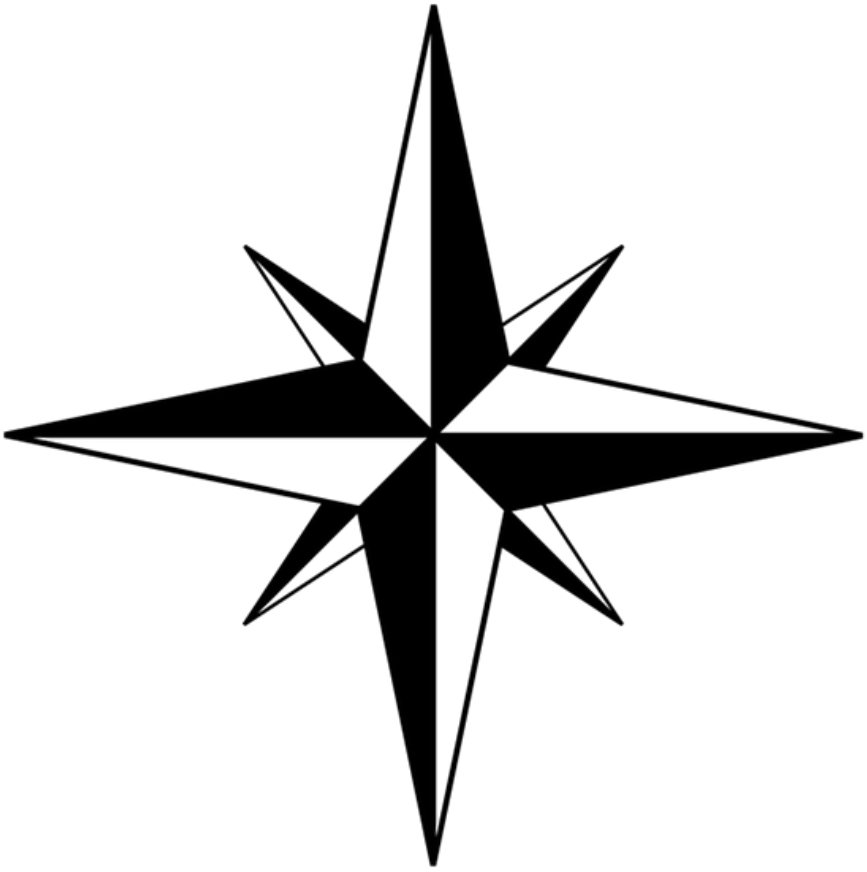


INTROSPEC

DEFINING OUR SPACES

Jon Rasche | Industrial Design Engineering | May 19, 2016

Executive Summary

IntroSpec is a set of tools that enable creators to better understand their clients and employees and then provide them with the optimum environments to maximize their potential.

This project asks a lot of different questions, but the goal was always to challenge and change conventional architecture. To update it. To change the relationship between people and the spaces they inhabit. The sum of the work completed on this project has resulted in three things: A testing method, A language, and A Tool.

> **A testing method...** that builds upon credible psychological tests, links them to my own, applies them to measure hard to quantify 'emotional and subjective' data, and uses that data to create a landscape to plot a person's performance data in relation to the environments and stimuli they are subjected to.
>
> **A language...** that condenses a codex of a person's psychological responses to different environmental conditions and how those conditions impact their performance at tasks. It then compiles all that meaningful data into an easily sharable code.
>
> **A tool...** that takes common everyday words, activities, goals and feelings that a person wants a design to be associated with, determines the mental state associated with those properties, and uses a person's psych-profile code to translate those desired associations into tangible environmental conditions and stimuli.

Ultimately these three outputs will allow creators to have a deeper understanding of the people they are designing for and how their designs might impact a person. It will enable employers to better customize their office spaces for the wellbeing and productivity of their employees. It will eventually allow the architectural feedback loop to quicken until eventually our spaces will provide the optimum conditions for every aspect of life by dynamically changing and responding to the lives of the people inside them.

Statement of Originality

Except where indicated in the text, the following work presented is my own original work.

Acknowledgements

The author would like to thank the RCA and Imperial Staff as well as guest tutors for helping to guide the project. Special thanks due to Savina Torrisi for maintaining a high level of skepticism that pushed the project further.

Thanks and apologies are due to those present in the IDE Studio for tolerating, accepting and sometimes joining into the shenanigans involved with this project.

Additional thanks is due to the countless people who logged their lives and shared their homes, as well as those involved with detailed experimentation: Harry, Olivia, Malav, Lori, Wan, Laura, Noach, Martina, Phil, & Olli.

A list of Symbols

Food for thought

CAVES

Humans have lived pretty much the same since caveman time… the caves are just nicer now. In my opinion, today's living spaces still draw most of their most basic design queues from the cave: Floors, walls, a ceiling, an entrance, and an end.

LUXURY

Luxury has long been a goal and dream for many people on the planet. Luxurious items often have certain qualities to them that make them inherently luxurious. Scarcity makes things unique and difficult to obtain. Specialization of products, staff, or even rooms in a house meant that one could afford things or spaces that they don't need at all times (unlike some who can hardly afford the small shared space they currently live in).

A POTENTIAL ISSUE WITH ARCHITECTURE

Current architectural practice focuses on making ends meet. Today's architects speak with clients and users to determine the needs of the space and then combine all the desired qualities into a "Best fit" Scenario. While this obviously differs architect to architect, one problem architecture faces is rectifying differing and contrasting conditions needs and requirements into one holistic refined design.

CUSTOMISATION

In a world of mass production individuality is at risk of being lost due to everyone wanting and owning the same products clothing and services. The desire for personalized products is increasing. The challenge is providing rich personalization without increasing cost.

POSSIBILITIES

At this moment, humans are more capable of doing anything than ever before, but what if we could be even more empowered to succeed, achieve and grow? We all have such varyingly different lives that we fill with countless different activities, however our world isn't quite as dynamic as we are. The spaces we live in are static, inanimate, permanent and perpetual. A fixed system leads towards a fixed outcome. Can the relationship between a constantly evolving species and their consistent living spaces be improved?

Main text

1 - THEORY, METHODOLOGY, INITIAL RESEARCH, AND RESEARCH LANDSCAPE

Theory

It all began with an analogy: Buildings are like packaging. They shelter, protect, and attract but ultimately the buildings themselves are superfluous to the real product inside: People and their lives. Much like the packaging and product design industries are doing with their containers and product, *can the relationship between people and their buildings be brought closer, or can the relationship become cyclical and dynamic as opposed to the current one-way static relationship?*

Methodology

In order to properly determine the nature of the relationship between people and the architecture they inhabit, and eventually suggest how to modify this relationship, a deeper understanding of human lives and the environments buildings provide was necessary.

Research and experimentation around daily activities, the psychology involved with performing those activities, the environments in which people generally perform these activities, the impact of those environments on those activities, and how varying those environmental conditions impact the activities was necessary.

Initial Research

Research manifested itself in both traditional book/web findings as well as detailed analysis and journaling of subjects during their day-to-day lives.

In order to get a better insight into what activities a broad range of people typically do throughout their day and the conditions they do them in, a focus group of 50-100 people was obtained (Number began closer to 100, however as time progressed, participation fell closer to 50). These participants were asked to log in as great of detail as they could manage, the activities or tasks they performed throughout their days, logging the time at which they do these activities.

Collecting this data showed where people are performing various activities.

135	entire apartment	find lost things
136	Family room	Ate Dinner
137	Family room	Socialized
138	Family room	Played with Dog
139	Family room	Read
140	Family room	Work - on computer
141	family room	watched american idol
142	family room	ate breakfast
143	family room	watched canal
144	family room	watched tv

Figure 1: Location/Activity Spreadsheet

Analysing the time spent on each activity, in each space, it was easy to see that people are spending the vast majority of their time, doing countless different and varying activities in the same few spaces.

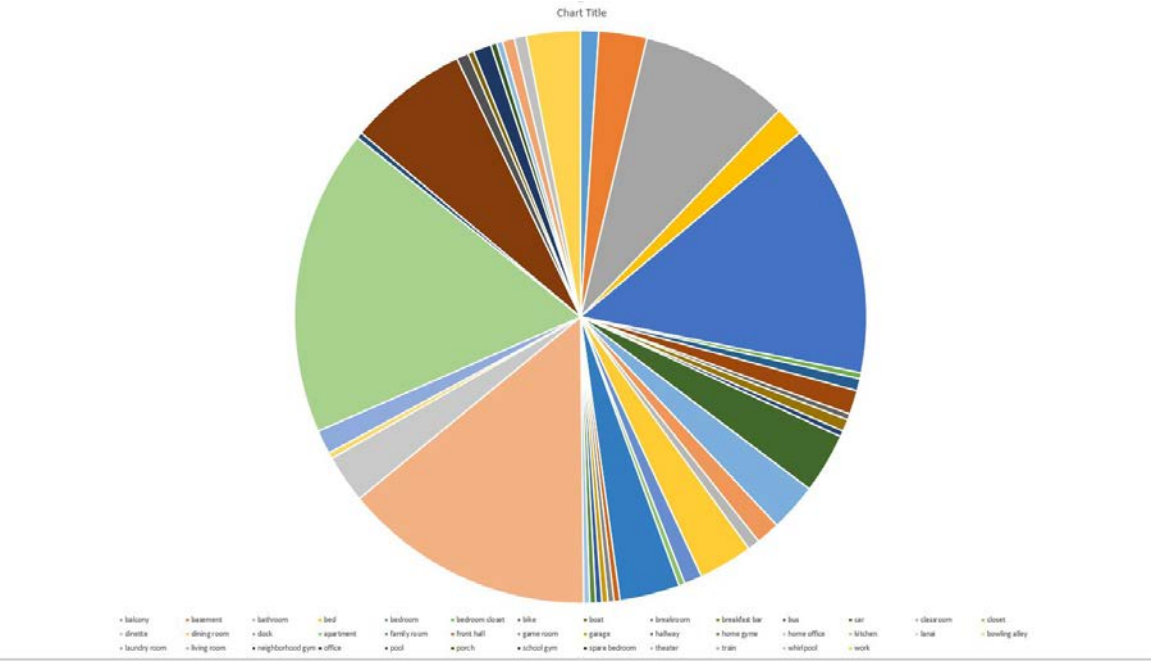


Figure 2: Visualization of time spent in various locations

These spaces were overwhelmingly the Livingroom, Office, Bedroom, and Kitchen. According to the data, participants spent almost 70% of their day in these four spaces (not including time spent actually sleeping).

This provided rough qualitative data, so in order to round out the data, they had also been instructed to run a sensor logging application on their smartphones which collected as much data as their phone could provide (sensor availability and accuracy varied by phone manufacturer and age). The sensor loggers used were SensorLog by Bernd Thomas for iOS and AndroSensor by Fiv Asim for Android.[1] [2]

Andro Sensor

Figure 3: AndroSensor Icon

SensorLog

Figure 4: SensorLog Logo

In addition to raw sensor data, an analysis of color was needed to get a greater perspective of the feeling of the environments. Color data was obtained through photos of each space. Instead of using averaging or blind guessing, a method of determining the predominant data in a set was used.

1 Asim, Fiv. AndroSensor. AndroSensor by Fiv Asim. Vers. 1.9.6.3. Google Playstore, 23 Jan. 2015. Web. 19 May 2016.
2 Thomas, Bernd. Sensor Log. Computer software. SensorLog by Bernd Thomas. Vers. 1.8. Apple AppStore, 10 Nov. 2016. Web. 19 May 2016.

K-Means clustering processed with Photoshop and Mathworks' Matrix-Laboratory (MATLAB) along with a tool by Martin Krzywinski. [3] [4] [5]

K-Means clustering allowed an image to be broken down in to its 8 most predominant colors (see below).

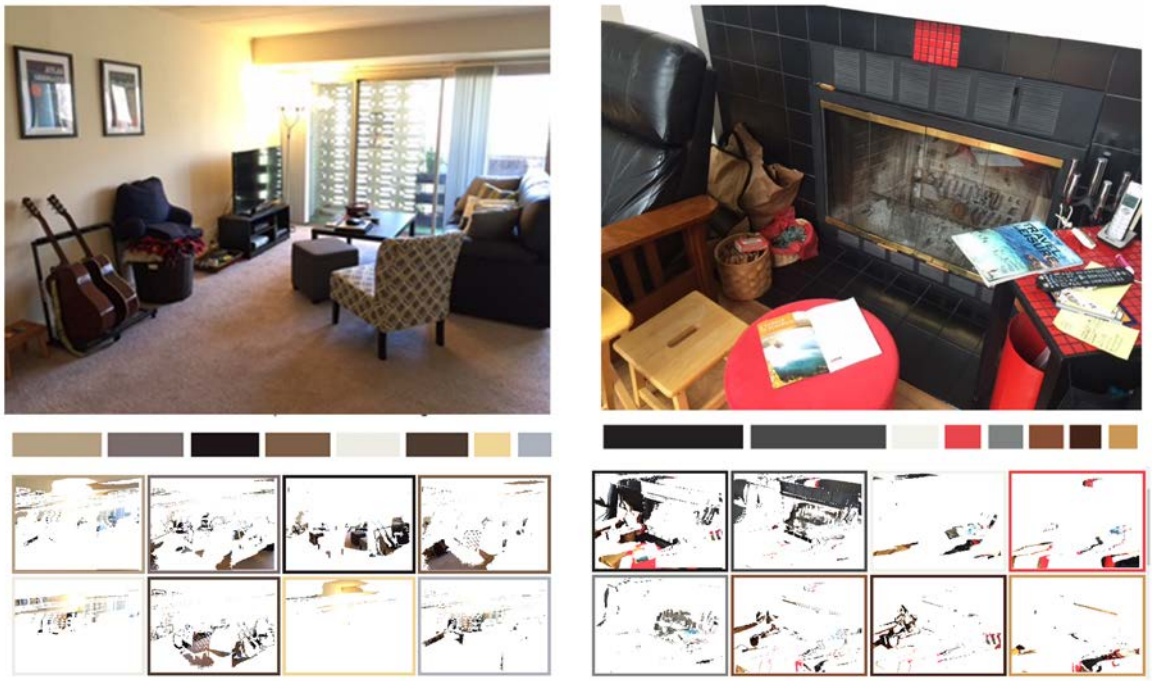


Figure 5: Two K-Means Color Segmentation Analyses

Using data that spanned individuals across various ages, incomes, and locations, it was determined that four colours were overwhelmingly present throughout people's daily lives.

Figure 6: The Most Prominent Colors

Combining the knowledge that people spend so much time in these few particular spaces, with sensor data show the environmental conditions of each location, such as brightness (lux), sound (volume and consistency), motion (how active they were in the space or if the space was moving), and in the presence of a neutral color palette, it was easy to see that the vast majority of environments regardless of age, income, or location were pretty much the same.

How did this come to pass? Through brief discussions with the participants about the spaces they live in, most felt they didn't have control over them citing that their office color or size was decided

3 Matlab & Simulink. Natick, MA: MathWorks, 2010. Computer software.
4 "Documentation." Color-Based Segmentation Using K-Means Clustering. Mathworks, n.d. Web. 19 May 2016.
5 "- RGB and HSV Image Statistics." RGB and HSV Image Statistics. Martin Krzywinski, n.d. Web. 19 May 2016.

for them and that since many of them rented their accommodations they were unable to change things like wall color or floorplan.

Are these indeed the best environmental conditions for everyone? How would different conditions affect people and their lives if they could change them?

If people all generally live in the same environmental conditions, how would different environmental conditions impact their lives?

Related Research Landscape

It is hardly news to anyone in the architecture and design industries that key factors in a space, product, poster, or package design can greatly affect the perception and ultimately opinion of said piece of design. Colour Psychology, ceiling heights and even the effects of corners have all shown to influence a person's capacity to perform a task as well as the efficiency and proficiency at which they perform it.

The psychological meaning and impact of colour has long been studied in a quest to unlock people, personalities, and businesses.

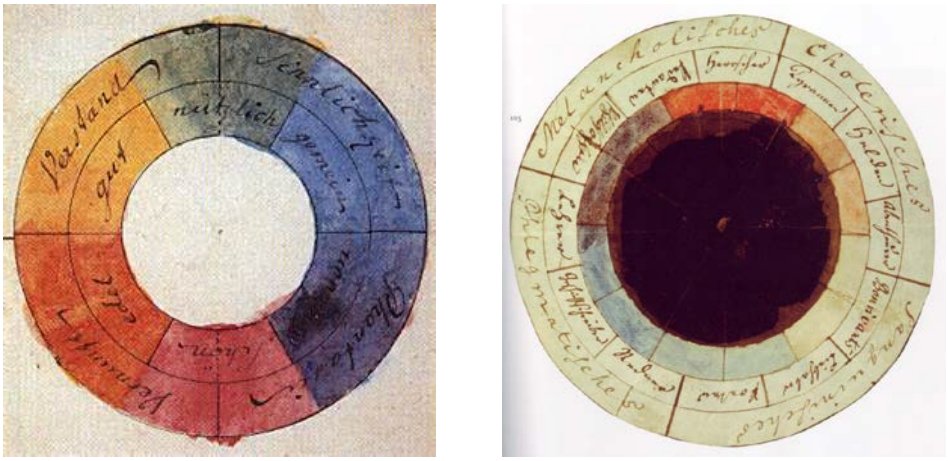


Figure 7: Groethe's Color Psychology Wheels

Johan Wolfgang von Goethe is a notable (also critically rejected poet pseudo-physicist) first explorer into the field of making colour psychology a science rather than a personal intuition. His work aligns colours with the four proto-psychological temperaments: Sanguine, Choleric, Melancholi, and Phlegmatic.[6] Even though the popularity of temperaments has declined significantly there is still widespread practice in associating meanings to colours and thereby using those psychological influences to improve, for example, the perception of a brand.

6 Kagan, Jerome. Galen's Prophecy: Temperament in Human Nature. New York: WestviewPress, 1994. Print.

Figure 8: Zohar Design's Logo Psychology Infographic

This infographic created by Zohar Designs shows that they have incorporated color psychology into their branding design practice.

Research into colours and their impact on people hasn't been left solely to those in the creative industry; a recent study by the University of British Colombia suggests that colors don't just give off a mood, they actually impact performance.

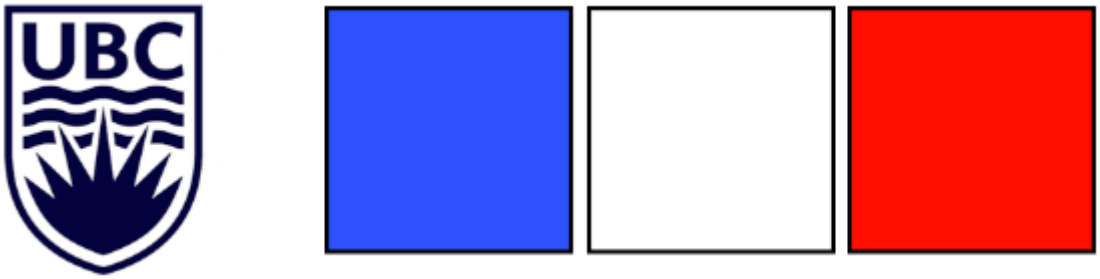


Figure 9: UBC Logo and Corresponding Research

"Red boosted performance on detail-oriented tasks such as memory retrieval and proofreading by as much as 31 per cent compared to blue. Conversely, for creative tasks such as brainstorming, blue environmental cues prompted participants to produce twice as many creative outputs as when under the red colour condition."[7]

Seeing that colour can have a direct positive effect on performance and not just an assumed effect due to mood, what other environmental conditions can influence a person to be more or less prepared to accomplish a task? Joan Meyers Levy, a psychologist at the Carlson School of Management believes that ceiling height, something that has varied over architectural periods can put the mind in an altered state just before a given task. She refers to this as 'Priming' stating,

7 Mehta, Ravi, and Rui Juliet Zhu. Blue or Red? Exploring the Effect of Color on Cognitive Task Performances. Rep. N.p.: ScienceXpress, n.d. Print.

"Priming means a concept gets activated in a person's head," "When people are in a room with a high ceiling, they activate the idea of freedom. In a low-ceilinged room, they activate more constrained, confined concepts."[8]

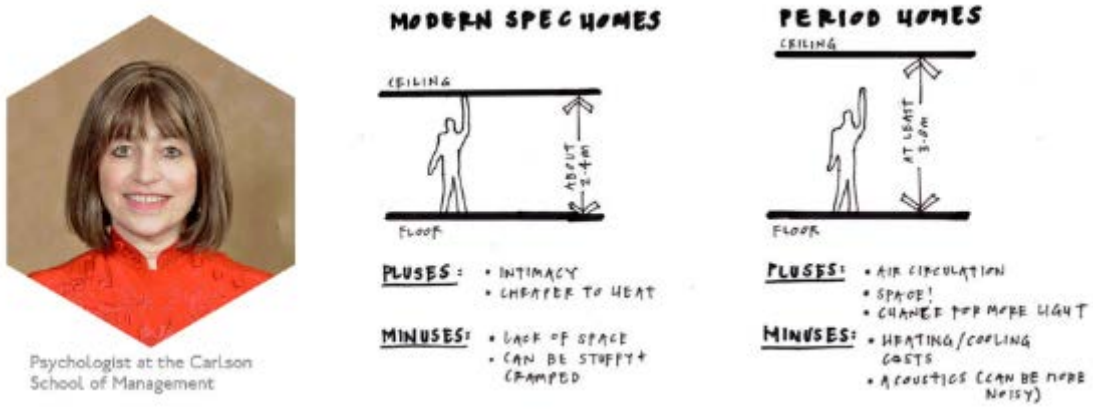


Figure 10: Photo of Joan Meyer's Levy and Corresponding Research

The ability to prime an individual in a space has powerful implications when considering using this psychological tactic to 'prime' them into a mindset that is more aligned to the task you want them to do. The tools for priming may not be limited to architectural-environment factors but also furniture and interior design.

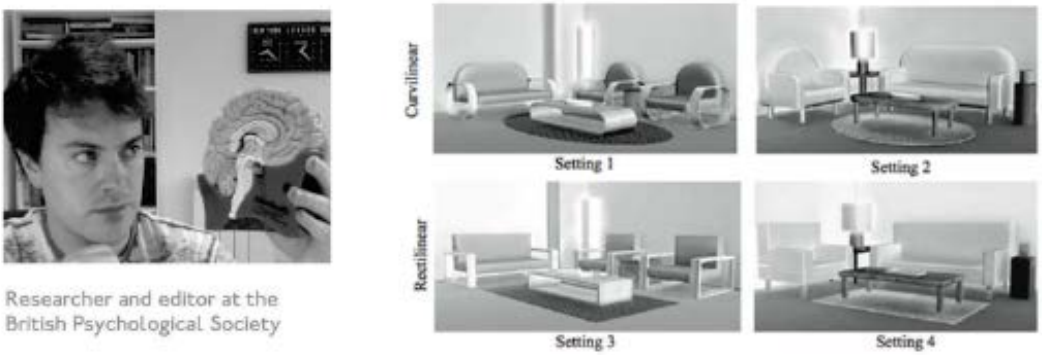


Figure 11: Photo of Christian Jarett and Corresponding research

Researcher and editor Christian Jarett at the British Psychological Society conducted a study on how curved versus rectilinear forms of furniture can alter a state of mind saying, "the two room versions full of curvilinear furniture provoked significantly higher pleasure and approach ratings from the students … The rounded furniture seems to give off that calming feel."[9]

8 Meyers-Levy, Joan, and Rui Juliet Zhu. He Influence of Ceiling Height: The Effect of Priming on the Type of Processing People Use. Rep. Print.

9 Jarett, Christian. "Why You Should Fill Your Rooms with Rounded, Curvy Furniture." BPS Research Digest. The British Psychological Society, 4 Apr. 2011. Web. 19 May 2016.

Knowing that environments and the various conditions, factors, and elements that make them up all have the ability to significantly impact a person's psychology, and that people spend a significant portion of their lives in a very limited set of environmental conditions: New design challenges presented themselves.

> What are the optimum environmental conditions for people to experience when undertaking certain types of tasks?
> Can a space dynamically provide the right set of conditions to a person based on the activity they are performing?

2 – WHAT ARE THE CONDITIONS

Beginning with what people have worked with in the past, how do various environmental conditions impact an individual's ability to perform an activity? Starting out in a basic and conceptual experimental phase, qualitative data was observed on how various simple interventions affected the perception of a task.

Figure 12: ColorVision Glasses

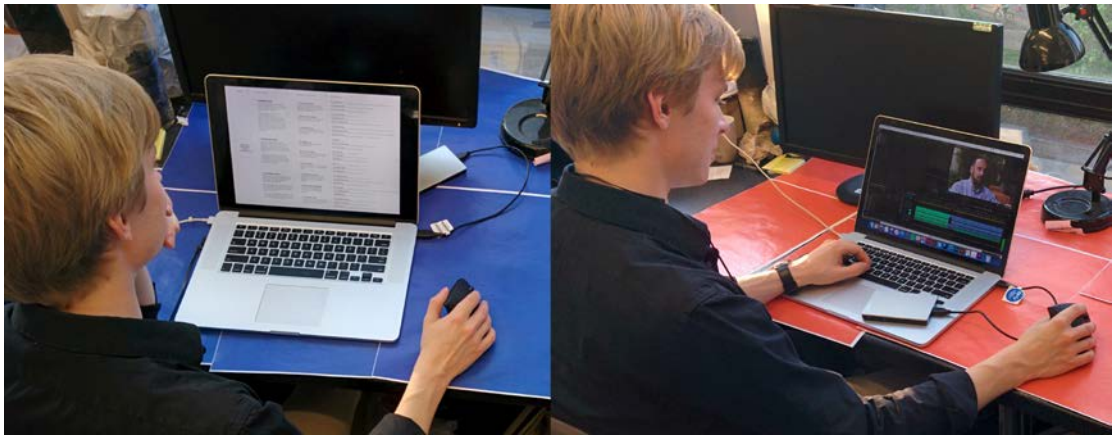


Figure 13: Red/Blue Workspace

While these experiments provided a foray into the experiment phase, and did provide some overarching feedback on how people perceive color change in their environment; namely the preference for objects that were colored by pigment versus worlds that were colored through projected light. Beyond that insight, a need for a more rock-solid, quantitative approach was needed.

Quantifying human emotion is no easy task, however a few half quantifying analyses are available for categorizing human emotion and reactions, and using a tool called the PAD Emotional State Model, the research was able to begin doing just that.

The PAD Emotional State model was developed by Albert Mehrabian and James A. Russel in 1974 in an attempt to quantify an individual's emotional state. [10]

It has been widely used to study nonverbal communication, body language, consumer marketing and to create more realistic expressions for animated characters in movies and video games.

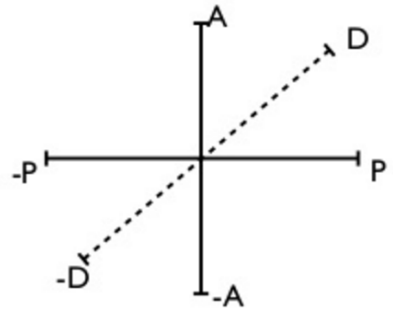


Figure 14: 3D Graph of the Mehrabian PAD scale

It works by plotting a person's perceptions and reactions on three scales that are oriented perpendicular to each other. The scales are "Pleasure-Displeasure," "Arousal-Nonarousal," and "Dominance-Submissiveness."

+P+A+D: admired, bold, creative, powerful, vigorous
+P+A—D: amazed, awed, fascinated, impressed, infatuated
+P—A+D: comfortable, leisurely, relaxed, satisfied, unperturbed
+P—A—D: consoled, docile, protected, sleepy, tranquilized
-P+A+D: antagonistic, belligerent, cruel, hateful, hostile
—P+A—D: bewildered, distressed, humiliated, in pain, upset
—P—A+D: disdainful, indifferent, selfish-uninterested, uncaring, unconcerned
—P-A-D: bored, depressed, dull, lonely, sad.

Figure 15: PAD Associated Emotions

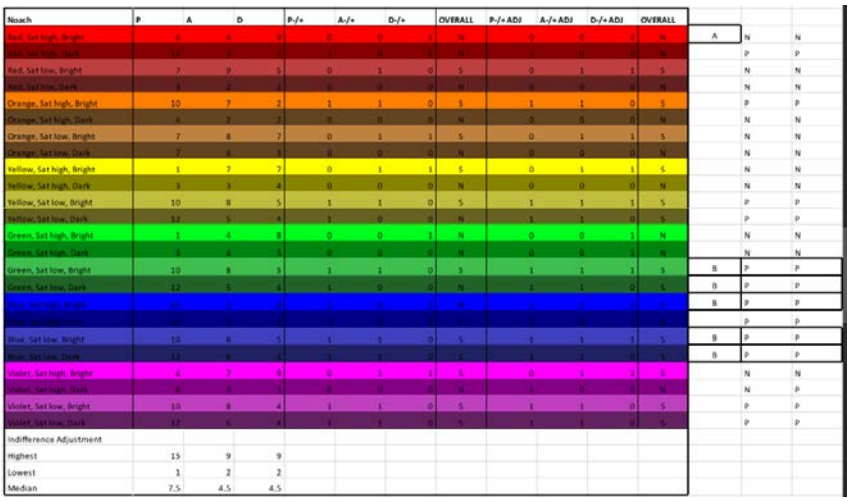
Based on where a person's score fell in this three dimensional grid (positive/negative and to what degree) higher order feelings and states of mind can be inferred.

In addition to the states set forth by Mehrabian and Russell, I further added conflicting categories of "Stimulating and Non-Stimulating" as well as "Positive Connotations and Negative Connotations" to add more control swaths.

10 Mehrabian, Albert. "Pleasure-arousal-dominance: A General Framework for Describing and Measuring Individual Differences in Temperament." Current Psychology 14.4 (1996): n. pag. Web.

It was determined that by first creating an emotional topographic map to each particular variation for each environmental condition, the participant's performance and reaction to the environment would essentially have a point of origin. Having a point of origin, and in turn collecting data relative to said point of origin made it significantly easier to judge the performance of the participant.

After refining this procedure, experiments were conducted to gauge performance changes based on contrasting environmental conditions "Stimulating and Non-Stimulating (SN)" as well as "Positive Connotations and Negative Connotations (PN)" to see what types of situations people worked best under.



Noach	P	A	D	P-/+	A-/+	D-/+	OVERALL	P-/+ ADJ	A-/+ ADJ	D-/+ ADJ	OVERALL			
Red, Sat high, Bright	8	8	9	0	0	1	N	0	0	1	N	A	N	N
Red, Sat high, Dark	12	9	7	1	0	0	N	1	0	0	N		P	P
Red, Sat low, Bright	7	9	5	0	1	0	S	0	1	1	S		N	N
Red, Sat low, Dark	9	7	4	0	0	0	N	0	0	0	N		N	N
Orange, Sat high, Bright	10	7	2	1	1	0	S	1	1	0	S		P	P
Orange, Sat high, Dark	4	3	7	0	0	0	N	0	0	0	N		N	N
Orange, Sat low, Bright	7	8	7	0	1	1	S	0	1	1	S		N	N
Orange, Sat low, Dark	7	6	3	0	0	0	N	0	0	0	N		N	N
Yellow, Sat high, Bright	1	7	7	0	1	1	S	0	1	1	S		N	N
Yellow, Sat high, Dark	3	3	4	0	0	0	N	0	0	0	N		N	N
Yellow, Sat low, Bright	10	8	5	1	1	0	S	1	1	1	S		P	P
Yellow, Sat low, Dark	12	5	4	1	0	0	N	1	1	0	S		P	P
Green, Sat high, Bright	1	4	8	0	0	1	N	0	0	1	N		N	N
Green, Sat high, Dark	3	6	5	0	0	0	N	0	0	1	N		N	N
Green, Sat low, Bright	10	8	5	1	1	0	S	1	1	1	S	B	P	P
Green, Sat low, Dark	12	5	4	1	0	0	N	1	1	0	S	B	P	P
Blue, Sat high, Bright	10	7	8	1	0	1	N	1	1	1	S	B	P	P
Blue, Sat high, Dark	12	9	7	1	0	0	N	1	1	0	S		P	P
Blue, Sat low, Bright	10	8	5	1	1	0	S	1	1	1	S	B	P	P
Blue, Sat low, Dark	12	8	4	1	1	0	S	1	1	0	S	B	P	P
Violet, Sat high, Bright	4	7	6	0	1	1	S	0	1	1	S		N	N
Violet, Sat high, Dark	8	5	3	0	0	0	N	0	0	0	N		N	P
Violet, Sat low, Bright	10	8	4	1	1	0	S	1	1	0	S		P	P
Violet, Sat low, Dark	12	6	4	1	1	0	S	1	1	0	S		P	P
Indifference Adjustment														
Highest	15	9	9											
Lowest	1	2	2											
Median	7.5	4.5	4.5											

Figure 16: An example of a PAD/SN/PN Color Chart complete with a custom "indifference" error correcting.

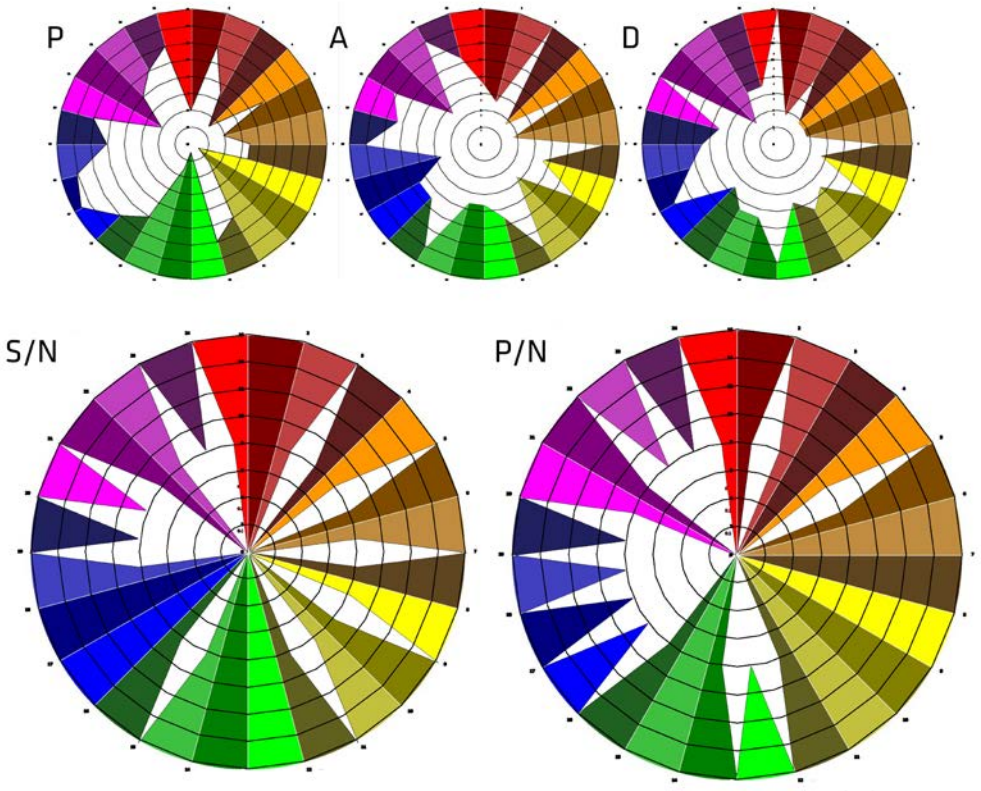


Figure 17: Noach's Color Landscape

After thoroughly testing the effects of light and color on individuals, the process is being repeated for other environmental variables, such as ceiling height, shadows, presence of curved versus rectilinear forms, movement, and muses.

Figure 18: Photo of Experiment: Colour Efficiency

By plotting task proficiency under various conditions around a person's generated landscape a direct link forms from activity to environmental condition. This will soon form a system that is fed an activity or emotion, translates that into a psychological reaction, and then displays the corresponding environmental conditions that stimulate that reaction and therefore that activity or emotion.

Going through these experiments and learning more and more what possibilities different environments hold for impacting human potential as a whole, it became worrying that even with this knowledge, this data, there are no means to execute a solution with.

Methods of implementing dynamic environments, architectural elements that could vary themselves to provide specific and differing qualities at any given time, were needed.

3 – HOW TO PROVIDE THEM

Having proved that varying environmental conditions has a measurable psychological impact, and that a space can be transformed in such a way that it produces a desired change in the way a person functions, the question became: "how can the way we build construct and embellish our buildings to be able to dynamically change their qualities and in turn our psychological state?"

Dynamic floor plans presented itself initially as a fun and visually dramatic way to change a space. Beginning with the concept of a room-divider, the goal became to increase functionality, impact and size of a space without increasing the square-footage of the building as a whole.

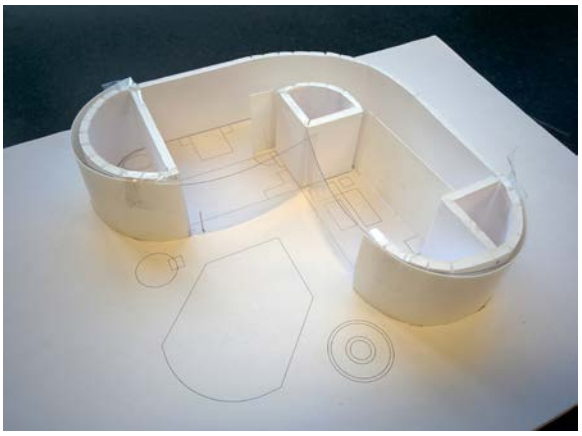


Figure 19: A foam-core model of a simple house with retractable walls and windows.

This lead to a crazy exploration of Harry Potter staircases and how to create centripetal spaces where it didn't matter which way was up.

Figure 20: An unfulfilled dream.

How could a wall change its shape and size? What was the simplest and least mechanical solution to create lots of varying shapes out of sturdy materials? The use of linear actuators to torque adjacent panels of high-density polyethylene was employed. This method created smooth transitions between numerous shapes while only using one component. (Hydraulics were to be explored in the future).

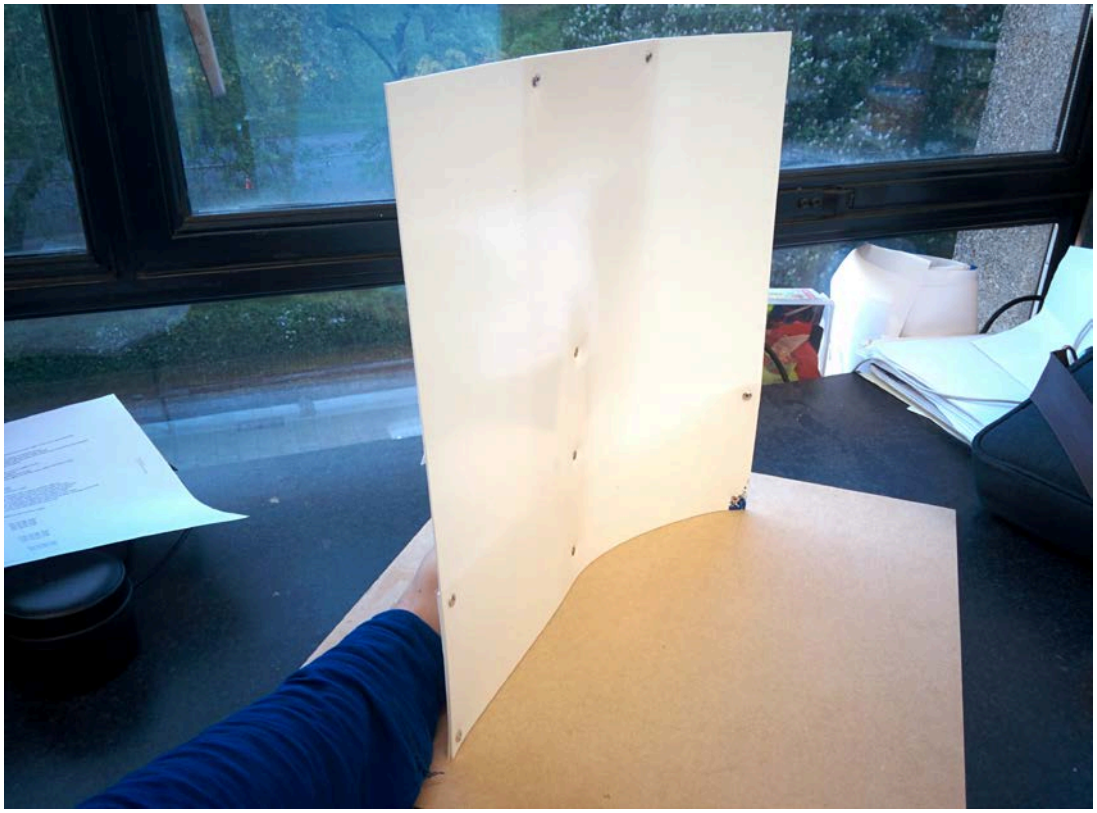


Figure 21: A small scale model of a wall that was capable of bending in 3 dimensions.

Figure 22: Larger wall section to show the materials and simple control system worked at 1:1 scale.

Ultimately, even if the HDPE walls had been the perfect solution, they were still white, or just one colour. They needed to be chromatically dynamic as well. Since that material can be semi-translucent, backlighting could have been utilized to give a coloured glow, however as discovered before, projected light is less preferred compared to reflected light. The need for a pigment based colour changing material was desired.

After research into various colour changing materials, thermochromics chosen due their low cost when compared to electrochromics and practicality compared to hydrochromics.

Figure 23: A thermochromic sheet on a Peltier chip (A device that creates a temperature differential when electricity is applied) changing temperature at around room temperatures.

These sheets were fun but ultimately proved too simple, un-innovative, and visually unappealing. Experimentation towards creating a thermochromic paint that would be more specialised to the desired output began.

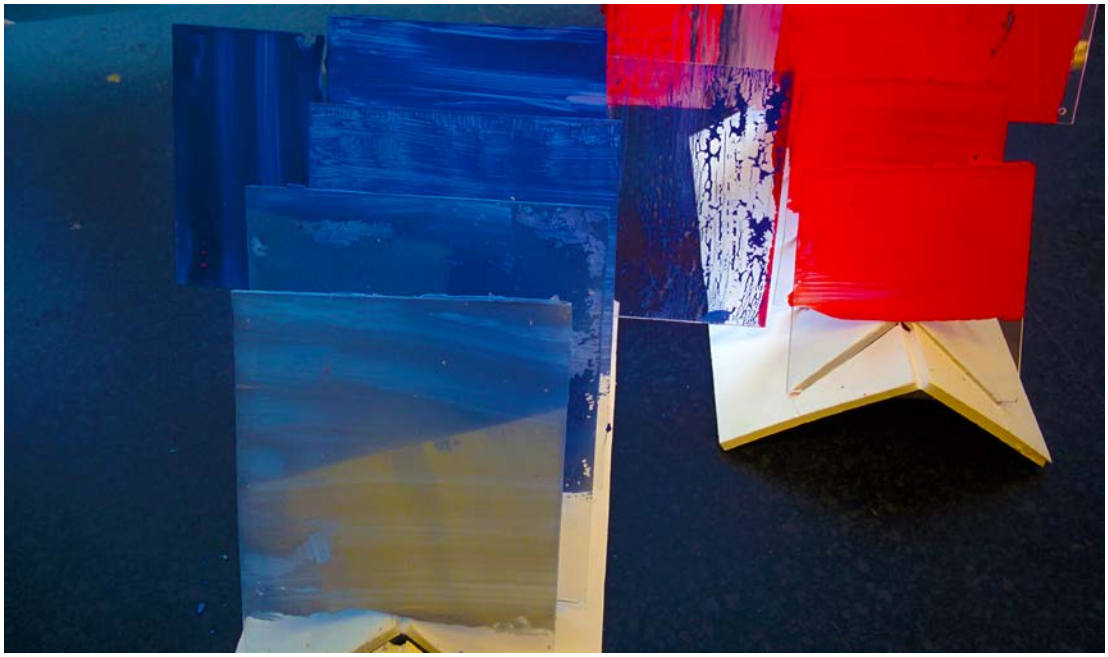


Figure 24: Red and Blue Thermochromic Paint (Notice white half of front blue pane)

Figure 25: Semi-Failed experiments with making thermochromic paint.

Research into this field was shut down due to repeated failures at producing the desired result. The paint successfully shifted from a rich red or blue hue to a bright white colour but did not produce the desired clear result.

The reason for wanting a paint that went from a rich hue to clear at a certain temperature was that it would allow multiple layers that activated at different temperatures to stack up and show through each other. The walls needed to dynamically shift between multiple hues, not just a single hue and white.

After backtracking from the wild and crazy zero-gravity dead-end, the chemistry heavy dead-end and the overly simplistic robot wall dead end, the project returned to a concept that had been quite fun to explore: Light and Colour. How to make a space seem larger or smaller than it physically was. This exploration path mainly involved the use of lights, mirrors (which could move), and shadows.

Knowing the profound impact light and colour can have on an individual, using reflected light to trick the mind into perceiving more than is there seemed like a great place to start.

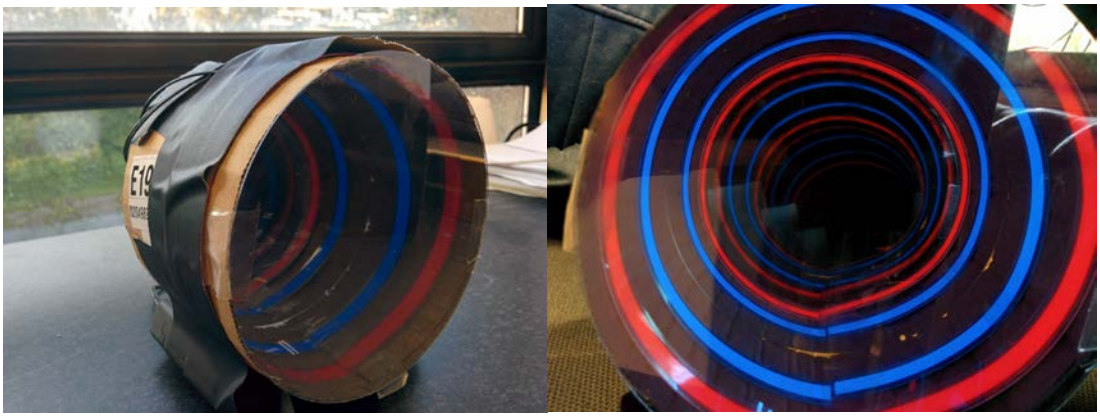


Figure 26: A nifty Infinity Tunnel

Initial responses to devices such as this “infinity” mirror proved positive, which prompted further exploration into utilizing these little devices in more expressive ways.

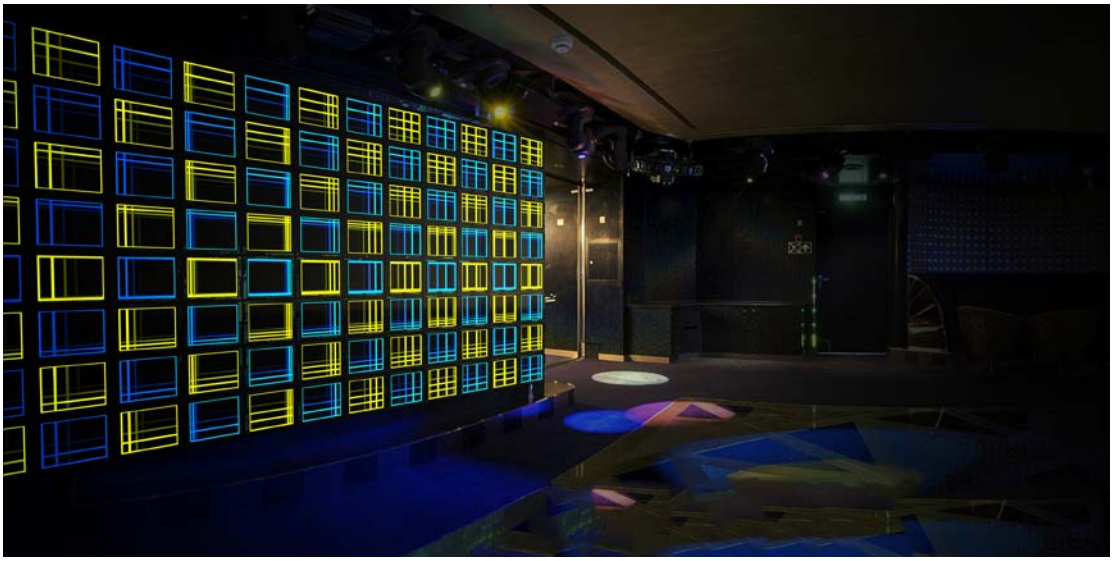


Figure 27: A Modular Infinity Mirror Lightwall

One small device hardly provided the room changing effect this project sought, leading to combining numerous units into an array for a larger effect. Work on these modular units evolved into an extruded structural building block.

Figure 28: Sketches and Cad Render of a TunnelVision Module

To be honest, this just didn't seem very innovative.

This solution, while it would definitely work and create quite a dramatic effect, was ultimately an expensive, inelegant solution that lacked real practical use besides perhaps nifty club venue lighting. One could make an argument for an office space implementing such a light wall, however to try to embed a very expensive system like this into the average household would be ludicrous. These large dynamic architecture systems were ultimately not that dynamic, they become static over time. A poorly designed technological, 1-size-fits-all solution is not the way to tackle the problem of dynamic environments.

The world is filled with a plethora of brilliant designers, engineers and artists. Instead of attempting to tackle the whole issue of dynamic environments all at once, why not empower those skilled individuals out there with the knowledge of exactly how to enrich their designs and prepare for a world with dynamic environments.

4 – A SYSTEM THAT MATCHES ENVIRONMENTS TO OUTCOMES

The current practices used to design for people are 100% valid. They successfully take in a general consensus, generate an average that works for most people and champions that throughout the design. In most cases, such as advertisements, branding, and architecture, this works! But imagine a world where everything is perfectly tailored to the person who is about to experience it. For that world to exist, a one size fits all solution does not work.

Personalization and customization is a growing trend throughout many industries, even now cell phone manufacturers are implementing co-creation production. Customers can choose how their products are made! However, as many designers and engineers will know, customers and clients don't always know what they want.

Designers spend their lifetimes learning how to translate certain emotions or provocations into reality, and designing for someone else's emotions, provocations or goals always proves more challenging. Client meetings, visioning sessions, and mood boards etc. all seek to learn our clients in an expedient way and attempt to give us the necessary info to design for them.

What if there was a tool that quantified a person's psychological reactions to different design elements and environmental conditions, tested the influence of those elements on the person's performance and the quality of their outputs in order to provide designers and Architects with a psychologically backed target design zone including colors, size, shape, symbolism and more for a given design project?

[A tool that employs the PAD/SN/PN system along with tests to evaluate efficacy.]

↓

In an easy to use package.

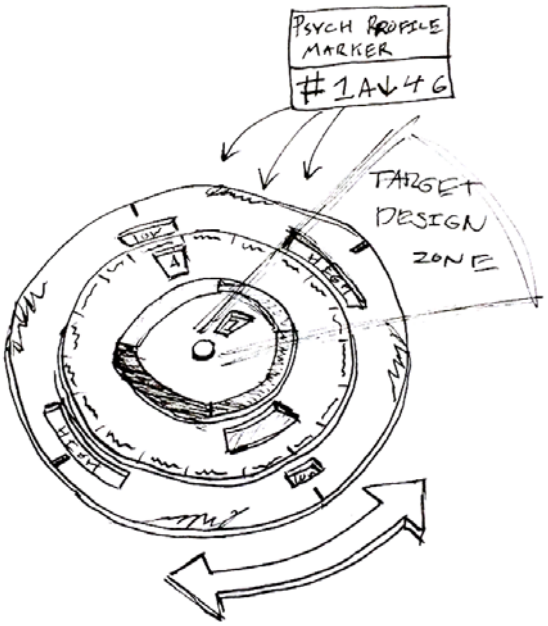


Figure 29: A sketch of a possible physical representation of the Psych Profile Translator

5 – COMPETITION/MARKET/DISRUPTION/COMMERCIALISATION OF RESEARCH AND THE SUSTAINABILITY OF IMPLENTATION.

A tool that translates a client or employee's psychological profile marker into a set of concrete design elements that the designer can choose to utilize to achieve various psychologically confirmed results. A cool idea, but in terms of commercial viability and responsible sustainability, how could this ever come to fruition and should it?

Commercial Viability

The standardization of certain elements of design and design language has been key to the advancement of design across a global market. RAL, Munsell, and Pantone, at least in the color industry, dominate their market by creating universal languages to quantify and standardize elements of design. In this case, the proportions of C,M,Y,&K to produce consistent colors worldwide.

This project seeks to do the very same thing with people's psychological reactions to certain stimuli. The concept of mixing various pigments together to produce "Blue" isn't far off from what architects do when designing a bedroom. They can make it "blue" but is it the *right* blue? They can and will design a highly functional bedroom for someone, they'll cover all the bases, but is it the *Best* bedroom design for that person? More often than not, it will be the best because architects have become experts at understanding their clients and turning their intuitions into tangible spaces. The problem lays in two key parts. Architect A understands their client while Architect B is halfway around the world and has never met the client. Architect B is now tasked with completing the design. Architect B lacks the deeper understanding of the client required to produce the perfect design. Architect B and A can share a timely conversation with each other or with the client in order to exchange or re-discover this information. A simple language would prevent both these problems, saving time and money for designers and architects everywhere while only increasing the perfection of their work. Not just for architects, this language could inform designers of all kinds about the impact their work might have on a specific person.

Example: What color, form, size, or shape to make a product seem the most reliable for that specific person.

Beyond acting as a universal design language and tool for designers, a tool like this could be heavily utilized in a corporate environment. Imagine you were just hired at Google or Epic (companies both known for their innovative and non-standard workspaces). During your orientation with the company Human Resources has you perform a few tests. Your employer now knows the precise conditions you work happiest or most efficiently under when performing various types of activities. This would provide vital data to your employer for when they assign your workspace. In the future, a standard plain Jane workspace could even transform around you as perform the tests becoming the ideal office for you as you sit in it for the first time. This could improve employee satisfaction as well as efficiency, (notably it also could be abused to potentially overwork or overwhelm a person if an efficient but displeasing workspace was provided to them.

Example: A business could identify the optimum working conditions to increase that particular employee's productivity for any specific type of task. (A perfect idea generation environment for Jon, or Susie's ideal environment for mathematics proficiency.)

Responsible Sustainability

A system that empowers designers with a deeper understanding of clients. While this might not need a discussion centered on traditional sustainability like CO_2 production or deforestation,

psychological tools and tools that can manipulate the human mind to improve, for example, work output have serious Mental Sustainability concerns.

Without going political, the topic of work hours during the day, time spent per week, and how taxing those hours are, have serious effect on stress levels and the mental well-being of a person. If an employer increases productivity of its chemists by bathing them in red light, they might get that much more work done in the same amount of time. Are their brains more tired after this period of higher output, or are they just operation happily and efficiently since they're unimpeded by improper conditions? If a worker can now do a task in a hypothetical 'half the time' do they now need to do twice as many tasks, or are they free to leave work hours earlier than before?

If you increase worker efficiency, you increase output per unit of time. If you keep the time constant (as many employers might do) production increases. If production increases, what is the strain on resources other than human mental wellbeing?

These ethical considerations are not to be taken lightly, however, they are not reason enough to stifle the progress of this tool. Like any tool, it depends on how it is used, it depends on people using it responsibly.

6 – TEST REFINEMENT AND FUTURE PLANS

Make the tests more fun and faster.

Currently the PAD/SN/PN tests and performance evaluations are by-hand, proctored assessments and they're a bit time consuming to perform and evaluate. Ideally, these tests and evaluations can be boiled down into a shorter and more entertaining "game." By implementing the tests into such a format the commercial viability increases exponentially since games like The Witness, Portal, and Qube have taken the gaming industry by storm. Everyone could enjoy a fun stimulating game, and at the end of it, have a useful output (something most video games currently lack). Playing the game would generate your environmental outcome index which could then be shown to any designer, architect, or employer for improved life-customization. You could even play a videogame to know how to optimize your own life.

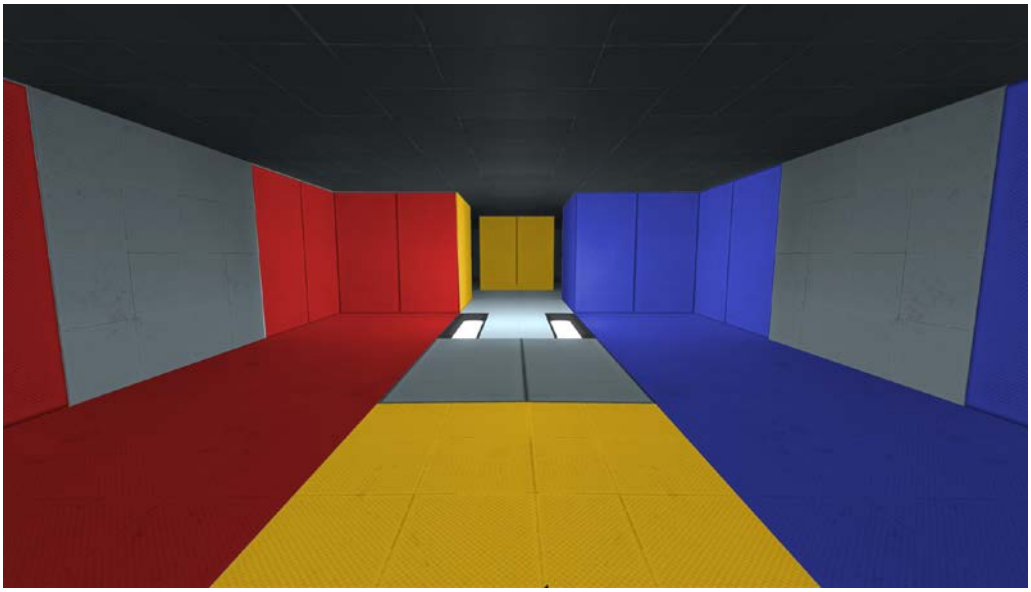


Figure 30: In-Game Environmental Priming

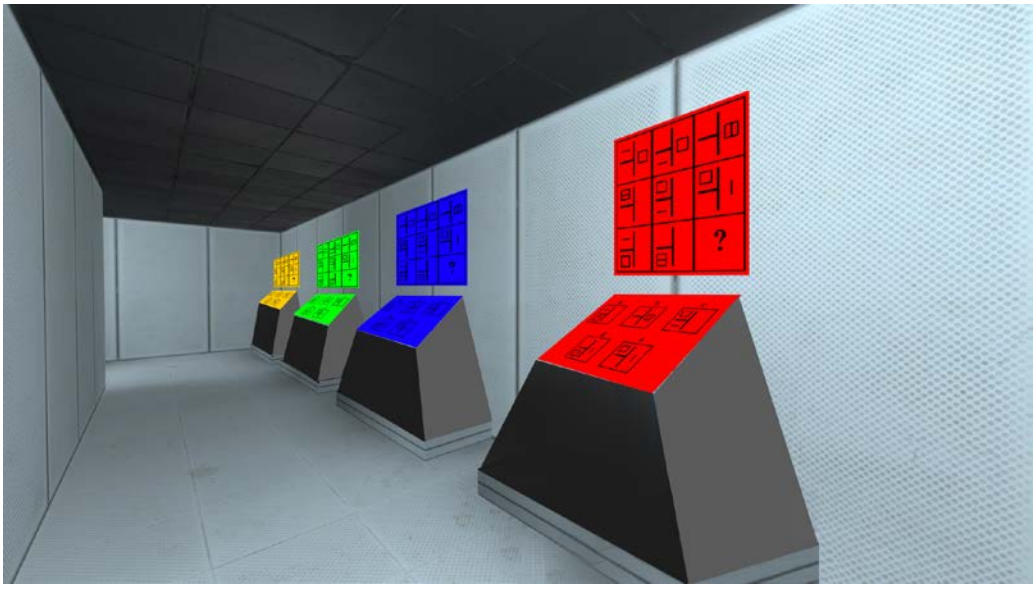


Figure 31: In-Game Puzzles to evaluate performance

Conclusion

In conclusion, the sum of the work done on this project has resulted in three things: A testing method, A language, and A Tool.

A testing method that builds upon credible psychological tests, combines them, and applies them to measure previously unquantifiable 'feeling' data, and uses that data to create a landscape to plot a person's performance data in relation to the emotions and environments they are subjected to.

A language that compiles into a code all that meaningful data of how certain conditions will psychologically affect a person and therefore their performance at a variety of tasks.

A tool for interpreting this code that returns given design parameters for a desired output.

Through research and experimentation, I managed to come up with a reliable quantifiable way to plot human emotion and performance against environmental conditions and design elements. With that information, instead of making robotic architecture that could subject a person to various conditions I focused on the process of obtaining this information and have worked to make it more user friendly. This output is not what I intended to produce. Instead it is a tool that will enable designers and architects around the world to better produce what I had hoped to.

Moving forward I hope to add new "pages" to this codified language that I've created, allowing for more and more complex conditions and elements to be quantified and shared.

In addition, I hope to refine the method of obtaining the information that feeds this tool, by refining my experimentation and evaluation process into a videogame that will in real-time analyze, adapt, and run the experiments I have laid out.

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