

A SYSTEM FOR MAPPING YOGA

DIGITALLY MAPPING YOGA TO CREATE A VR YOGA GUIDE

HARRIS MAWARDI
YR 3
BARC0106

Lockdown sparks global yoga craze, digital health survey shows

May 4, 2020

Digital health firm Withings has used its technology to produce a read-out of how COVID-19 lockdowns have affected the health of its users, showing a smaller than expected increase in weight, a global yoga craze and an increase in exercise in some areas of the US.

International Day of Yoga: yoga's growing importance to post-COVID-19 wellbeing

Meditation and Yoga Practices as Adjunctive Therapies for COVID-19

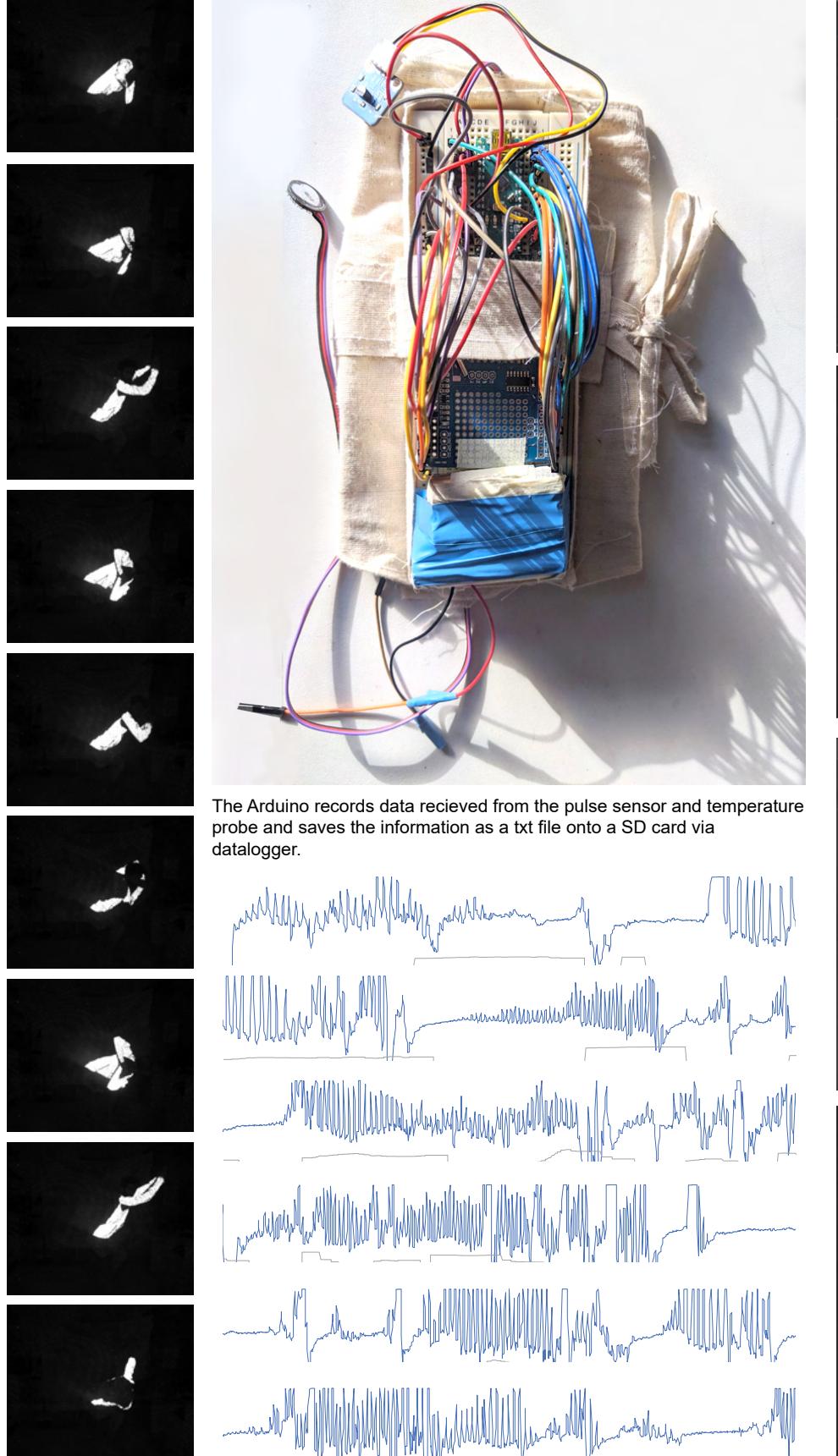
by Sarah McEwen, PhD

WASHINGTON: People staying indoors due to coronavirus lockdown could benefit from yoga which helps boost immunity, according to an Indian-American cardiologist who has written guidelines on behalf of the American Heart Association on the role of meditation in cardiovascular disease.

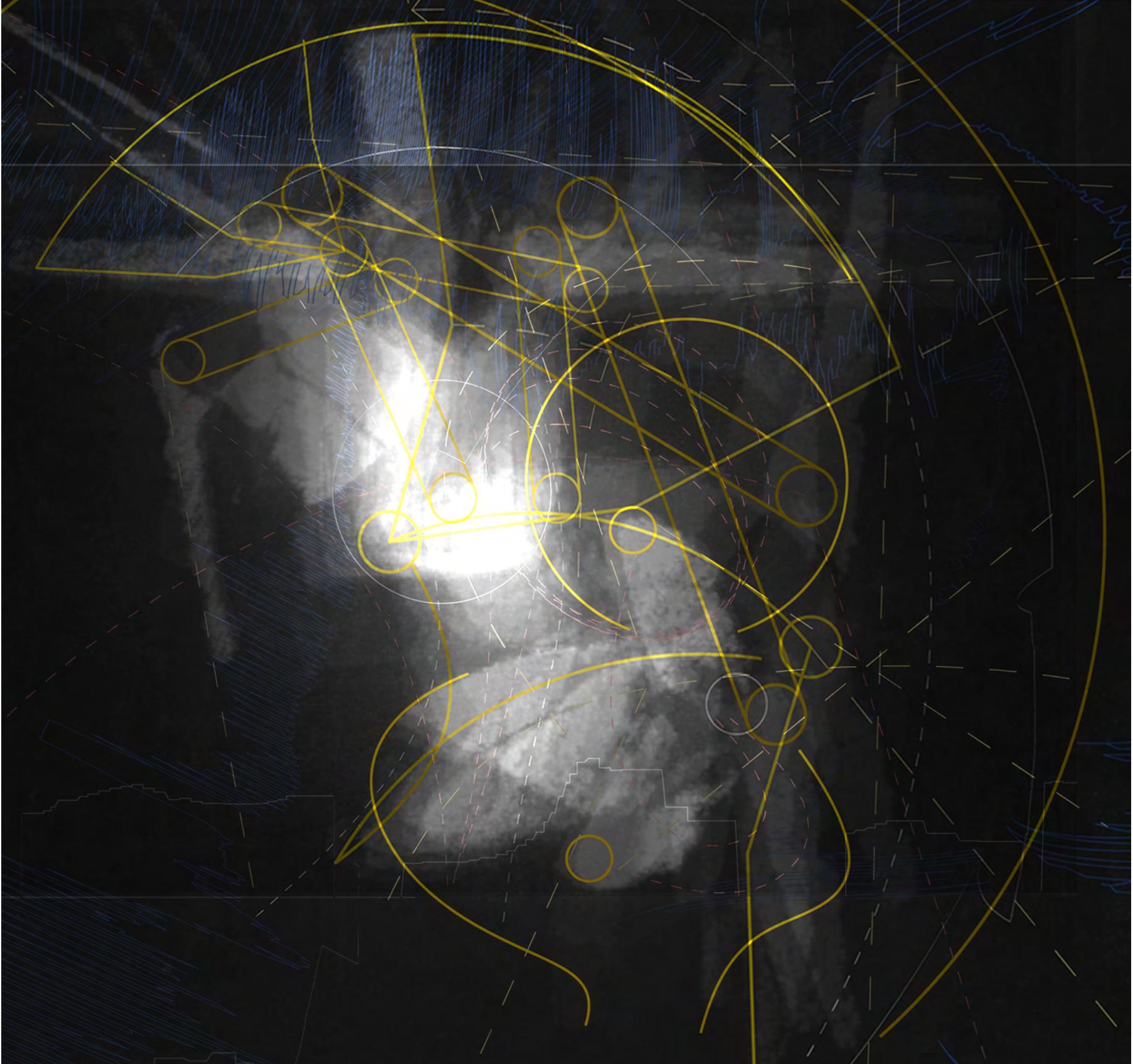
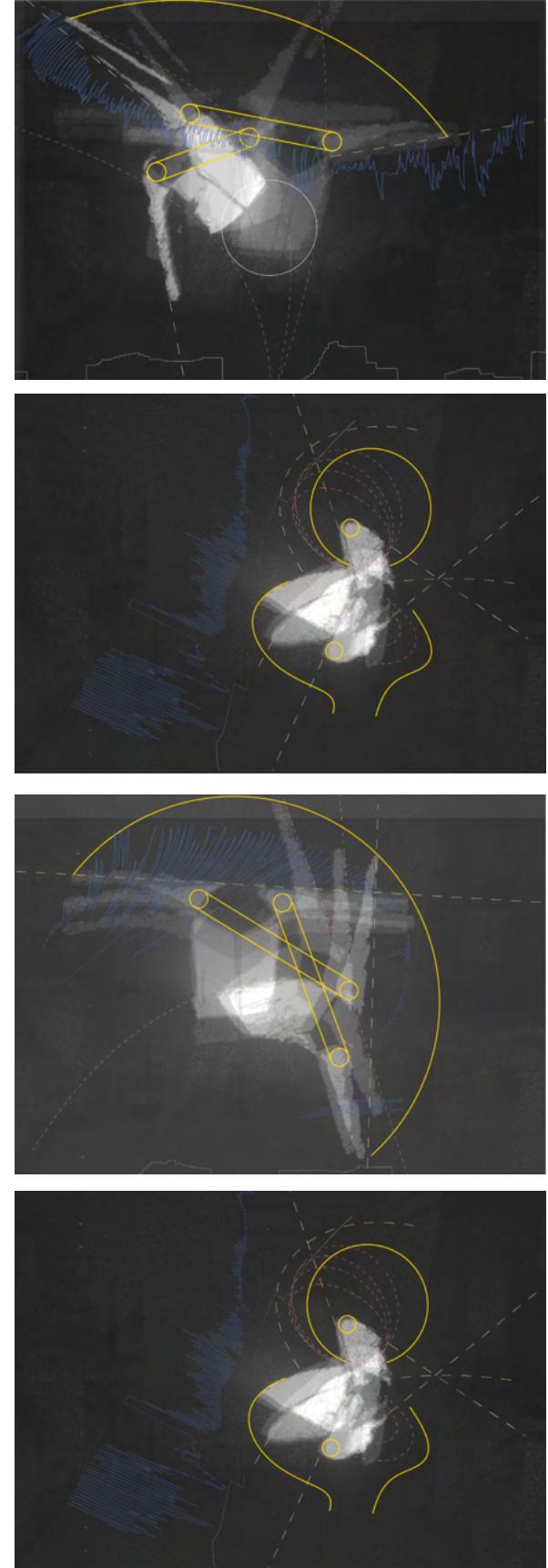
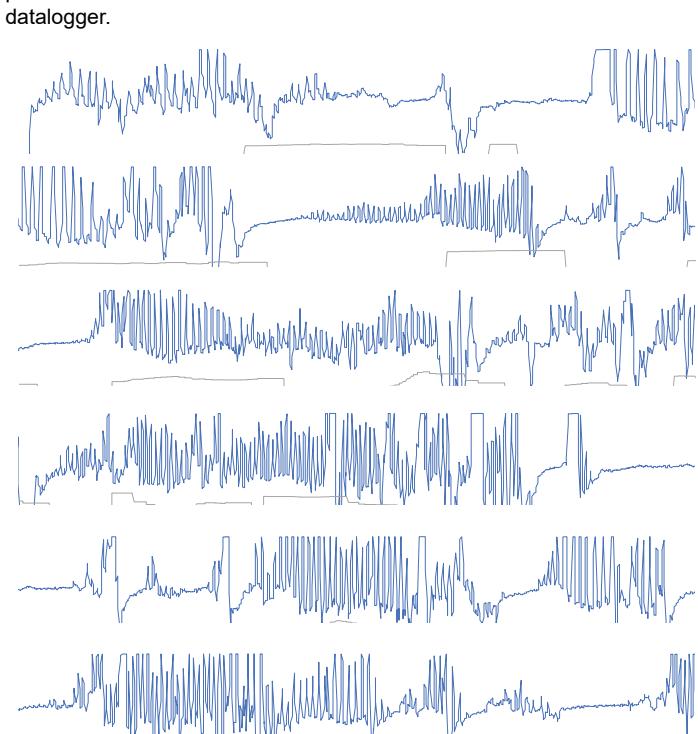
Yoga as interaction during lockdown

The practice of yoga during the COVID-19, as seen a large influx due to a desiree to manage anxiety, practice mindfullness, exercise or as some research suggests to boost the immune system.



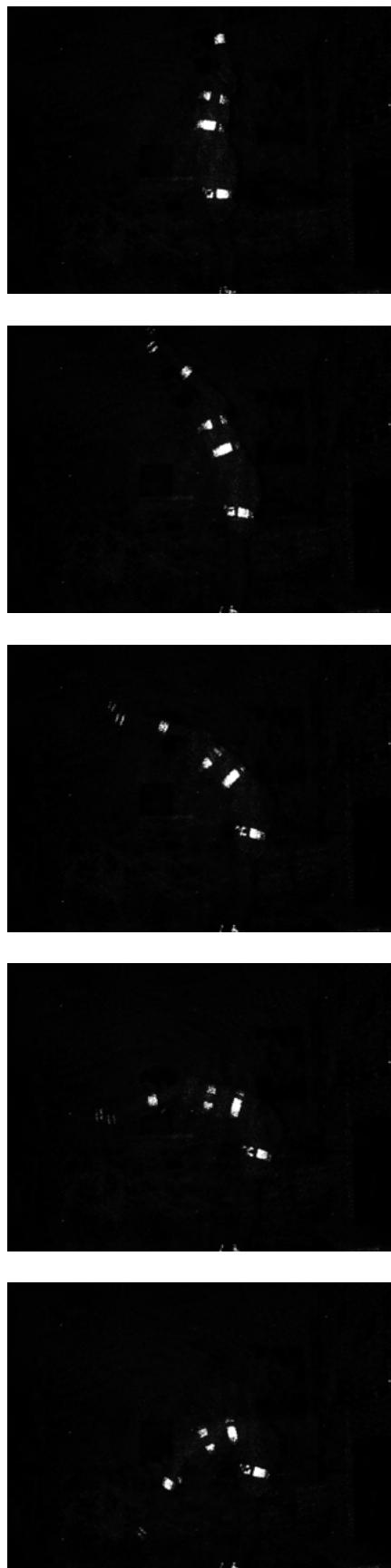


Reflective surface detected using an infra-red camera.

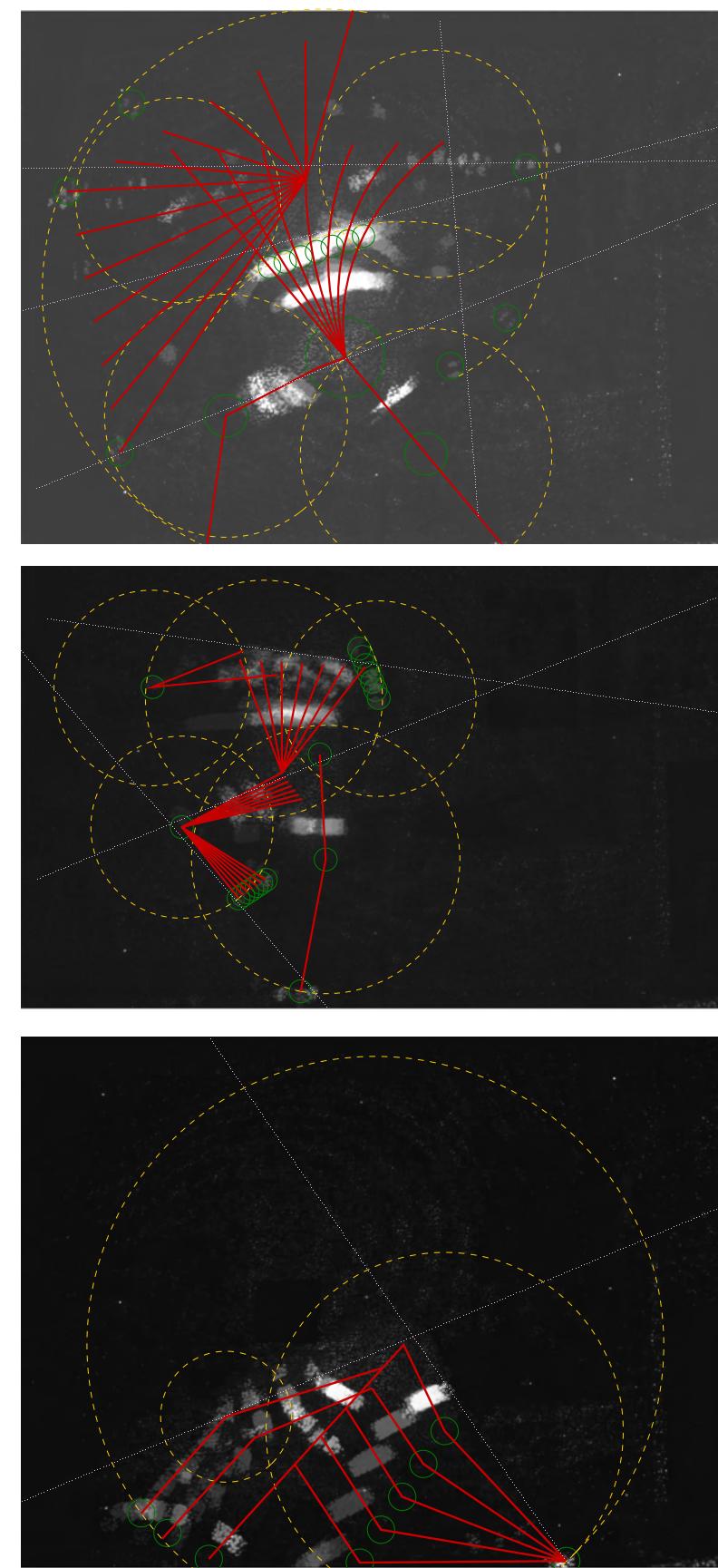


Collecting data of body conditions

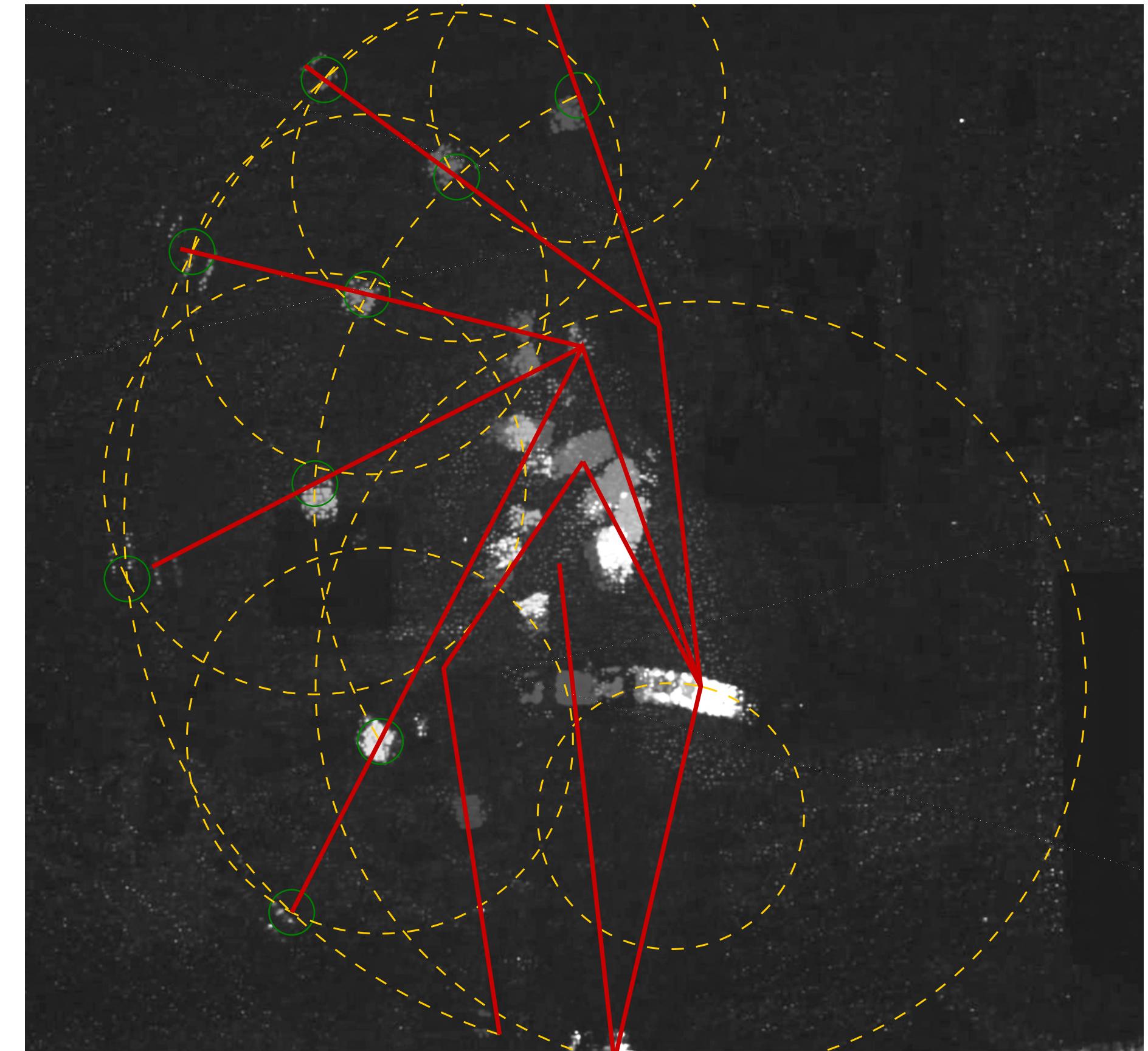
An arduino micro-controller was intergrated into a garment that records the pulse rate and the temperature of the body condition. The data was then included graphically into the motion traced images of each of the poses. These annotations focus on the physical paths made by the limbs as well as the imagined spaces of tension that form during the stretching of the body.



Frames from the recorded footage. The specific body areas are visible in white.



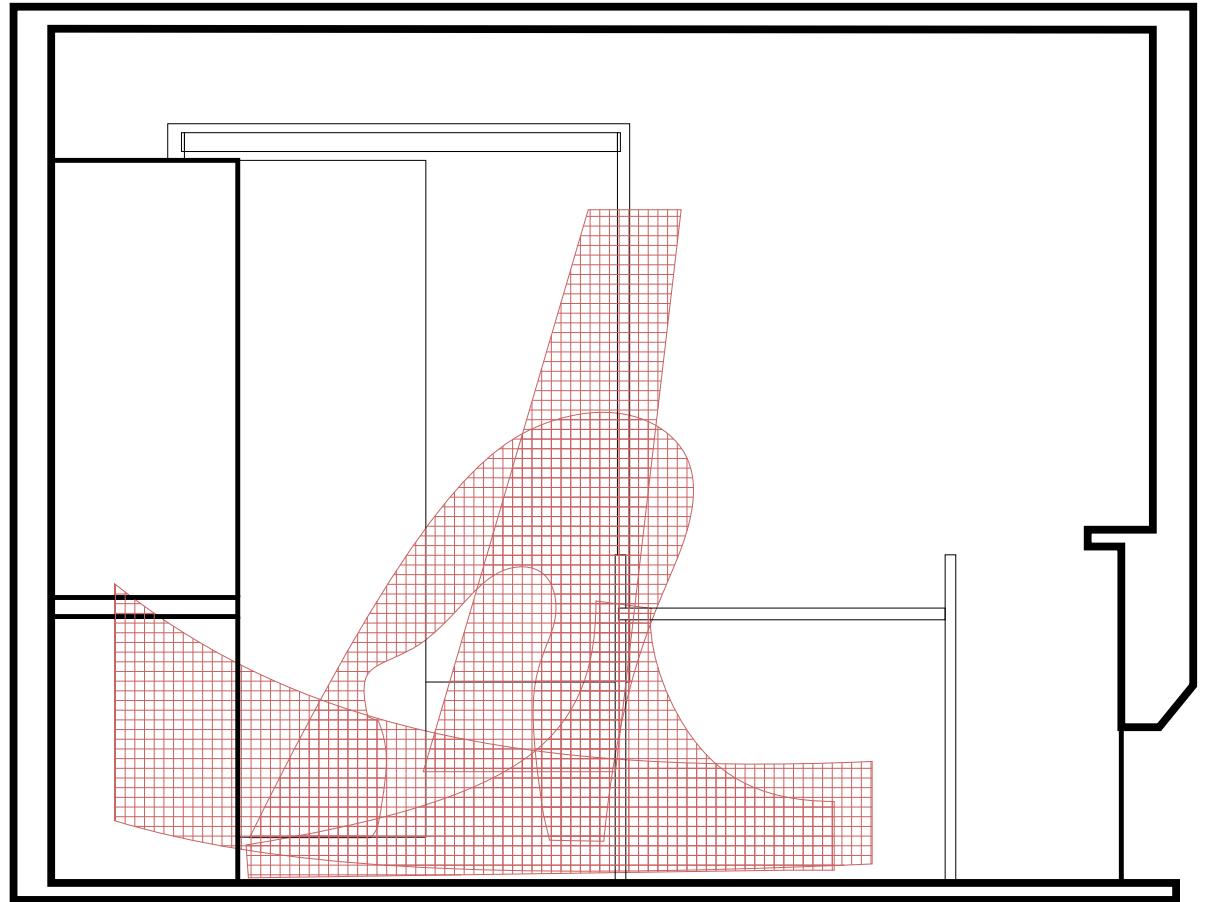
(Top) Warrior Flow, (Middle) Tree, (Bottom) Downward Facing Dog



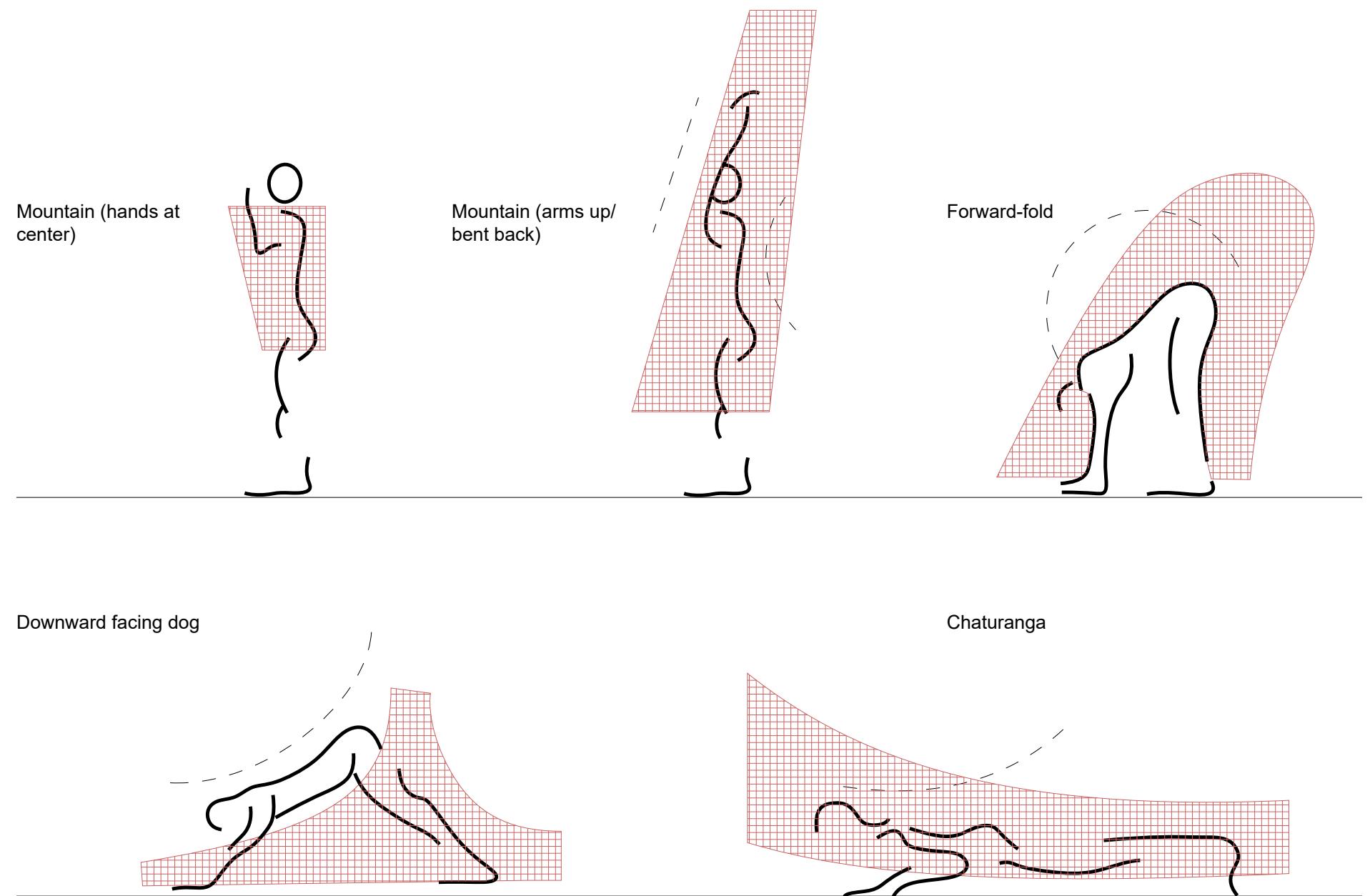
The annotations are highlighting the positions of the limbs (red) and joints (green), the potential orbits of each of these body parts (dotted yellow). If the body has a direction of general alignment then this is indicated (dotted white.)

Motion tracking: passive tracking points

To increase the accuracy of the body observations using an infra-red camera, reflective strips were attached to the chest, thighs, elbows, ankles and wrists. These create precise positions of body to then create annotated drawings of.



Section (scale TBC) : The boundaries of yoga within the bedroom environment.



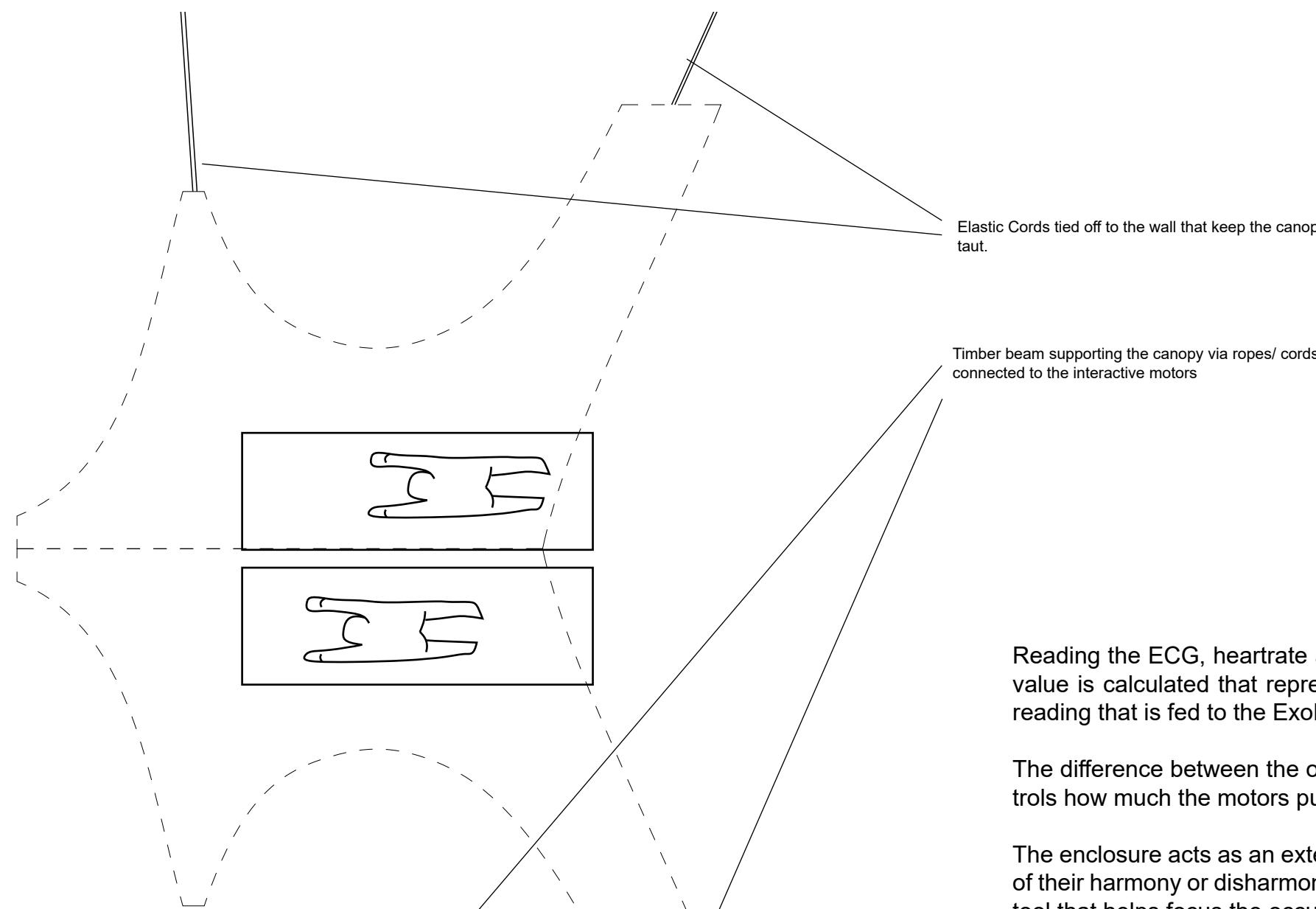
Annotations of the direction of the yoga movement and the spaces they occupy.

The intersection of yoga in the domestic space

The boundaries of the body and the space that it occupies in the home. The confines of the close-quarters becomes an obstruction in the practice of yoga e.g. the foot hits the mantel piece.



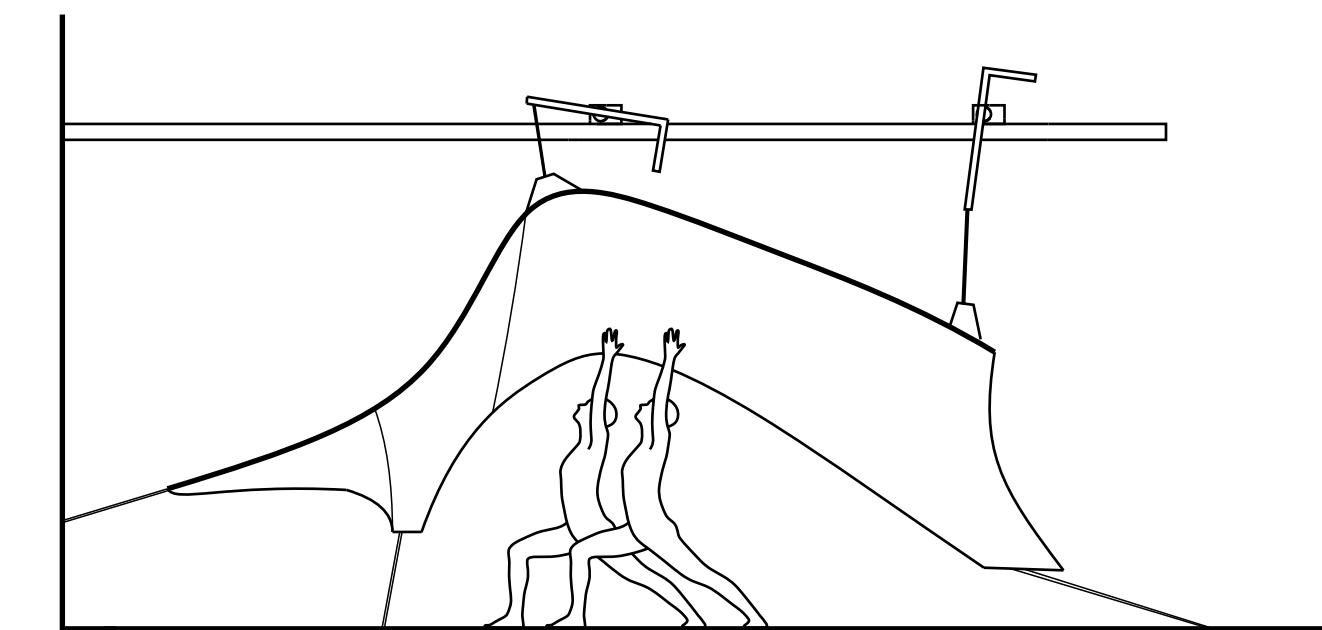
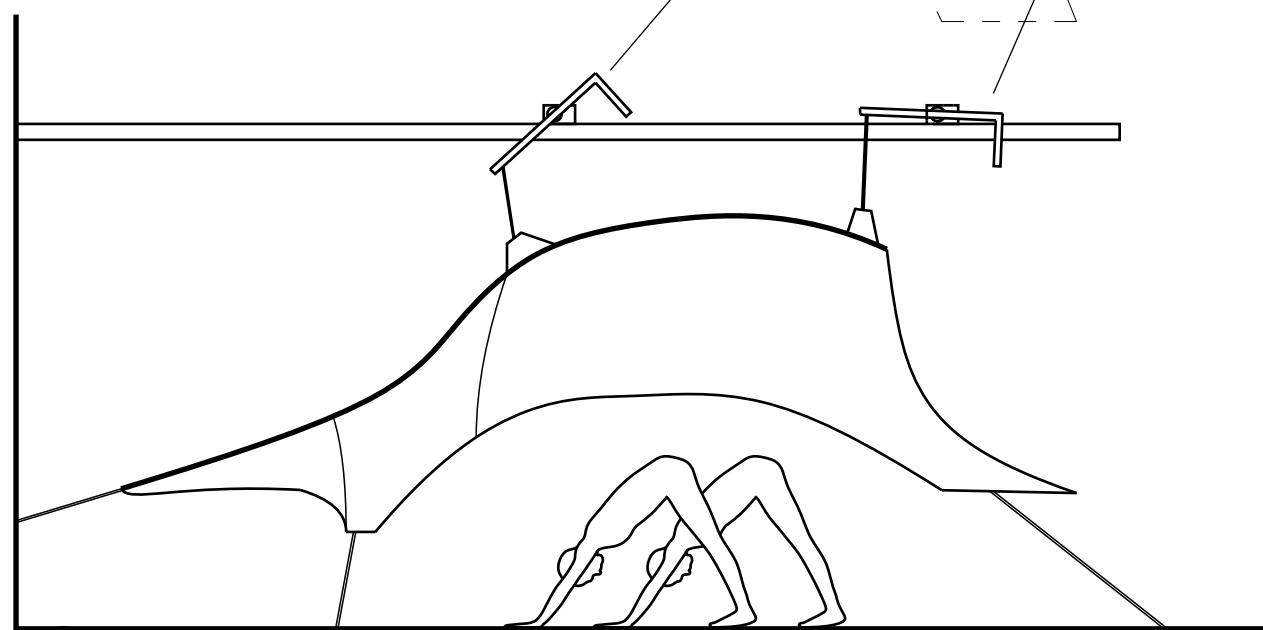
The ExoBuilding was also tested with participants trying to relax. The tent canopy rose and fell, corresponding with the inhabitants breathing. This researched into how significant the impact the external space could have in encouraging relaxation.



Reading the ECG, heartrate and rate of respiration data from the occupants, a value is calculated that represents the difference in their readings. This is the reading that is fed to the ExoBuilding.

The difference between the occupants body conditions is the variable that controls how much the motors pulls the stretched membrane.

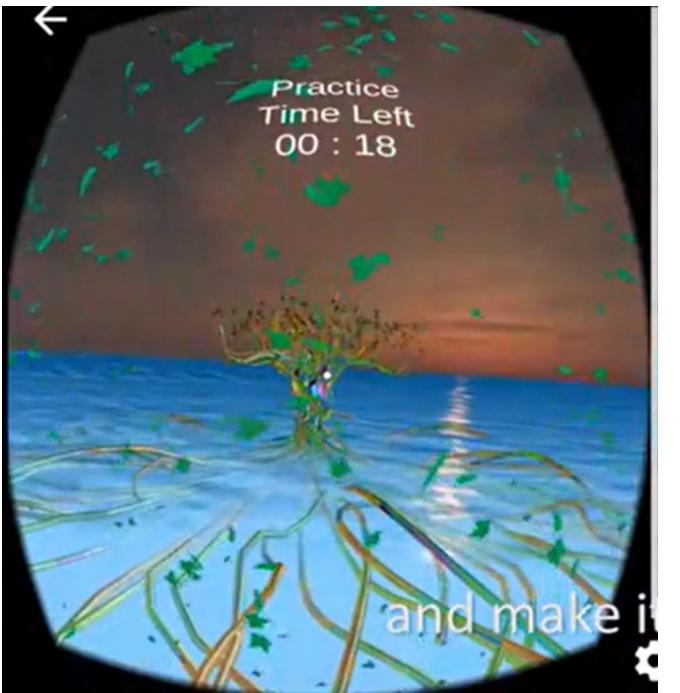
The enclosure acts as an extension of their bodies and is a visual manifestation of their harmony or disharmony. The movement of the tent can act as a teaching tool that helps focus the occupants meditation.



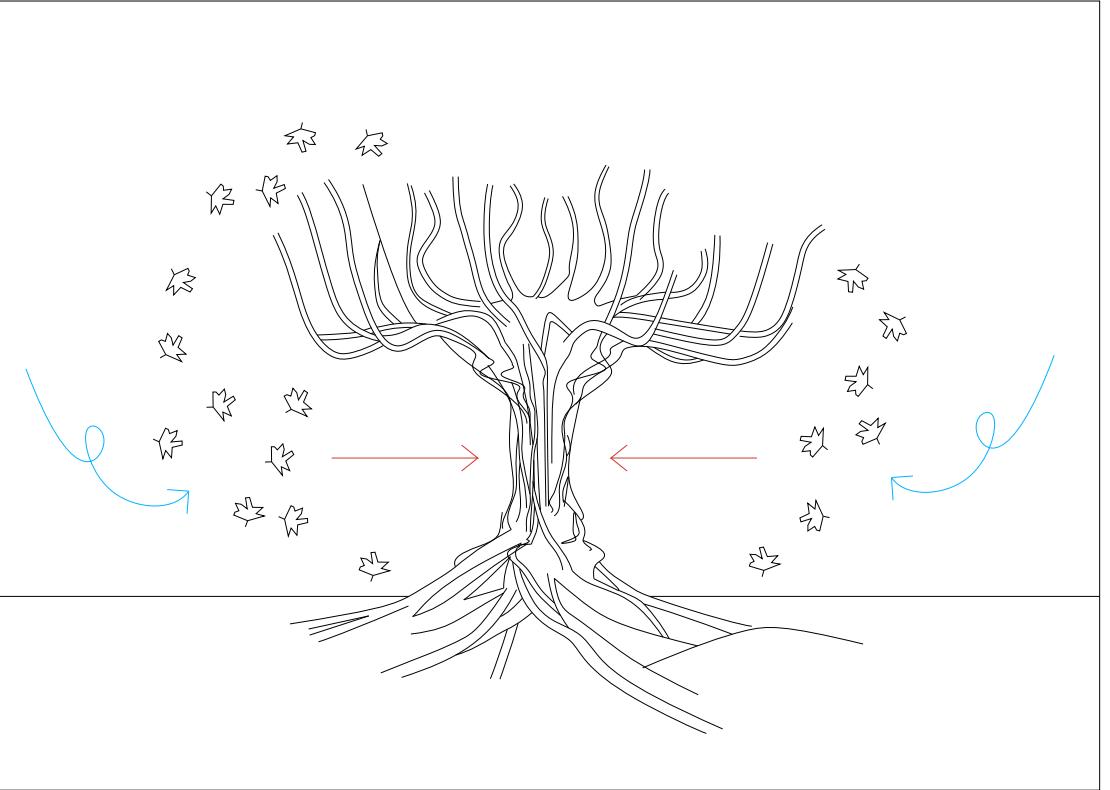
ExoBuilding: 'Breathing new life into the Yoga Experience'

The Exobuilding is an interactive covering designed to respond to the inhabitants body conditions. The fabric is held suspended by motors, that pull the canopy in different directions to create a responsive environment.

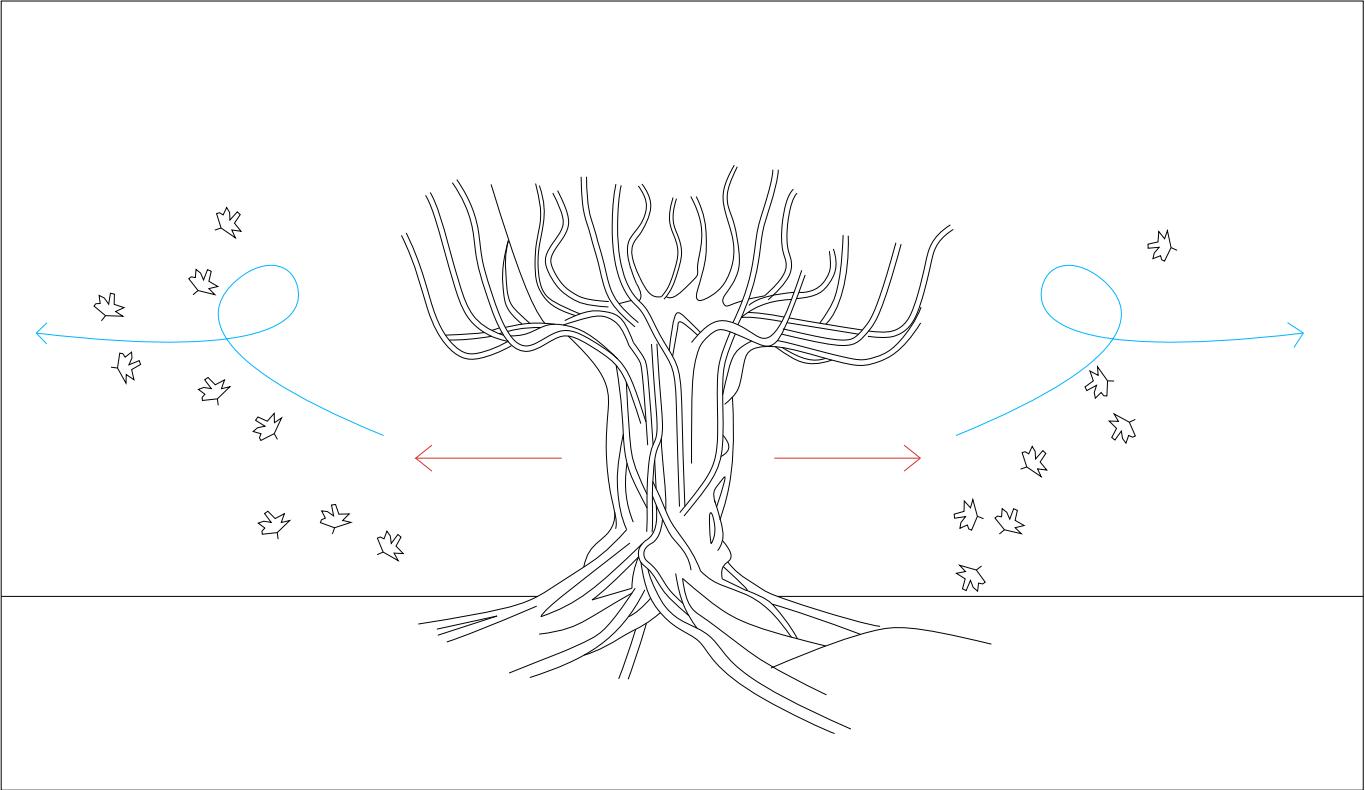
INHALE



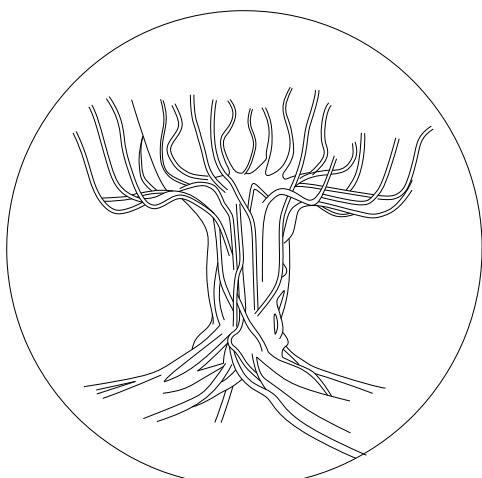
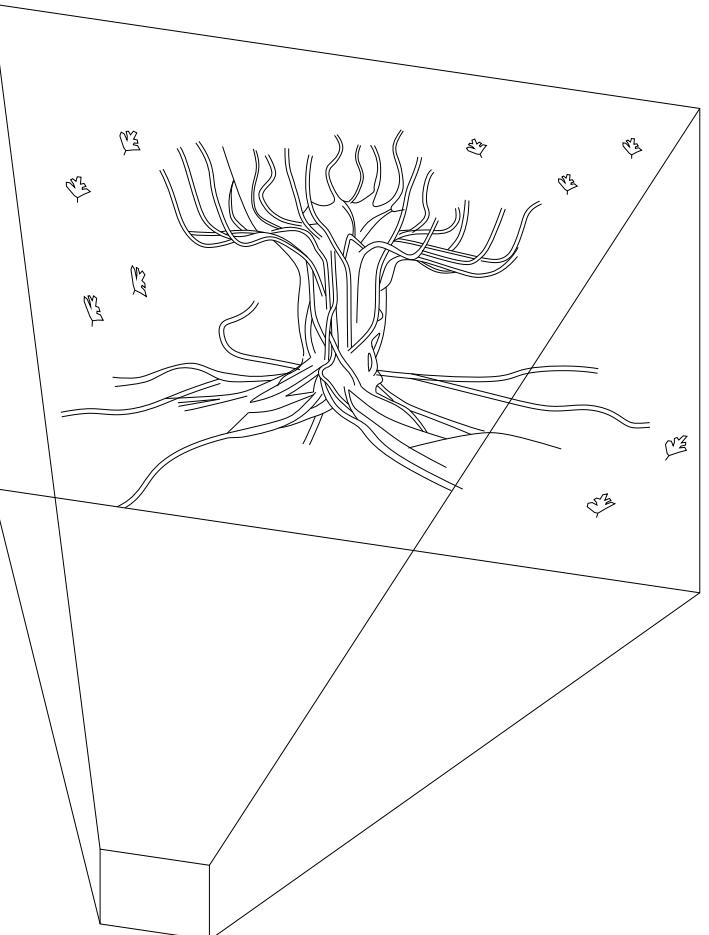
Person Practising Pursed Lip Breathing (PLB). This is a breathing technique developed to be calming and practise often when meditating and to reduce anxiety. The VR headset provides a way of focusing on the breathing and maintaining a steady rhythm.



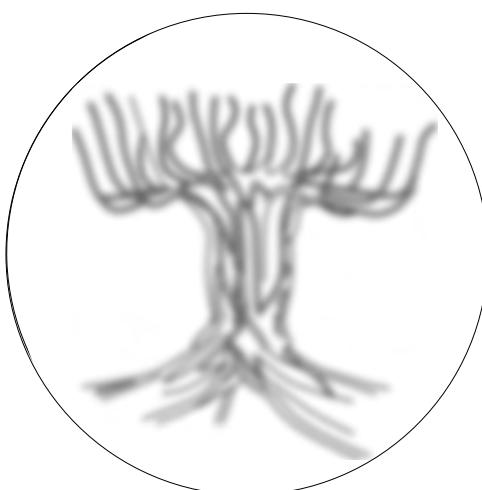
EXHALE



Regular Breathing



Irregular Breathing

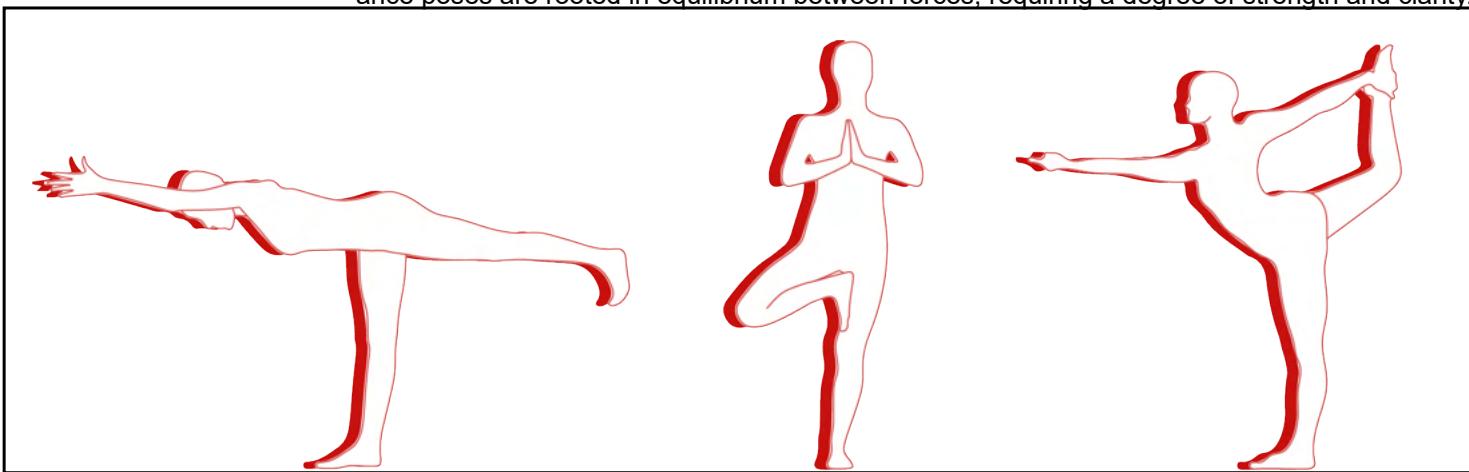


Life Tree: Breathing Exercise Game

Using a VR headset, visuals of a tree are provided to the users as they practice Pursed Lip Breathing. The tree reacts to the inhale and exhale of the meditator, driving indirect breathing feedback. This augmented meditation was able to provide a distraction free environment and meditators could truly focus on their breathing technique.

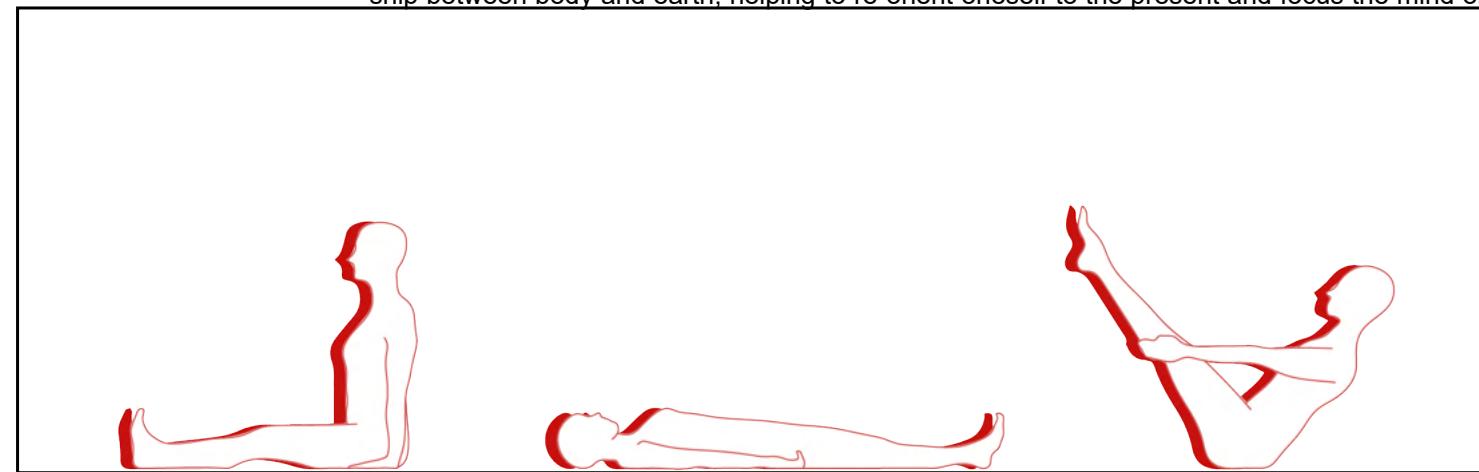
BALANCE

Requires degree of focus and direction that implies physical and mental balance. Allows you to understand centre of gravity. Minute wobbles are encouraged - makes the pose valuable. Balance poses are rooted in equilibrium between forces, requiring a degree of strength and clarity.



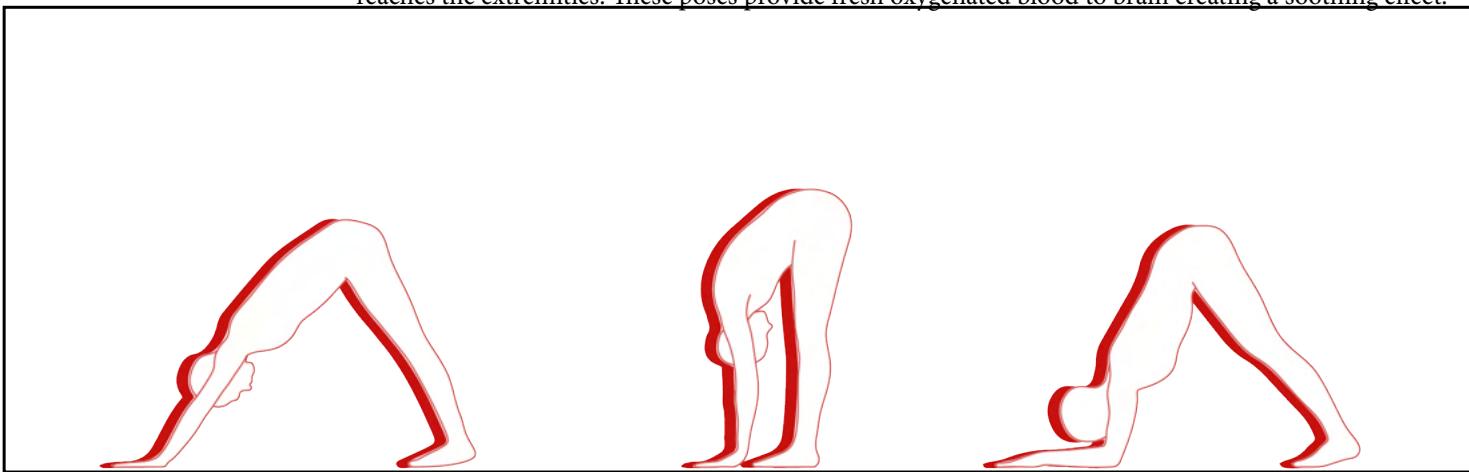
RECLINED

Encourages relaxation and release of tension, improving flexibility in deep muscles of the core and back. Reconnecting the yogi with the ground, these poses form an unmistakeable relationship between body and earth, helping to re-orient oneself to the present and focus the mind on



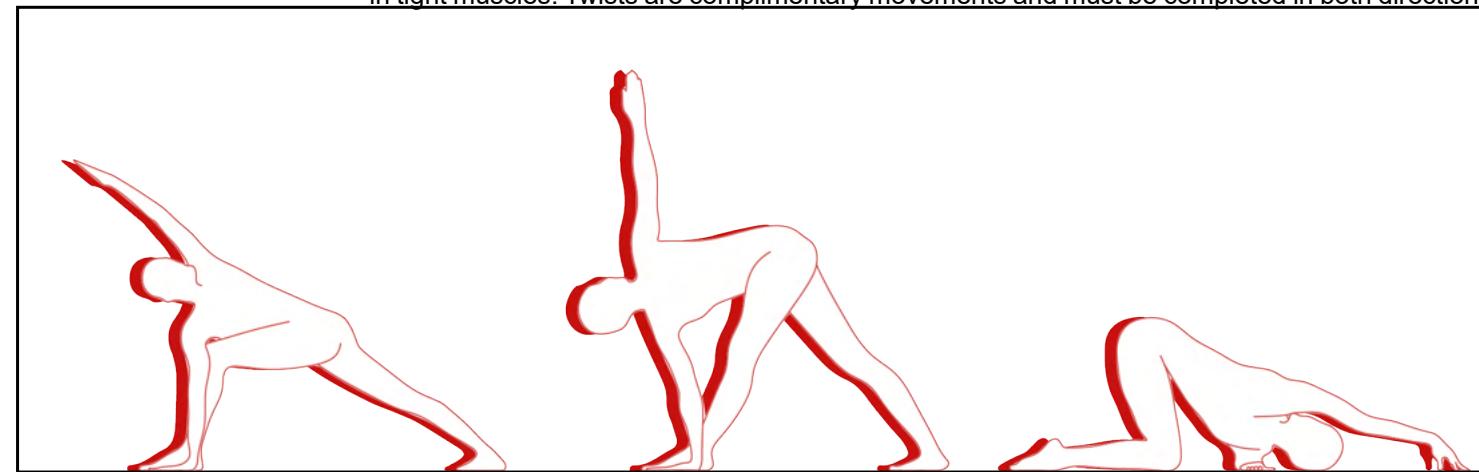
INVERSIVE

Inverting the yogi upside down, blood is redirected to flow to the brain. Once the pose is complete the blood is released to the rest of the body. The key to the pose is the reversal of gravity so that circulation reaches the extremities. These poses provide fresh oxygenated blood to brain creating a soothing effect.



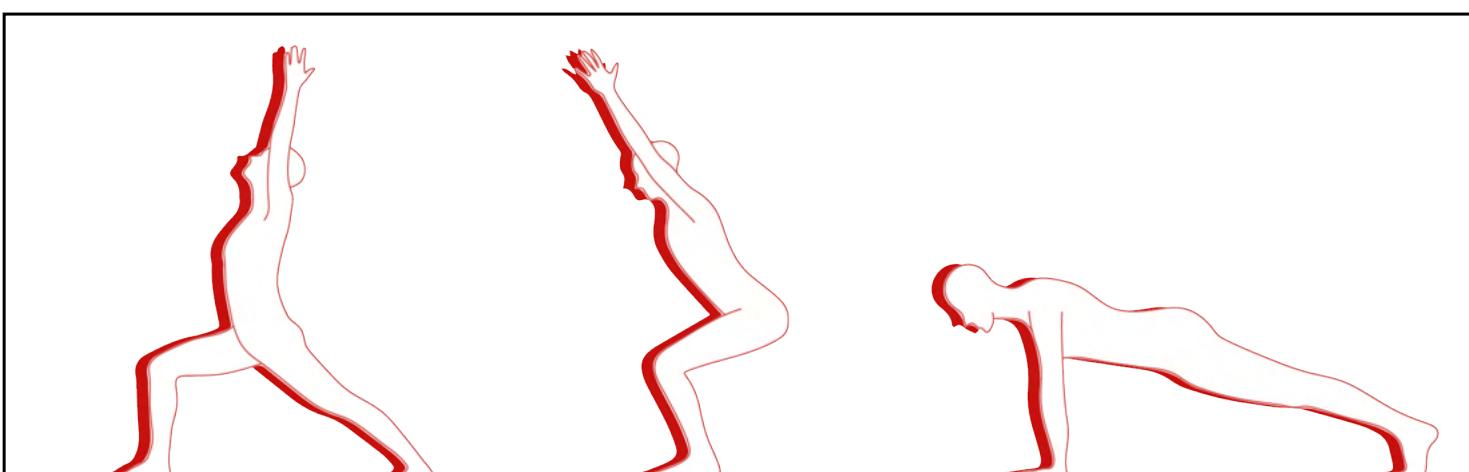
TWIST

An in and out motion. These are stretches that are meant to compress and release the muscles in one way and then the other. Poses release tension and lengthen the spine, increasing mobility in tight muscles. Twists are complimentary movements and must be completed in both directions



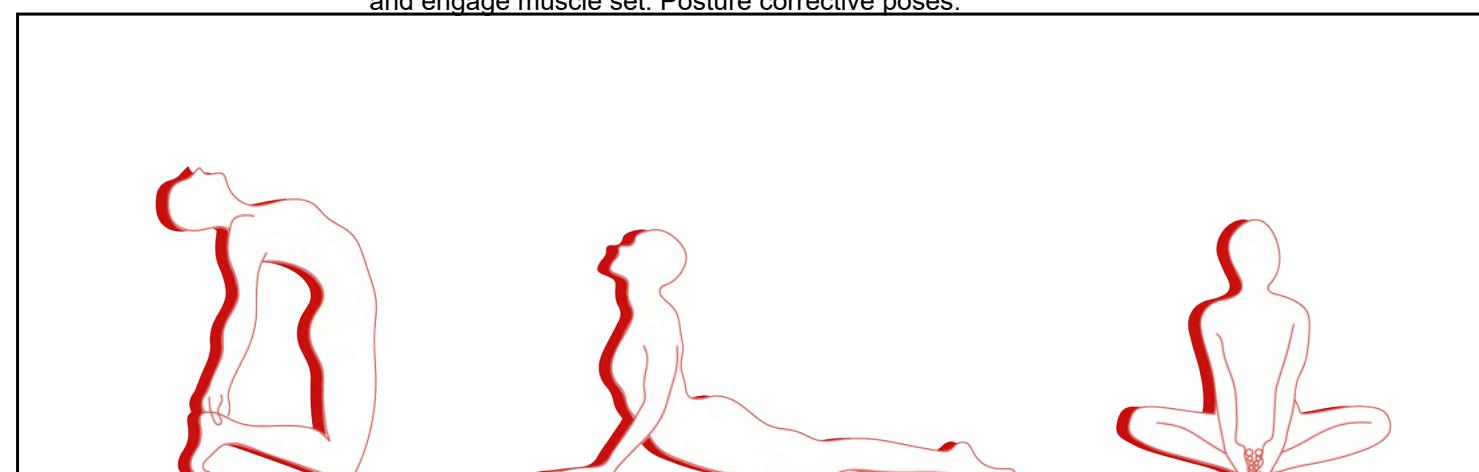
STRENGTH

Strength poses are rooted in challenge and develop coordination between muscle pairs and engage level of agility. Mentally require persistence. Challenging due to muscle fatigue.



OPEN

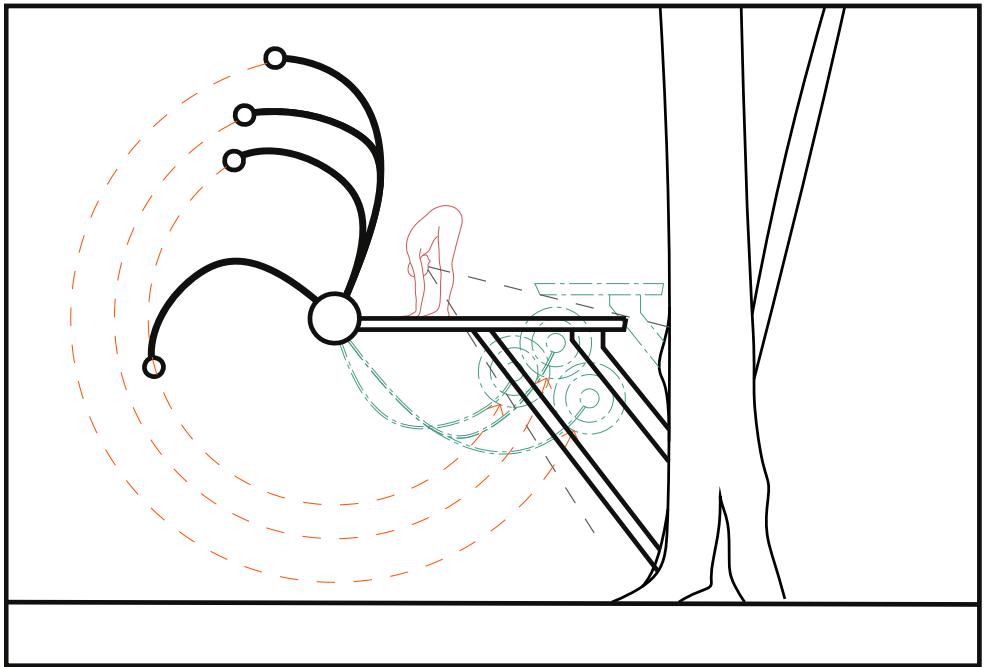
Simultaneously compress and stretch muscles. Breathing is slow and catered to the movement of the pose. Instructed to direct breath to the portion of the body being stretched. Helps to focus and engage muscle set. Posture corrective poses.



Yoga Asanas: categorising poses

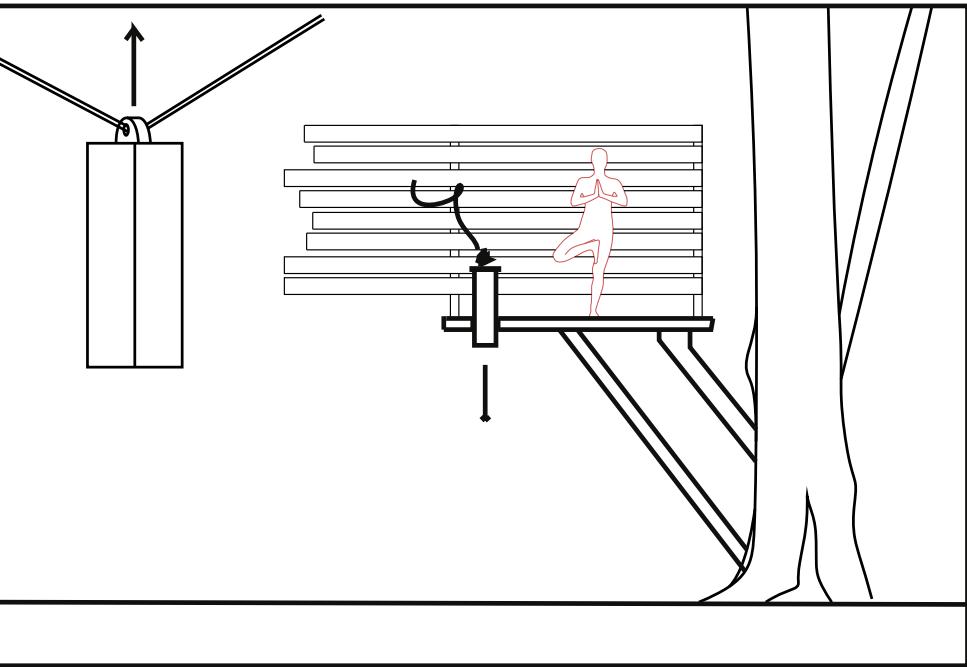
The yoga asanas (poses) that make up the different flows and routines, each have a different role within somaesthetic theory of 'change' and 'attention'. Each category works the body in a different way and makes the yogi focus on their body in different way.

INVERSIVE



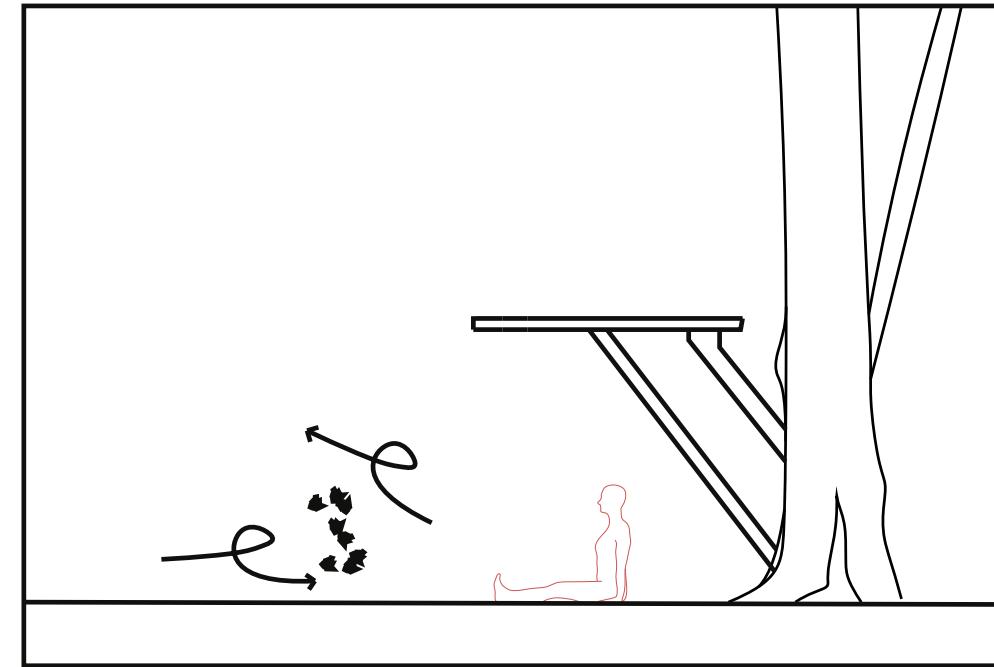
The inversion poses flips the yogi's view point to behind or below them. This instrument could guide the gaze of the practitioner as they transition into this pose, from above the platform to looking beneath it.

BALANCE



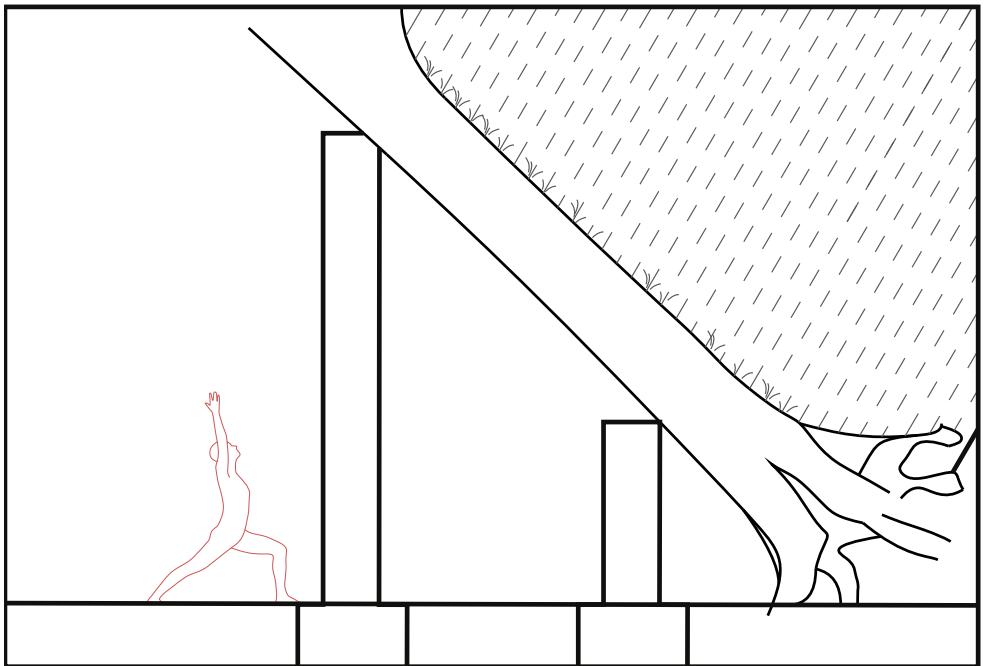
The balance poses do not involve much movement, but they require a lot of concentration, with much of the focus being on the wobbles and instability of the poses. This instrument could be a balanced weight system that provides the stability to aim for.

RECLINED



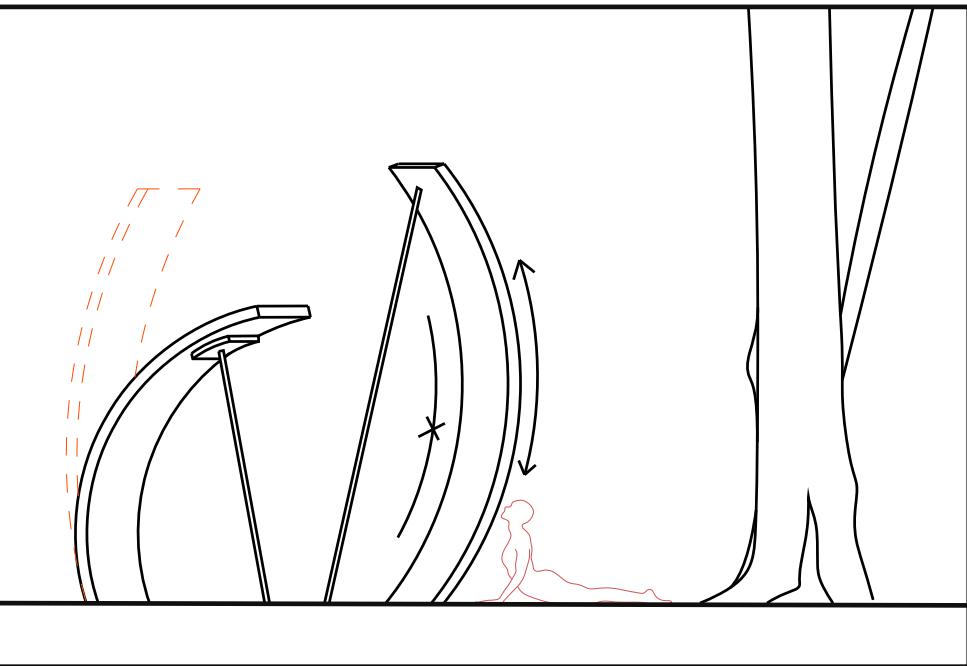
The reclined/ grounded poses are an opportunity to interact or at least acknowledge the yogi's surroundings. This zone should be paired back and focus being on the virtual surroundings rather any of the instruments.

STRENGTH



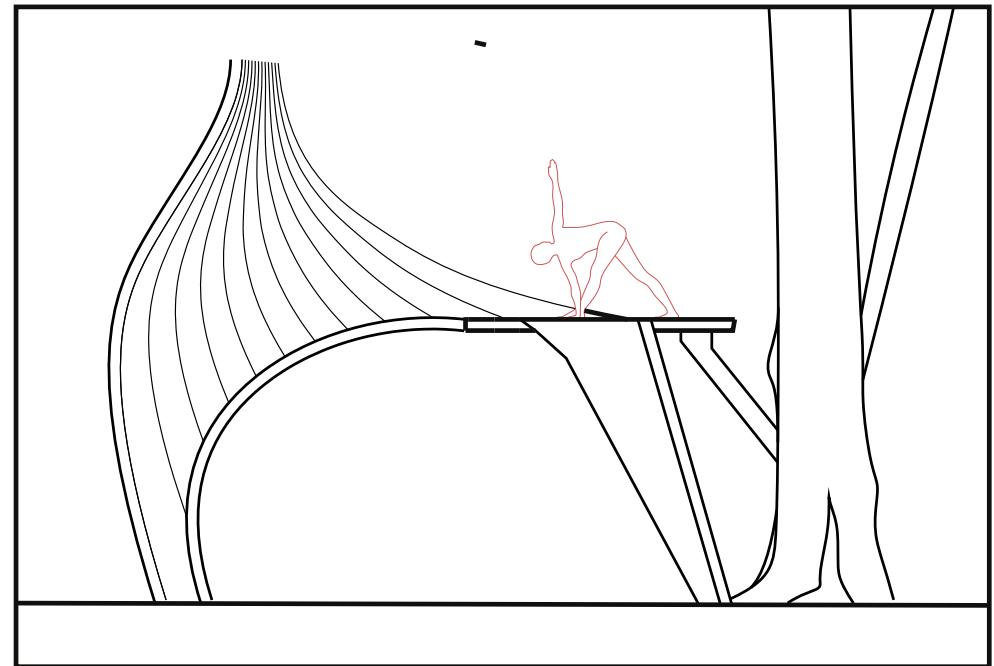
The strength poses require endurance from the yogi, as they can experience great fatigue in these positions. The zone could embody this strength in its thickness or material qualities. Such as thick foundations.

OPEN



In the twist poses, the body is both stretching and compressing muscles. This zone's instruments could also act out these forces, such as bent planks that undergo tension and compression forces.

TWIST



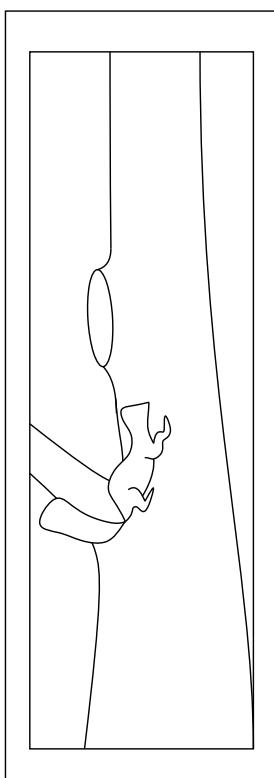
In the twist poses, the body is both stretching and compressing muscles. This zone's instruments could also act out these forces, such as bent planks that undergo tension and compression forces.

Focusing yoga practise with zones

By using the six types of yoga asanas/ poses, the practise of the yoga could be focused by using specific environments to correspond to the action and position the Yogi is currently in. Each zone should provide a unique method of breathing feedback as in previous works in the field.

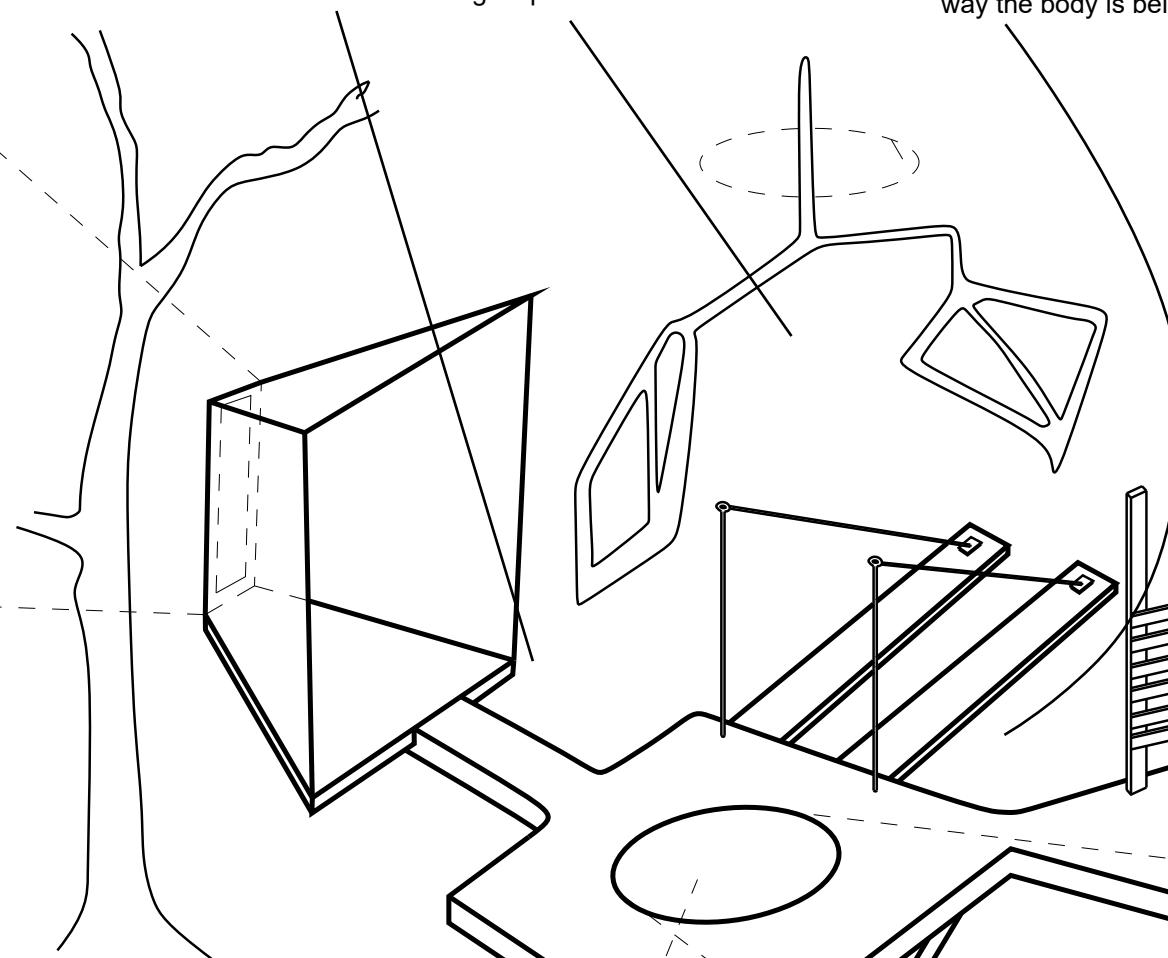
Grounded

Room / enclosure that focuses yogi on the activities of the park. E.g there are grey squirrels - These could be looped in front of the viewing screen.



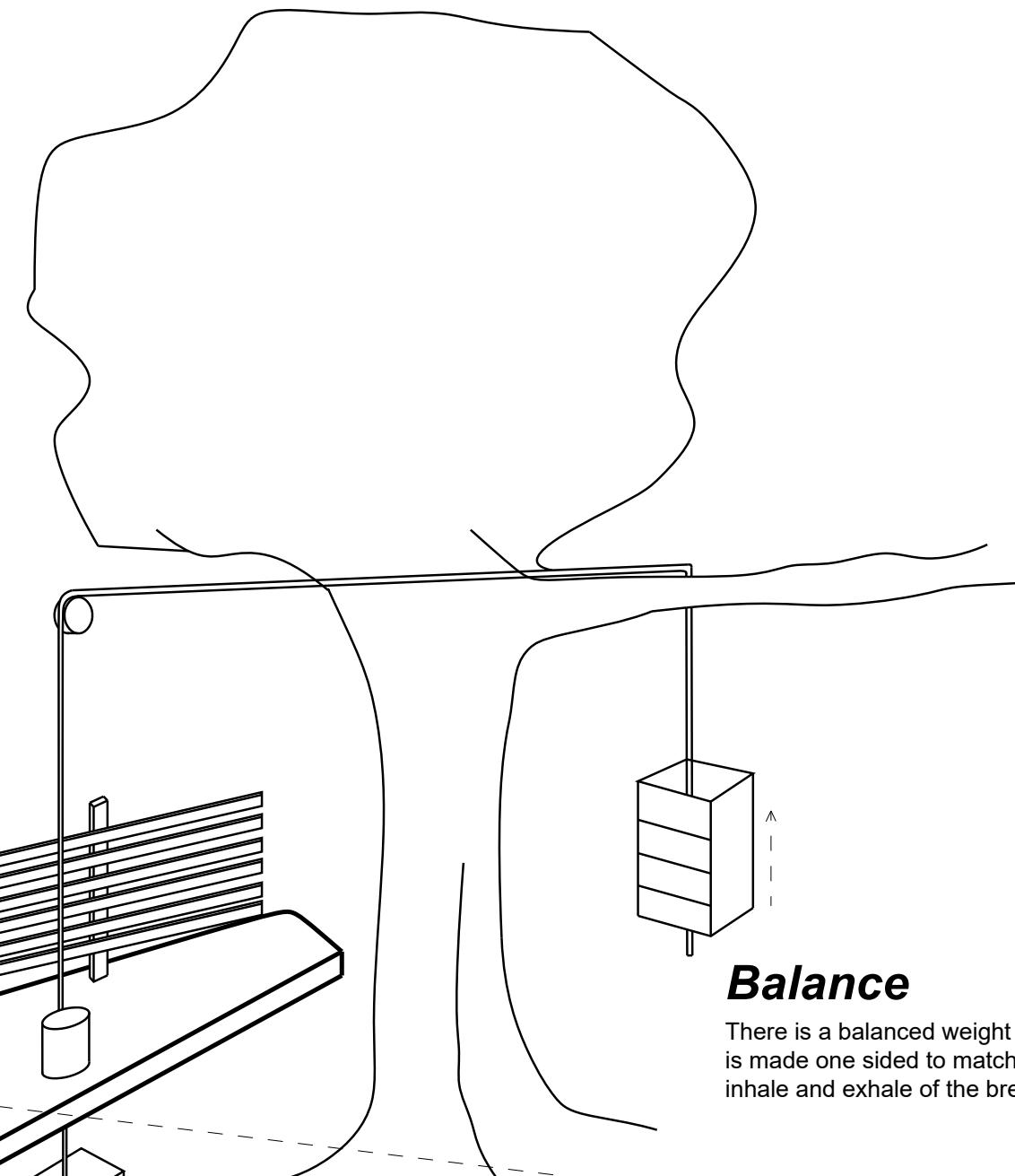
Twist

Mobile that rotates above the yogi that matches the orbit paths of the movements during these poses. It gets pushed with the breath.



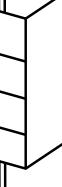
Open

These planks are pulled up in front of the yogi. As the planks are under bending force, one side experiences compression and the other experiences tension in the same way the body is being



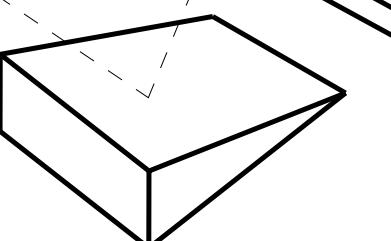
Balance

There is a balanced weight that is made one sided to match the inhale and exhale of the breathing.



Inversion

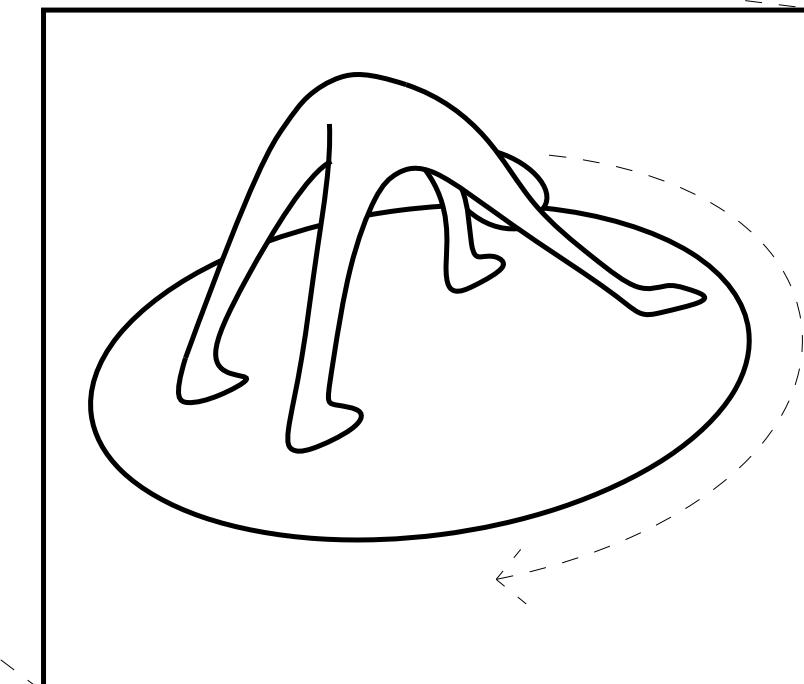
The view of the yogi is directed towards the ground during these poses. The mirror will reflect the sky to the yogi to watch for calm and soothing focus.

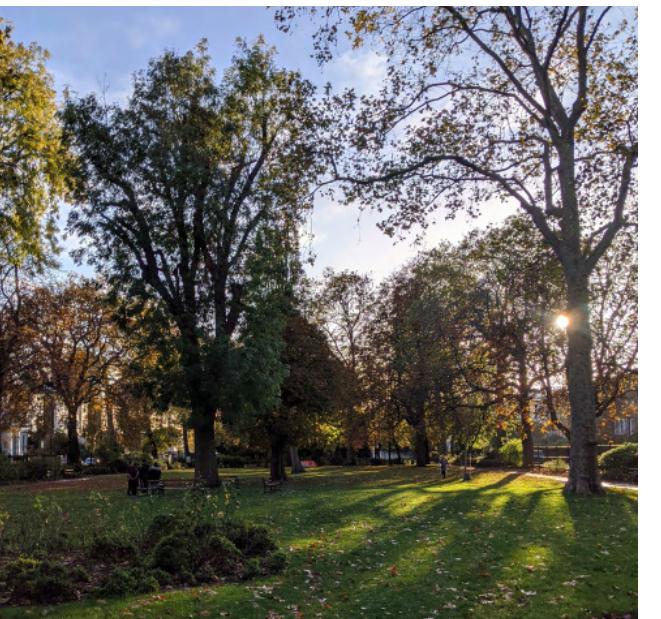


Apparatus in the park

The combination of the six zones in a virtual environment could be oriented around a central platform that the practitioner would rotate around. The transition between the positions could happen as the sightlines of the Yogi are directed downwards, to reduce distraction from the routine.

Rotating platform, transitions the yogi through the different zones. Downwards dog could be the transition pose that makes this seamless.





Site Plan 1:1000 @ A3

SITE: Camden Square, London, NW1 9XB

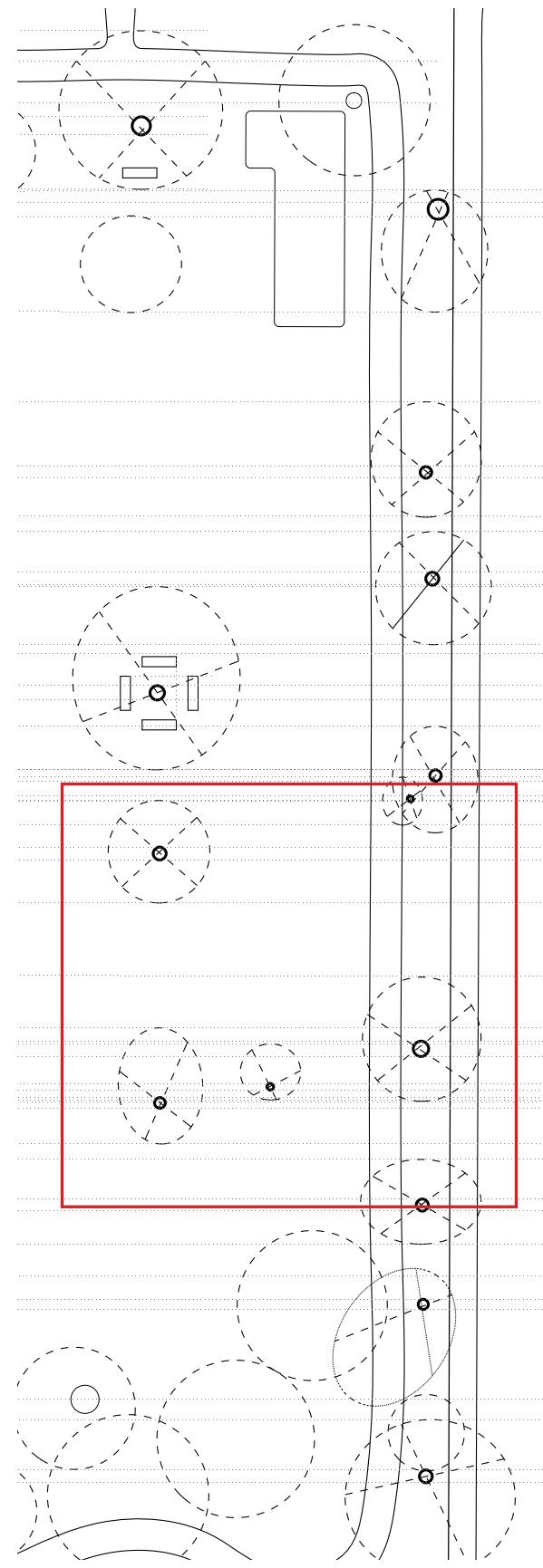
Located in a residential area of Camden, Camden Square provides a space for the local residences to exercise (football, yoga, running), walk their dogs, etc. However during the UK lockdown due to the COVID-19 pandemic, it has become a needed and essential place for connections to the outdoors.





Site section: 1:200

The footpath runs around the perimeter of the square, with bench seats placed along its length. They act as spots to rest after a runner's 5 laps round the square; to drink a cup of tea with your neighbour; to watch the local yoga group stretch more than you have all year in 5 minutes. Spots of vital escape from the house-now-workplace.

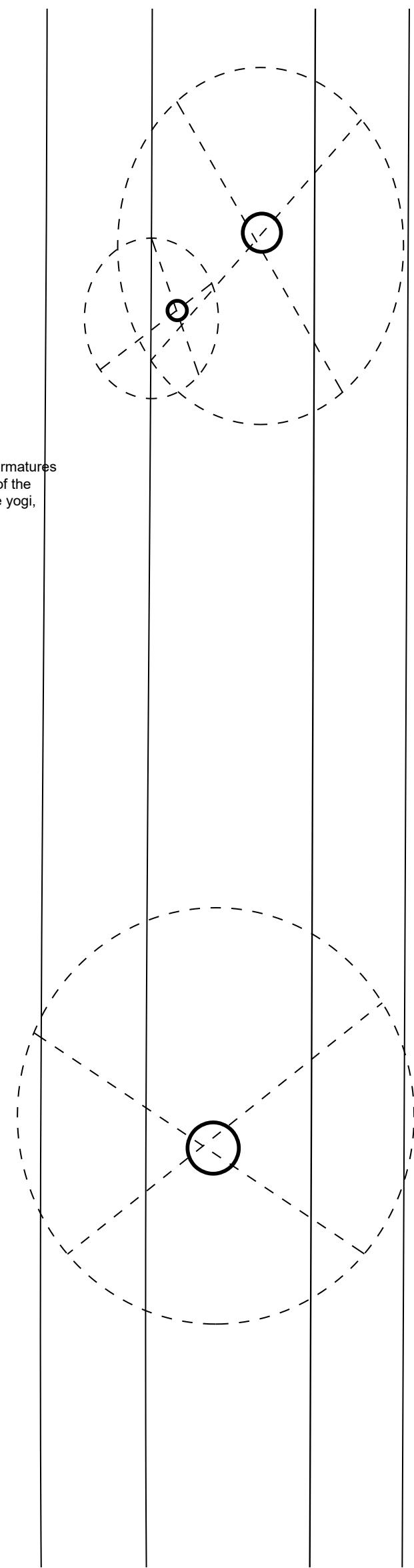
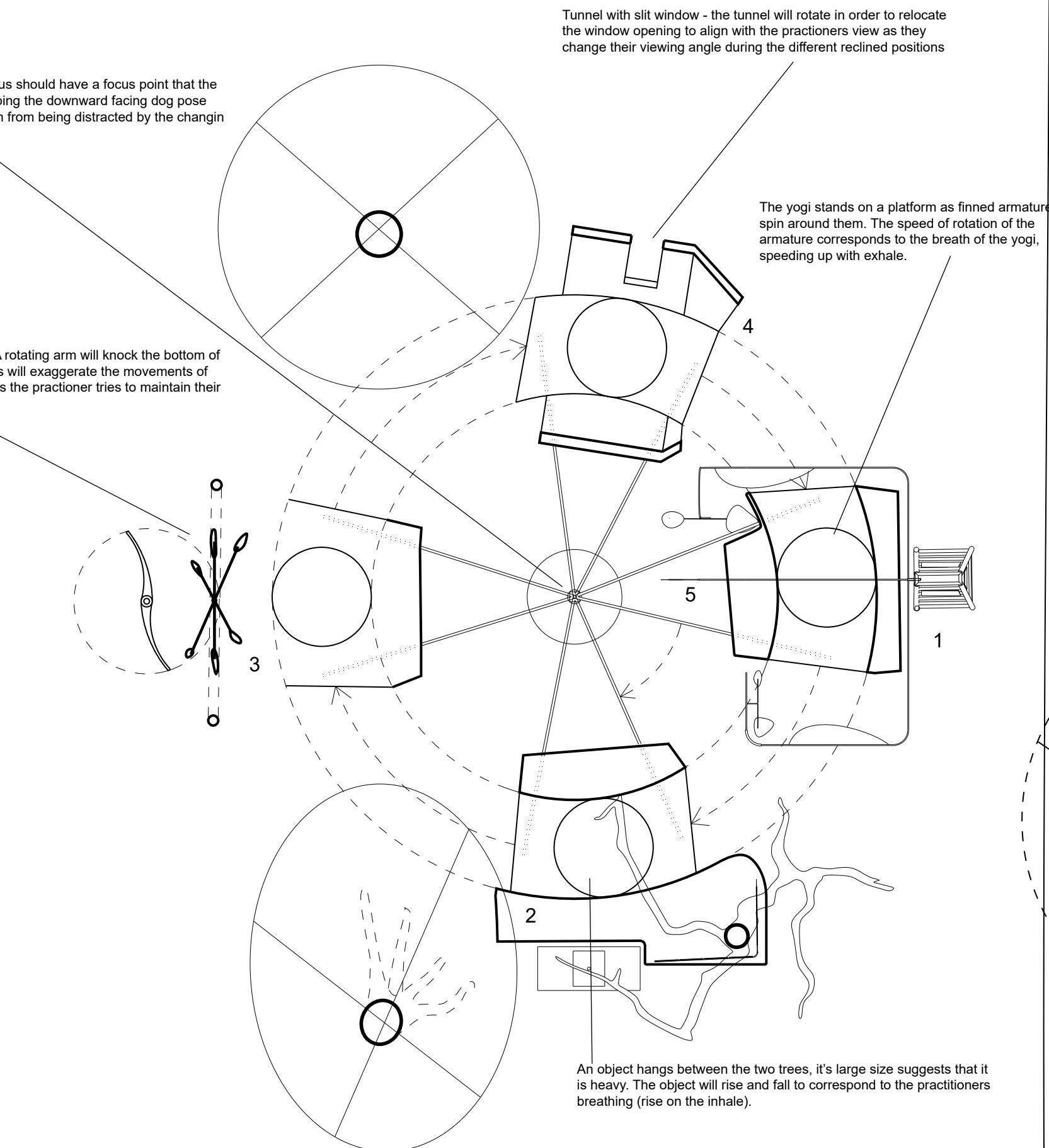


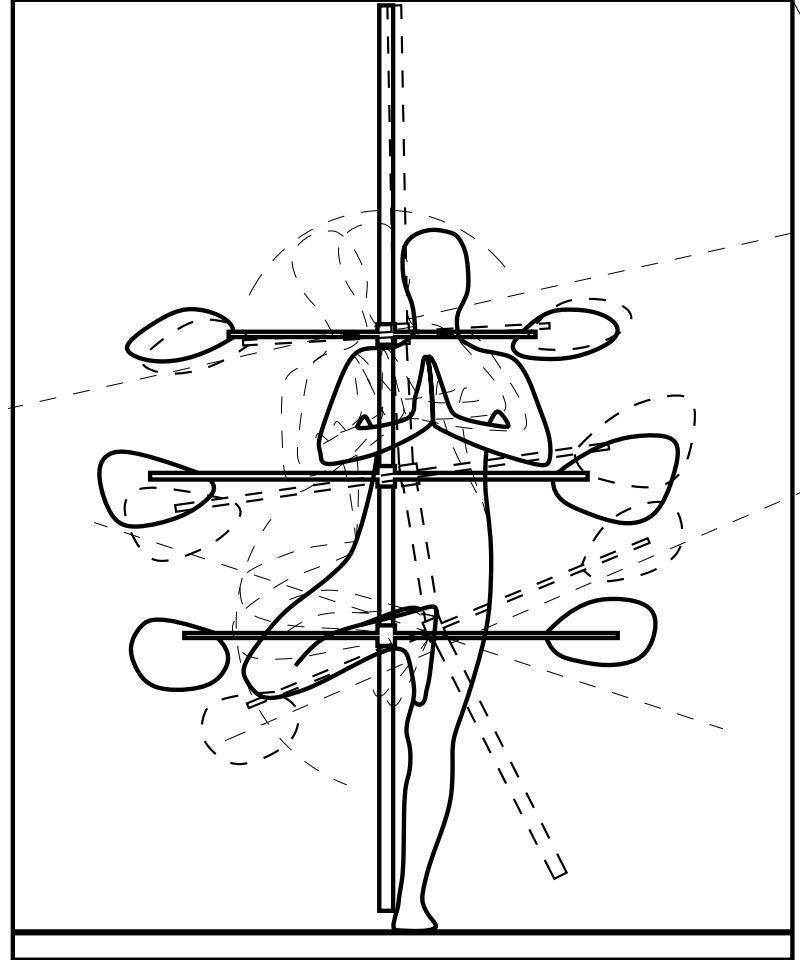
KEY:

- 1. Twist
- 2. Strength
- 3. Balance
- 4. Reclined
- 5. Inversion

Plan 1:100

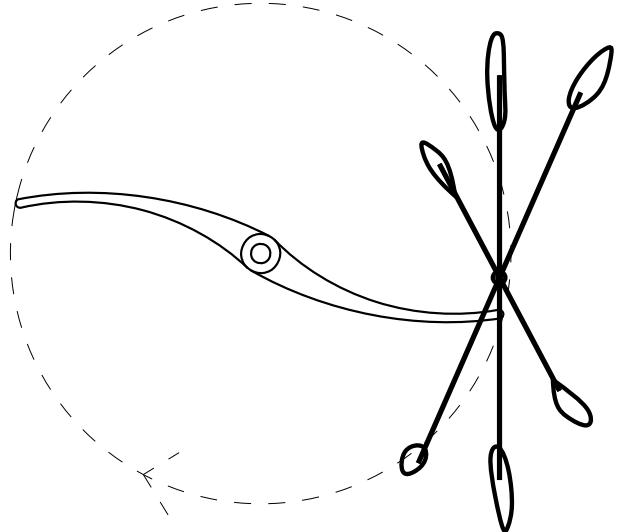
The apparatus has a central pivot that rotates a platform around to the different focus zones. The yogi will practise their exercise and move through the different zones dependant on the type of movement/ stretch they are doing.



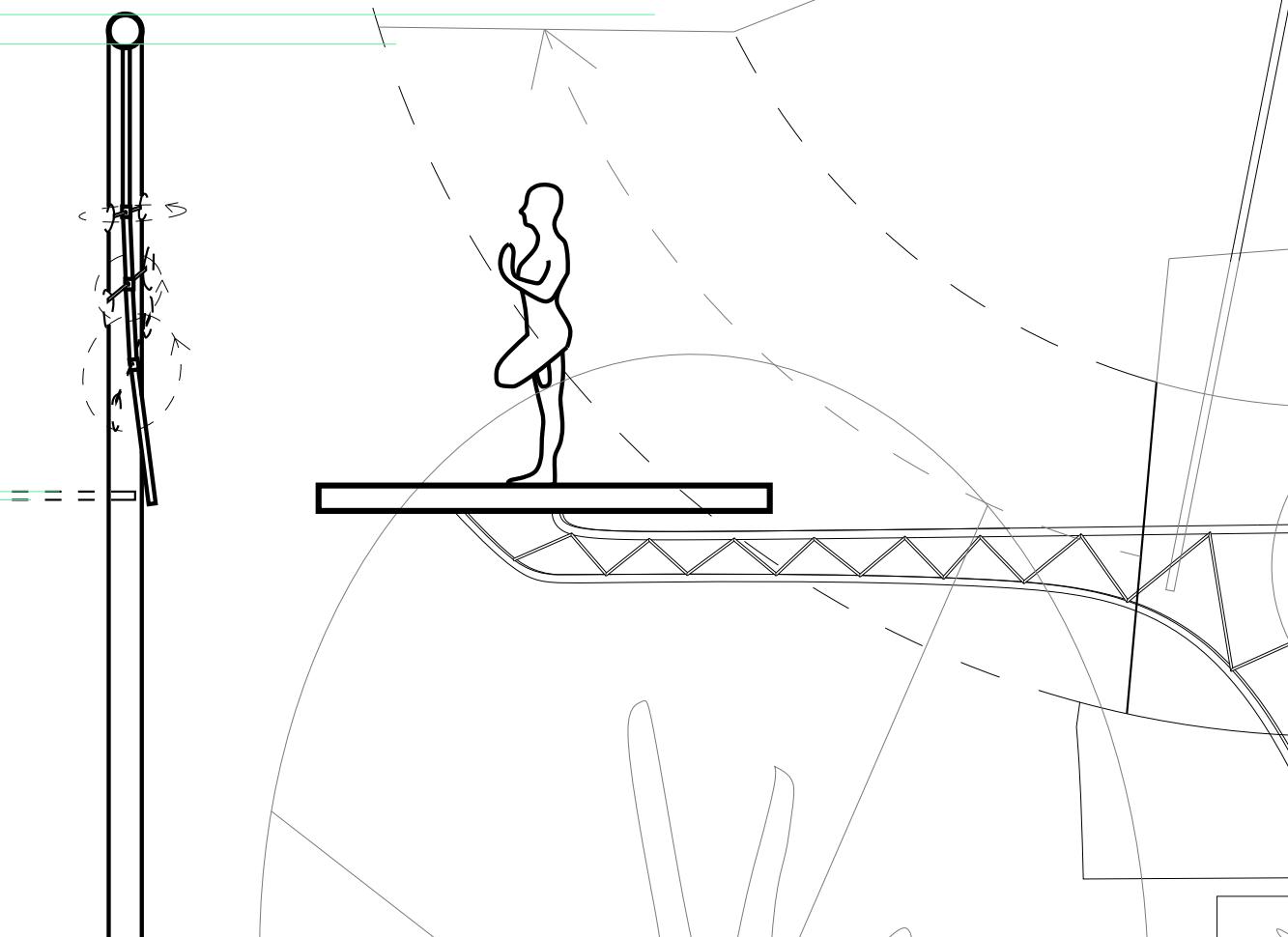
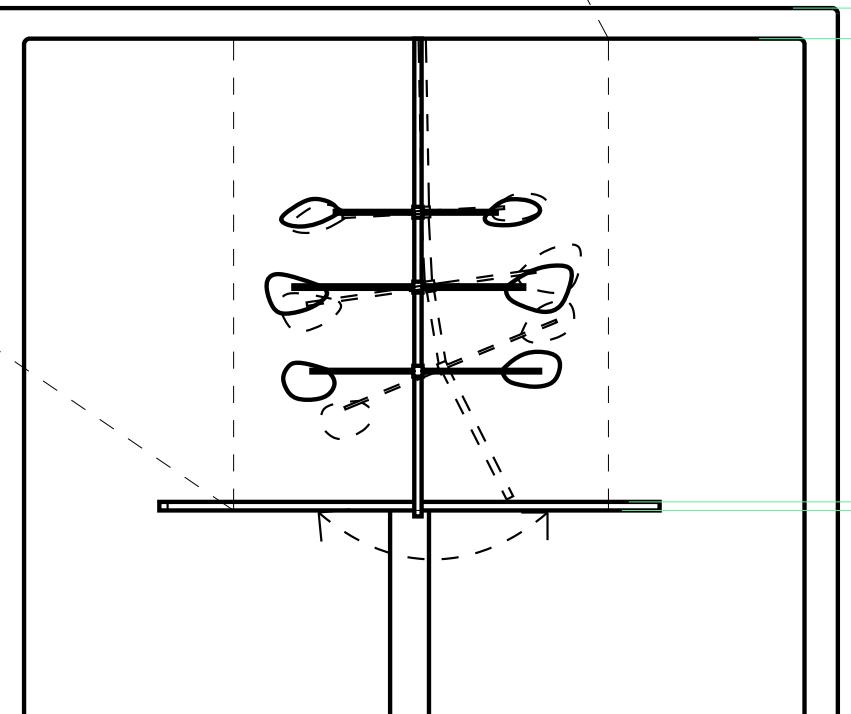


The extensions of the mobile will exaggerate the movements of the swaying. As the yogi is in this position they are able to draw relation to the wobbles and swaying in themselves.

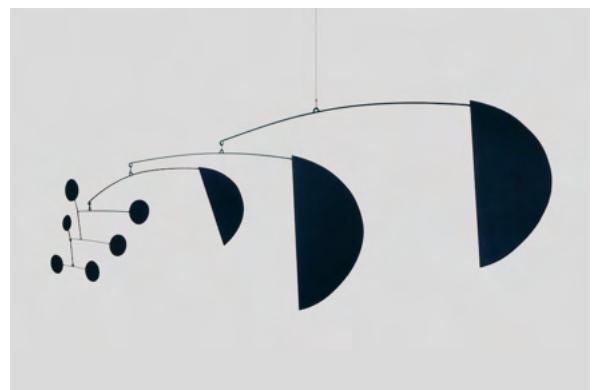
An arm will spin so that one of its blades will periodically knock the bottom end of a hanging mobile device. This will disturb the mobile causing it to sway.



The turning of the arm will be timed so that the disturbance will occur on the exhale of the yogi. This will be a tool for them to practice proper breathing techniques.



Section 1:50 - Balance

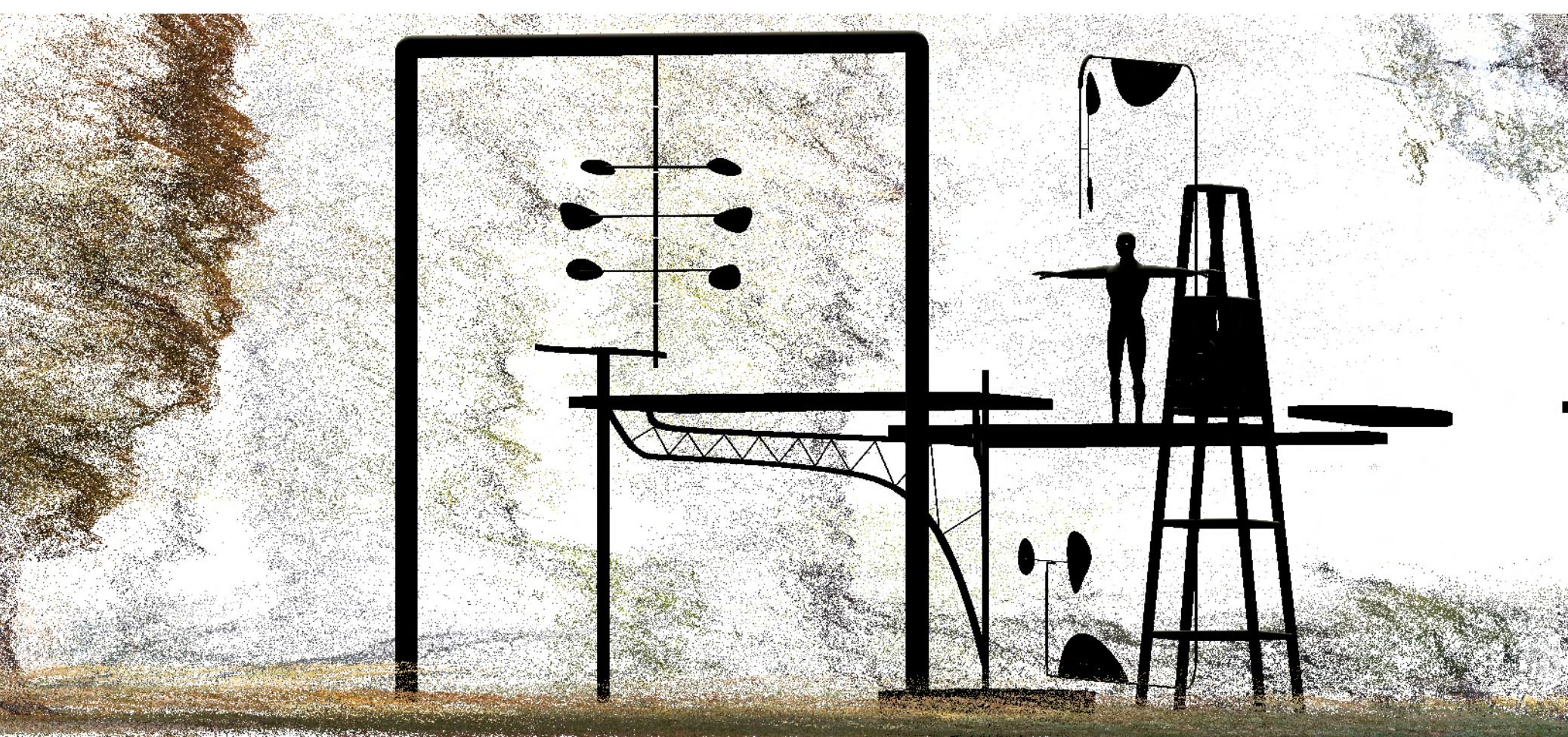
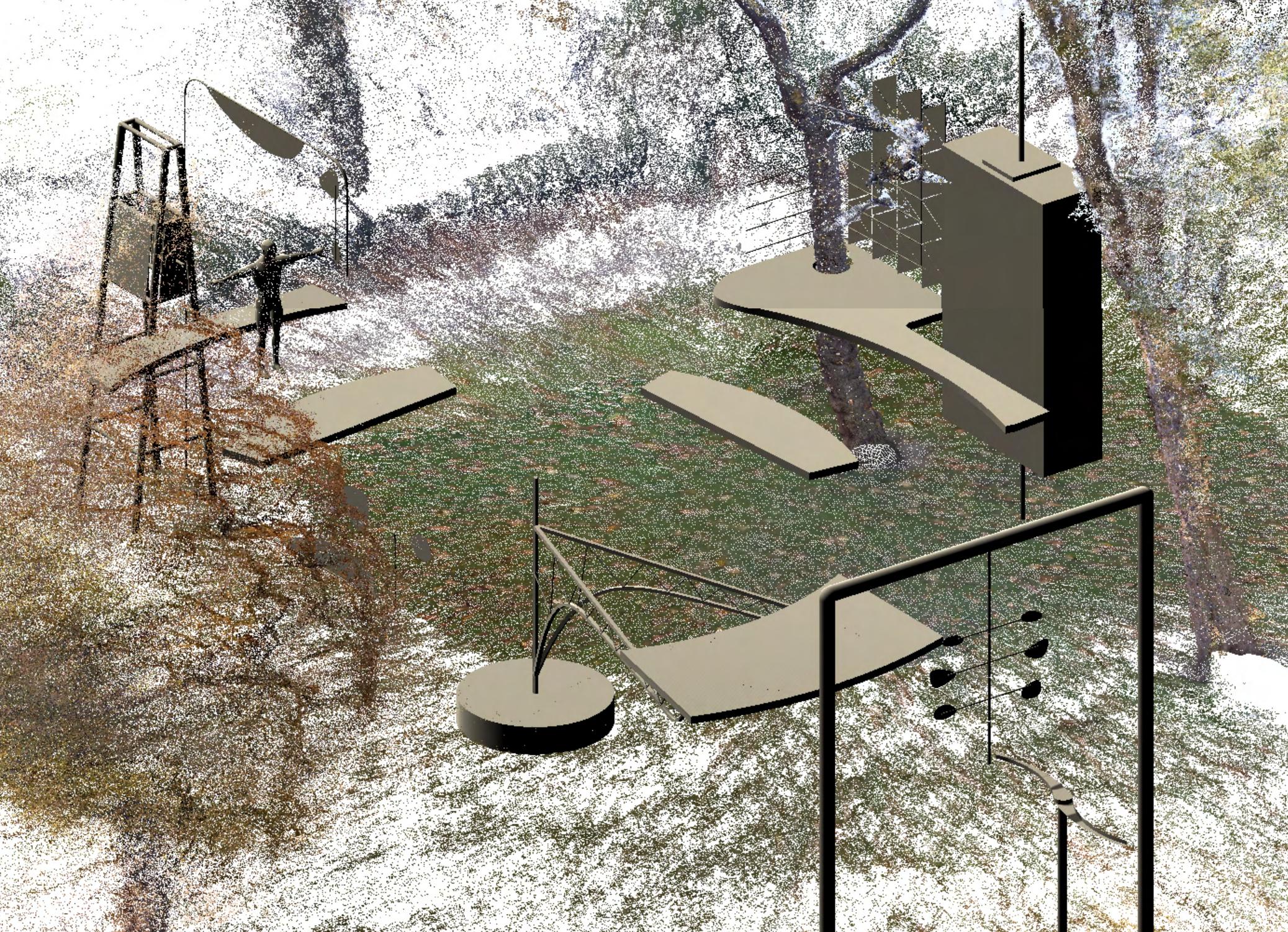


Alexander Calder - Kinetic Sculptures

These sculptures rotate, with the movements powered by the disturbance in air current.

Apparatus in Camden Square

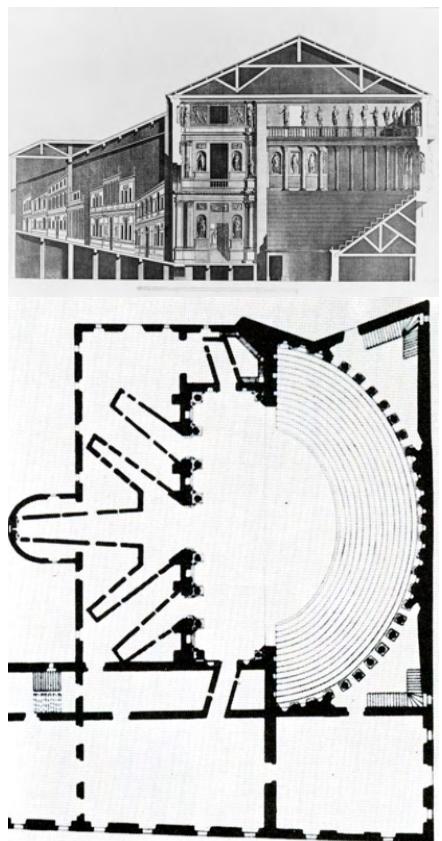
An arrangement of spaces that should provide a focus point for the yoga practitioner and encourage good breathing technique through indirect feedback and highlighting their breathing activity.





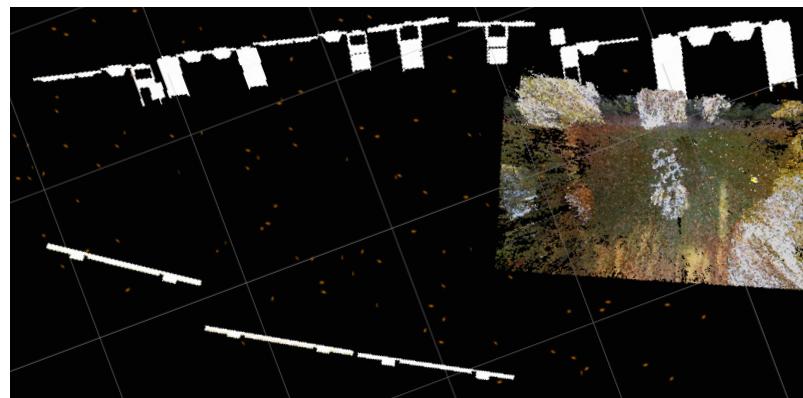
Site Surroundings:

The site is overlooked on both sides by housing and residences, creating quite an intimate relationship between the house and the square. How should a virtual visit to the park interact with its real world environment and context.



Teatro Olimpico ("Olympic Theatre") 1580-1585.

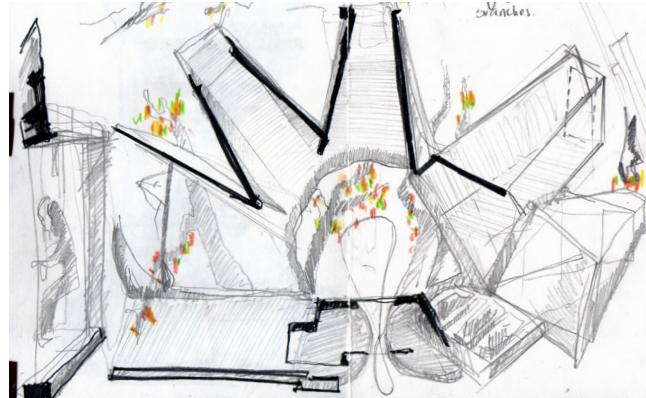
The onstage scenery gives the appearance of long streets and a receding horizon by using a forced perspective.



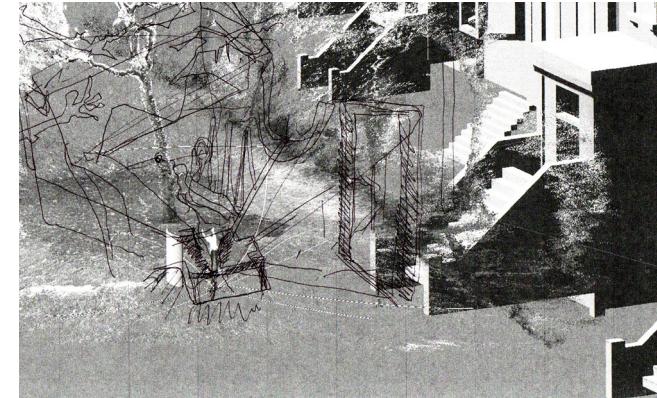
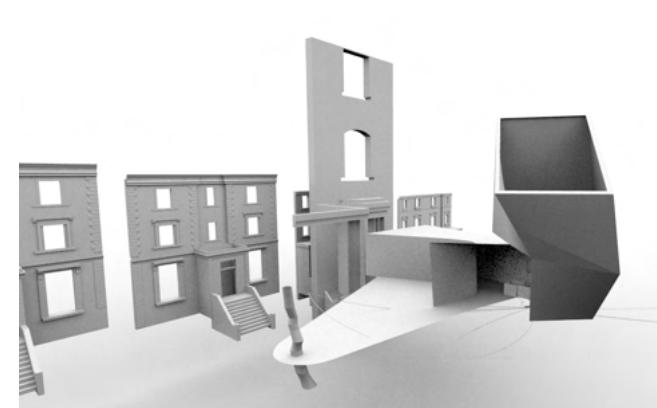
Rotating the houses and angling them in towards Camden Square so that they are visible when the practitioner is facing forwards within the virtual environment.



The neighbouring buildings to the correct scale and the manipulated scale. The practitioner is restricted to the movements that is prescribed to them by the yoga routine and are not free to move around the site as in real life. By manipulating the buildings the practitioner should have the same effect as being overlooked and within a community space.



The virtual environment allows the condition of the park to be manipulated, such as growing leaves, increasing saturation as the routine progresses.



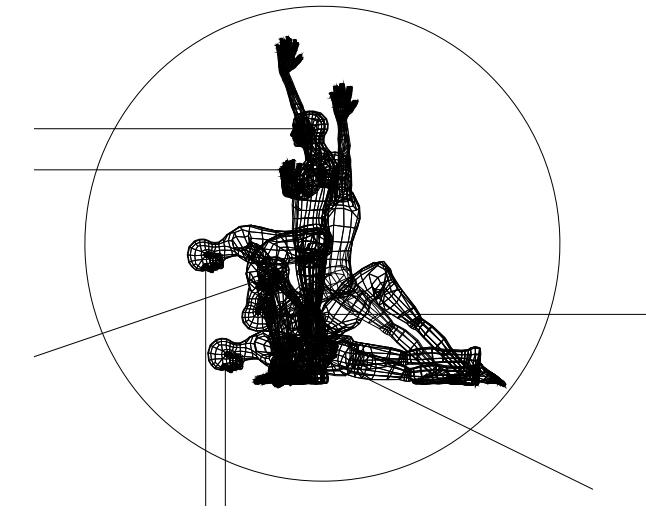
The scale of neighbouring buildings can be manipulated to appear larger and closer than they would in real life - this is in order for their digital presence to have the same impact as that of the real square's atmosphere.



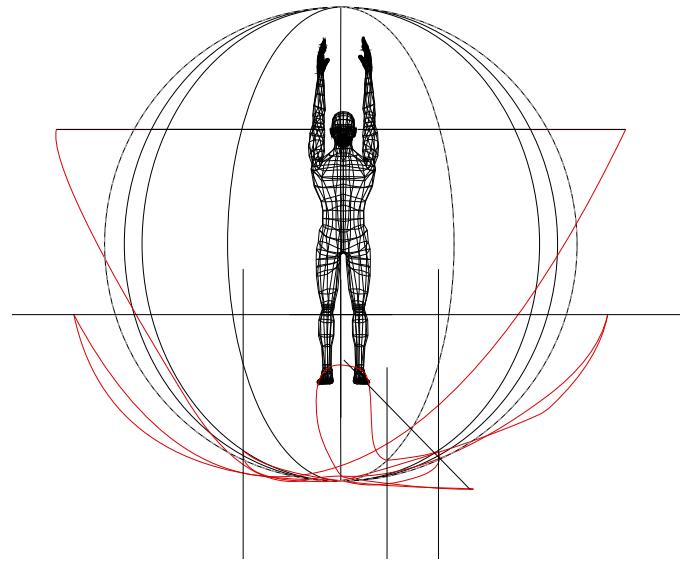
The roof of the enclosure is formed of viewing cones that align to the different poses in the yoga routine. The 'wonky' tree in the square becomes a focus point for the practitioners forward-facing sections of the exercise.

Virtual Pavilion in Digitally Manipulated Camden Square

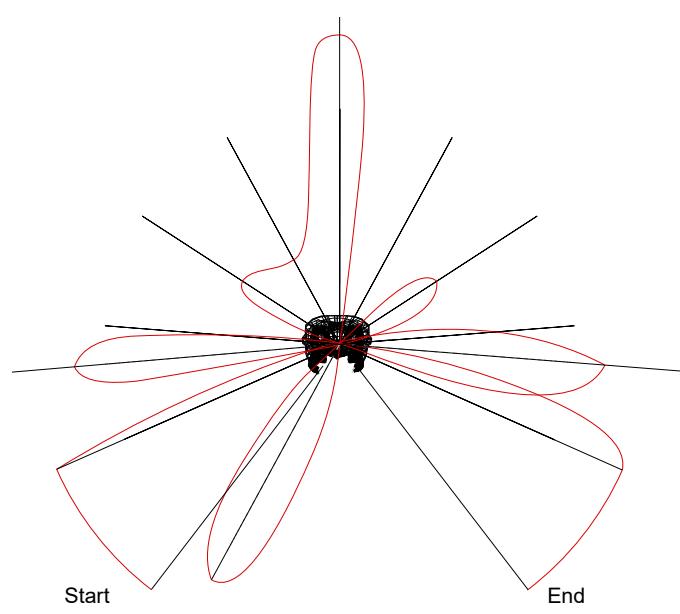
Design development into a pavilion that provides 'focus windows' for the practitioner that align with their views in a given routine. The points of focus would be on the elements of the site: the neighbouring houses and flats, and the surrounding trees. The pavilion would only frame these elements.



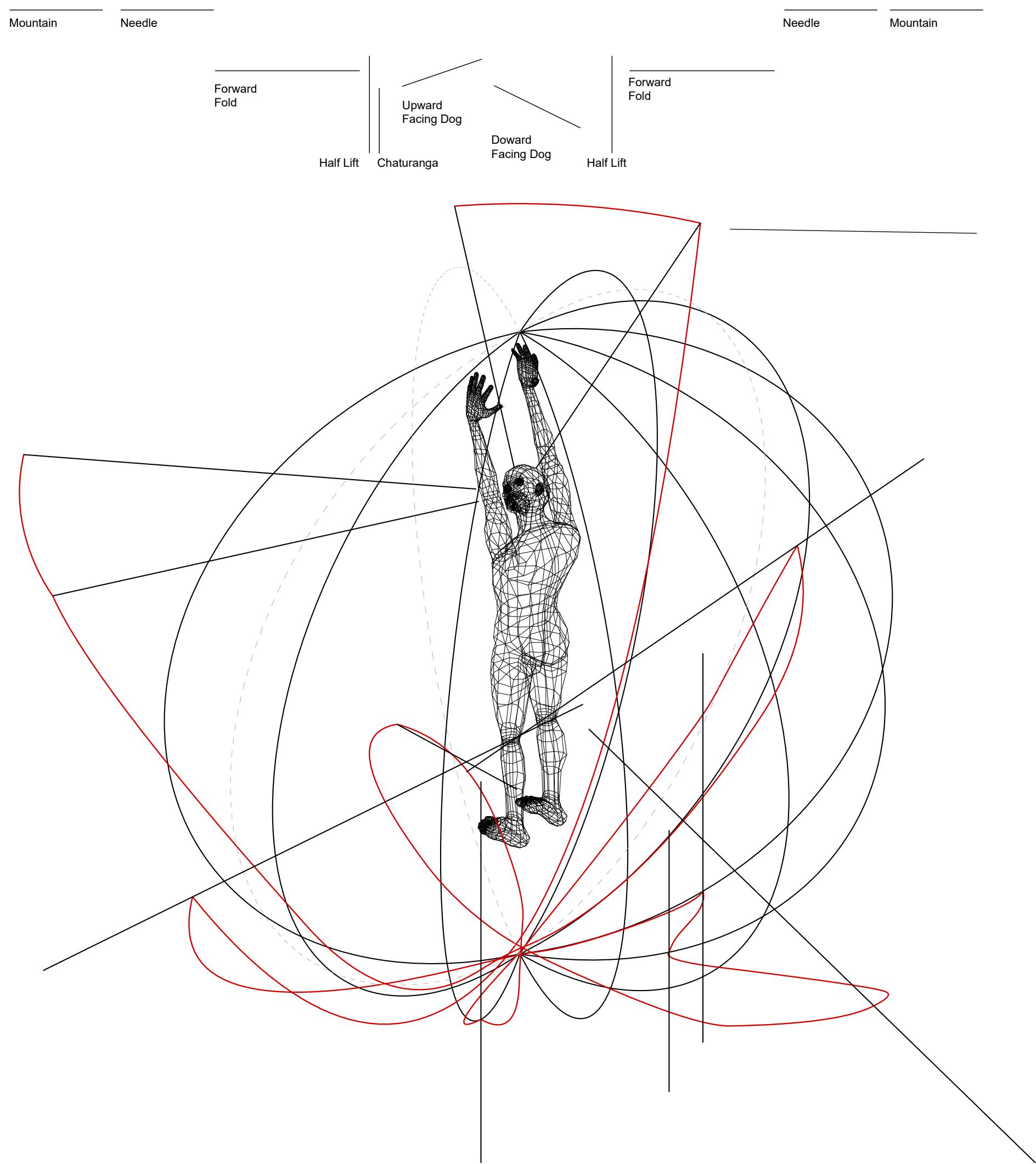
The views of each pose aligned on the same axis.



The views rotated around 360 degrees. Spreading the movement around the surrounding space of the practitioner. For the path to align up correctly with the yogi's view the path must rotate around them.

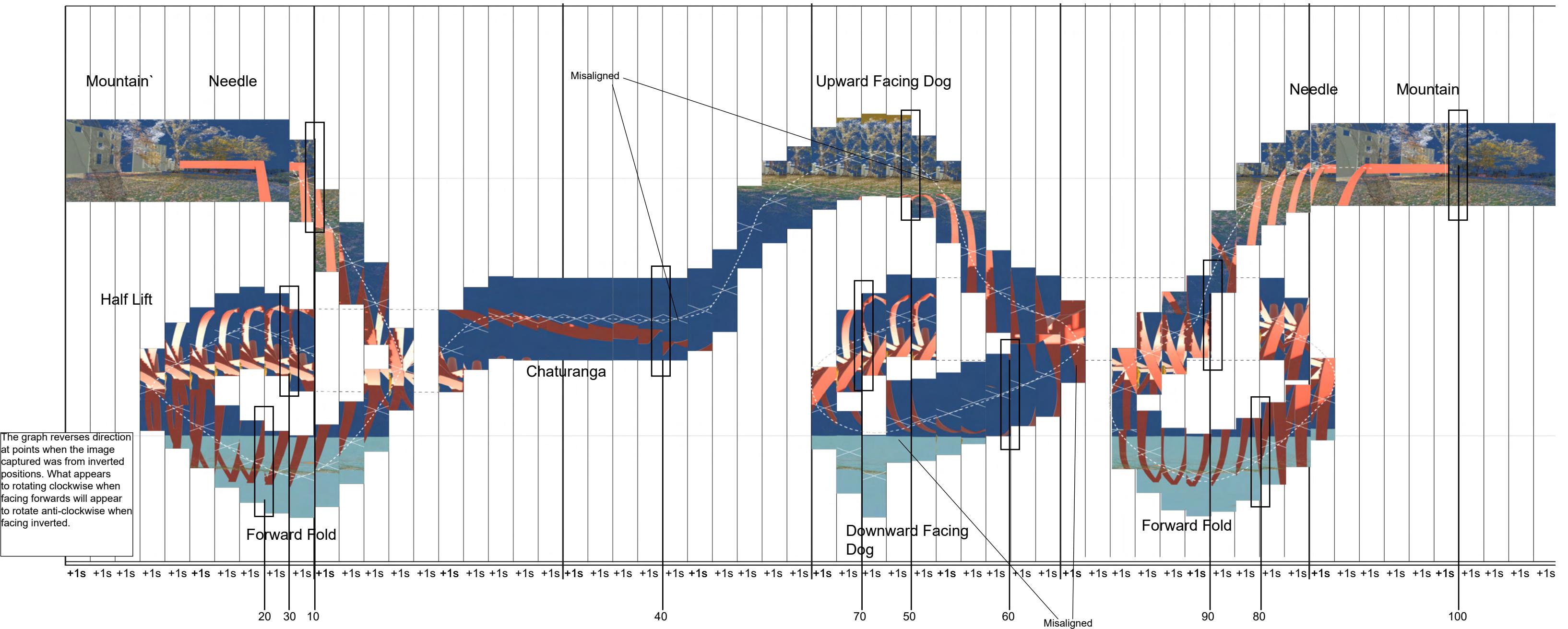
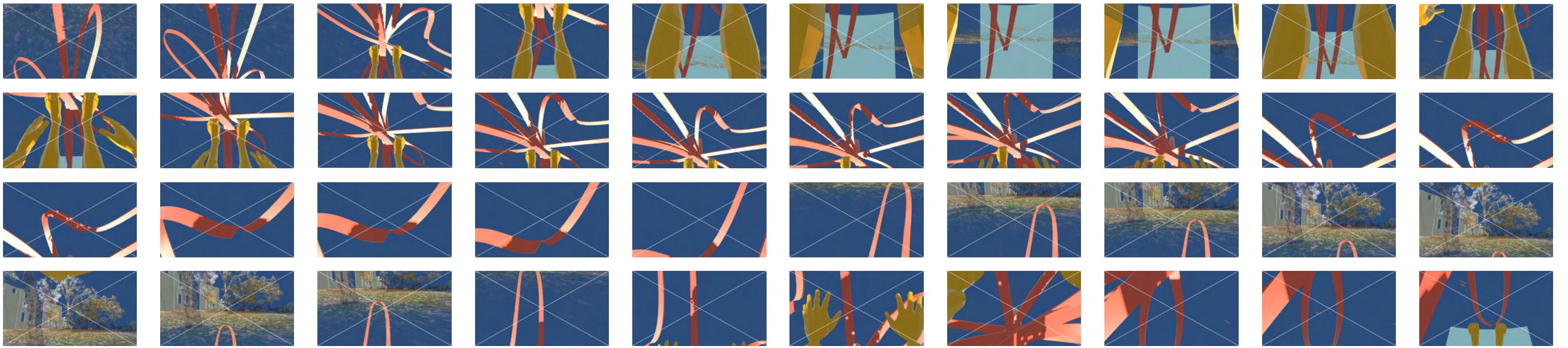


Plan view of the estimated viewing path of the practitioner. The path is in red.



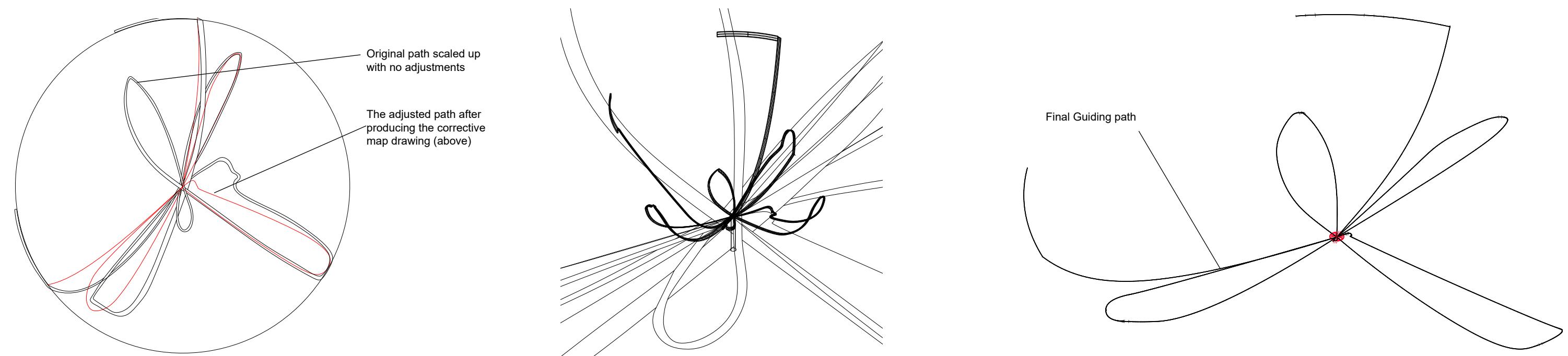
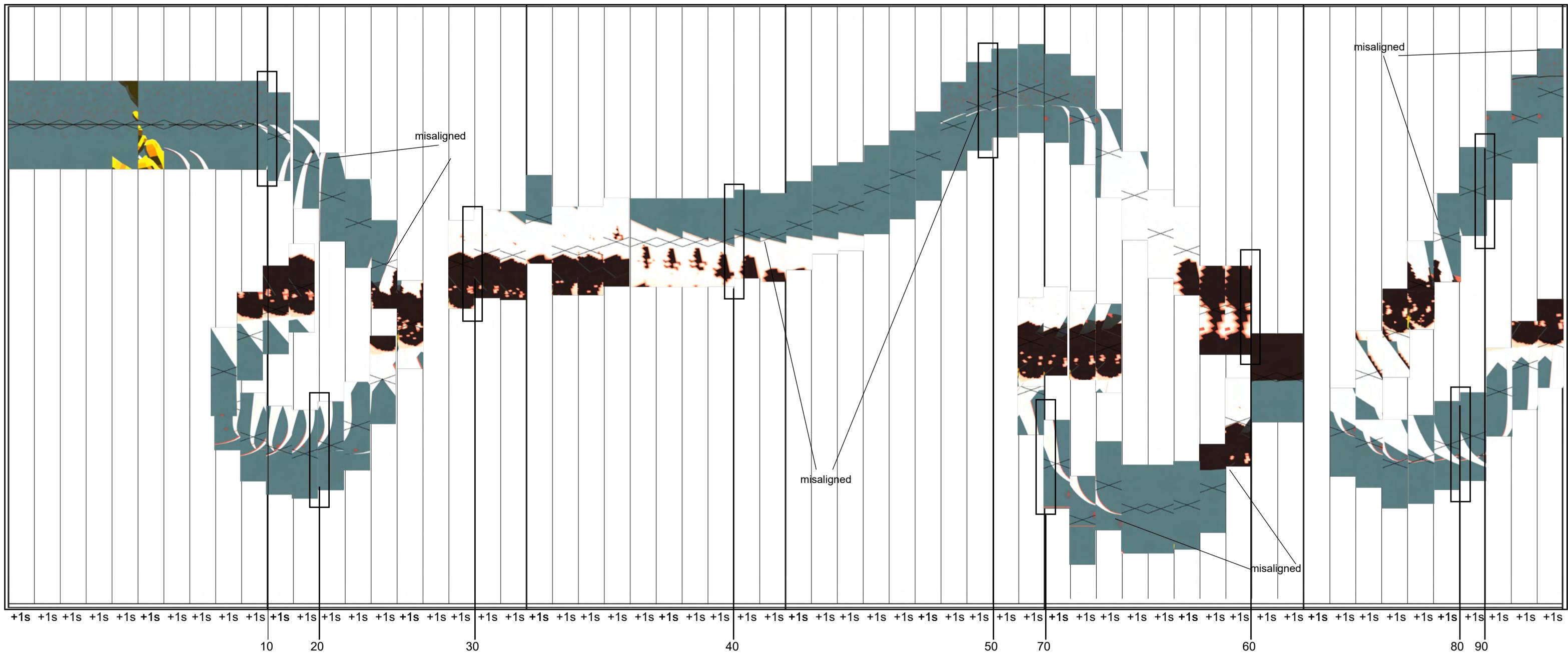
Mapping the Viewing Paths of Sun Salutation A

Drawing and mapping the viewing paths of the practitioner during the yoga routine. By recording the traced path that is traced by the eyes during yoga, this same path can be used as guiding route for the practitioner repeating the action - or to someone who has not done the action before.



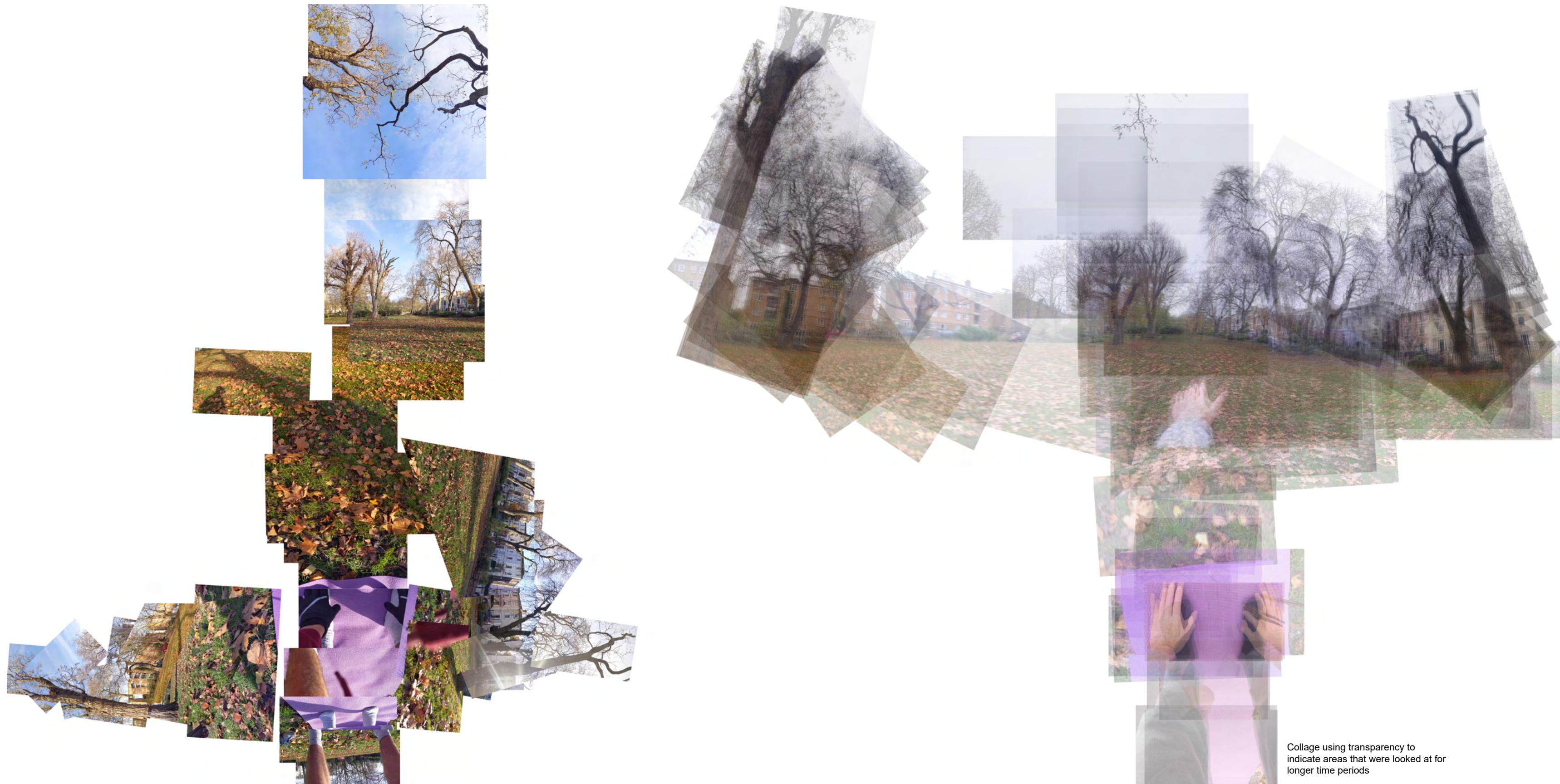
Correcting Path through Drawing

The estimated path was tested in a virtual environment and compared to the centre point of the camera as the yoga routine was simulated. Mapping the captured space of the avatar during the routine allows the estimated guide path to be adjusted.



Creating Optimal Path through Drawing.

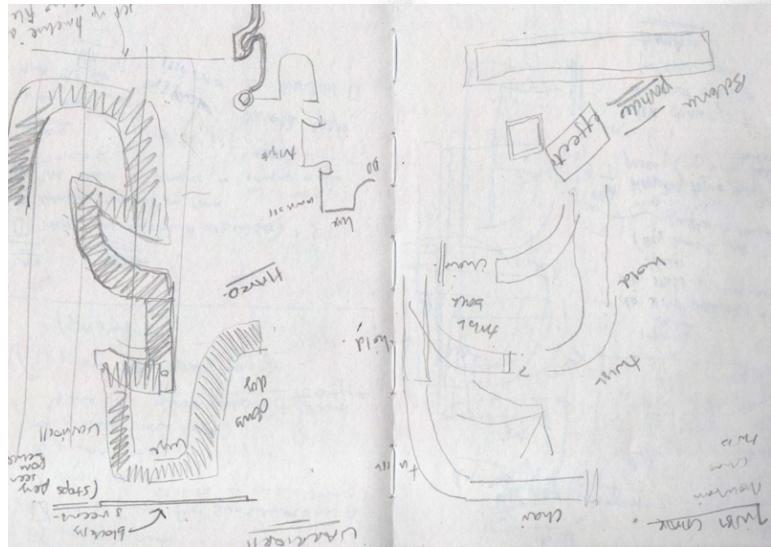
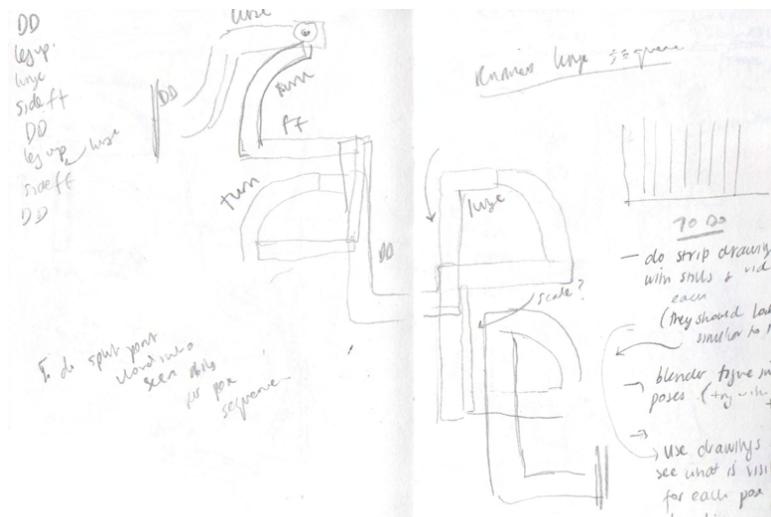
After correcting the initial guiding path of the yoga positions, to create more space around the practitioner in the virtual environment the scale of the guide path was enlarged. Another corrective drawing was produced to adjust any corrections.



Mapping the Visible Environment

Visiting the real site, the yoga routine was recorded from the first person point of view. Using this as source material and reference, an estimation of the site which is totally not seen during the yoga sequence can be made - these areas' importance within a virtual world are under question when they have little impact in the physical experience.

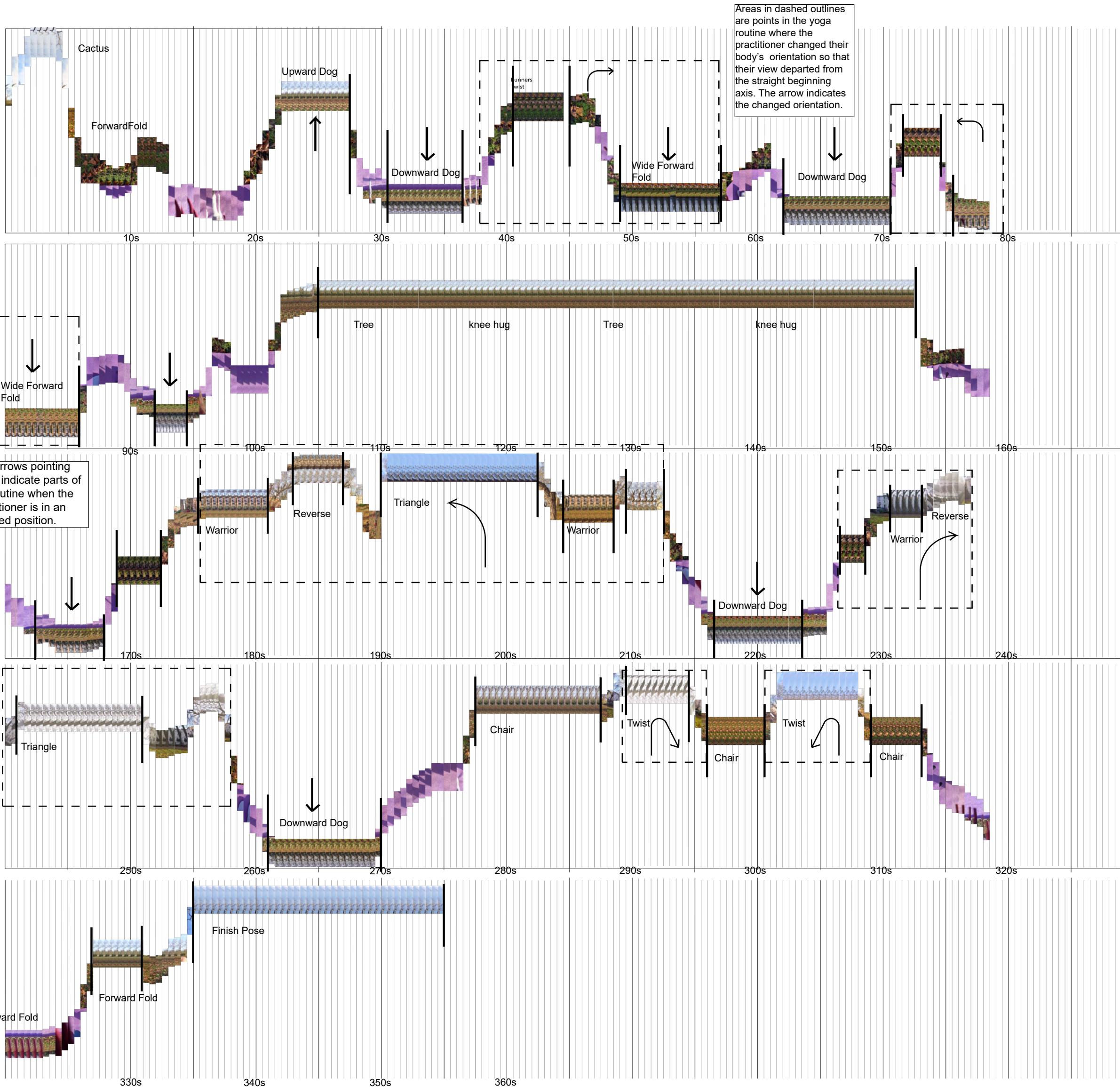
Collage using transparency to indicate areas that were looked at for longer time periods



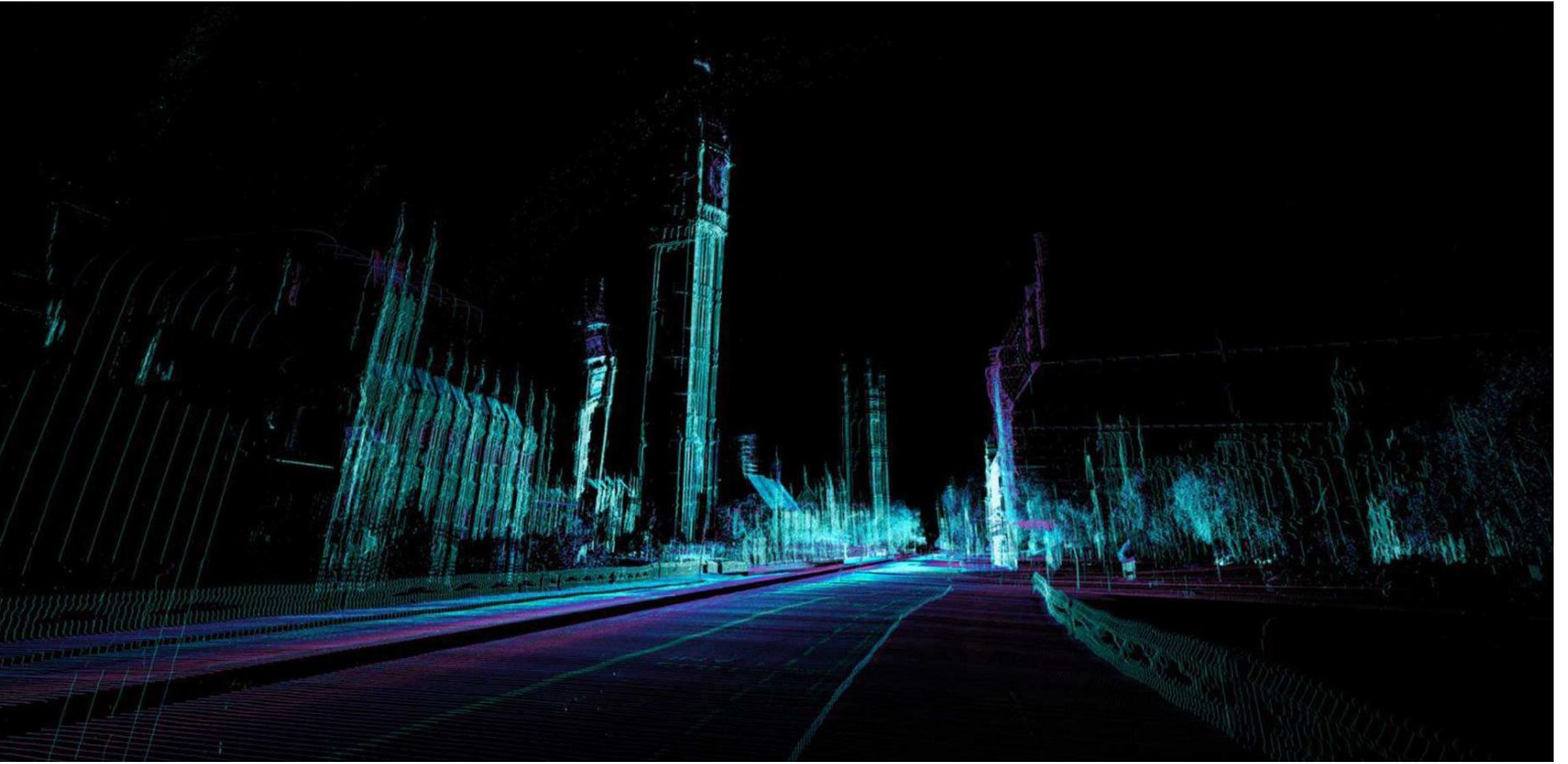
Sketches estimating the guiding path that would be generated from this latest yoga routine. This system doesn't work on a rotating guide but one that moves perpendicular to the direction of the view.

Mapping the Visible Environment

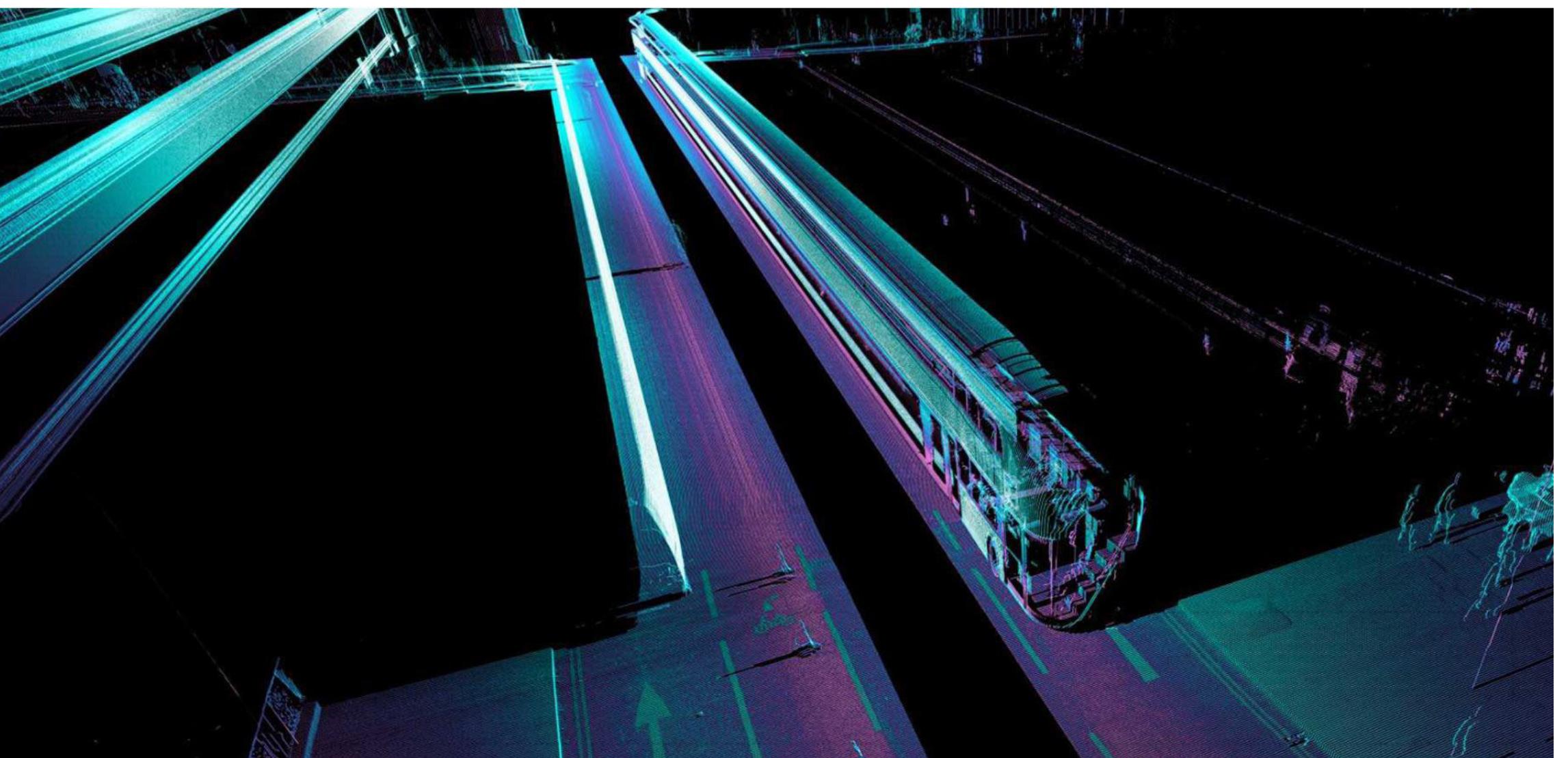
The drawing spreads the previous collage of what was visible during the yoga routine over an axis of time. Each slit is the captured view during the routine. The interval between captures is 0.5 seconds.



The scanner will repeat things in the map that it has already detected. In this image, Big Ben is repeated as a result of the scanner 'seeing' it multiple times as it crosses Parliament Bridge.



The scanner was stuck in traffic next to a London bus, so in the map the bus has become stretched and deformed.

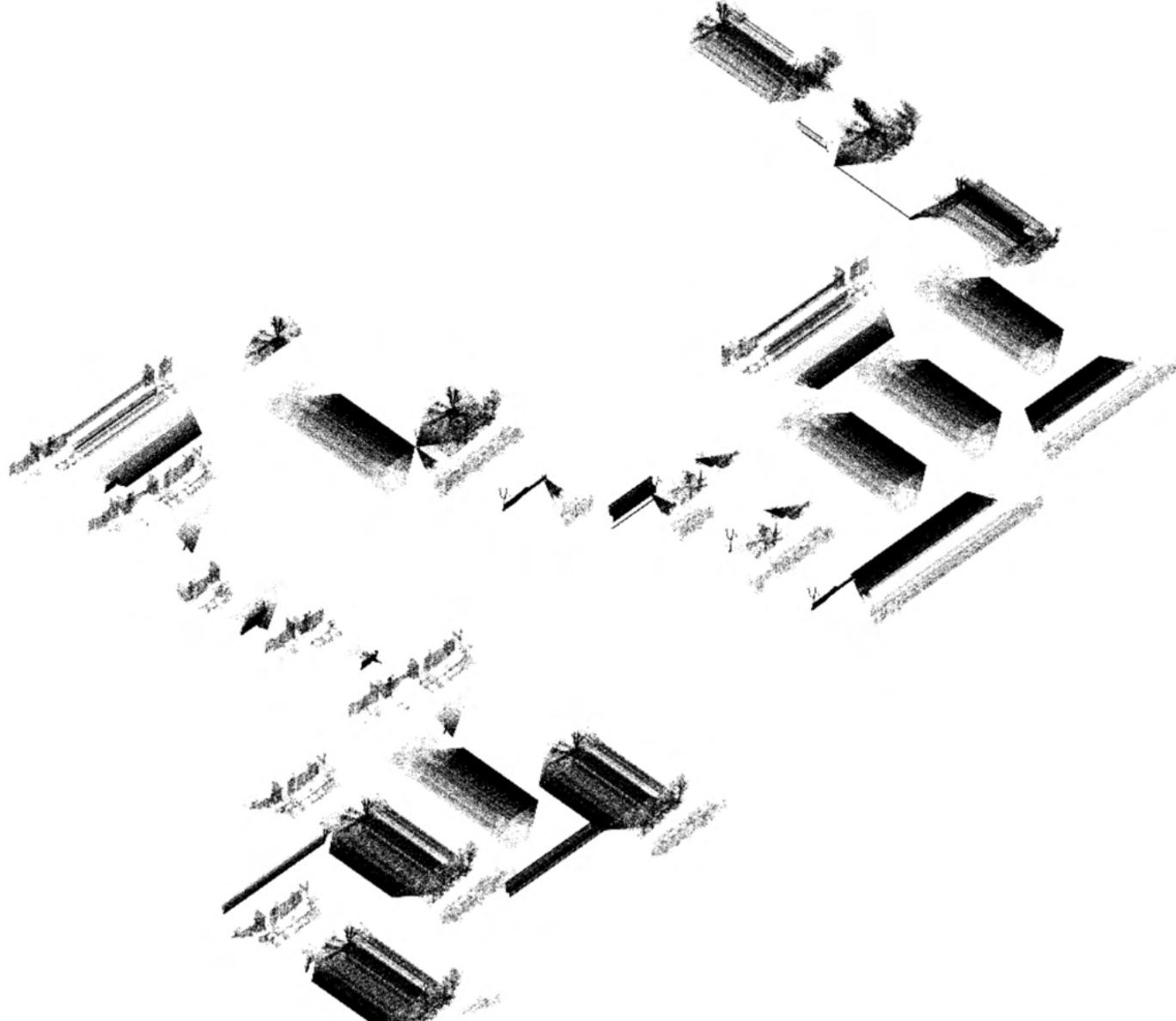


Reference:

ScanLAB - Dream Life of Driveless Cars

A 3D laser scanner was driven through the streets of London. As the scanner moves through the city, gets stuck in traffic and slows for speed bumps the map created is warped dependant on the speed of the car. The longer the scanner detects an object the longer/ the more extended it appears in the map.

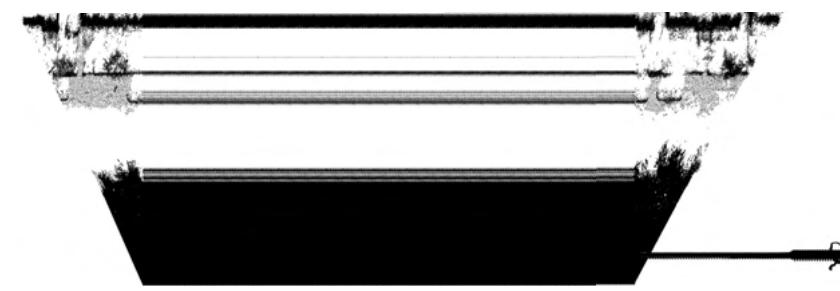
Isometric view of VR sequence



Elevation

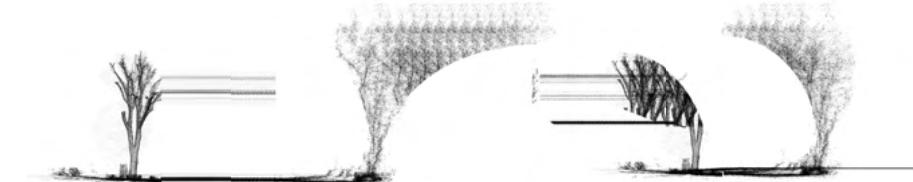


Plan

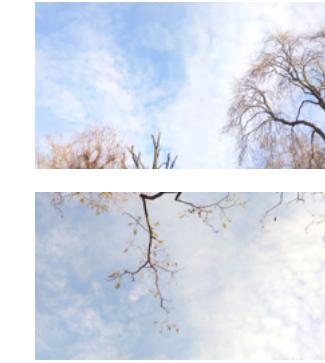
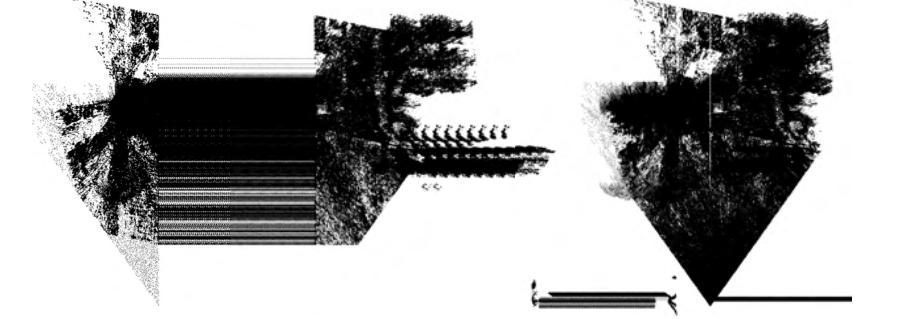


Warrior Flow: As the practitioner bends backwards different parts of the tree trunk become visible, the curve represents what was seen over time but spread across the axis of time. The house is separated by a stretched section where it was looked at in a held position.

Elevation

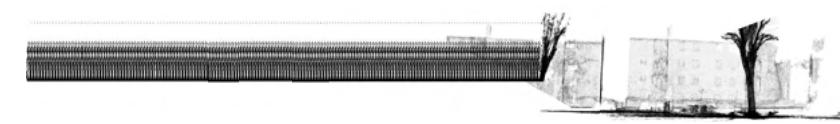


Plan

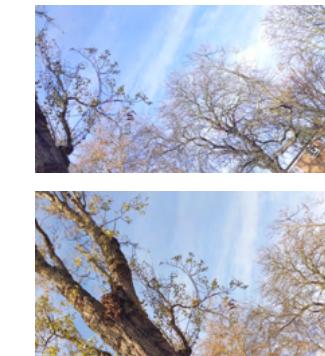


Sun Salutation A: As the practitioner looks upwards less of the tree is visible. The tree appears curved as the top sections of the tree are stretched for longer amounts of time.

Elevation



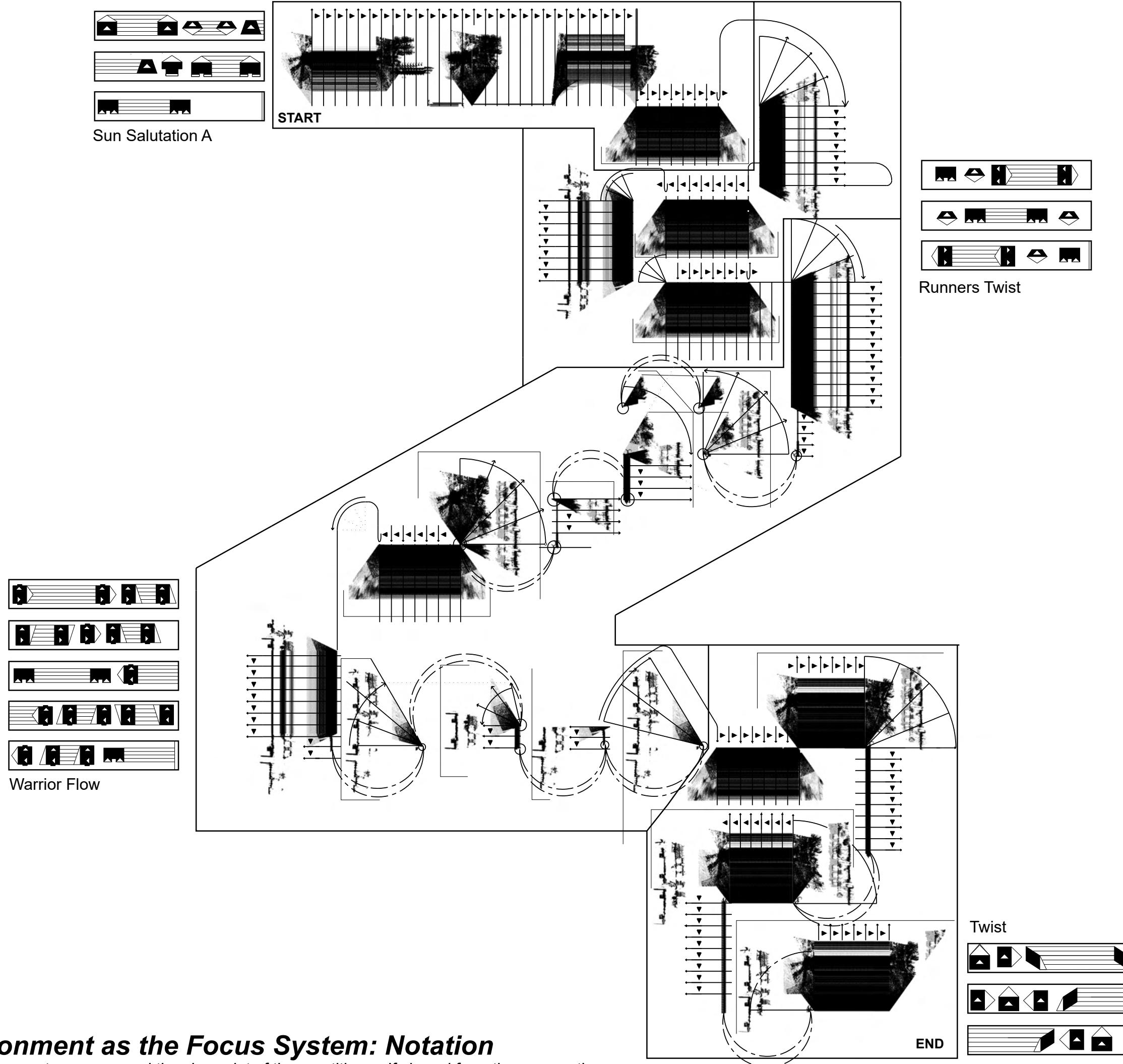
Plan



Twist: The upper part of the tree is what is visible during this held position. The tree is stretched in the virtual environment for as long as it is looked at. Everything else has been deleted.

Using the Environment as the Focus System

Building on both the previously developed system of the viewing trail as a guiding system for yoga positioning, and the virtual pavilion's aims at recentering the site's surroundings as the focus for the practitioner, the new VR system renders only the environment which is necessary visible. The environment ceases to exist if the practitioner strays from the correct orientation.'

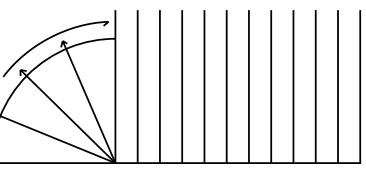


Environment as the Focus System: Notation

The environment wraps around the viewpoint of the practitioner. If viewed from the perspective of an observer and from a vantage point outside of the designated viewing position, the manipulated environment is hard to understand. The notated drawing is a way to understand how this environment is supposed to be experienced.

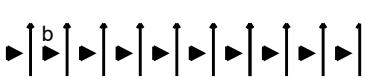
Key:

Timeline:
Measured in seconds, this indicates the point of the sequence viewed by the user at a given point in time since the start of the sequence.



The timeline is uniform as the sequence is moving, but when the environment is stationary during pose transitions the timeline arcs to follow the orientation of the user.

Directions:
The viewing direction of the user.(a)



The direction of the next parts of the sequence.(b)

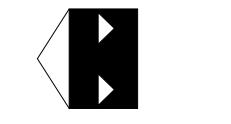
Skips:
The sequence 'jumps' or 'skips' at certain points. At either end of a 'skip' is a repeated reference point.



Short Notation:

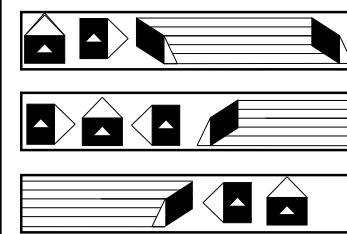


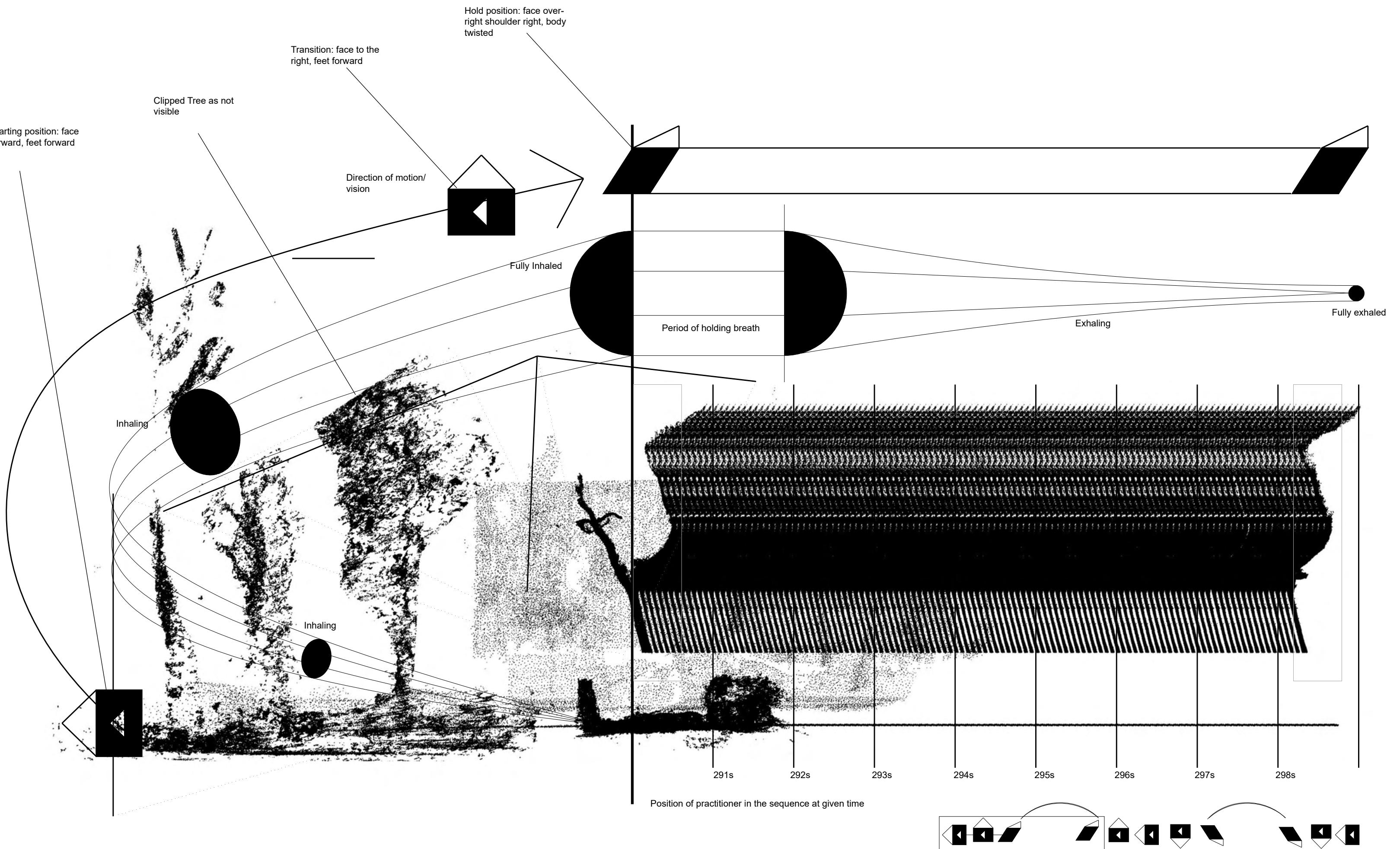
Position is held.



Position is part of a transition

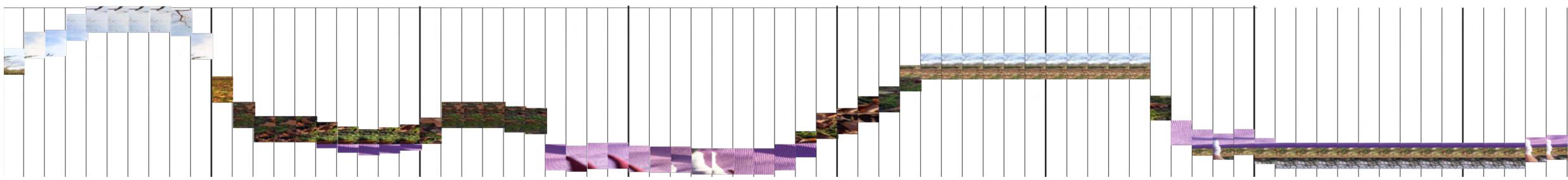
Twist





Focus System Notated: Elevation (Right Twist)

Only what is necessary is kept. The tops of trees are clipped, the bottoms of trunks also. As the Practitioner turns and looks over their shoulder they see the top of the wonky tree stretch as much as they are. As the row of the stretched view ends, the practitioner knows to turn back to center.



25s

20s

15s

10s

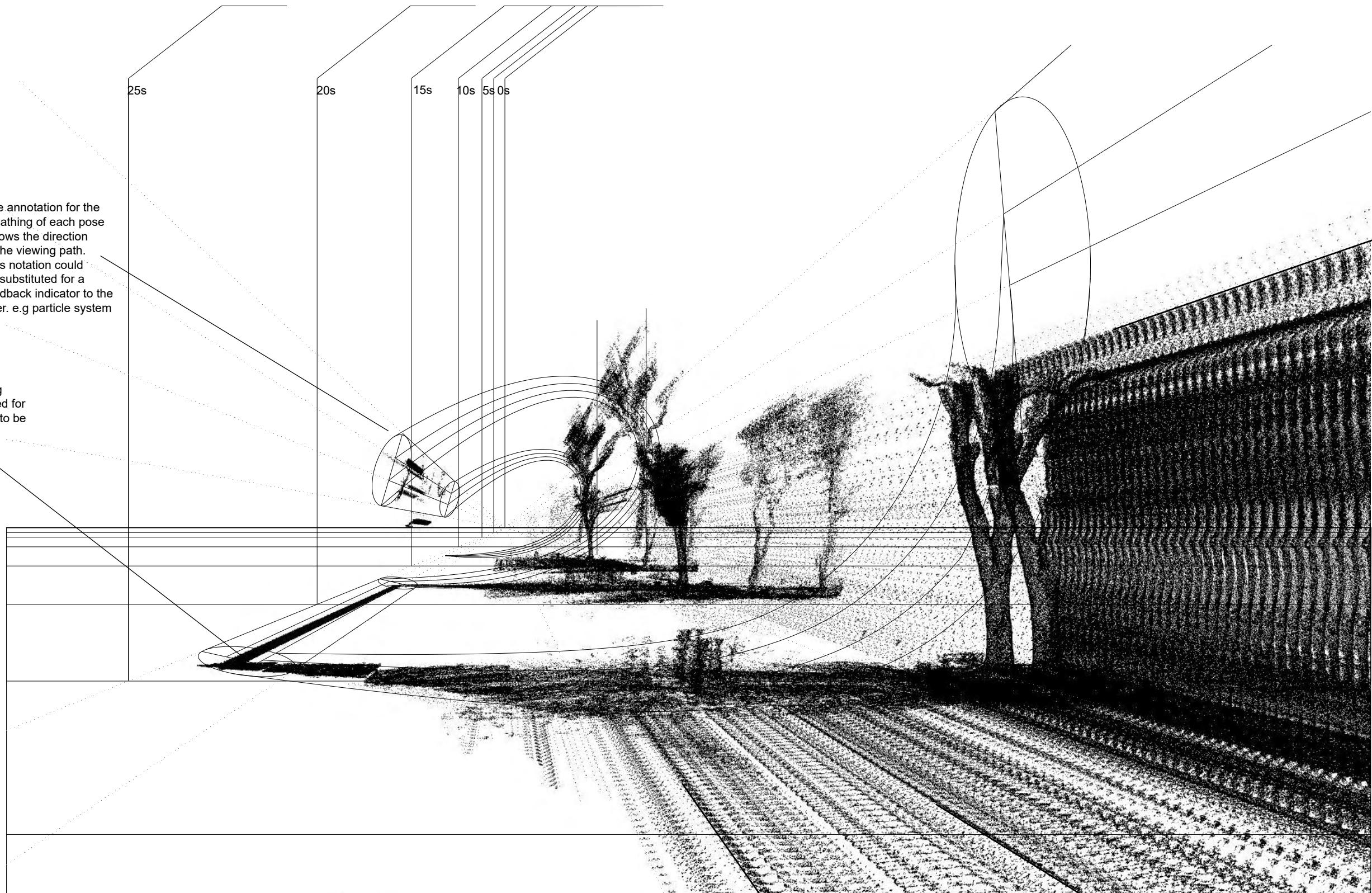
5s

0s

The annotation for the breathing of each pose follows the direction of the viewing path. This notation could be substituted for a feedback indicator to the user. e.g particle system

The practitioner is looking down so there is only need for a small patch of the floor to be rendered.

The cut of the tree that is repeated along the axis of time for this particular pose.



Focus System Notated: Perspective (Sun Salutation)

Narrow strips of ground are all the practitioner has to see. If they wobble then the floor seems to fall away from them. The sequenced spaces are a digital map that serves the purpose of this specific routine. Without the correct viewing orientation this environment is unintelligible. With it, the environment serves to be a guide.

