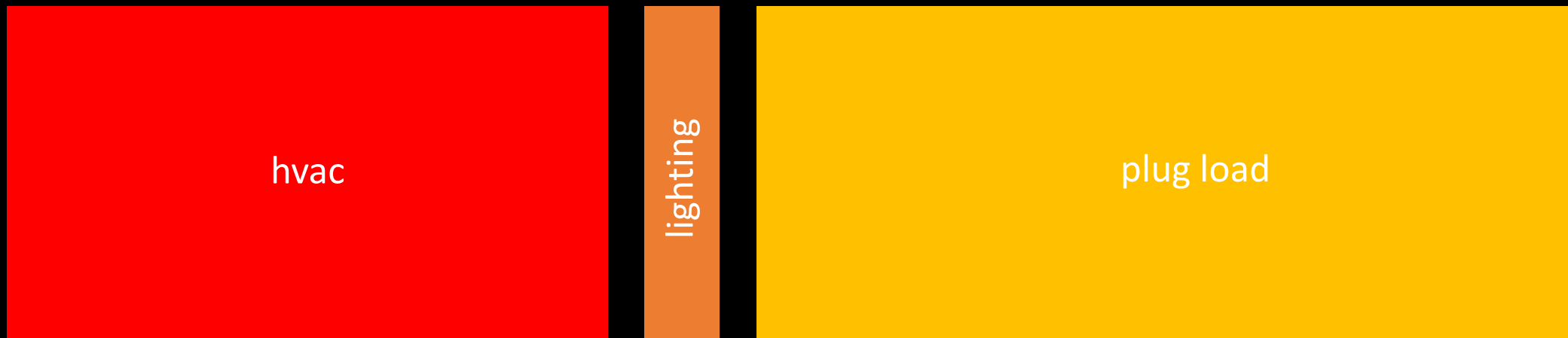
hvac

5%

lighting

55%

plug load



**WHAT DOES THIS MEAN?**









**100%**  
**Battery Charged**

Mobile

93% 3:35 PM

**HOW OTHERS THINK OF IT**



### Operational energy

- Meet EUI target
- Meet heating demand target



### Future of heat

- Use low carbon heat



### Demand response

- Incorporate demand response measures



### Renewables

- Incorporate renewable energy on-site



### Data disclosure

- Monitor energy use
- Any energy not met by on-site renewables must be met by an investment into additional renewable capacity

EUI = Energy use intensity (kWh/m<sup>2</sup>.yr)

 Operational carbon

 Embodied carbon





### Operational energy

- Meet EUI target
- Meet heating demand target



### Future of heat

- Use low carbon heat



### Demand response

- Incorporate demand response measures



### Renewables

- Incorporate renewable energy on-site



### Data disclosure

- Monitor energy use
- Any energy not met by on-site renewables must be met by an investment into additional renewable capacity

EUI = Energy use intensity (kWh/m<sup>2</sup>.yr)

 Operational carbon

 Embodied carbon



## Data disclosure

Meter and disclose energy consumption as follows:



### Metering

*(Metering strategy following BBP Better Metering Toolkit guidance)*

1. Record meter data at half hourly intervals
2. Separate landlord and tenant energy use meters and clearly label meters with serial number and end use
3. Submeter renewable energy generation
4. Use a central repository for data that has a minimum of 18 months data storage
5. Provide thorough set of meter schematics and information on maintenance and use of meters
6. Ensure metering commissioning includes validation of manual compared to half hourly readings.

123

### Disclosure

1. Carry out an annual Display Energy Certificate (DEC) and include as part of annual reporting
2. Report energy consumption by fuel type and respective benchmarks from the DEC technical table
3. For multi-let commercial offices produce annual landlord energy (base building) rating and tenant ratings as well as or instead of a whole building DEC
4. Upload five years of data to a publicly accessible database such as GLA and/or CarbonBuzz.



## ~~Data disclosure~~ technology

Meter and disclose energy consumption as follows:



### Metering

(Metering strategy following BBP Better Metering Toolkit guidance)

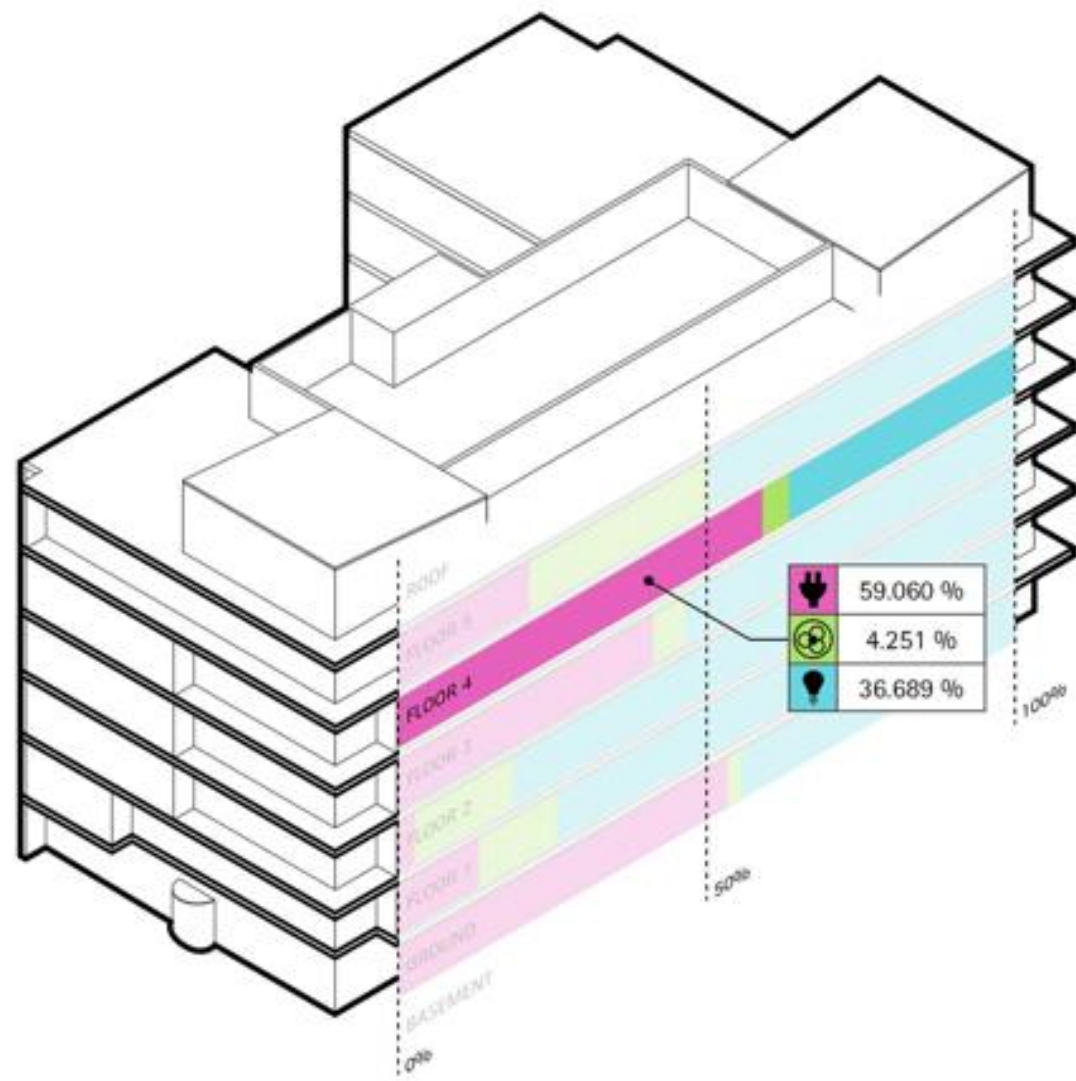
1. Record meter data at half hourly intervals
2. Separate landlord and tenant energy use meters and clearly label meters with serial number and end use
3. Submeter renewable energy generation
4. Use a central repository for data that has a minimum of 18 months data storage
5. Provide thorough set of meter schematics and information on maintenance and use of meters
6. Ensure metering commissioning includes validation of manual compared to half hourly readings.

123

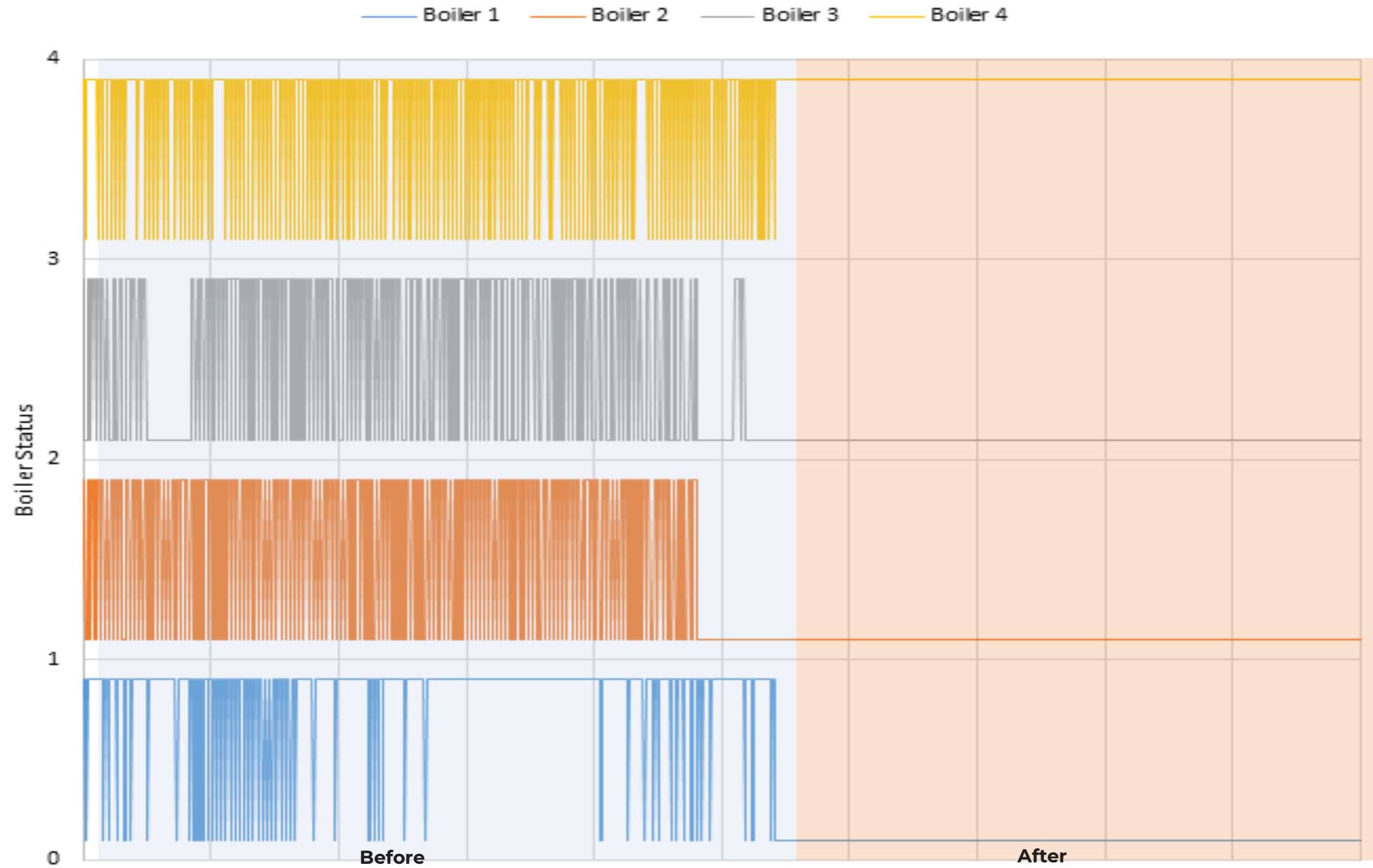
### Disclosure

1. Carry out an annual Display Energy Certificate (DEC) and include as part of annual reporting
2. Report energy consumption by fuel type and respective benchmarks from the DEC technical table
3. For multi-let commercial offices produce annual landlord energy (base building) rating and tenant ratings as well as or instead of a whole building DEC
4. Upload five years of data to a publicly accessible database such as GLA and/or CarbonBuzz.

LIVE	START	01/02/2017	12.00							
PAST	END	08/02/2017	13.00		PLUG	HWAC	LIGHT	ENERGY	CO2	COSTS



# Boiler Optimization



# Want More?



[tinyurl.com/bddtyct3](https://tinyurl.com/bddtyct3)

# THE VALUE OF A SMART PLACE IS DERIVED BY THREE PRIMARY VALUE LEVERS

sustainability.

**space.**

sapiens.





“79%

**OF MILLENNIALS SAY THAT  
THEIR ENVIRONMENT IS  
MORE IMPORTANT THAN  
THE PAY CHEQUE**

Accenture, Workforce of the Future Study

”



“**39%**”

**OF EMPLOYEES CLAIM  
THEIR ORGANISATION'S  
CULTURE DOES NOT  
SUPPORT WELLBEING**”

British Council for Offices



**WORK//LIFE**

**BLUR**

**EMPLOYERS EXPECT MORE  
FROM THEIR EMPLOYEES.  
EMPLOYEES ARE EXPECTING  
MORE IN RETURN.**







**NEW**

**WAYS OF WORKING**

**DIGITAL HAS  
REVOLUTIONISED THE  
WAY WE LIVE AND WORK.  
IS YOUR BUILDING READY?**



An aerial, high-angle photograph of a busy city square paved with light-colored cobblestones. The square is divided into sections by dark grey lines. Numerous people of various ages and ethnicities are walking in different directions. A person in the center-left is holding a bright orange umbrella. The overall scene is one of a bustling, public urban space.

# THE WAR FOR TALENT

**WITH A PINCH ON HIGH  
VALUE SKILLS, THE  
WORKPLACE IS NOW THE  
BATTLE GROUND IN THE  
WAR ON TALENT.**





**LET'S NOT JUST  
DIGITISE THIS**

# IMPORTED IMPRESSIONS

With ubiquitous digitization of services, consumer's expectations are blurring the lines between traditional barriers.



## DIRECT COMPETITORS

Services/Products that directly compete



## EXPERIENTIAL COMPETITORS

Experiences which remove the need for your services/products



## PERCEPTUAL COMPETITORS

Those that change customer expectations

# BUILDINGS NEED TO ACT AS A DRIVER FOR STRATEGIC VALUE

## C-SUITE GOALS

### INCREASE REVENUES



#### INCREASED PRODUCTIVITY PER EMPLOYEE

- 8% Productivity Gains
- 15% Reduction In Productivity Leakage



#### INCREASED INNOVATION AND COLLABORATION

- 83% Increase In Innovation Index Scores



#### INCREASED TALENT ATTRACTION AND RETENTION

- 24% Increase In Job Satisfaction
- Increased Employee And Customer Net Promoter Scores

### REDUCE COSTS



#### REDUCED EMPLOYEE ABSENTEEISM

- 28% Reduction In Sick Days



#### REDUCED OCCUPANCY AND SERVICE COSTS

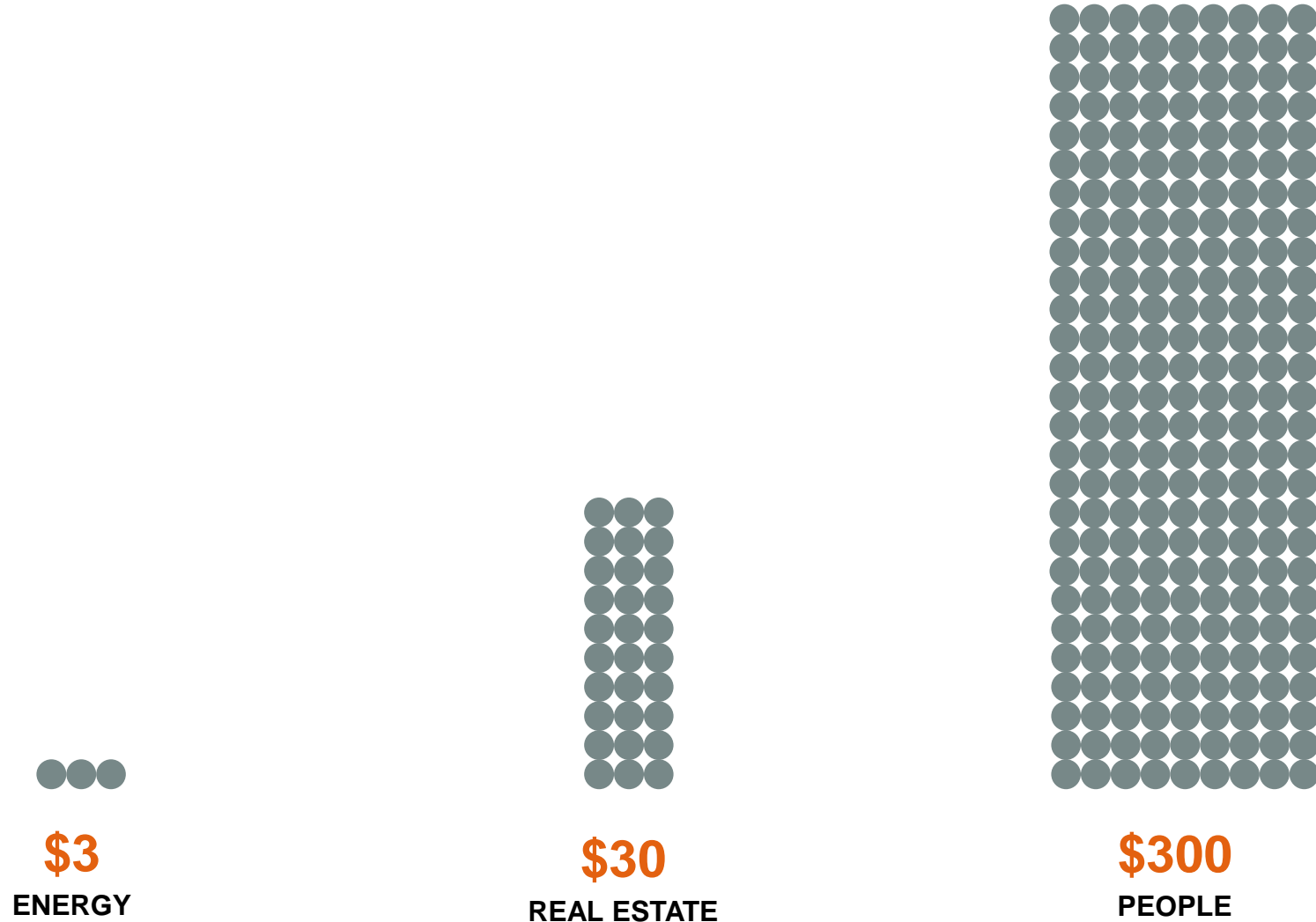
- 29% Reduction In Space Requirements (and FM Costs)
- 5% Reduction In Cleaning Time



#### REDUCED UTILITY & MAINTENANCE COSTS

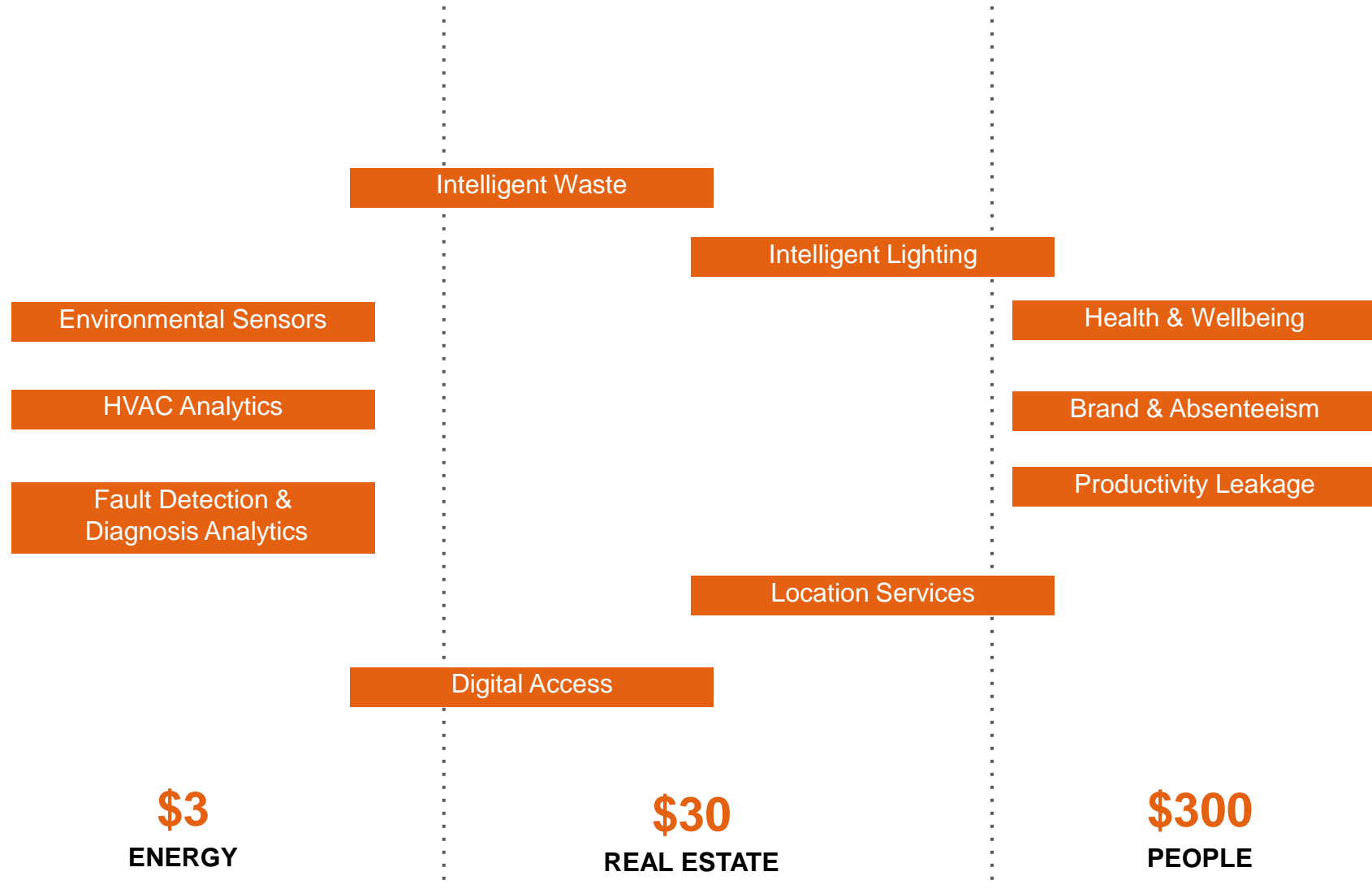
- 20% Reduction In HVAC ENERGY
- 25% Reduction In HVAC Maintenance
- 75% Reduction In Lighting Energy

# BUSINESSES INCUR OPERATIONAL EXPENSES PER SQ FT





# TACTICAL DECISIONS HELP TO REDUCE THE COST



# APPLICATION IN CONTEXT DELIVERS VALUE

## PRODUCTIVITY IN THE CONTEXT OF A FORTUNE 100

### 1. INNOVATION

The number of patents filed, and projects sold

### 2. COLLABORATION

The number of interactions and interdisciplinary projects sold (eg. Increased use of designers)

### 3. EFFICIENCY

The running cost of the building





3RD FLOOR

14:55

# SMART BUILDING

is a world leading smart building. See how we are using energy and where people are dispersed throughout the building.



Energy Usage  
(per floor)

User Devices  
(via WiFi)





Learning Program  
- Life Sciences

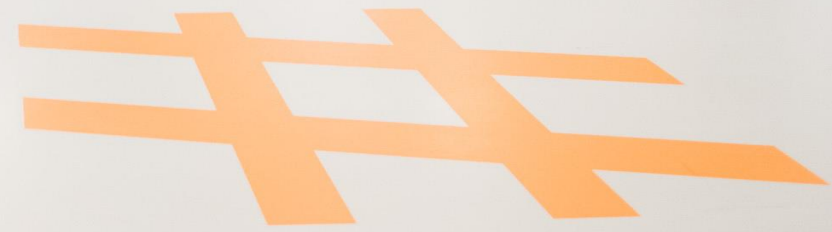
Cases

- B&W
- AXA
- Disney
- Michelin
- Indesit
- JPM
- Shell
- B&W
- BBDO
- Agendat

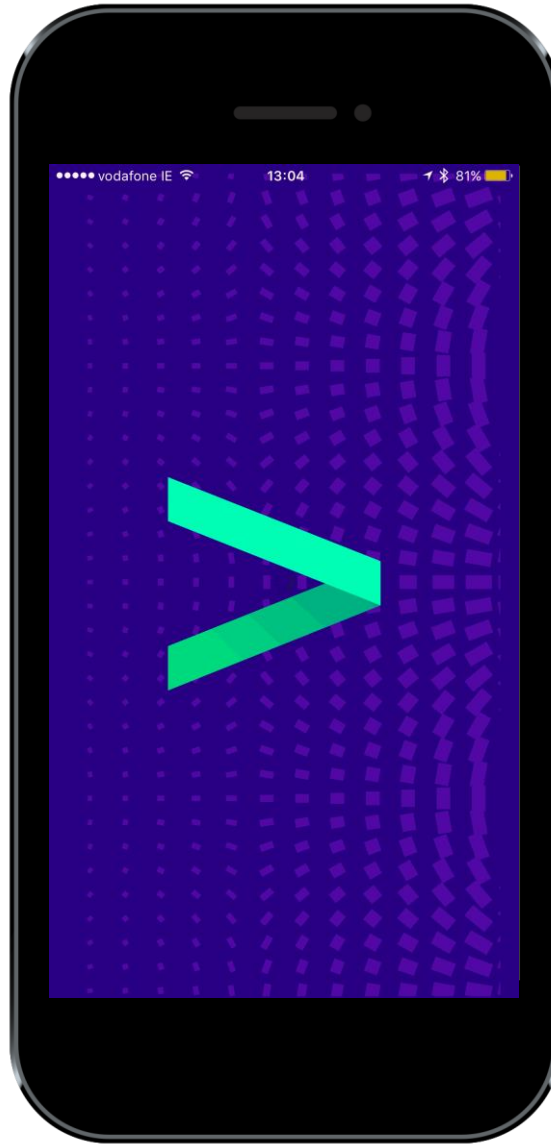
Vancouver

COMMIT TO GIT!

Content strategy  
Customer journey & M  
Content model  
Story telling







3RD FLOOR

accenture  
THINK

# THE WHEEL OF CULTURE

Science Gallery Dublin

Progress indicator: 0000●00





Name: 000  
Equipment: 2 Alpha Series  
Light: 100  
Temp: 63.4 deg  
Occupancy: 30.0%

Name: 000  
Equipment: 2 Alpha Series  
Light: 100  
Temp: 63.4 deg  
Occupancy: 30.0%

Name: 000  
Equipment: 2 Alpha Series  
Light: 100  
Temp: 63.4 deg  
Occupancy: 30.0%



# THE VALUE OF A SMART PLACE IS DERIVED BY THREE PRIMARY VALUE LEVERS

sustainability.

space.

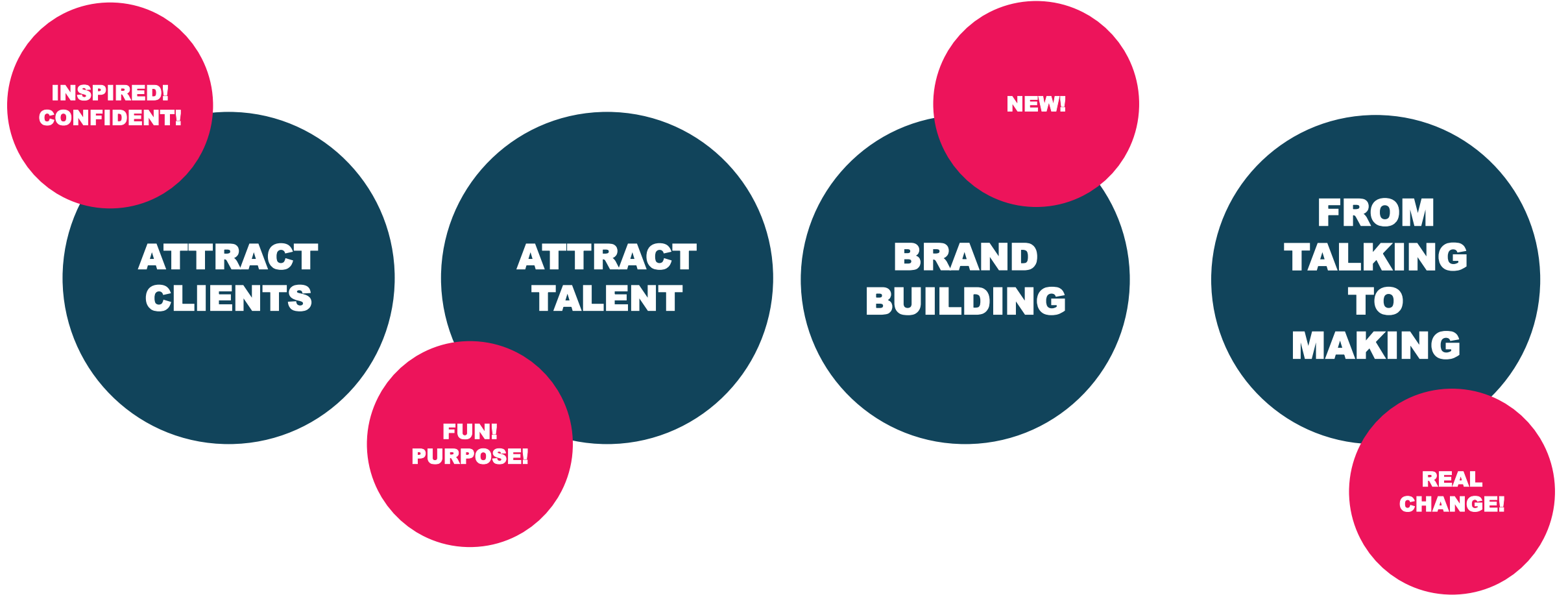
**sapiens.**



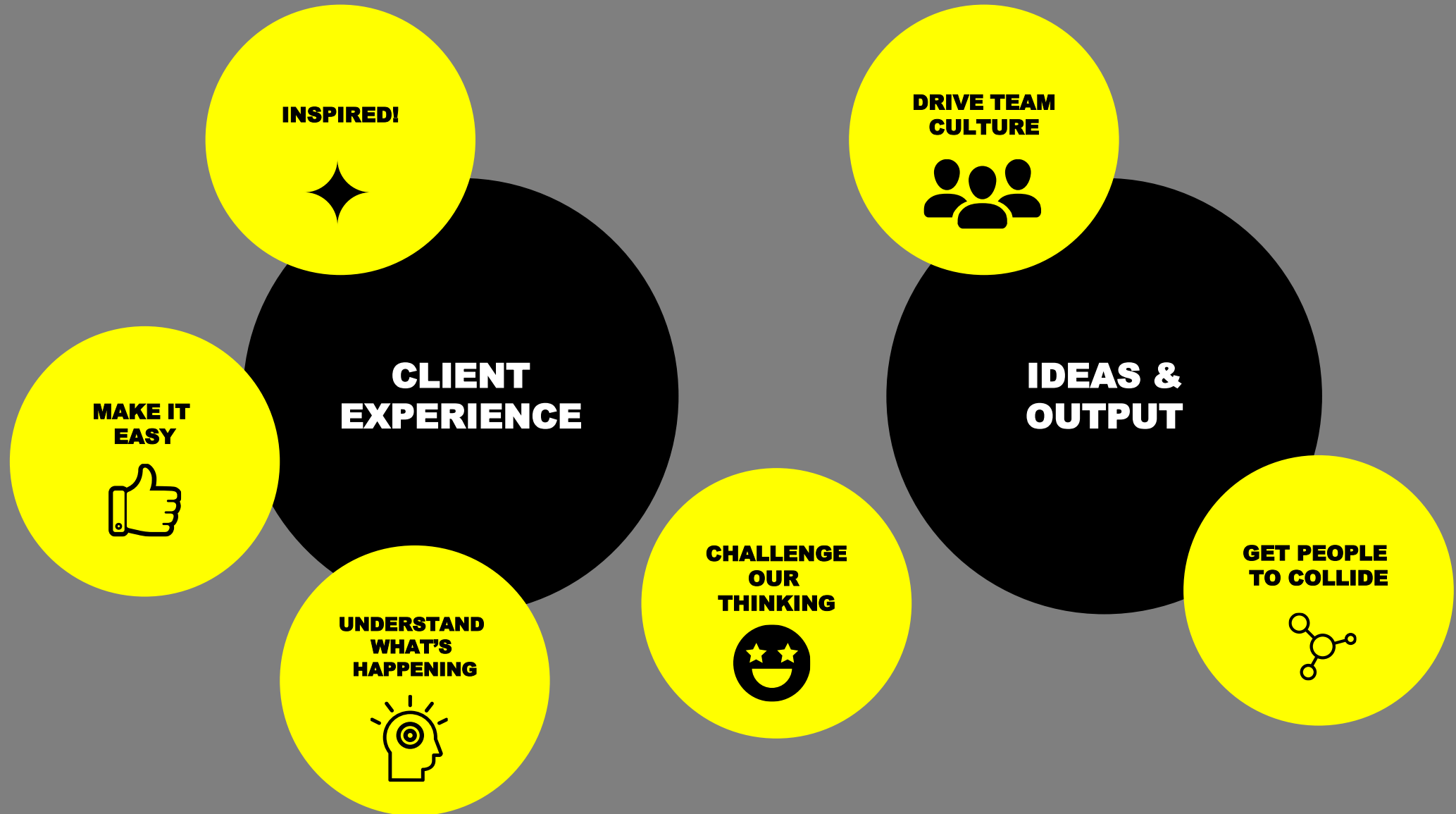
# THE DOCK DUBLIN



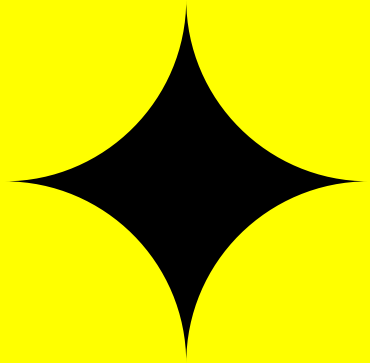
# THE GOALS



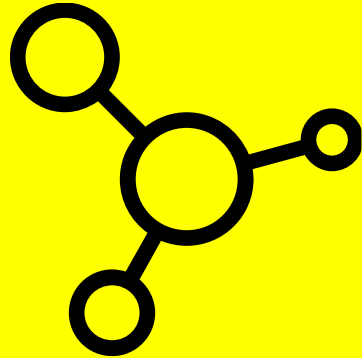
# DOCK EXPERIENCE



**BY FOSTERING SMART CULTURE ACROSS DIGITAL TOUCHPOINTS, WE PUSH FOR REAL INNOVATION**



**WOW**



**CONNECTION**

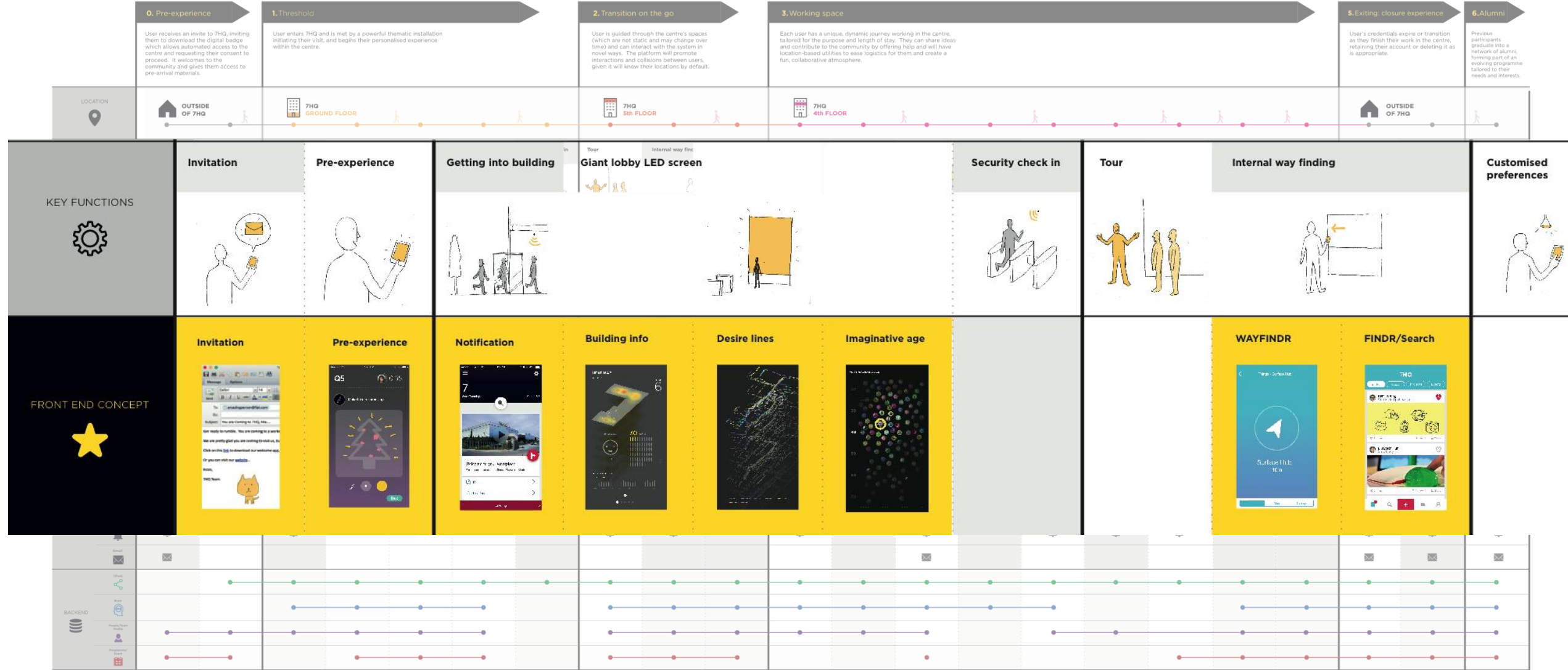


**INSPIRATION**



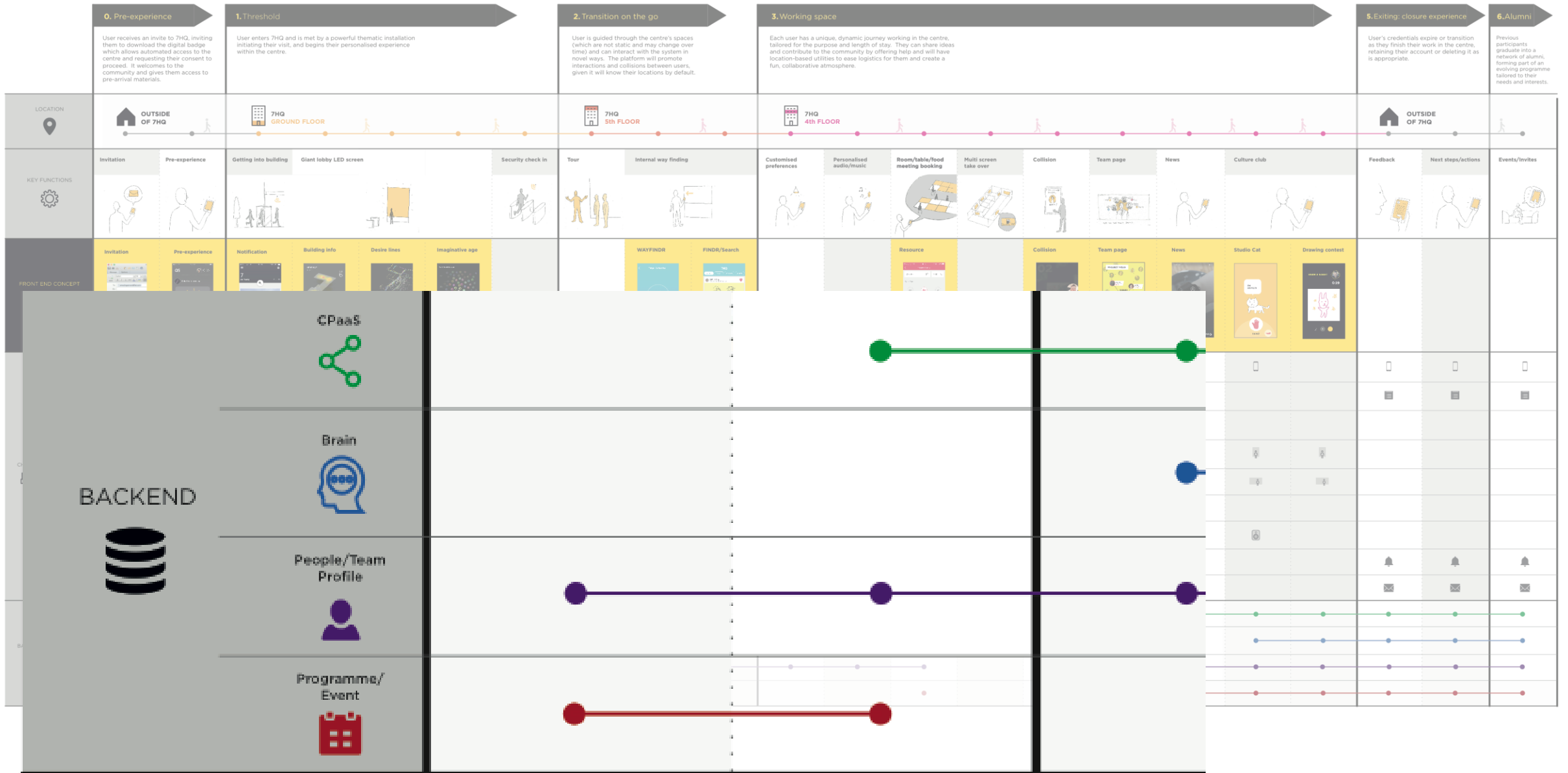
**SHARING**













# DJ

**ENABLES OTHERS TO HAVE FUN**

**READS THE ACTIVITY OF THE  
ROOM**

**ENERGIZES**

**SURPRISES**

**CREATES AND PLAYS**

**DYNAMIC AND RESPONSIVE**

**MIXES VARIED INTERESTS**

**GUIDING HAND**

**EVER-PRESENT**

**ONE EAR TO THE GROUND**

**DEMOCRATIC**

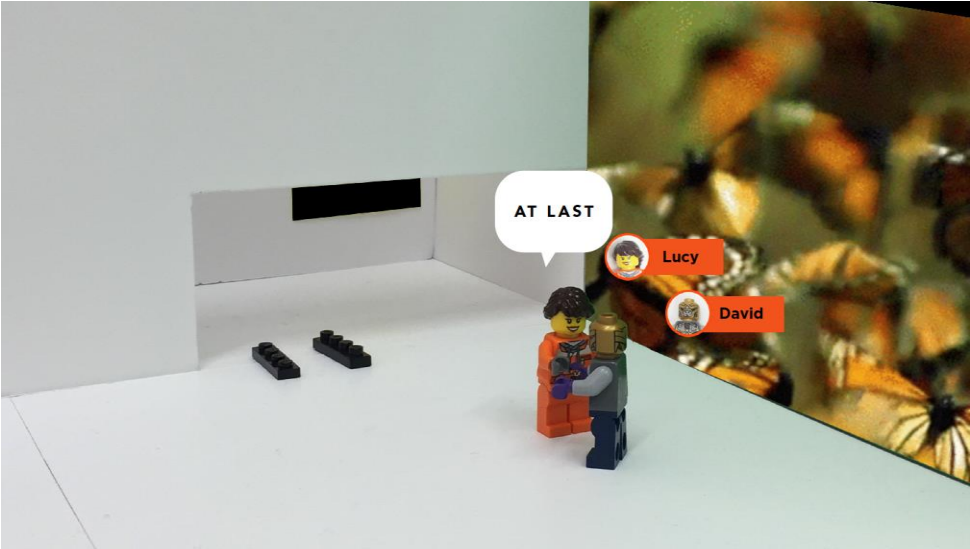
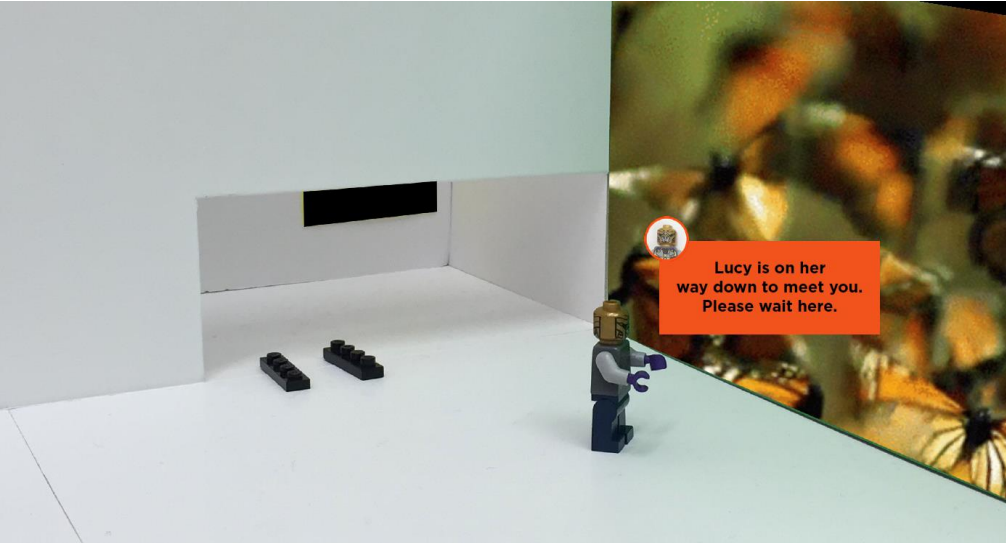
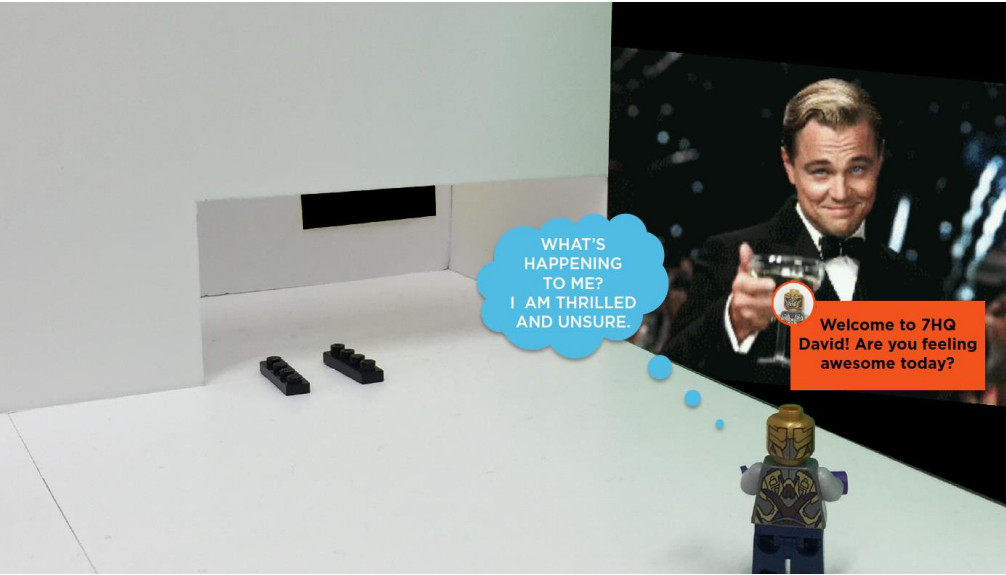
**UPBEAT**





# STORYBOARD

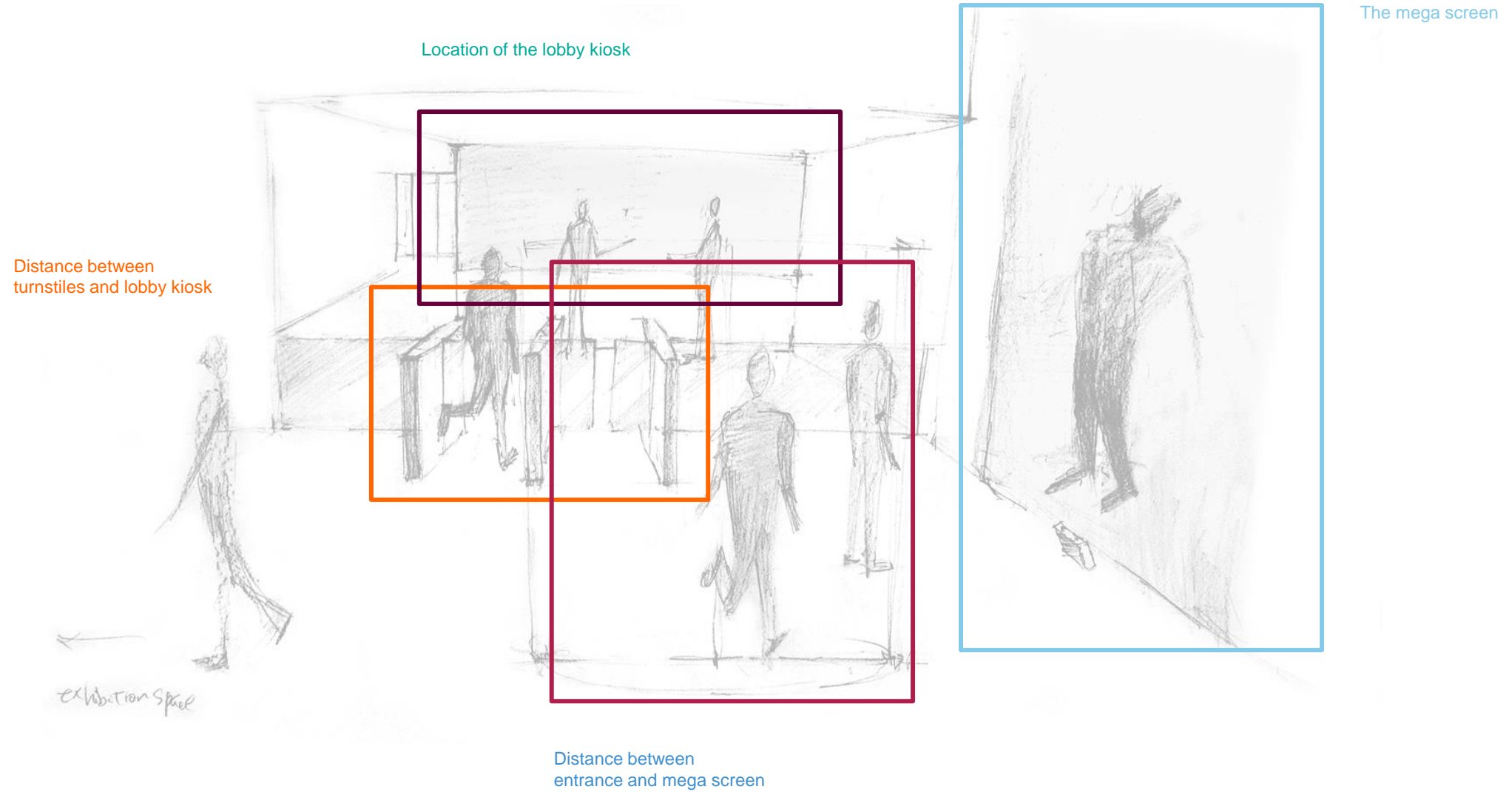
DAVID'S FIRST VISIT TO 7HQ



# SITE INVESTIGATION



# SITE INVESTIGATION - ASSESSING LOBBY SPACE



# DEVICES + CONTENT



## LOBBY SCREEN



- LARGE SCREEN
- INTERACTION WITH DOOR
- INITIAL ATTRACTION

- NOT TOUCH SCREEN
- LOW RES



## KIOSK 98" & LIFT 86"



- INTERACTION WITH BARRIER
- NOTICE BOARD FUNCTION
- NOTICE BOARD FUNCTION
- PERSONAL SPACE
- FILLING TIME BEFORE GETTING ON LIFTS

- BUSY AREA (NOT IDEAL FOR WAITING)



## APP

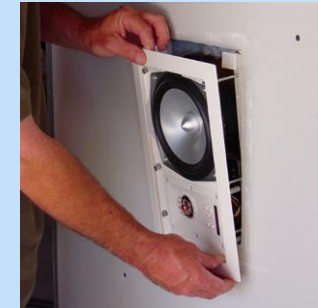


- PERSONALIZED DEVICE

- NOT-SHARABLE WITH OTHERS



## AUDIO

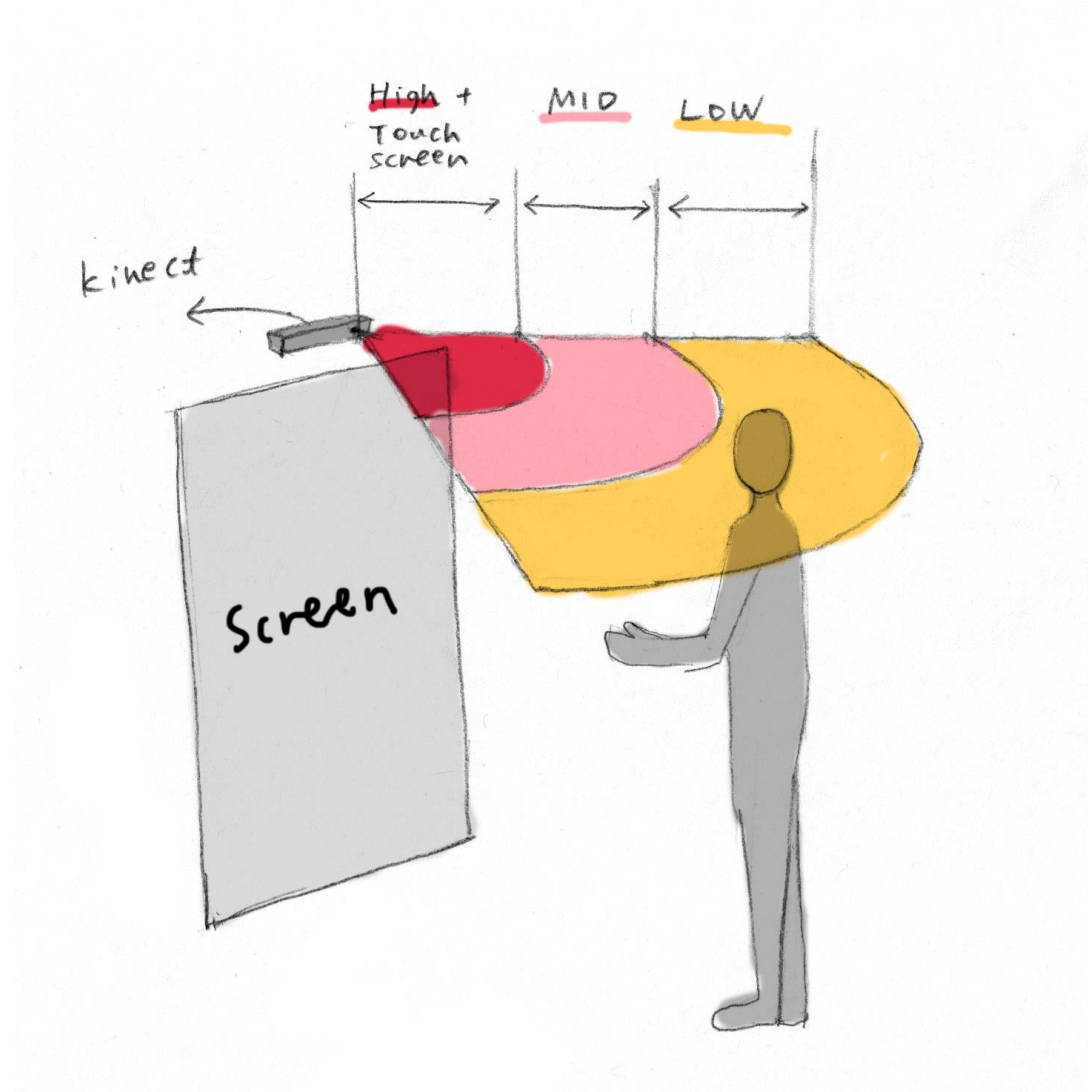


- ADD AUDIO CONTENT FOR SPACE

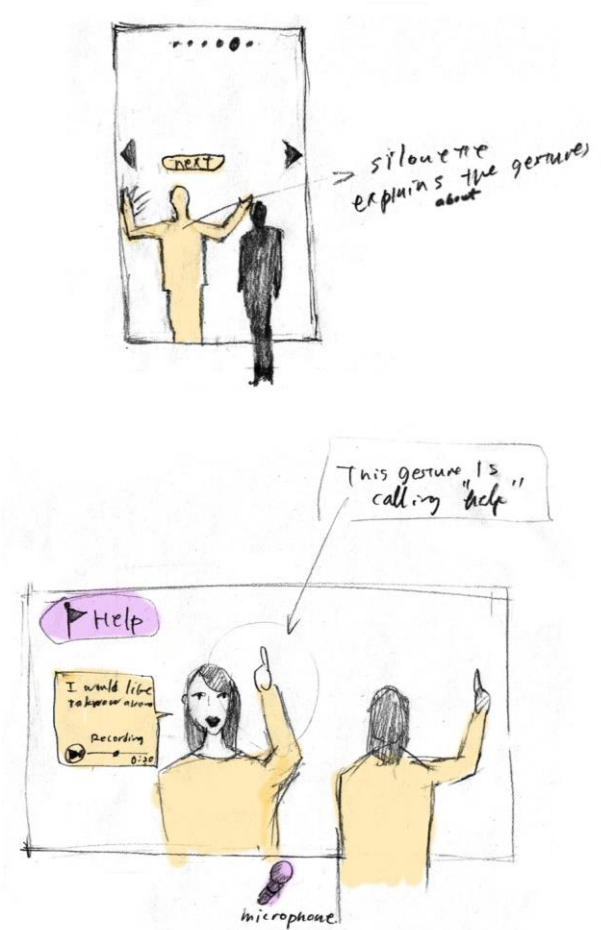
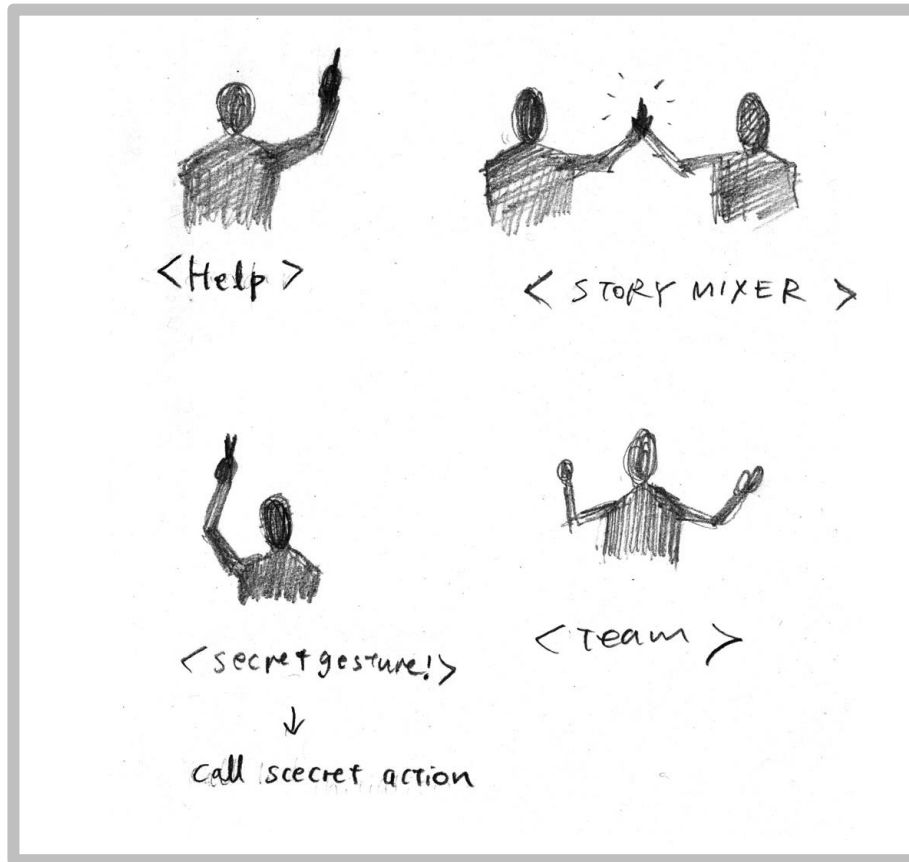




# KINECT: CONTEXTUAL CONTENT DELIVERY BASED ON PROXIMITY



# BROAD GESTURAL INTERFACE



THE KINECT INVITES INTERACTION VIA SPECIAL GESTURES.

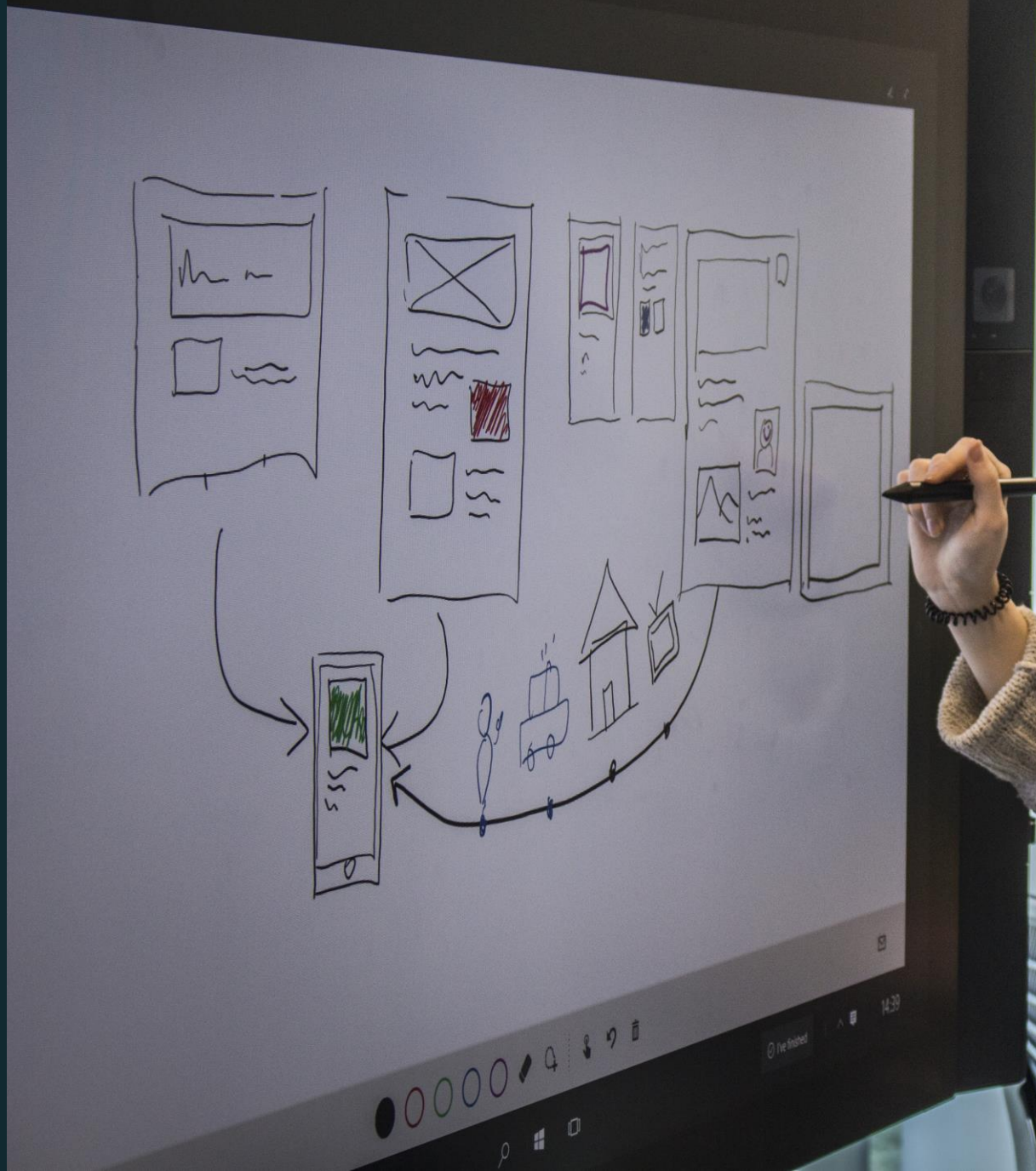










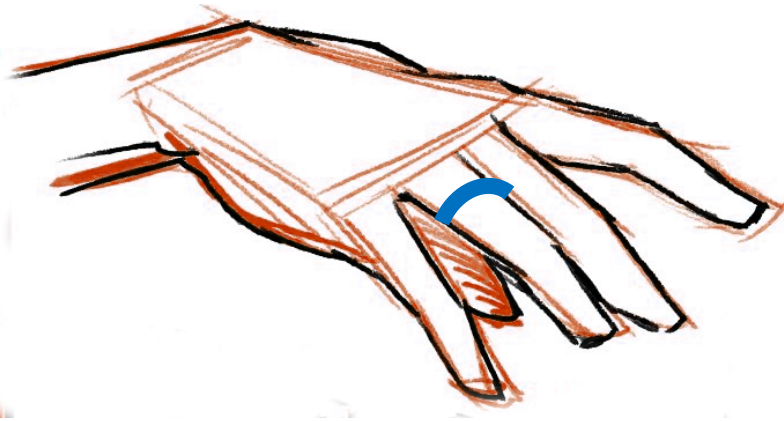
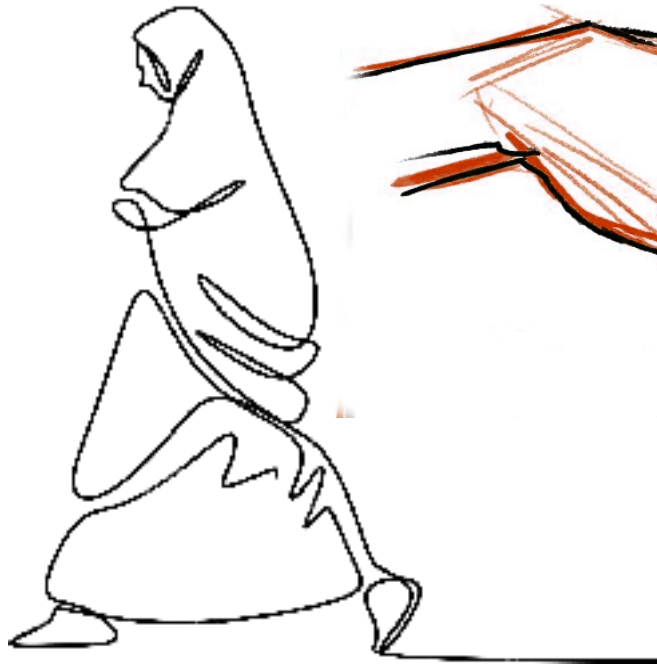




**THE**  
**ATOMISATION**  
**OF**  
**SERVICES**



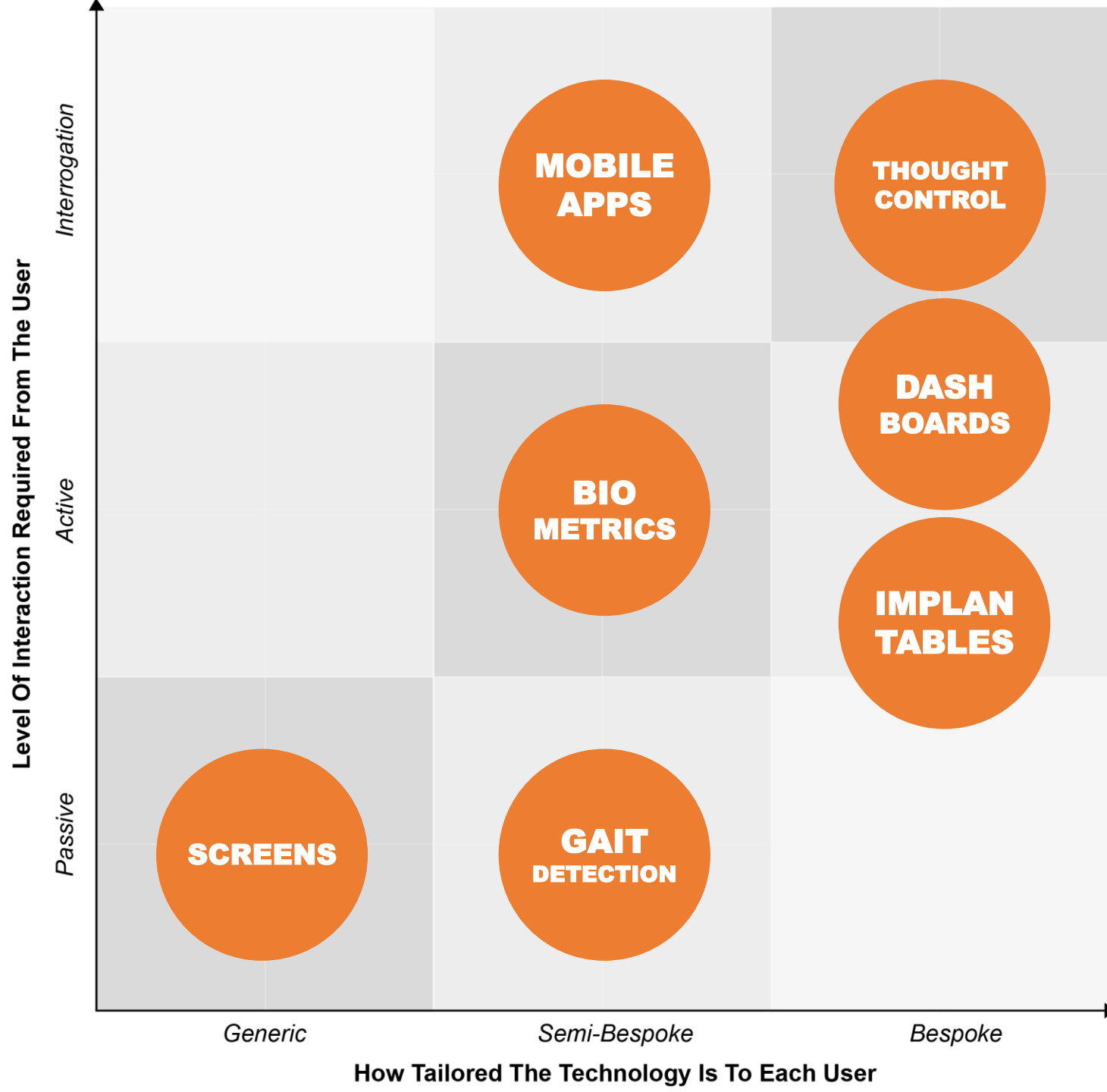
# SUBTLE BUT SECURE

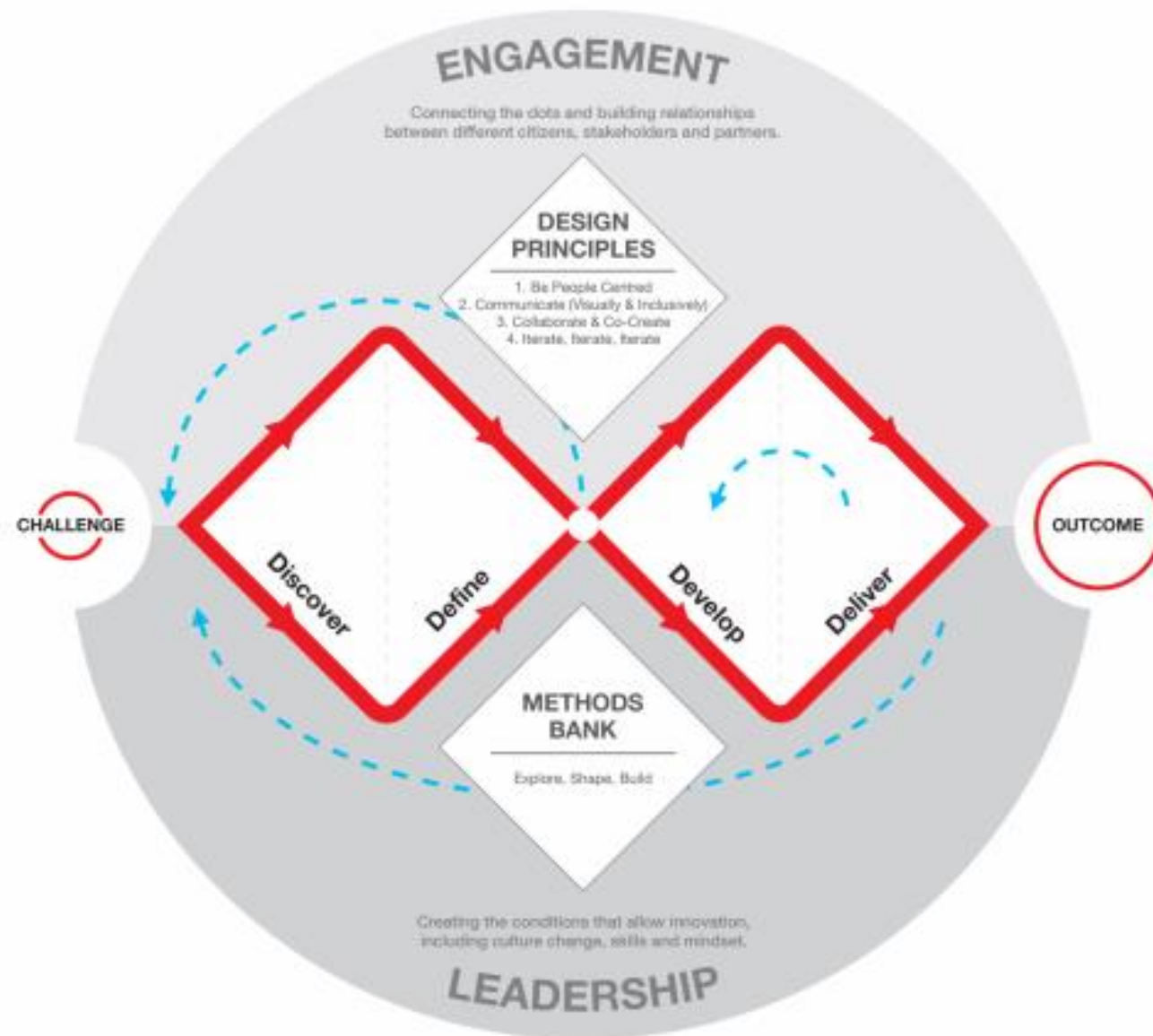


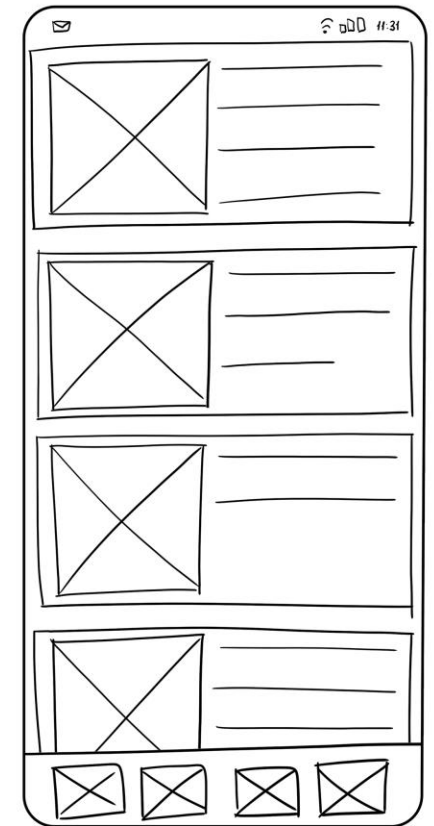
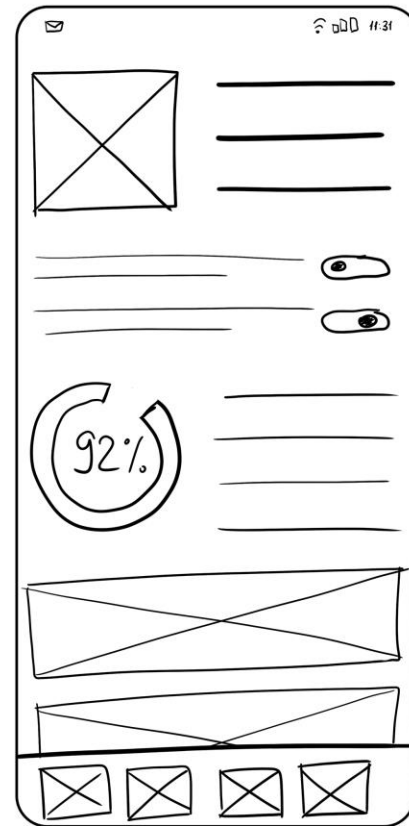
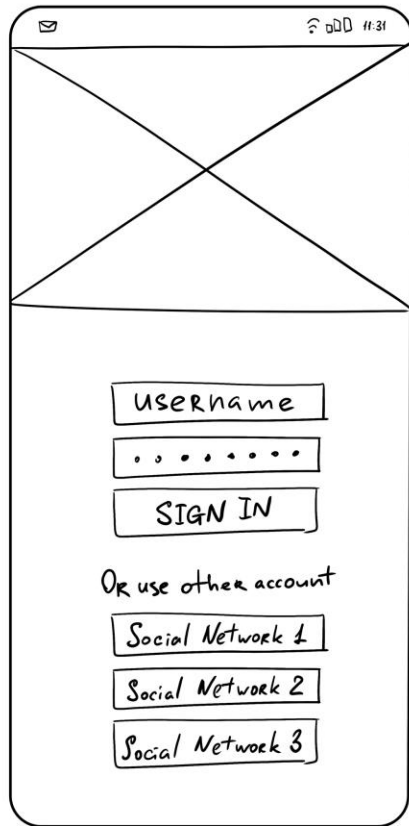
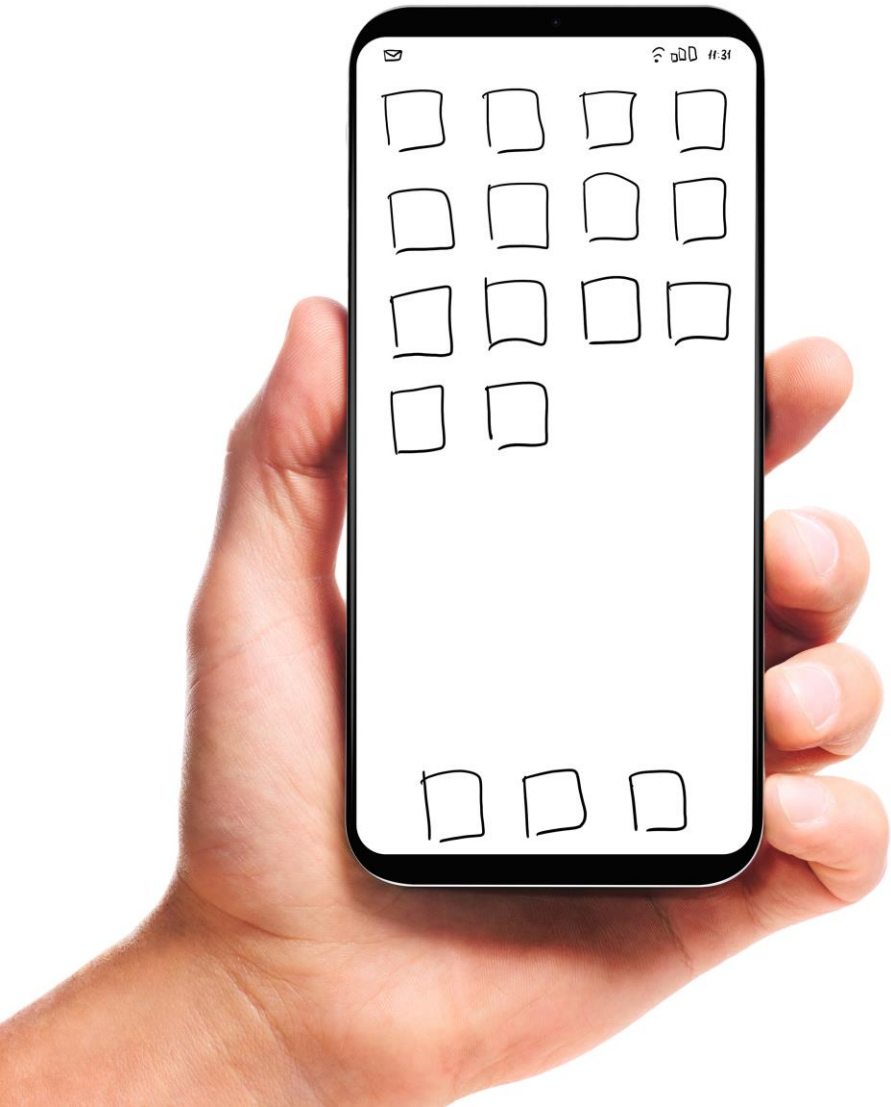
# SMILE TO PAY













**RULES**



**MAKE  
IT  
FUN**



**WHY**

**SHOULD I**

**CARE?**





**WHAT  
CAN I**



**REUSE?**

WALL-E





**DESIGN**

**THE DIGITAL + PHYSICAL**

**TOGETHER**



**WE'RE GONNA  
NEED SOME**

**FRIENDS**



# FURTHER READING

- Brown, K., et al., 2016. *Environmental Sustainability Principles for the Real Estate Industry*, Davos: World Economic Forum.
- Yang, T., Clements-Croome, D. & Marson, M., 2017. *Building Energy Management Systems*. In: M. A. Abraham, ed. *Encyclopaedia of Sustainable Technologies*. London: Elsevier, pp. 291-309.
- Marson, M. & Kinch, J., 2020. *The Challenges of Retrofitting Smart Systems Into Existing Buildings*. Royal Institute of Chartered Surveyors Journal.
- Podcast >>>





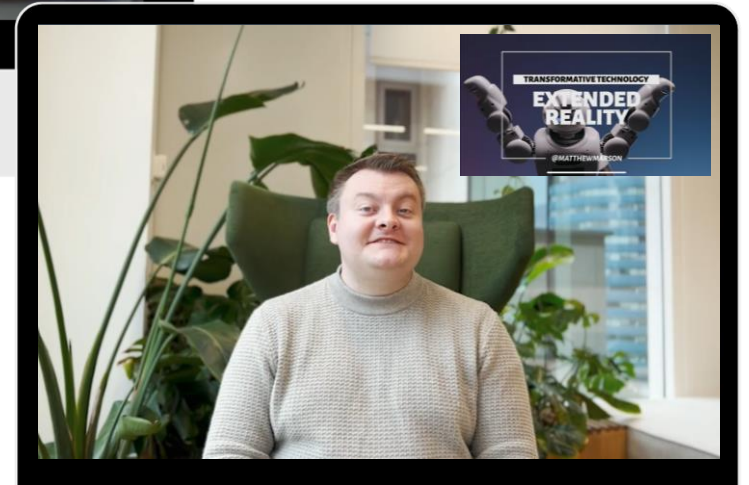
**Smart Thinking Podcast**  
Brief and punchy Intro's to  
all aspects of smart  
buildings



**Transformative Tech**  
Quick-fire on the  
technologies that are  
shaping the future



**Smart Simplified**  
How-to guides for delivering  
your smart building





@matthewmarson  
mail@matthewmarson.com  
[linkedin.com/in/matthewmarson](https://www.linkedin.com/in/matthewmarson)



