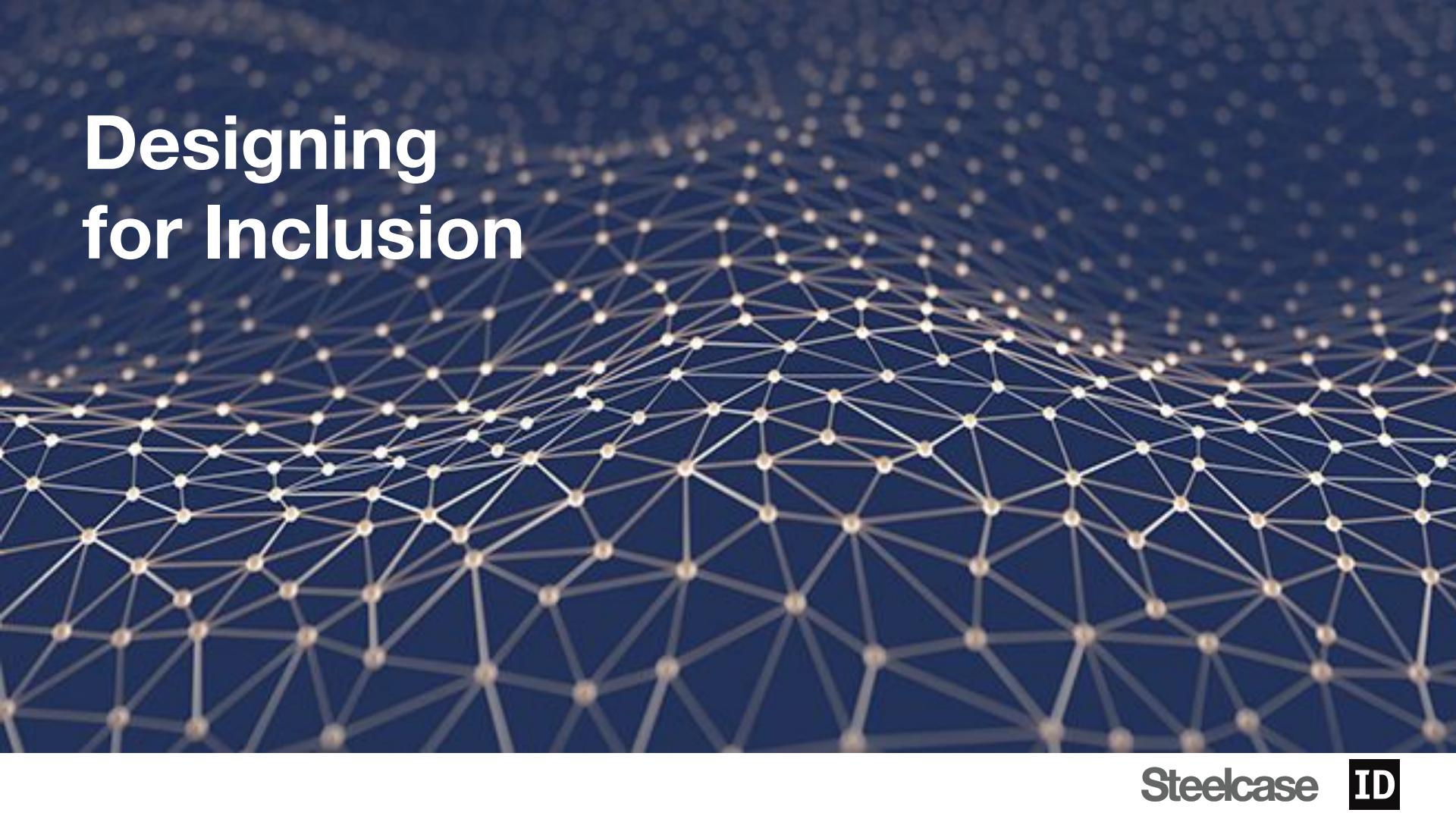


Designing for Inclusion

The background features a complex, abstract network graph composed of numerous small, glowing yellow and white dots connected by thin, light-colored lines. This pattern creates a sense of depth and connectivity, resembling a digital or organic structure.

We understand **inclusive design** as design that:

- Reduces the cognitive, emotional, and physical load of the user
- Accommodates a wide range of potential users, and offers those individuals choice in how they engage with the design
- Enables individuals to fully participate in an activity or space, and/or adjusts the threshold for full participation

We understand an **inclusive workplace** as one that:

- Offers a diversity of options for individuals to choose from
- Can evolve and adapt to the people within it
- Accommodates multiple work styles
- Promotes awareness of inclusive practices and features
- Encourages individuals to advocate for themselves if their needs are unmet

In order to **make design inclusive**, designers must:

- Understand space and objects as non-neutral actors
- Engage a diverse set of users to co-design and test solutions
- Consider the culture and context of space/organization/company
- Assess and iterate continuously after initial implementation
- Embed capabilities for design to adapt and evolve over time

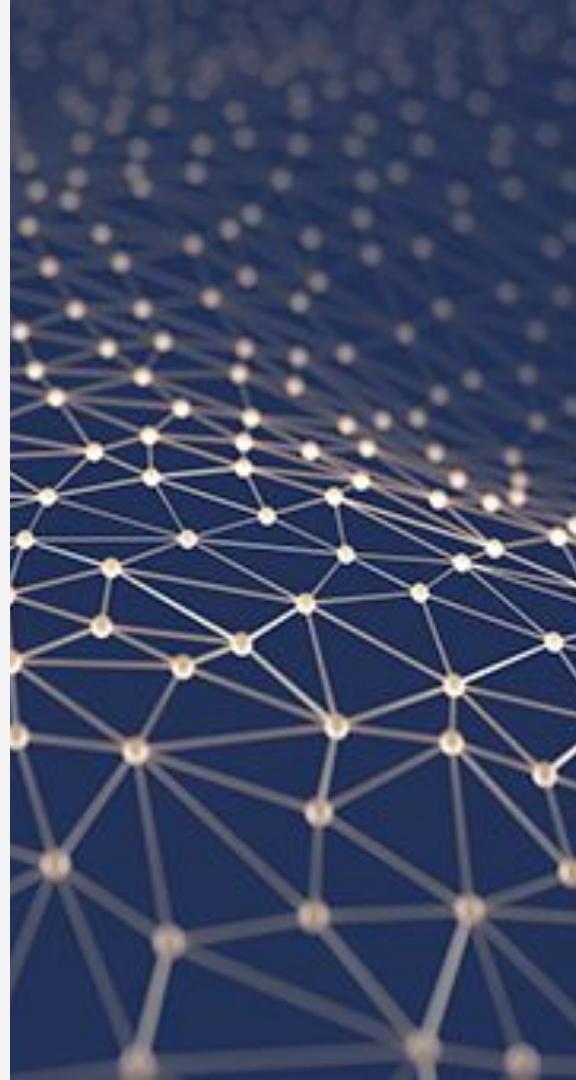


Mapping Inclusion - present

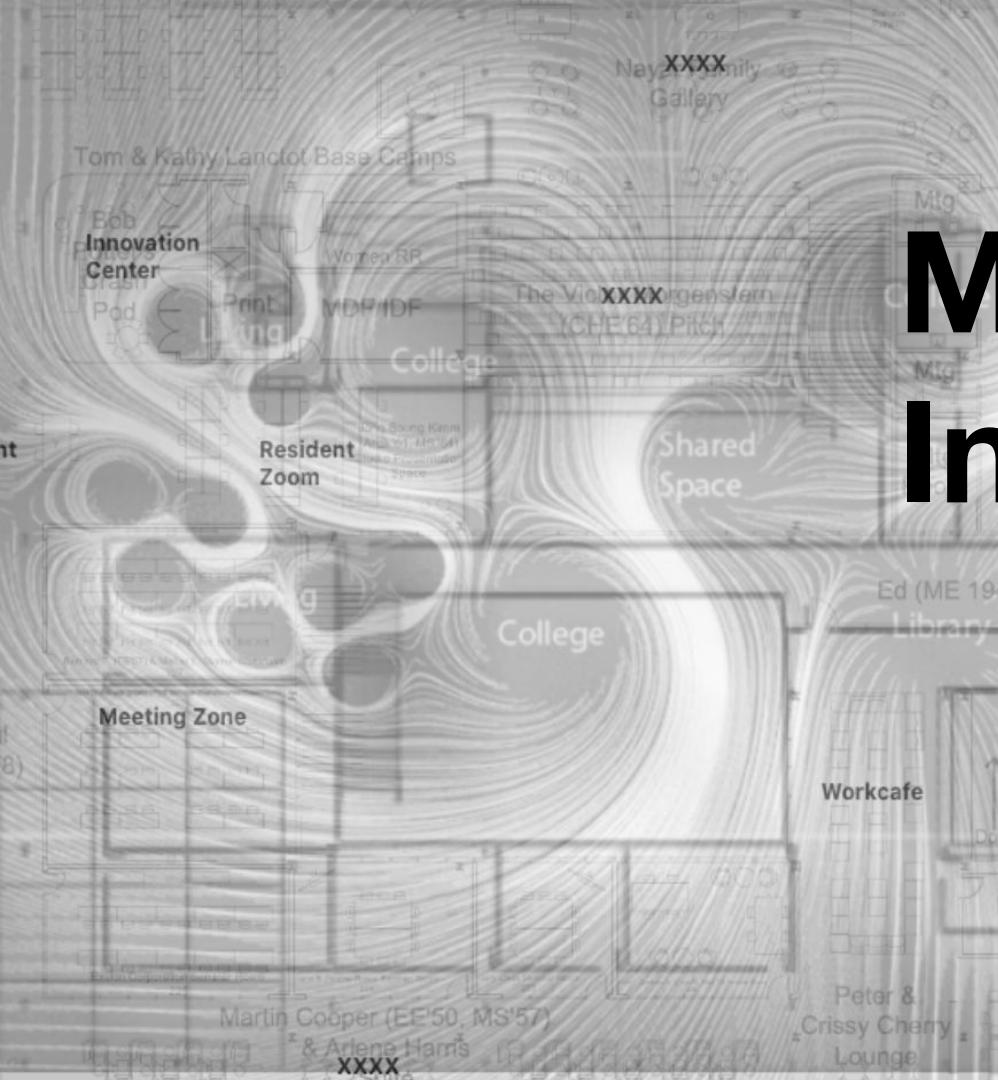
Mapping Inclusion - future

Transforming Objects

Co-authoring Inclusive Workspaces



Mapping for Inclusion



Jessica DeMeester, Mrinali Gokani, Minyi Zhang

Through the utilization of metadata from spatial and cultural inputs, our tool enables Steelcase dealers + designers to **evaluate, educate, and embed** inclusivity into design offerings.

Tool Objectives

- Assist **dealer designers** to evaluate the levels of inclusion a floor plan offers to inform the creation of environments based on our **three key principles**.
- **Catalyze education/conversation** between designer and client around cognitive diversity, inclusion, and how designing environments with these values is critical.
- Act as a complementary tool to the current specifying process to **build inclusivity** into designs.

Process

Our team of Masters of Design Students embarked upon this project by rejecting assumptions, and rigorously researching to understand what inclusive design means, looks like, acts like, and affords. We synthesized our findings into three main principles:

Reduces the cognitive, emotional, and physical load of the user.

Accommodates a wide range of potential users, and offers those individuals a choice in how they engage with the design.

Enables individuals to fully participate in an activity or space and/or adjusts the threshold for full participation

These are the principles that informed how we framed the opportunity, and built our prototypes. The opportunity we elected to engage with is assisting workplace designers to create inclusive environments. Where we began was with a common, 2-D, B&W floor plan. Floor plans are rich in data, and if analyzed properly, tell a story of inclusion or exclusion.

We developed a technology that extracts encoded spatial data to identify hotspots and locuses of inclusion and exclusion, as well as the factors that contribute to those feelings. This tool allows users to upload floor plans, and have them evaluated across several factors relevant to inclusive environment creation. Optimization algorithms are employed to make recommendations for improvement to the designer.

The algorithms that determine if an environment is inclusive are trained on the below principles:

- Offers a diversity of options for individuals to choose from
- Can evolve and adapt to the people within it
- Accommodates multiple work styles
- Encourages individuals to advocate for themselves if their needs are unmet

Future developments include building out additional data-collection and analysis capabilities that take into consideration materiality, points of human interaction, and even emotion detection through sound.

Input Data

- Inclusion Value
- Work mode
- Floorplan

Algorithm

- **Identify** and **extract** data from 2D floor plan.
- Run the **encoded formulas** on the floor plan data.
- **Evaluate** plans after factoring in preferred work modes, desired work values and inclusion parameters.

Output

- Provide a **visual mapping** of the evaluations along with **recommendations** for space design
- **Educate** the significance and relevance of inclusive parameters to space design and company culture
- Generate the map for inclusive and exclusive hot spots to be **embedded** in the design process.

Diagnosing a more inclusive workplace.

[Start Here](#)

We have built an **interactive website** that hosts our prototyped tool for diagnosing inclusion.

We would like to **build additional algorithms** to **thoroughly assess floor plans** considering all principles of inclusive design.

Our final goal will be for this tool to be integrated into existing Steelcase digital design resources and manifest in an architecture tool plug-in so **inclusive design can be practiced and embedded across the world.**

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[Social Impact](#)
[Steelcase Foundation](#)
[Suppliers](#)
[Supplier Diversity](#)
[Marketplace](#)

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[Site Feedback](#)
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[User Manuals](#)
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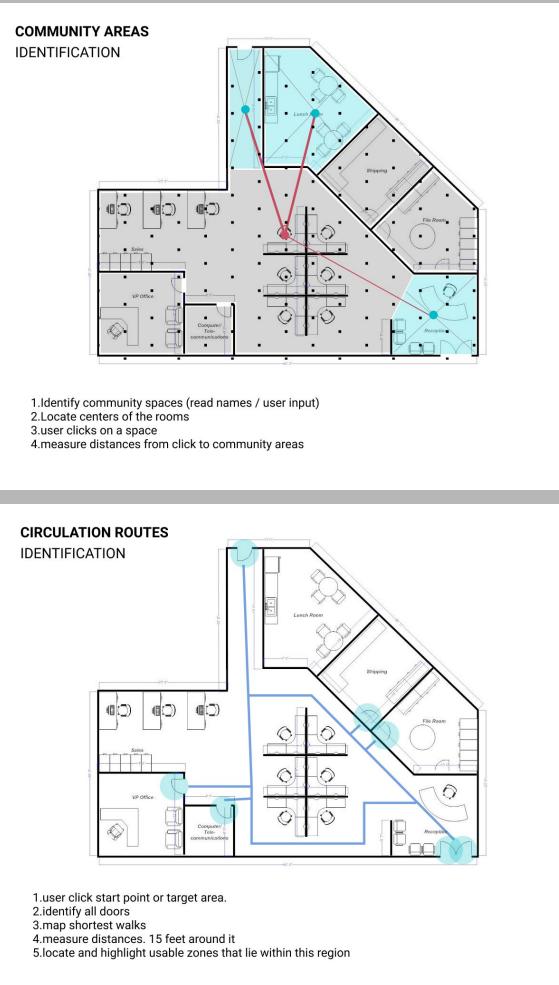
CONTACT US
We would love to hear from you! Contact us for sales requests, career information, investor relations, corporate information, or general questions.

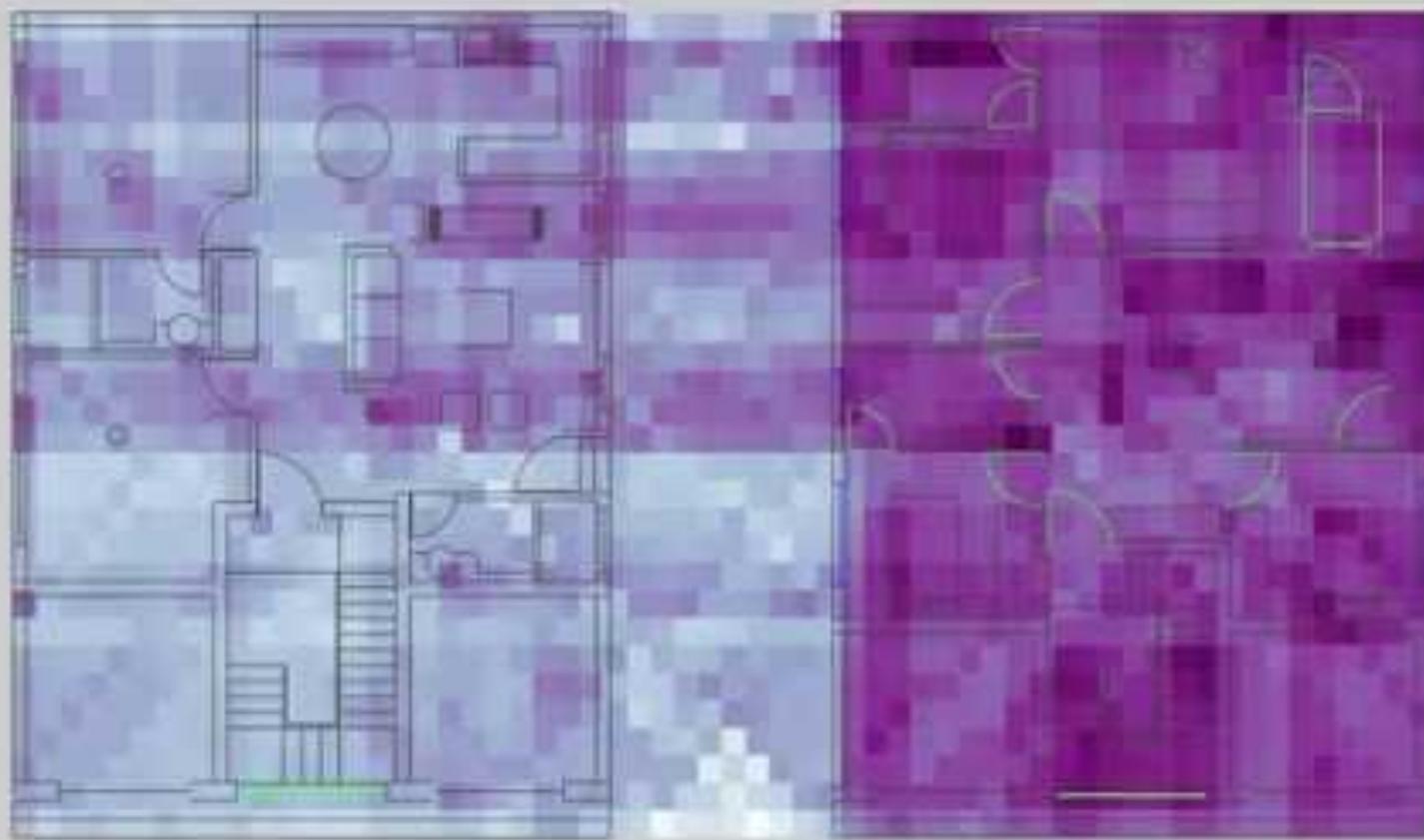
Steelcase coalesse turnstone DESIGNTEX A/M/Q

Smith System orangebox Steelcase EDUCATION Steelcase HEALTH



Algorithm Identifies parameters for inclusion evaluation

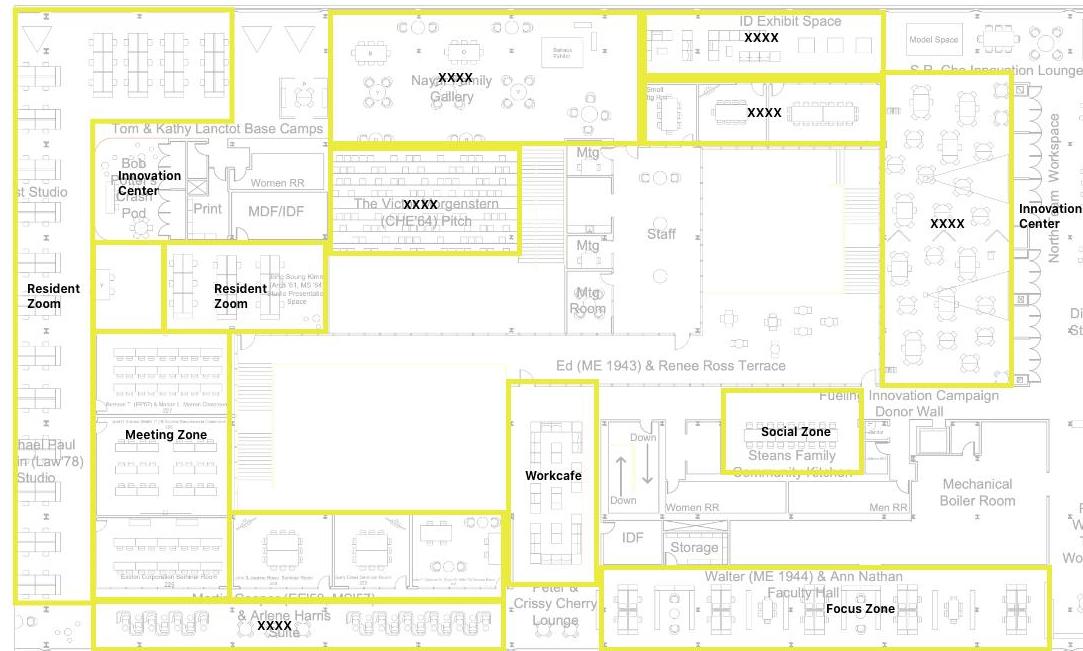




Review

SAVE | SHARE

Ensure the floor plan zones and furniture are correctly identified, then run the evaluation.



Need to be Identified

Zone Identification

Map Identification Percentage

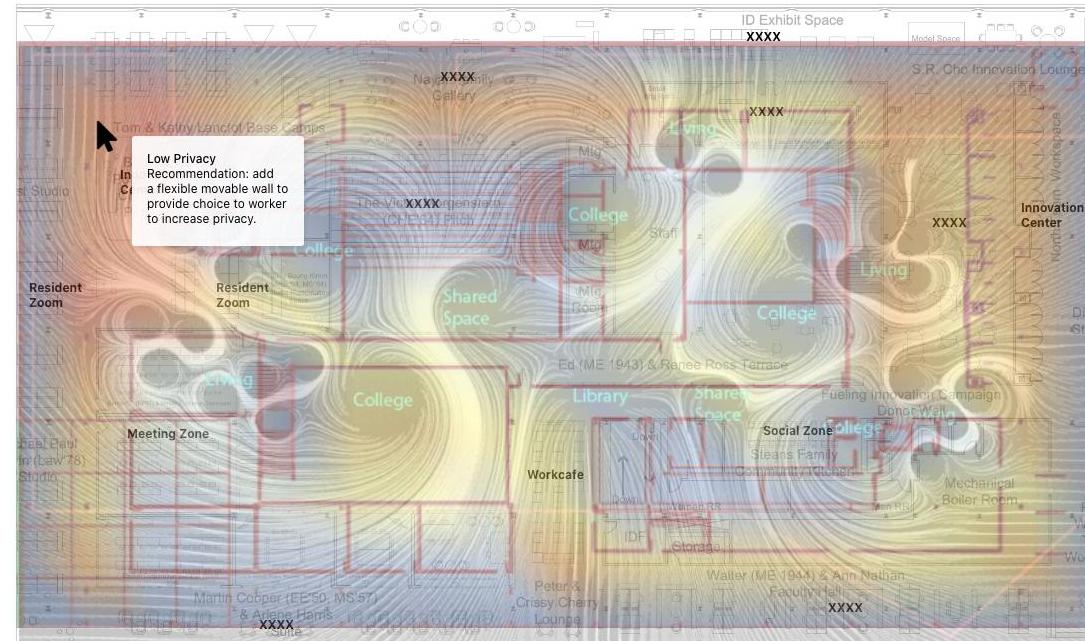
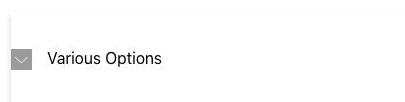
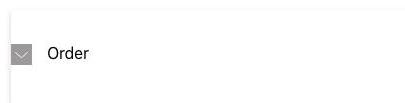
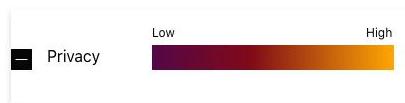
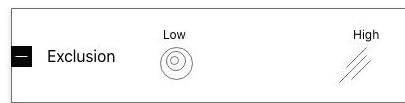
100%

Run Evaluation



Inclusion Mapped

SAVE | SHARE



This is what we're making:

Web-based tool that intelligently diagnoses inclusive/exclusive nodes within 2-D floorplans. This tool is positioned to Steelcase dealer designers to assist them in creating more inclusive work environments.

This is what we're doing to prototype it:

A website demo for one specific inclusive parameter, privacy.

Use dummy data to test the parameter hypothesis for Kaplan Floor Plan

This is what is needed to make this real:

Thousands of floor plan and CAD examples for training algorithm

Dealer designer usability test

Team for guidance

- Engineers
- Designers
- Inclusivity Experts

This is what it could be in the future:

Build out additional algorithms for all inclusion principles to get a 360 view of the inputted floor plan.

Scope can be broadened to education, residential, and healthcare environments with certain reconfigurations.

Plug in for architecture tool plug-in.



Future Mapping

Photography: Flocking behavior of birds
From internet

Alvin Jin, Harini Balu

We aim to develop a **space planning tool** that **facilitates designing activity oriented spaces** in office environments.

“Organizations are organic. Business needs, people and spaces evolve.”

Our tool seeks to **promote neurodiversity for increasing the sense of belonging in the workplace through prioritizing the emergent patterns of human behavior** in varying modalities of space and objects in the workplace.

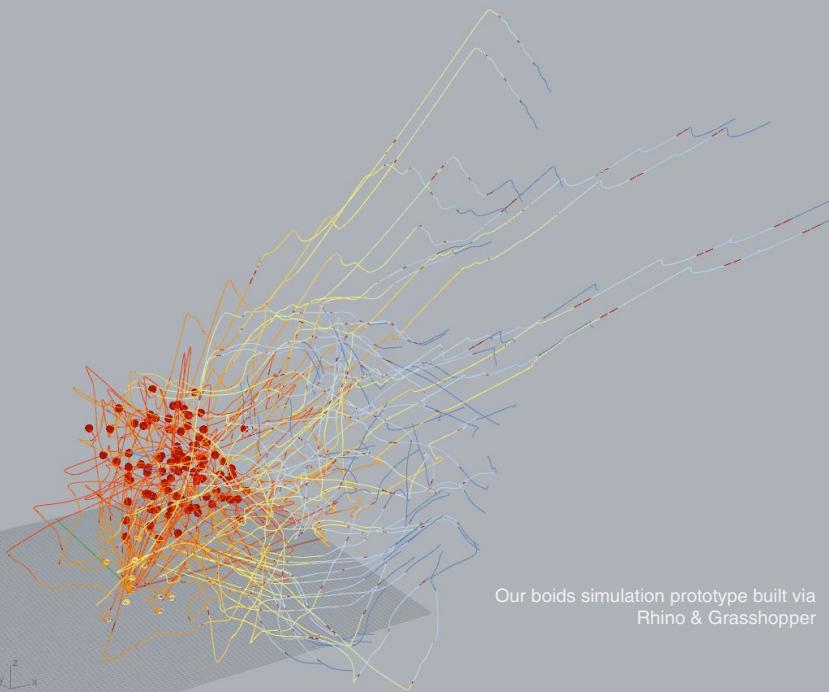
Designing inclusive spaces through behavioral modeling

Our tool will embed principles of inclusive design through:

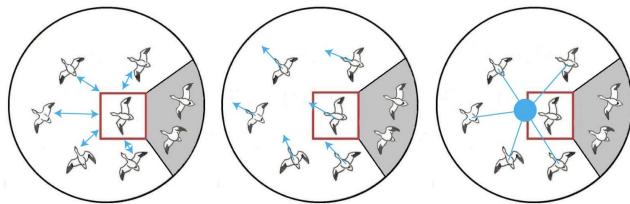
- Developing parameters that adapt to the sensitivity and complexity of human behavior
- Enables customization through interpreting emergent behavioral patterns in the workplace and determining the appropriate methods to enhance the natural rhythms of the office
- Facilitates co-creation by adapting parameters to the information leveraged through sensor data, surveys and lived experiences

Boids + Generative Design

Based on boids logic, the tool attempts to create an artificial life simulation through generative design, to understand swarm intelligence and emergent behavioral patterns.



Boids is an example of emergent behavior, like Flocking behavior of birds; that is, the complexity of Boids arises from **the interaction of individual agents adhering to a set of simple rules**.



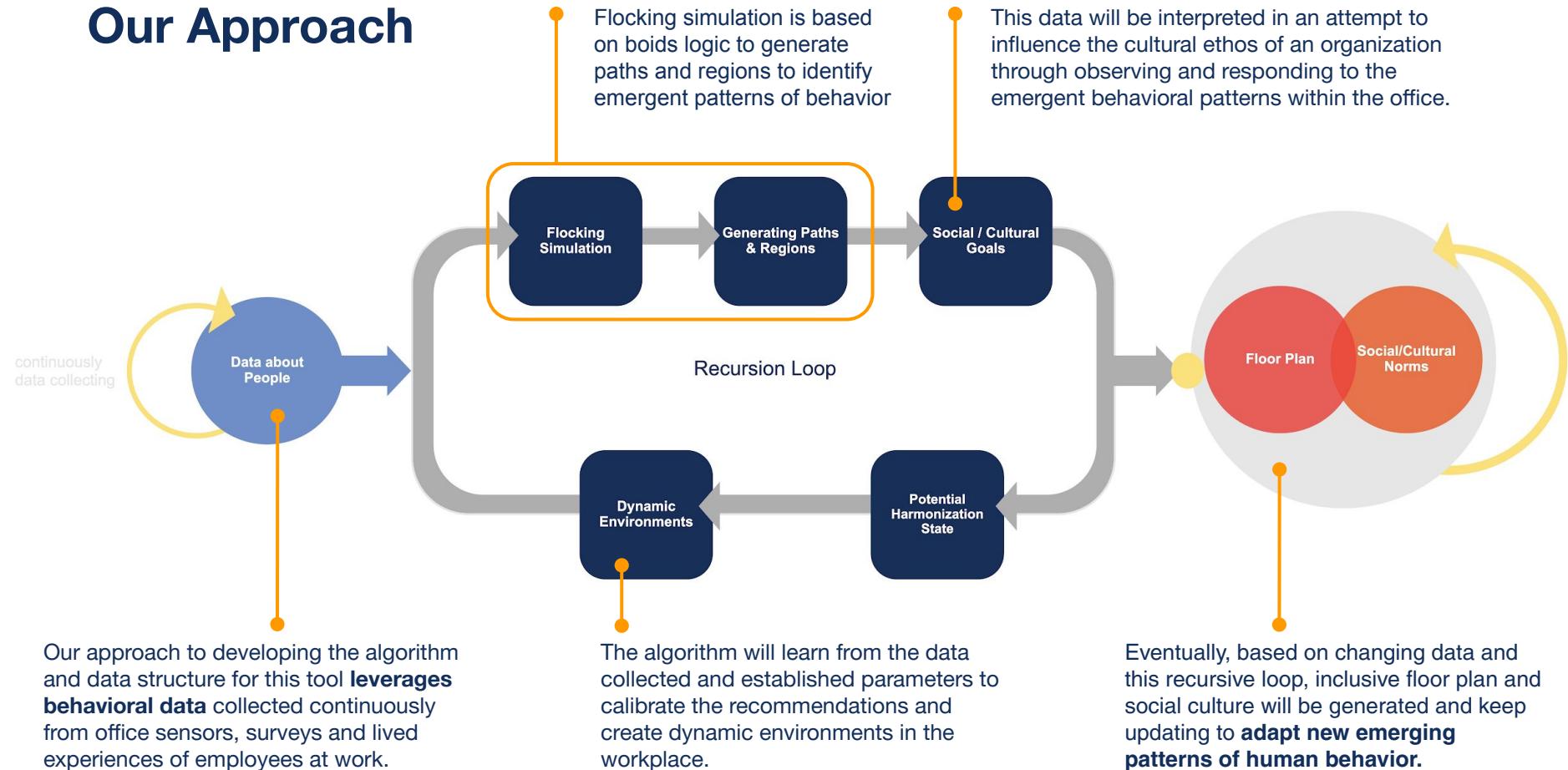
The three flocking rules from the *Boids* model: 1) Separation; 2) Alignment; and 3) Cohesion.

In our case, Boids attempts to distill the complexity of human behavior through observing the **self-organizing characteristics** seen in flocking and swarm intelligence.

The flocking paths can be understood as emergent behavioral patterns through interpreting the birds response to a set of rules that govern the simulation.

Behavioral modeling allows for **variance in individual action while simulating collective behavioral response**

Our Approach



Flocking Simulation

- how neuro-divergent behavior presents in an empty classroom

Red clusters indicate people flocking at a given moment.



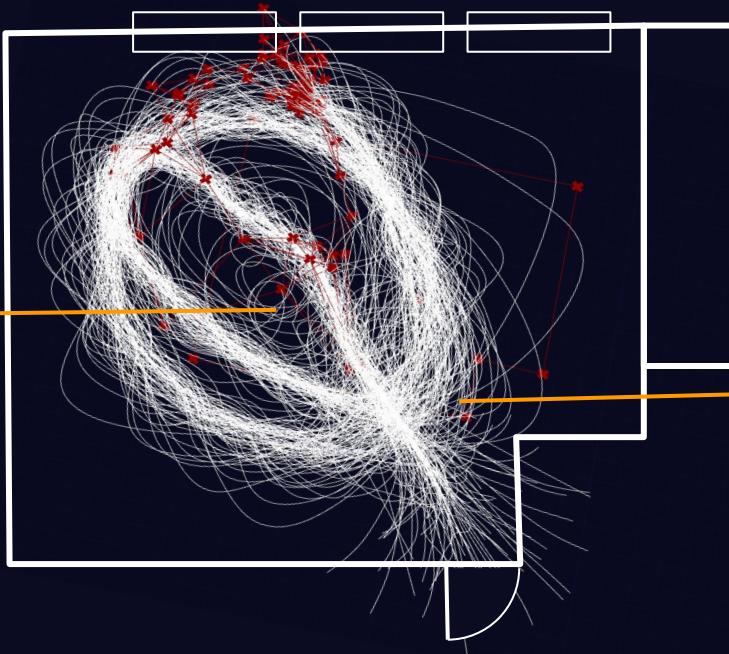
Workforce

Introversion

Sensitivity

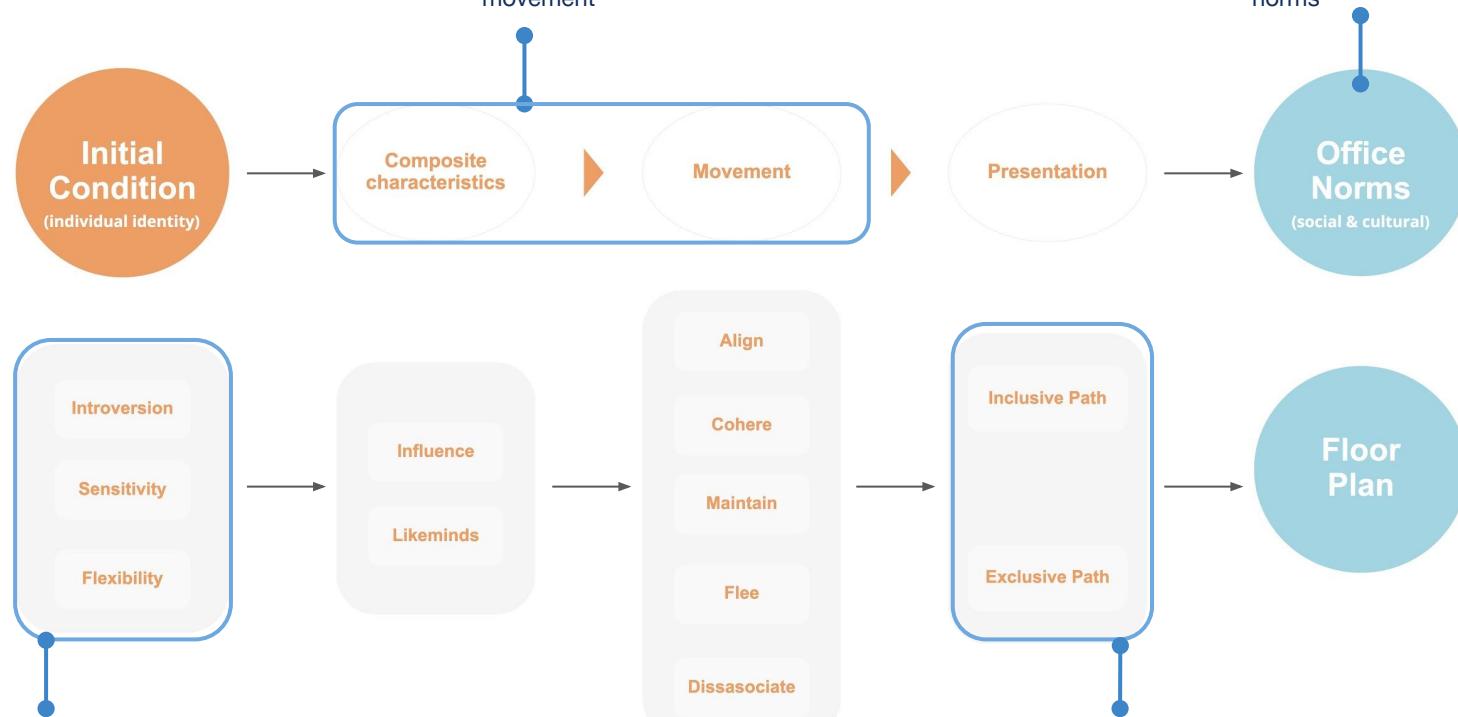
Flexibility

...



White lines is the
“Inclusive” movement
Path of neuro-diverse
people

Boids Logic



Identity parameters for individual agents. Each parameter is a spectrum to incorporate variability in presentation of cognitive functioning.

Paths determined by inclusive and exclusive calculations determined in simulation steps.

Presentation of composite behavior indicates emerging office cultural and social norms

Space design through observing emergent behavioral patterns

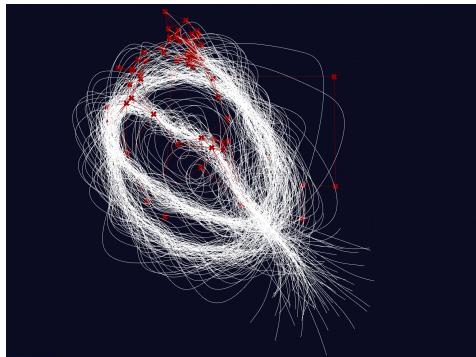


Fig1:

Dynamic behavioral patterns are generated through the parameters programmed in the Boids simulation. Red clusters indicate people flocking at a given moment and traces their paths. The white paths displayed here are “inclusive” paths observed through flocking behavior.

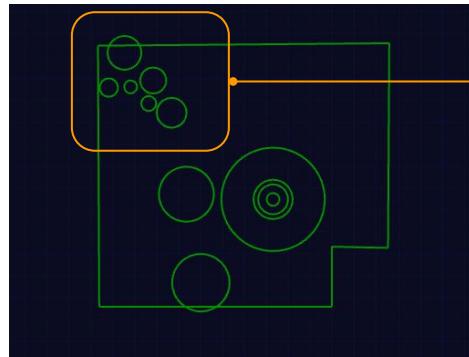
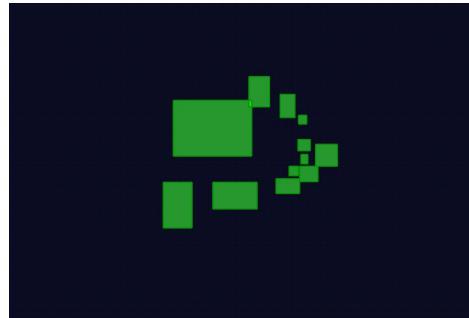


Fig2&3:

The emerging patterns can be extrapolated to indicate locuses of inclusion and exclusion. These locuses are calculated by the composite characteristics and movement then presented within particular radius to indicate potential space configurations.

The locuses of inclusion presented here might indicate an opportunity for smaller & private co-working spaces.

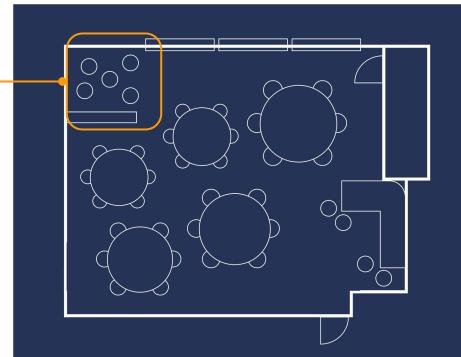
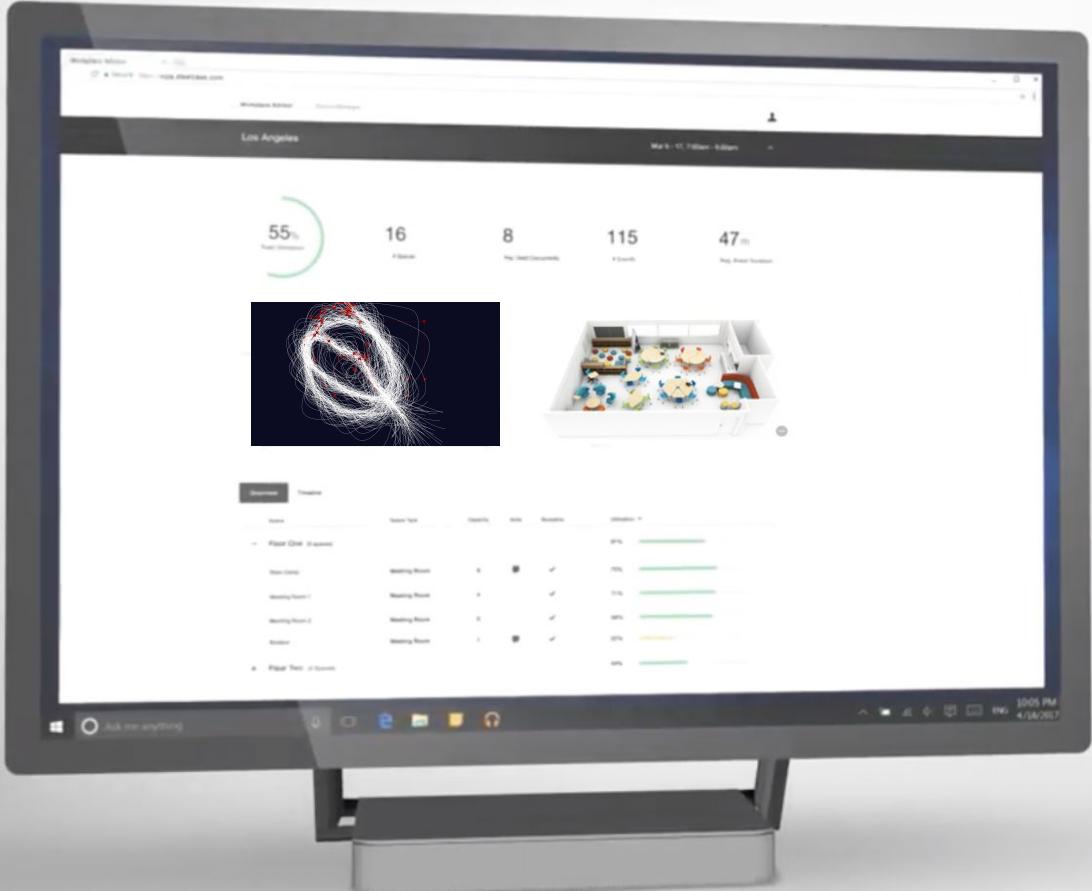


Fig4:

The patterns observed and visualized can be used in the spatial planning tool within workspaces. This feature allows for co-designing office spaces based on natural and emergent behaviors within the office. This figure shows variations of a single room based on locuses indicated in figure 3.





Steelcase®

Future Inclusion Mapping Tool

This **space planning tool** we are approaching will live as online webpage.

This is what we're making:

A tool for integrating behavioral patterns with floor plans to develop inclusive approaches to space layout.

This is what we're doing to prototype it:

Creating an approach for simulating emergent behavioral patterns and integrating spatial data to interpret adaptable approaches to inclusive workspaces.

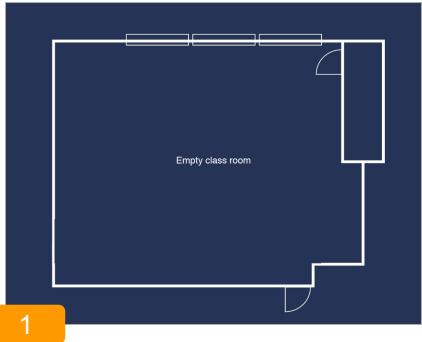
Mocking a tool that replicates the functionality of adapting parameters.

This is what is needed to make this real:

A data set of human behavior and movement in a workplace. This would include data that was aggregated over some time to show variance and options for customization.

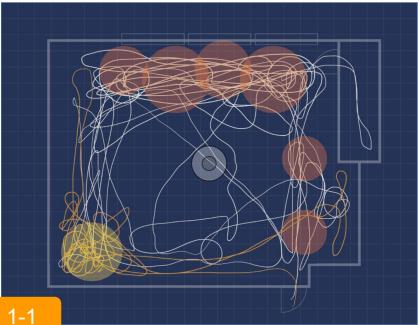
This is what it could be in the future:

A comprehensive space utilization tool that allows for customization and integration into specific work contexts.



1

Scenario - no activities



1-1

OUTPUT:

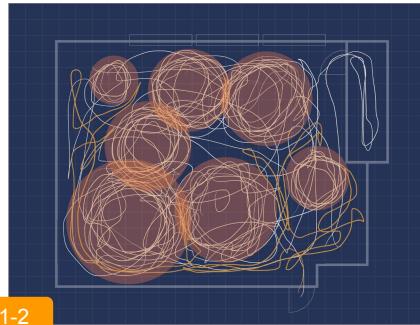
Generated path & region for neurotypical/autism people

*Behavior patterns of People with Autism - repetitive behavior, intention to isolate from others

INPUT:

Empty classroom floor plan
(with fixed installation - windows, doors)
Data of neurotypical people
Data of people with autism

Scenario - group discussion

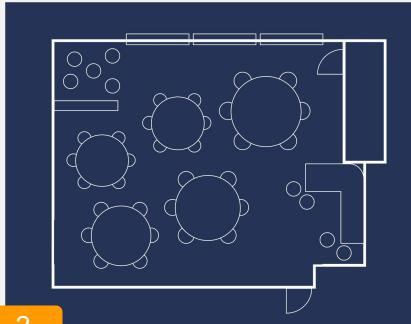


1-2

OUTPUT:

Generated path & region for neurotypical/autism people

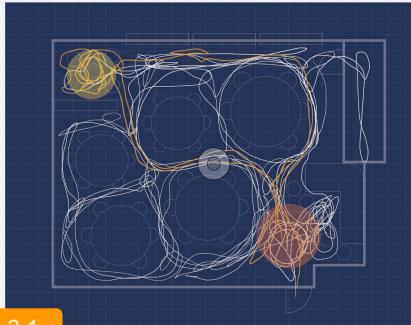
*Behavior patterns of People with Autism - Increasing anxiety driven behavior due to less room for isolation



2

HARMONIZED FLOOR PLAN:

Round table *5
Private space with shield
L-lounge sofa



2-1

More scheduled behavior of neurotypical people;
Less uncertainty for people with autism;
Private space to isolate for people with autism



**Steelcase
Qivi**

Qivi is an ergonomic chair that promotes movement and collaboration while supporting a variety of postures. It's ideal for meetings and conference rooms.



**Steelcase
Think**

The Think office chair intuitively responds to the movement of the body to provide comfort. Fully redesigned and reengineered, Think is smart, simple and sustainable.



**Steelcase
Reply**

Work happens in many places. Choices for seating are abundant with Reply — a complete global family of task and guest chairs that are as nice to look at as they are to sit in.



**Turnstone
Shortcut 5-Star**

Sleek, modern and incredibly versatile, Shortcut by Turnstone offers simple sophistication for the way you work.

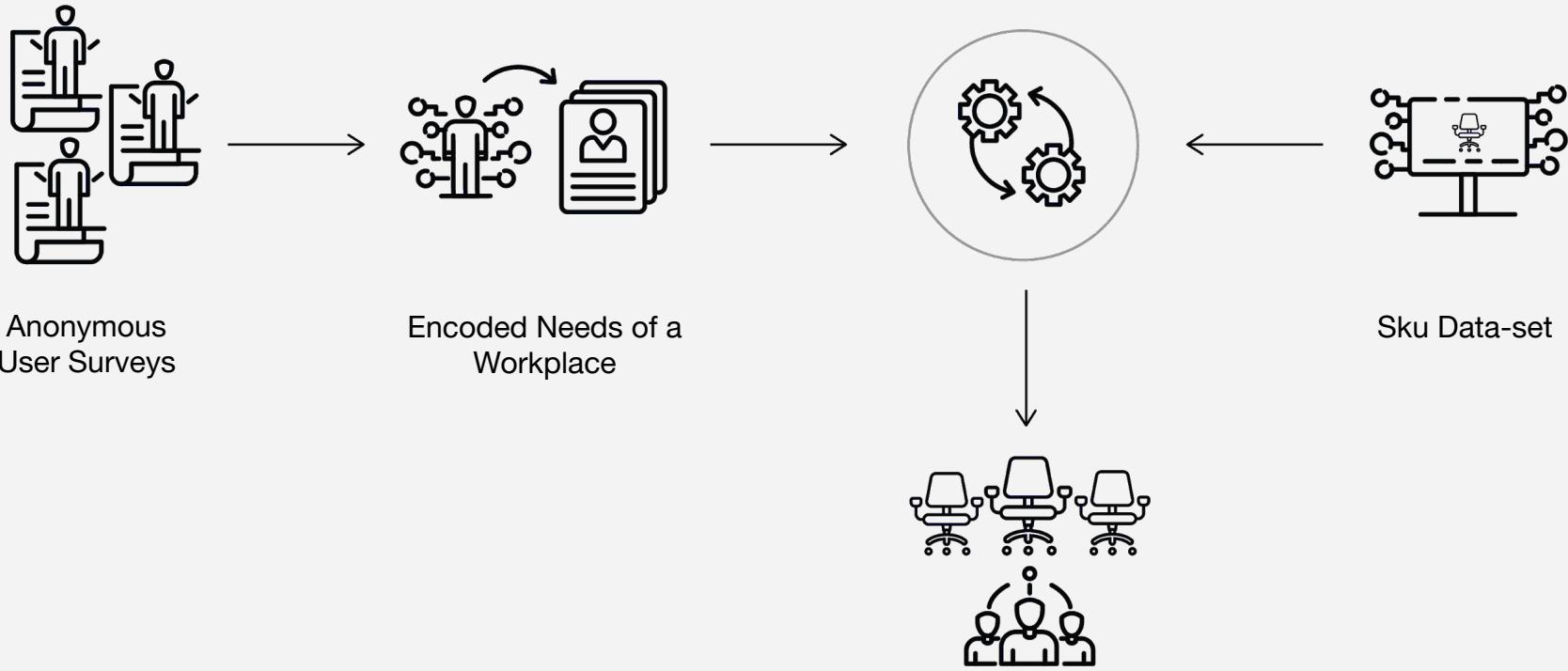
Transforming Objects

Tyler Besecker, Samar Elhouar

Our goal is to use **generative intelligence** to analyze user's needs to **recommend product combinations** and configurations that allow for a more **inclusive workplace environment**.

Inclusive Principles encoded in this tool:

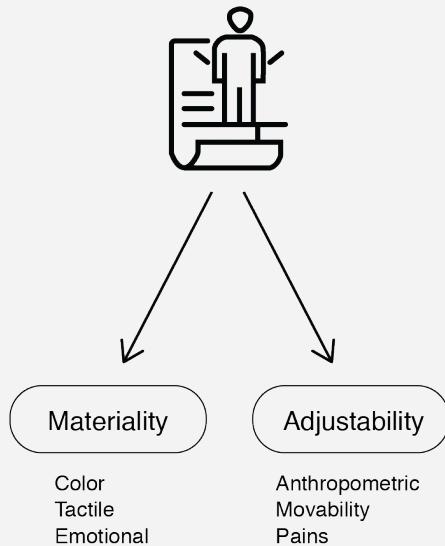
- Machine learning parameters derived from user's needs and preferences
- Diverse experiences and neurodiversity built into the collective identity of the office
- On-demand adaptability
- Specifications are unique to the context
- As learning develops the tool can respond in realtime



Combination of furnishings
to create a more
inclusive environment

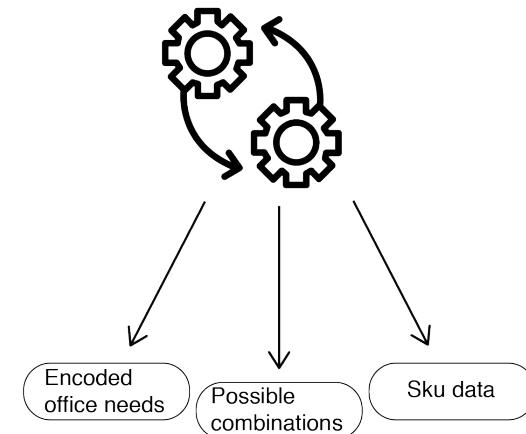
User survey

Sensitively asked questions allow the user to reflect on their work style and comfort needs in the office



Machine Learning

Matching data from user surveys to all possible sku combinations



Question 1 of 7

When collaborating with others, it is helpful when the meeting spot we work in is

A more private space
 One of our desks
 An open common space

Next →

Question 2 of 7

When I find myself losing focus, I like to

Select all that apply

Look out a window
 Look at plants
 Spin in my chair
 Take a short walk
 None of the above
 Other

Next →

Question 3 of 7

I get distracted from my work when

Select all that apply

There are many bright colors and/or patterns around me
 There is a lot of movement around me
 There is noise and echo
 The space is very quiet
 None of the above
 Other

Next →

8:30

Great Company International

Anonymous employee survey

Question 4 of 7

After spending time conversing in a room full of people

No
 Yes Select all that apply

I feel like I have less energy
 I feel like I have more energy
 I don't feel like my energy level changed

Next →

Question 5 of 7

When sitting for a long time, I begin to feel restless

No
 Yes Select all that apply

Look at plants
 Spin in my chair
 Take a short walk
 None of the above
 Other

Next →

Question 6 of 7

When working at my desk, I experience

Pain
 Fatigue
 Stiffness
 None of the above
 Other

Next →

Question 7 of 7

The pain I experience when working at my desk affects my

Upper back
 Lower back
 Neck
 Shoulders / Elbows
 Arms
 Hips
 Legs
 None of the above

Next →

Question 7 of 7

In comparison to most of the people in my office, I am

Taller
 Shorter
 Similar height

Next →

AMERICAS (English) | CONTACT | FIND A DEALER

Great Company International

Steelcase

Products Brands Design Resources 360 Research Spaces + Inspiration About

Our personal recommendation for your office backed by Machine Learning technology

SEARCH PRODUCTS

REFINE RESULTS

SEATING

- Office Chairs
- Guest Chairs + Stools
- Collaborative Chairs
- Lounge Seating
- Clinicians + Patient Chairs
- Sofas + Sleepers

DESKS + TABLES

STORAGE

32

Steelcase Think

The Think office chair intuitively responds to the movement of the body to provide comfort. Fully redesigned and reengineered, Think is smart, simple and sustainable.

Save image

Benefits of the Think chair for your office >

More information >

14

Steelcase Series 1

Steelcase Series 1 office chair delivers on what's important - performance, style and choice. It retains everything that's valued in a chair, while making it attainable for everyone.

14

Steelcase Leap

Leap is a desk chair that provides a high performance, ergonomic solution for any office.

Search



Company A

Employee survey

1 When collaborating with others, it is helpful when the meeting spot we work in is

- A more private space
- One of our desks
- An open common space

2 When I find myself losing focus, I like to

Select at least one

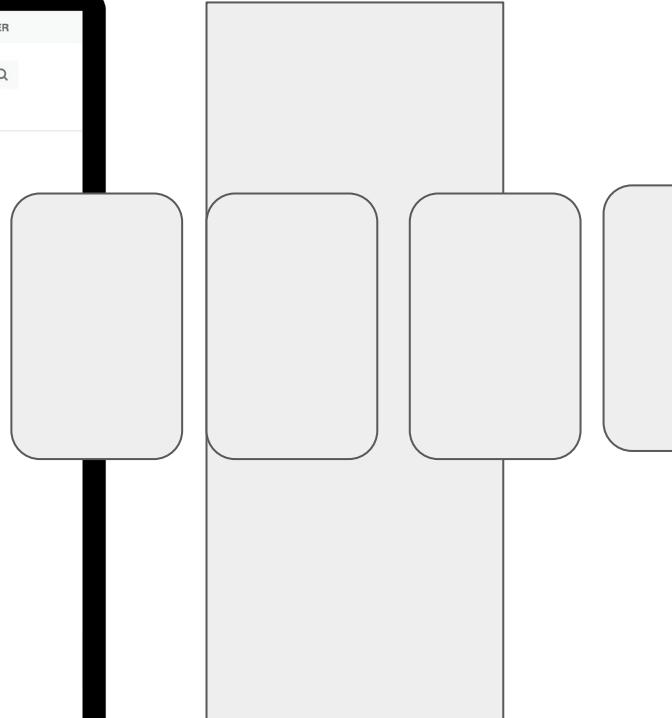
- Look out a window
- Look at plants
- Spin in my chair
- Take a short walk
- None of the above
- Other, _____

3 I get distracted from my work when
seen at my desk

- There are many bright colors and/or patterns around me
- There is a lot of movement around me
- There is noise and echo
- The space is very quiet
- None of the above
- Other, _____

4 After spending time conversing in a room full of people

- I feel like I have less energy



AMERICAS (English) | CONTACT | FIND A DEALER

Steelcase

Products Brands Design Resources 360 Research Spaces + Inspiration About

Results Based on Surveys

SEARCH PRODUCTS

Type keywords or style numbers

REFINE RESULTS

SEATING

- Office Chairs
- Guest Chairs + Stools
- Collaborative Chairs
- Lounge Seating
- Clinicians + Patient Chairs
- Sofas + Sleepers

DESKS + TABLES

STORAGE

Steelcase Think
The Think office chair intuitively responds to the movement of the body to provide comfort. Fully redesigned and reengineered, Think is smart, simple and sustainable.

Steelcase Steelcase Series 1
Steelcase Series 1 office chair delivers on what's important - performance, style and choice. It retains everything that's valued in a chair, while making it attainable for everyone.

Steelcase Leap
Leap is a desk chair that provides a high performance, ergonomic solution for any office.

This is what we're making:

A tool aimed at specifying the appropriate product combinations and configurations to enable a more inclusive workplace.

Sample anonymous survey capturing biometric, behavioral, and inclusive factors.

Sample task chair dataset with evaluations of inclusive factors

This is what we're doing to prototype it:

Applying generative intelligence to specify an appropriate combination of task chairs for a workplace.

This is what is needed to make this real:

Comprehensive Sku data set with rules for what sku combinations are possible.

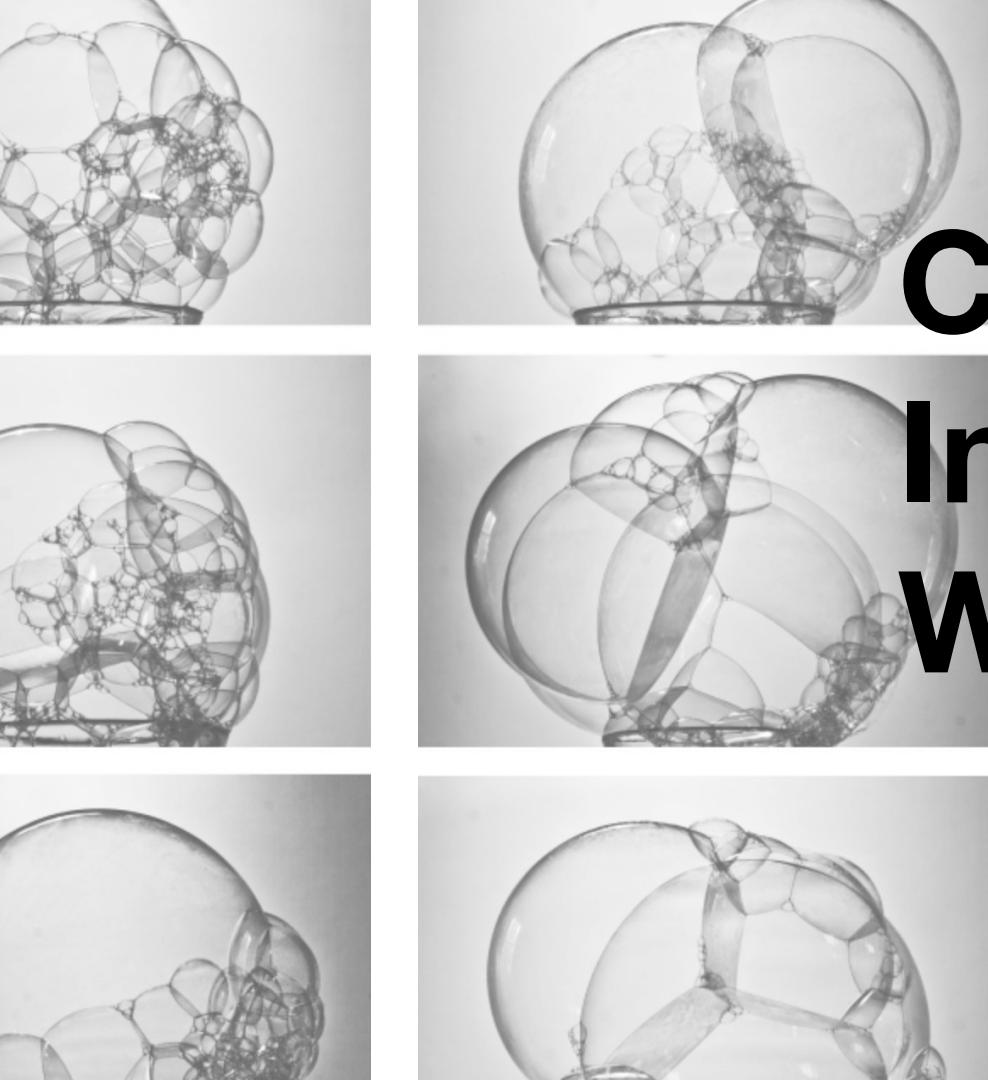
Anonymous survey into individuals needs, merged into a computational model of a workplace.

Capture of successes, failures, and corrections to inform and improve the algorithm.

This is what it could be in the future:

A proprietary tool for analysis of workplace factors like inclusivity, ergonomics, etc.

Realize deficiencies in offering and fill product opportunity gaps



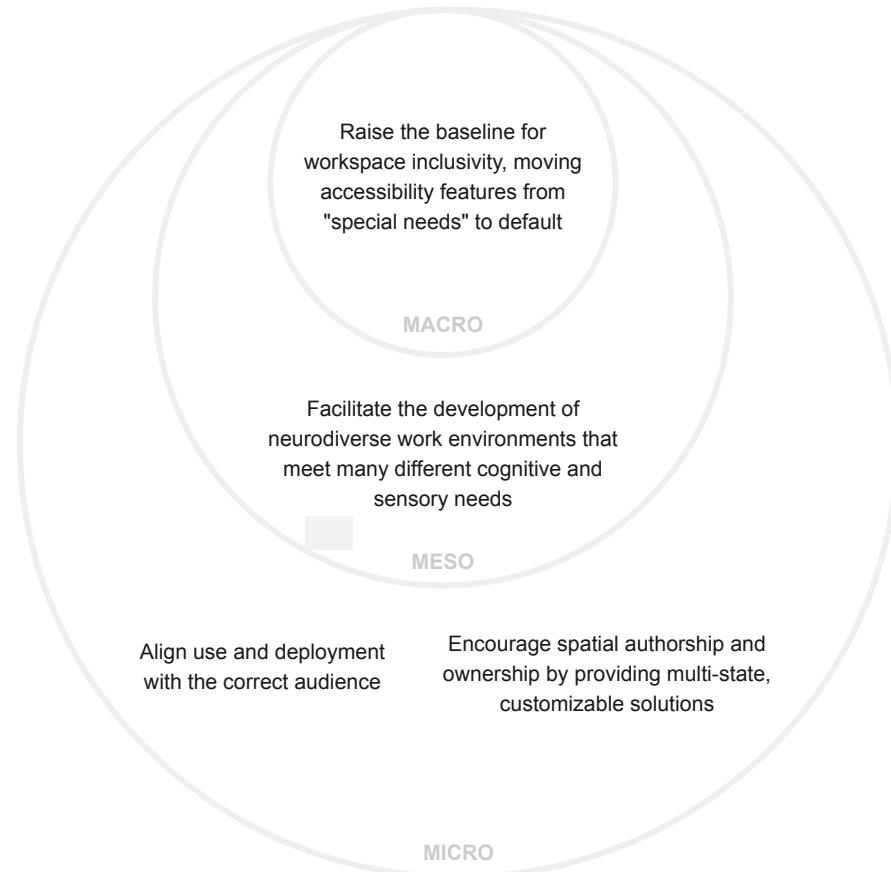
Co-authoring Inclusive Workspaces

Kie Ichikawa, McKinley Sherrod, J. Smyk

We aim to design a workspace intervention that facilitates spatial authorship, flexibility, and ownership. This design – tentatively called “Sculpt-FOR” – focuses primarily on **enabling neurodiverse work environments**.

- **Generative design** will help us determine the optimal design details given a set of spatial characteristics discerned from floorplans, sensors, or lived experience.
- Traditional **human-centered design** will help us refine the design and make sure it is physically inclusive.
- The end-user will **co-design** the final outcome, deciding how to deploy and engage various functions of the design.

PROJECT GOALS



From inclusive design principles to design criteria

Reduce barriers to engagement for people with physical disabilities. Easy to handle.



Semi-anchored location – removes accessibility barriers to physically moving an object to the desired area.

Trust the user to help co-construct or manipulate the object to best fit their needs.



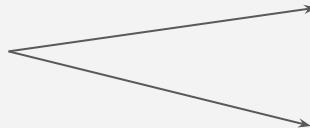
Adjustable positioning – allows each user to manipulate the object according to their preference.

Leverage generative design to reduce cognitive load and need for self-advocacy in the workplace.



Customized at purchase – analyzes spatial characteristics, resulting in a site-specific object that can immediately ease workspace friction

Embrace fluidity to account for users' changing needs and desires – of both the individual and group



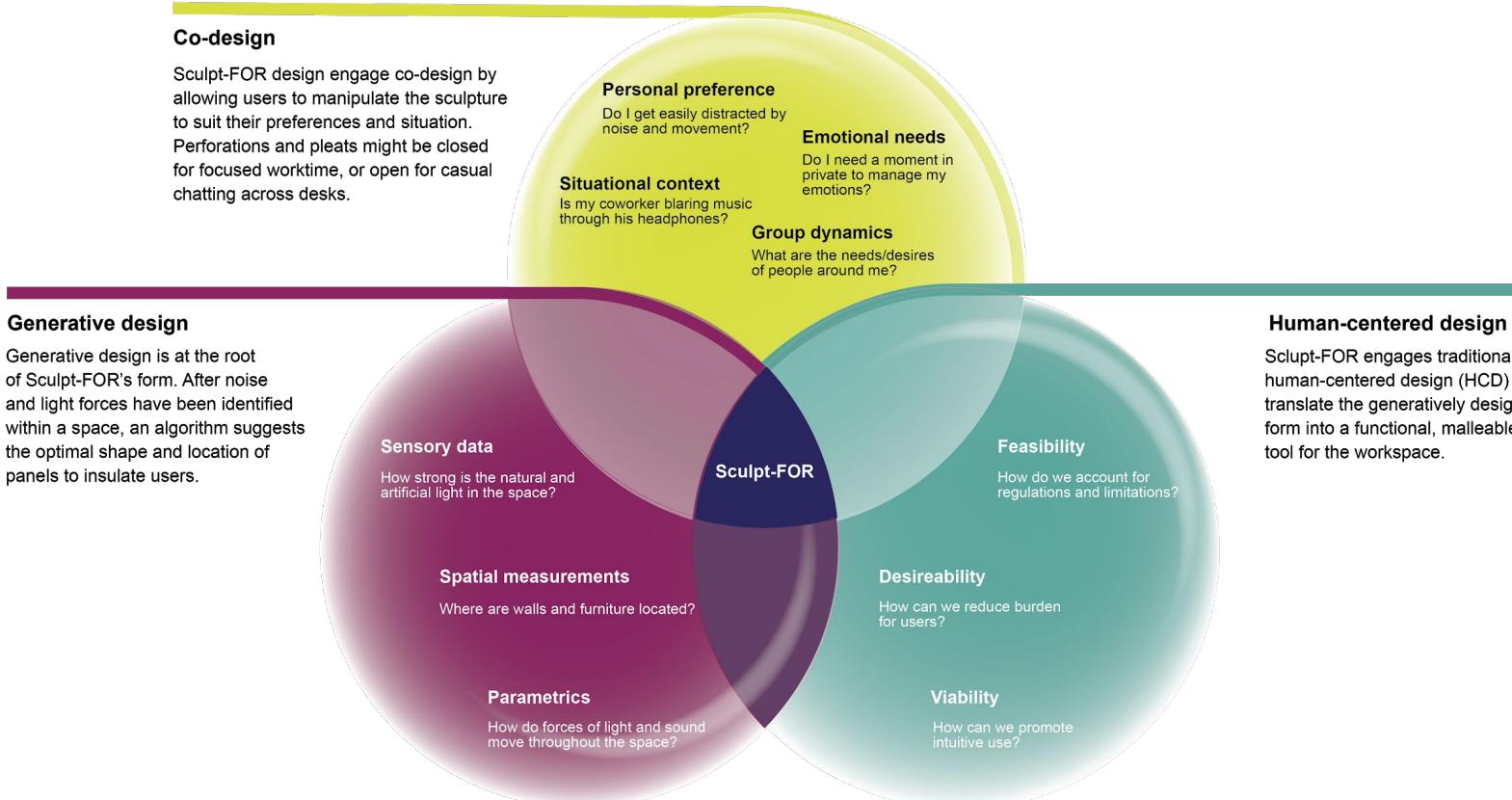
Deployable – allows for flexible use and changing needs or preferences.

Acknowledge nuance to consider how the deployment of an object by one individual might adversely affect another.

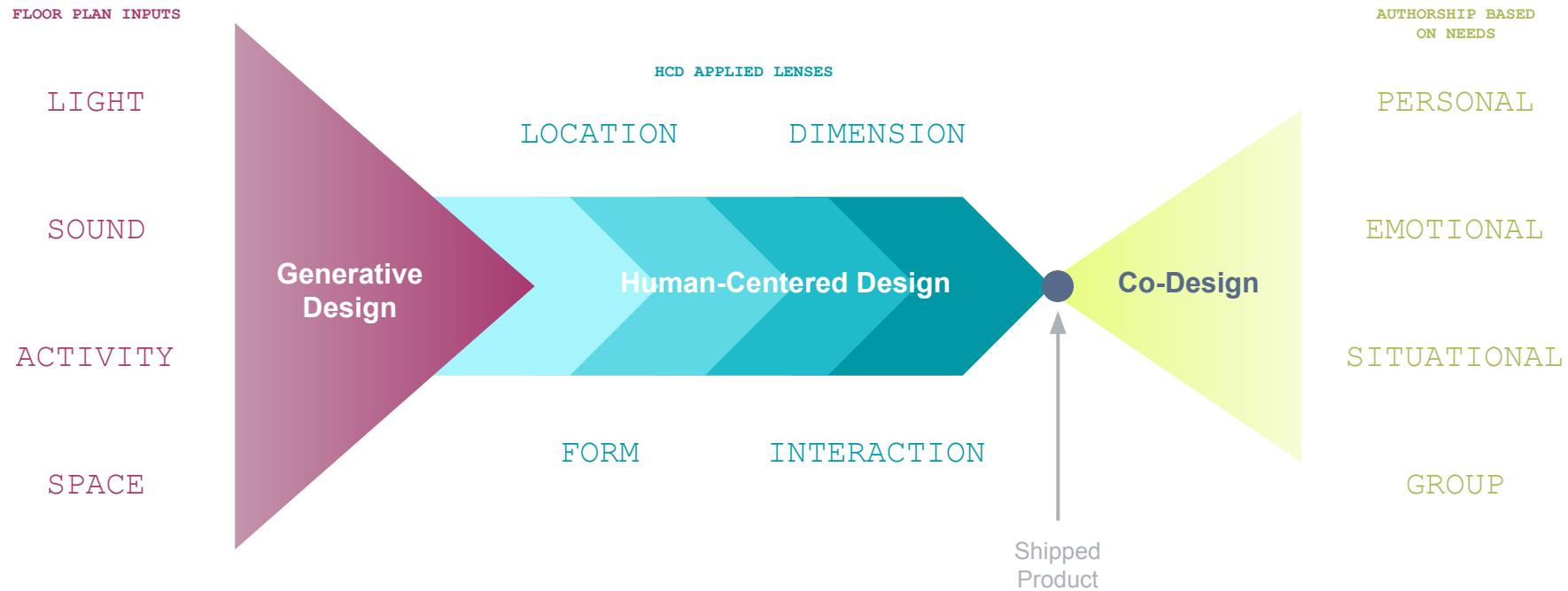


Multi-state – promotes user authorship by providing a variety of options for engagement

Multi-experiential – provide possibilities for individuals to engage differently at the same time

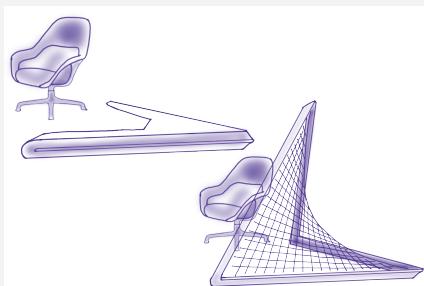
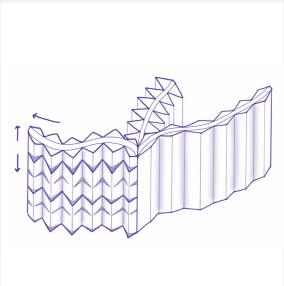
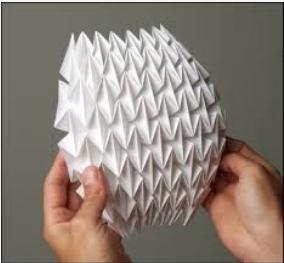


How Sculpt-FOR is created



Early inspiration

We took early inspiration from paper-folding techniques, which provide extreme state-changes for relatively little effort.



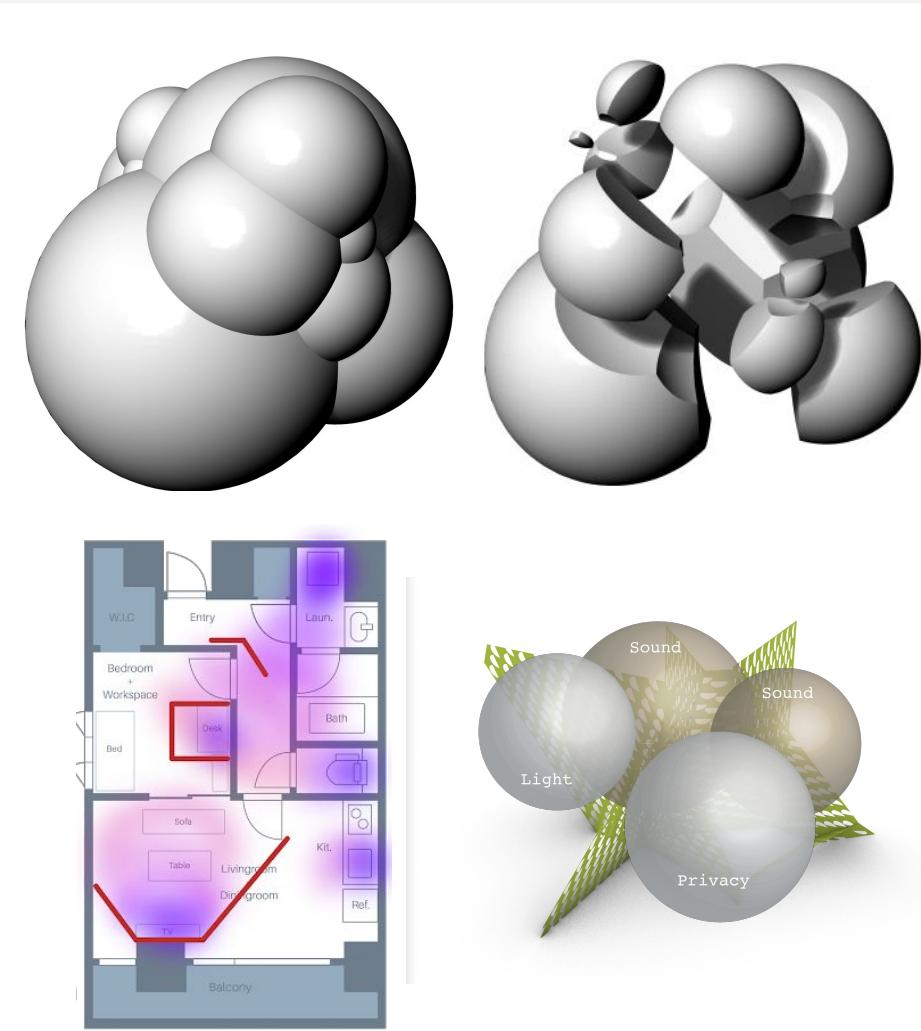
We identified wool felt as a promising primary material, due to its acoustic dampening properties, durability, and visual and physical softness.



Understanding space through hyperbolic forms

Using the logic of **hyperbolic paraboloids**, we can imagine audio, visual, and kinetic forces of a workspace as bubbles, with their radii corresponding to the force's potential impact.

By this logic, **the planes where the bubbles meet are the best places to insert spatial boundaries, which can then be popped or perforated as needed based on desired interactions and personal preferences.**



In context



This is what we're making:

-An algorithm-driven product that shapes new cultures in the workspace.

This is what we're doing to prototype it:

- Using Grasshopper to build simulated geometries.
- Demonstrating the end-product through renderings, diagrams, and paper models.

Limitations: not considering structural stability or manufacturing needs.

This is what is needed to make this real:

- Determine the best way to collect data around individual office space layout, materiality, and utilization...

And develop it?

This is what it could be in the future:

- Customizable family of products powered by a proprietary algorithm.
- Could expand into a future full-fledged product line with similar inputs and PoV.

A soft-focus background image of five diverse professionals in a modern office environment. From left to right: a young man in a grey t-shirt and glasses sitting in a high-backed chair; a man in a light blue button-down shirt sitting in a low-backed chair; a woman in a dark sleeveless top holding a white folder; a woman in a black blazer and glasses in a wheelchair; and a man in a dark polo shirt standing and holding a tablet. They are all smiling and appear to be engaged in a positive interaction.

Steelcase  **ID**

Why slide

- Why our work matters
- Why steelcase
- What is the future look like
by having our work

Future explorations

Next steps

- Support people with physical disabilities
- Affordance – Consistency in design to enhance an engagement with the objects (e.g. handle design)
- (Material research)
- Customer journey – Consumer buying processes
- Training, Education inside the client company

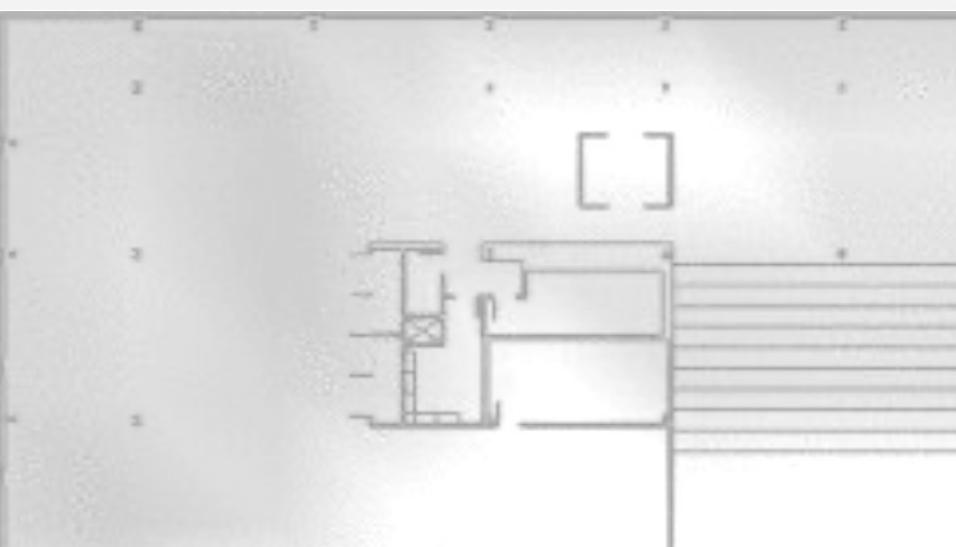
Tension

- User specificity <-> Site specificity
- Sense of belongings <-> Shared use

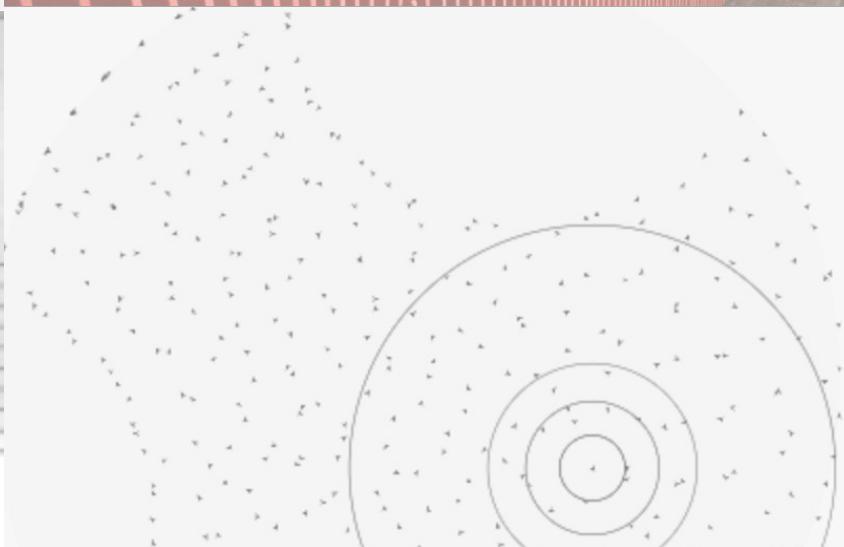
Our Approach

“Infographic” / diagram should show...

- How **spatial** data is collected
- How **person** data is collected
- Inputs/outputs of algorithm
- Internal logic of algorithm? At high level
- Output (what is it?)
 - Which elements user can manipulate
 - Which elements are “static” [suggested form]
- Process: algorithm suggests form → designer translates/”cleans up” form → user decides how to deploy form in space?



Sculpting Inclusion



Project Description

Mapping Present

Through the utilization of metadata from **spatial** and **cultural inputs**,

We are creating a **tool** enables Steelcase dealers and designers to

evaluate, educate, and embed inclusivity into design offerings.

Tool Objectives

Mapping Present

1. Assist dealer designers to evaluate the levels of inclusion a floor plan offers.
2. Catalyze education/conversation between designer and client around cognitive diversity, inclusion, and how designing environments with these values is critical to employee wellbeing and productivity.
3. Act as a complementary tool to the current specifying process to build inclusivity into designs.

Example

Mapping Present

Diagram

Mapping Present

Inclusive design

Point of view

1. Reduces the cognitive, emotional, and physical load of the user
2. Accommodates a wide range of potential users, and offers those individuals a choice in how they engage with the design
3. Enables individuals to fully participate in an activity or space and/or adjusts the threshold for full participation

Inclusive workspace

Point of view

1. Offers a diversity of options for individuals to choose from.
2. Can evolve and adapt to the people within it.
3. Accommodates multiple work styles.
4. Promotes awareness of inclusive practices and features.
5. Encourages individuals to advocate for themselves if their needs are unmet.

Designers' role

Point of view

1. Understand space and objects as non-neutral actors
2. Engage a diverse set of users to co-design and test solutions
3. Consider the culture and context of space/organization/company
4. Assess and iterate continuously after initial implementation
5. Embed capabilities for design to adapt and evolve over time