In Sense Sync

Integrating bio-based materials derived from nature to support sensory regulation, emotional grounding, and inclusive learning for ADHD users in Leith, Edinburgh.

The exploration of biomaterials emerged from a dual recognition: the heightened sensory sensitivities of neurodivergent users, and the environmental urgency to move away from synthetic, overstimulating materials common in institutional design. As I investigated the specific needs of individuals with ADHD, particularly their interactions with texture, temperature, and tactility. It became evident that the material language of conventional learning spaces often neglects their sensory experience. In parallel, I observed the abundance of organic waste in domestic and commercial settings, particularly eggshells and coffee grounds, which are rich in tactile potential yet absent from architectural discourse. This overlap revealed a clear design opportunity: to transform these waste materials into biodegradable, sensory-supportive surfaces that respond to neurodivergent needs while embedding ecological responsibility into the built environment. The resulting material investigations serve not only as architectural finishes, but as tools for self-regulation, engagement, and inclusion, positioning materiality itself as a form of care.

Benefits of Biomaterials

- Sensory compatibility
- Sustainability & Circularity
- Low embodied energy
- Customisability
- Tactile & Emotional Connection

Biomaterial Experimentation

I collected eggshells and coffee grounds as my base materials from neighbour bakeries and café.

Boiled and dried eggshell

Crushed eggshell powder

Used coffee grounds

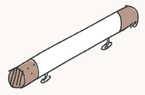
Corn starch

Corn starch and gelatin acts as a binder to build the materials

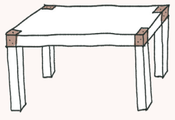
First Experimentation Outcome

Coffee grounds+Starch

Eggshell powder + Gelatin+Coffee grounds



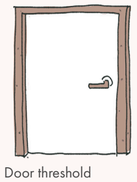
Handrail



Bench corner

Eggshell powder+ Gelatin

Crushed eggshell+ Starch



Door threshold

The eggshell composite, composed of powdered eggshell, gelatin, results in a matte, softly resistant surface. Its crumbly texture offers non-distracting tactile stimulation, ideal for transitional spaces, furnitures, and handrails where users may seek repetitive, grounding contact. The coffee ground composite, by contrast, produces a denser material with a warmer temperature profile and faint earthy aroma, suited for threshold zones or quiet corners that benefit from passive multisensory cues.

Sampling

The sampling stage focused on developing a biodegradable eggshell composite that supports tactile engagement and visual sensory comfort. Powdered eggshells were combined with gelatin to create a malleable yet structurally stable material. To explore natural colour variation and reduce visual monotony, a range of dyes, chlorophyllin, cutch, and iron. The resulting soft, earthy tones aligned with the project's aim to avoid overstimulating colour while providing calming visual cues to support focus and spatial orientation.

Step 1 Prepare enssential materials

Ground Eggshell 48g

Gelatin Powder 10g

Lukewarm water 20mL

Step 2 Prepare other materials

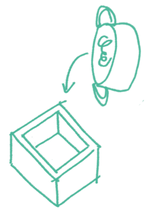
Natural Dye

Chlorophyllin 0.2g

Cutch 1g and Iron 0.1g

Step 3 Mix all materials in a pot over low heat until pasty.

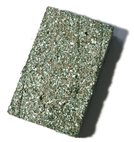
Step 4 Pour mixture into mold.



Step 5 Remove from mold when dry and hardened.

True Colour

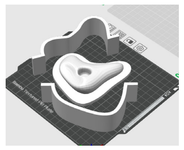
Cutch 1g & Iron 0.1g



Chlorophyllin 0.2g

Prototype

The climbing grip was developed to align with the building's physical learning space, a key area supporting movement-based learning for ADHD users. Designed to offer proprioceptive input, the grip enables focused physical engagement, aiding in self-regulation and sensory grounding. It also served as a test for the durability and tactile quality of the eggshell composite, demonstrating how material and movement can work together to support inclusive spatial experience.



3D modeling

3D printed mold

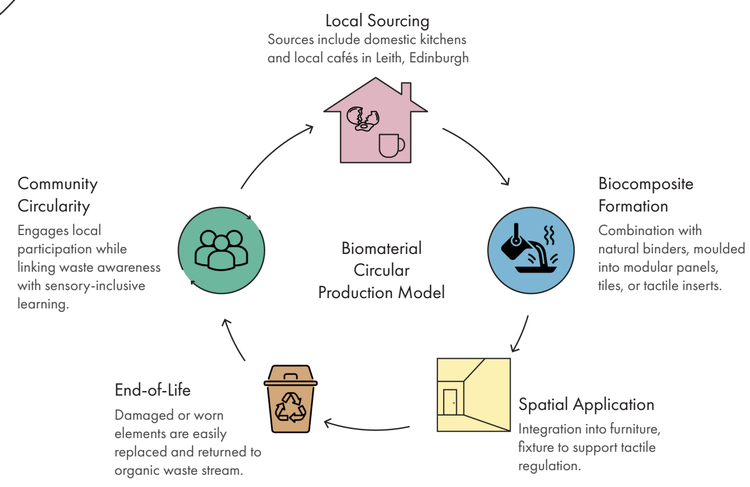
Silicone casting

Silicone mold

Biocomposite into mold

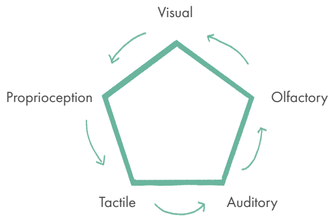
Scalable Potential

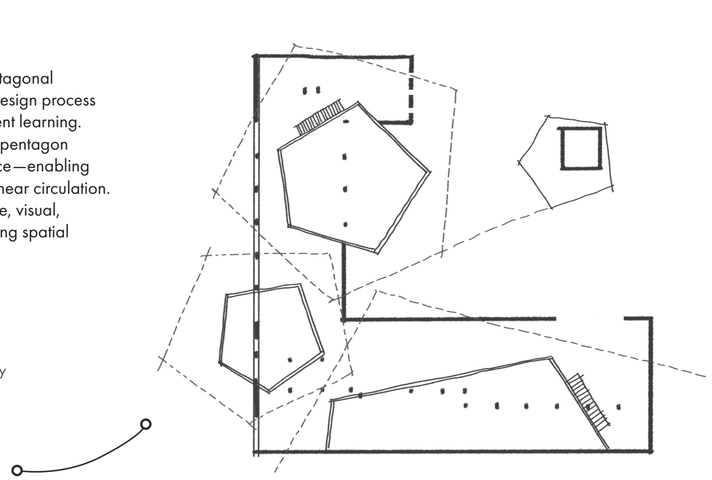
The climbing grip prototype demonstrated the material's suitability for broader use across the space. Its biodegradable, mouldable properties make it adaptable for furniture, wall panels, and sensory fixtures. Moving forward, the aim is to establish a circular production model, transforming local waste into durable, sensory-supportive elements for inclusive environments.

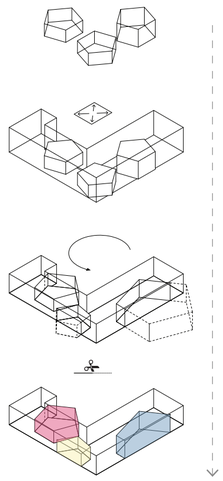


Spatial Arrangement

The spatial arrangement is structured around a pentagonal geometry, developed through a sensory-focused design process informed by research into ADHD and neurodivergent learning. Drawing from the framework of the five senses, the pentagon serves as both a symbolic and organisational device—enabling intuitive zoning and supporting a more fluid, non-linear circulation. This configuration allows for the integration of tactile, visual, auditory, olfactory, and proprioceptive cues, aligning spatial experience with the sensory needs of its users.







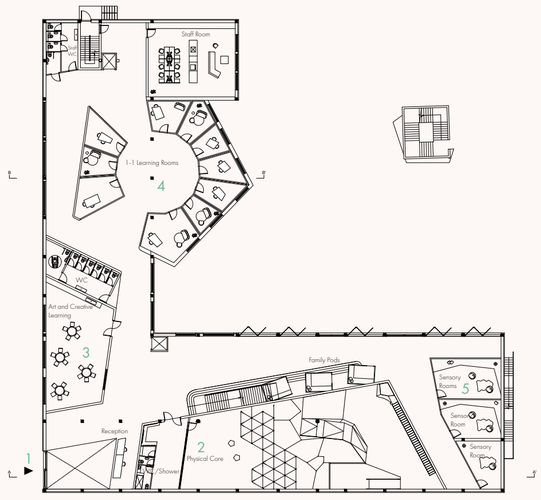
Pentagons are initially placed within the site context to establish the basic spatial framework and overall geometric rhythm.

Each pentagon is resized according to the functional requirements of the core spaces, allowing the layout to respond to programmatic needs.

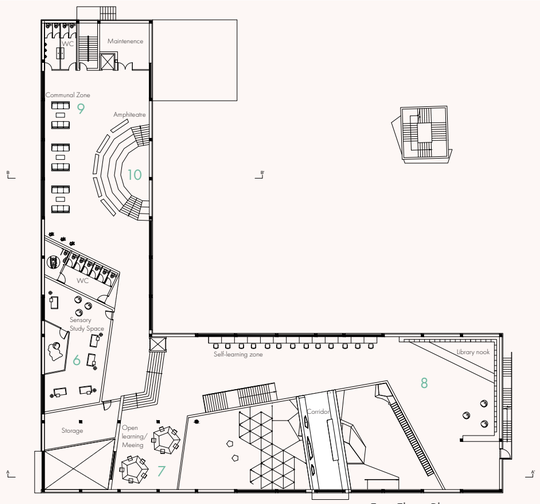
The pentagons are rotated strategically to form clear and intuitive circulation paths between enclosed zones, enhancing spatial flow.

Excess parts of the pentagons that extend beyond the existing site boundaries or structural walls are trimmed to maintain coherence and spatial efficiency.

Children engage in a series of activities that support physical movement, sensory exploration, and social interaction, encouraging both spontaneous play and self-directed learning.



Ground Floor Plan

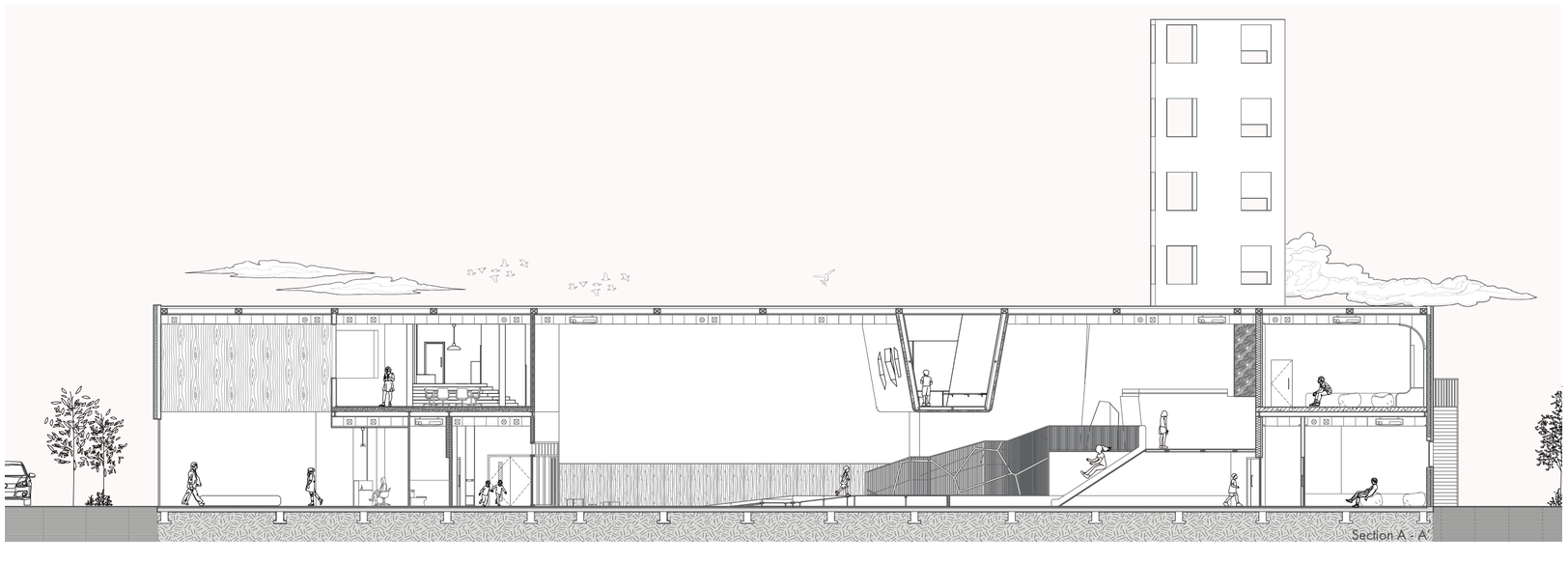


First Floor Plan

KEYS

1 Entrance
2 Physical and Play Core
3 Art and Creative Learning
4 1-1 Learning rooms
5 Sensory Rooms
6 Sensory Study Space
7 Open Learning/Meeting
8 Library
9 Communal Zone
10 Amphiteatre

This corridor overlooks the Physical and Play Core while leading toward a large window, drawing in natural light and offering a quiet moment of pause and rest.



Section A - A'

The self-learning space faces the garden and the tower, offering a light-filled environment that encourages focus, reflection, and connection with nature.