STRESS & CITIES   DESIGN PERSPECTIVE

[1]

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Q Can the design process be informed by mapping the physiological responses to stress in an urban environment?

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ABSTRACT

The urban environment creates spatial experiences and has a significant impact on people's state of mind. This project intends to propose an objective way of identifying the state of affect by means of mapping the physiological responses. Hence, devising a wearable biosensor and integrating with a mobile phone to obtain geo-referenced data in relation to spatial surroundings. The objective is to illustrate a layer of the responses spatially over the geographical map to investigate the inter-dependency between the state of affect with the urban environment.

FIG 1 : Hyperdense environment of Cities and their impact on people [2]

FIG 2 : People commuting to work in Central district , Hong Kong at elevated walkways [3]

"Hongkongers are the fifth most stressed population globally" [4]

AIM This project investigates a relationship between the physiological responses and spatial experience in an urban environment by assessing the activation of skin conductance level and heart rate and remotely studying the patterns with the urban spatial environment

HEART RATE   GSR   PHYSIOLOGICAL   SPATIAL ANAYSIS   ISOVIST
FIG 3 : The Figure explains the methodology in line with aim of the project

The methodology is to device a wearable that combines the readings from heart rate sensor and Electrodermal skin activity or galvanic skin response as I navigate through urban spaces of Hong Kong and identify the spaces where both the sensors show activation or both are at rest.

Isovist is the method of assessing the porosity and permeability of urban spaces through measuring the visible area, perimeter, occlusivity and compactness. This method is carried after the Hongkong site visit.

RESEARCH METHODOLOGY

CONCLUSIONS

AA ZONE
ACTIVATION AREAS (STRESSED)

RR ZONE
REST AREAS (CALM)

VISIBILITY

Very low visible area and very low porosity through the urban fabric.

Higher Visibility provides a very relaxed and calm responses

FEATURES

Lack of open spaces. Layered and complex spaces

Open spaces with greenery adds to the relaxation. Having a view to water /sea

DENSITY

[6] Very high density of people define high activation spaces

The high density of people started to become much relaxed in these spaces

The typologies concluded can facilitate the designers to identify the right intervention or response the urban spaces require, for example, the analysing the features of AA zone areas designer can respond by including more of features from the RR zone so relaxed experiences can be created and a balance is restored for the place.

SENSE

Increased blood flow to brain;
Increased production of catecholamines (epinephrine, norepinephrine, dopamine) which help to facilitate cognitive performance
Pupils dilate/Peripheral vision is reduced
Heart rate increases
Faster, deeper breathing
Increased blood flow to large muscle groups
Adrenal hormones (cortisol and DHEA) released, resulting in increased energy mobilization
Digestion slows dramatically
Blood pressure increases
sweat gland activates to cool body
FIG 3 : Physiological response to Stress [5]

Arduino Uno
Pulse Sensor
Galvanic skin response sensor

FIG 4 : Device sensing in Hong Kong

STRESS
Among the various physiological response to stress generated in the body when it is subjected to stress, sensing the heart rate and sweat production at fingers is key features used as a principle for selecting the sensor and developing a wearable..
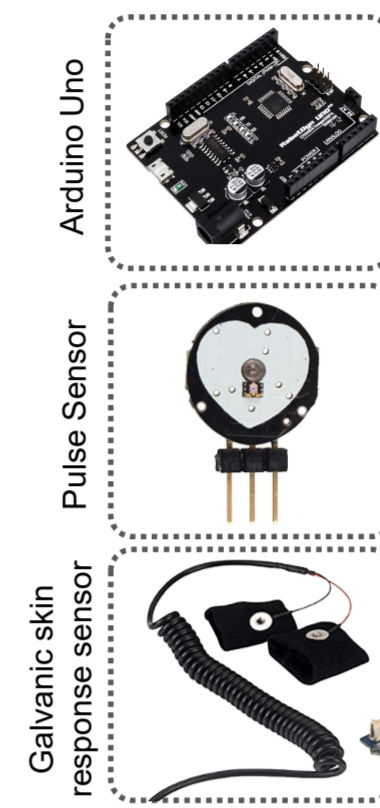
DEVICE
The device with Galvanic skin response sensor and Pulse Sensor is assembled by means of an Arduino Uno board that has the microcontroller to input data and transfer via SD card or a USB jack. As a part of the project the device is assembled through a wiring diagram and tested through the IDE program to sense physiological stress responses.
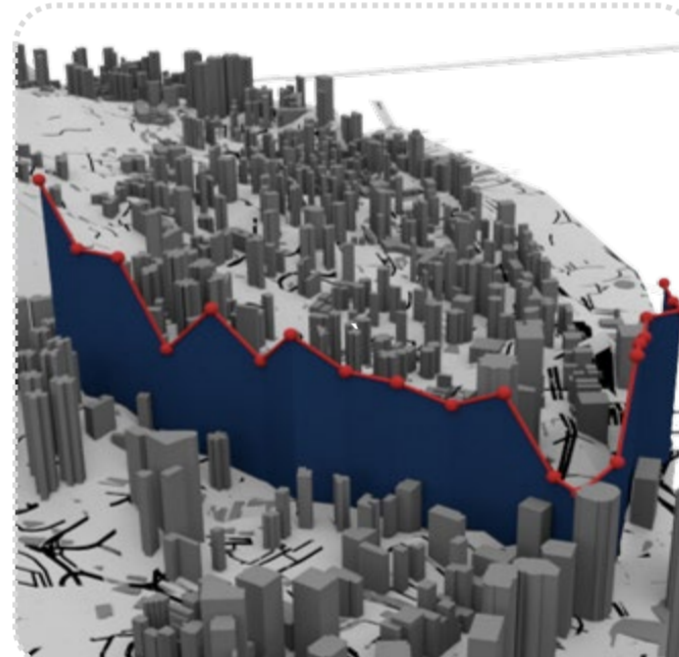
MAP

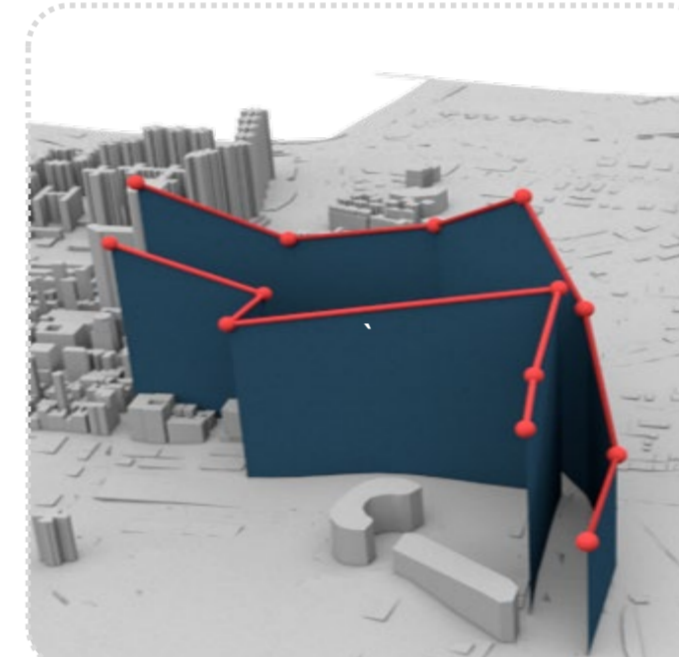FIG 5 : GSR response in Central District, Hong Kong

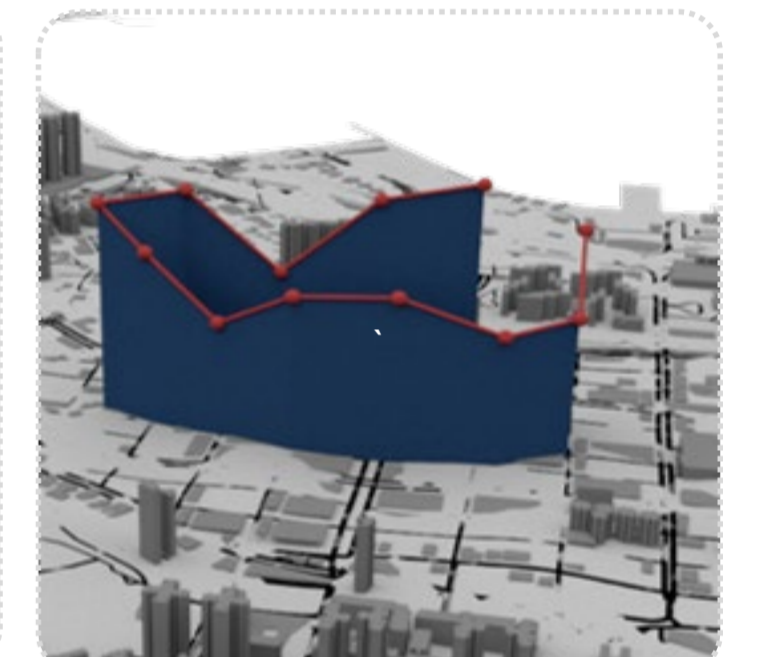FIG 6 : GSR response in Mongkok, Hong Kong

FIG 7 : GSR response in Sham Shui Po, Hong Kong

The mapping process is a preliminary data representation spatially to highlight and compare the physiological stress responses. Through this process it was more visible that the data collected in Central district showed most variation from where both sensors were active to both are at rest.

ANALYSE

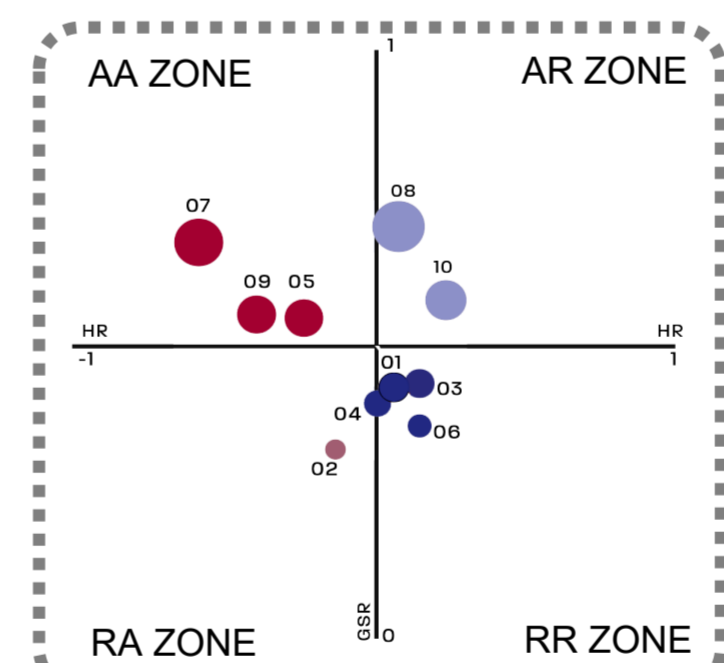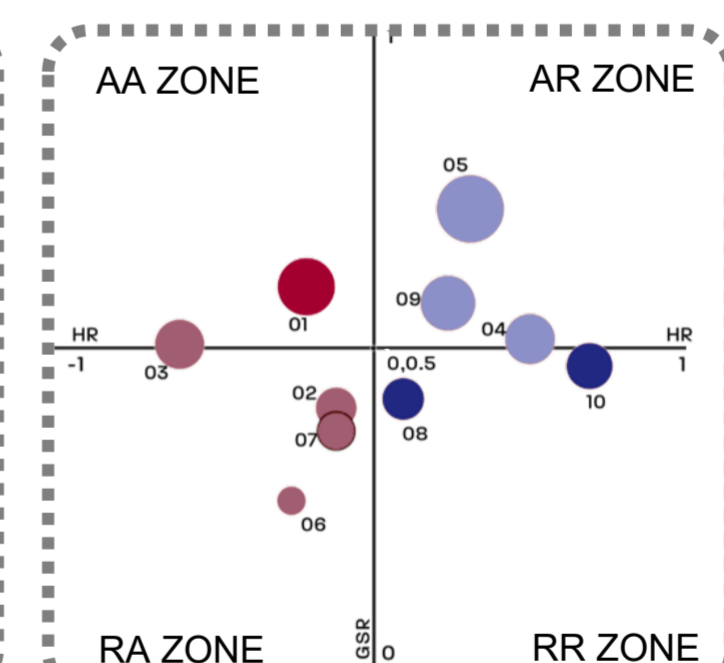### IDENTIFYING THE ZONES FROM MATRIX

AA ZONE   AR ZONE
RA ZONE   RR ZONE
FIG 8 : Matrix in Central District

AA ZONE   AR ZONE
RA ZONE   RR ZONE
FIG 9 : Matrix in Mongkok
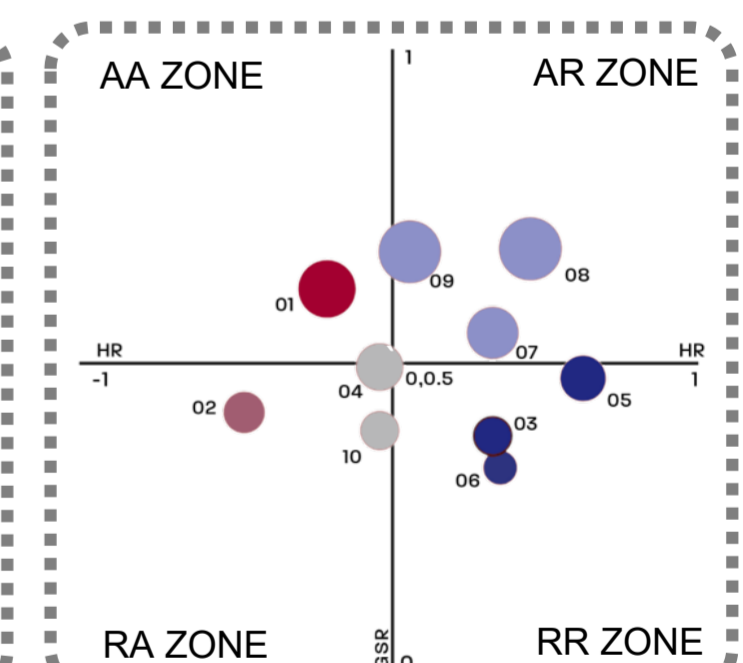
AA ZONE   AR ZONE
RA ZONE   RR ZONE
FIG 10 : Matrix in Sham Shui Po

DATA COMPARATIVE

GALVANIC SKIN RESPONSE
HEART RATE
ISOVIST OCCULUSIVITY
FIG 11 : Matrix in Central District

GALVANIC SKIN RESPONSE
HEART RATE
ISOVIST OCCULUSIVITY
FIG 12 : Matrix in Mongkok
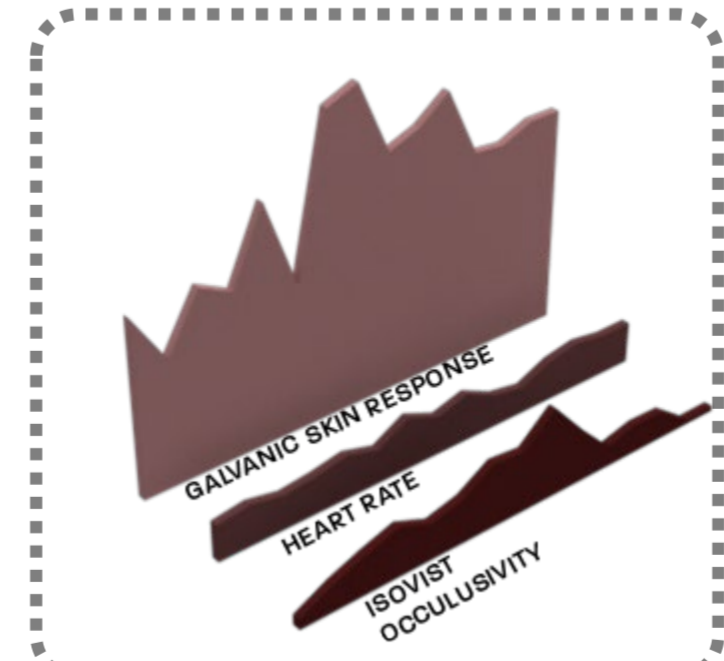
GALVANIC SKIN RESPONSE
HEART RATE
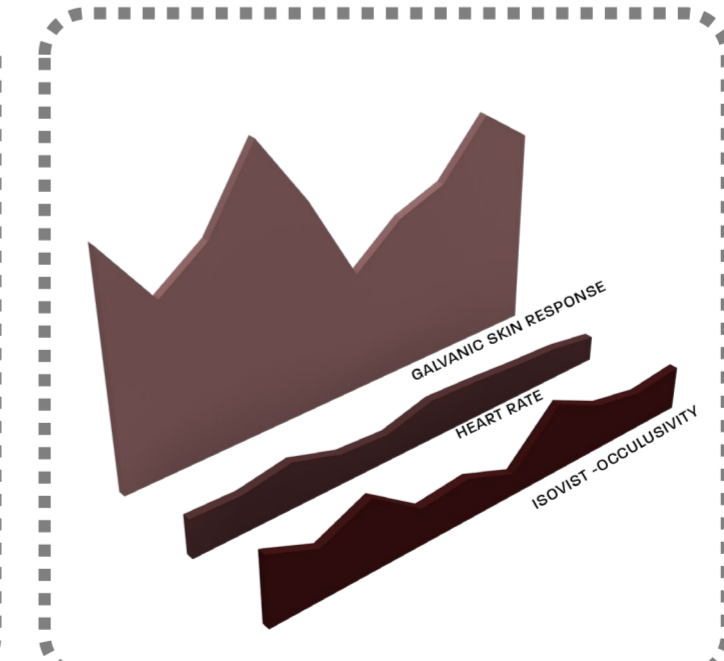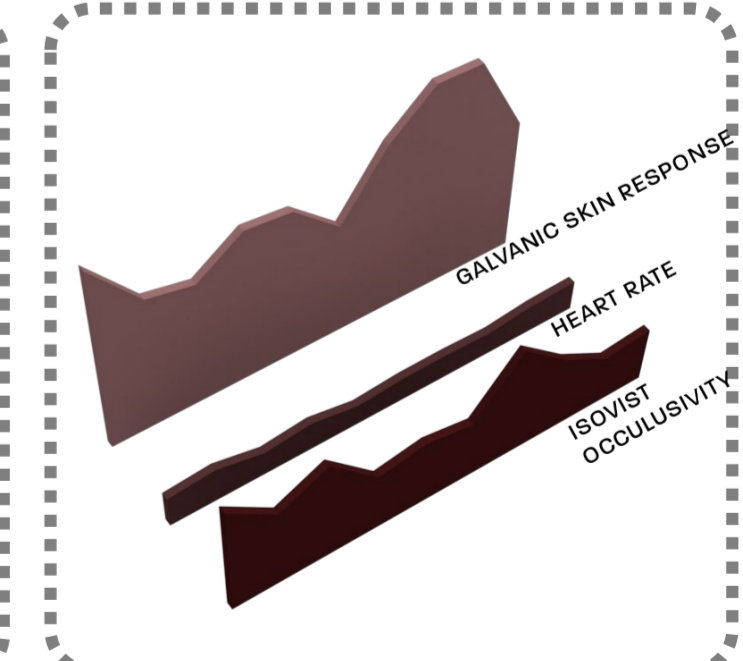ISOVIST OCCULUSIVITY
FIG 13 : Matrix in Sham Shui Po

The analysis is a two-step process, where the data is plotted on the matrix and the zones are identified for each location. The places where both the sensors are active is identified as AA zone and the zone where both the sensors are at rest is identified as RR zone

Data comparative is the process of identifying the typologies through the pattern common for each zone for example , Zone AA shows low visibility area and very high occlusivity.

REFERENCES

[1] Fig 1: Hong Kong Skyline Restitch - Dec 2007.jpg (2007) ; URL: https://en.wikipedia.org/wiki/File:Hong_Kong_Skyline_Restitch_-_Dec_2007.jpg ; Accessed on 30/10/18
[2] Fig 2: Hong Kong ; URL : https://www.lse.law/en/HKG/Office/Hong-Kong ; Accessed on 10/11/18
[3] Fig 3: 'Hong Kong: City as Process';(2016): URL : https://placesjournal.org/article/multilevel-metropolis-urban-skyways/?cn-reloaded=1; Accessed on 12/11/18
[4] Fig 4 : Liu ,Y ; 'All work and no play makes Hongkongers the world's fifth most stressed population' ; (2018): URL : https://www.scmp.com/business/article/2154538/all-work-and-no-play-makes-hongkongers-worlds-fifth-most-stressed ; Accessed on 15/11/18
[5] Fig 5: "Public Speaking "Fight or Flight" – Acute Stress Response' ;(2014): URL : https://princetonpublicspeaking.com/public-speaking-tips/public-speaking-fight-or-flight-acute-stress-response/ ; Accessed on 12/11/18
[6] Fig 6 : HK Central Elevated Walkway 中環行人天橋 Queen's Road 2 old market building noon.JPG;
URL:https://commons.wikimedia.org/wiki/File:HK_Central_Elevated_Walkway_%E4%B8%AD%E5%8D%80%E8%A1%8C%E4%BA%BA%E5%A4%A9%E6%A9%8B_Queen%27s_Road_2_old_market_building_noon.JPG ; Accessed on 10/11/18