iMeasure (iM) Headphones:

Sonar Mediated Listening Explorations

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Abstract. iMeasure (iM) Headphones is a set of sonar enhanced headphones that "play" particular sounds in relation to spatial readings. This investigation proposes alternative modes of listening that shifts and re-maps the relationship between body, sound and space. Therefore, through a series of experiments and walk, the device is explored as an apparatus that ties the movements of the body to the physical landscape with a sonar mediated listening experience.

iMeasure (iM) Headphones is a custom set of sonar headphones that explores digitally mediated sonic-spatial relationships. iM Headphones is embedded with a set of sonar sensors that take spatial readings of the physical environment and "play" particular sounds in relation to the data. iM Headphones therefore provides a specific pixellated aural experience. An individual's sonic perception of space is a direct translation of two measured points that extend from the headphones. On the one hand, listening becomes an immensely reduced experience. On the other hand, the individual's behavior and movement through the surrounding landscape fundamentally shifts when adapting and re-establishing their relationship between body, sound and space. The device is therefore explored as an apparatus that mediates the movements of the body to the physical landscape.

The following research is informed through multiple stages of design, fabrication and implementation of the device. The potential behavioral implications of iM Headphones are then explored through three separate phases of conducted experiments and walks.

Sound Locative Devices

The research trajectory of iM Headphones addresses the larger historical context of listening technologies that map the surrounding environment. These devices include World War I and II military development of sonar technology. In active sonar mapping, distance is measured by the time difference between emitted sounds and its reflections.[1] Devoid of traditional visual means of mapping in these extreme underwater environments, the ability to spatially locate objects is constructed entirely through understanding specific properties of sound.

Out of the water and listening instead to the skies, sound locators were also developed for anti-aircraft combat that explored aural and visual tactics in locating enemy fighters. Specially trained operators behind sound locators that resembled contorted conical shaped forms were used to determine the general direction of approaching airplanes before they could be visually seen. Human listening was also enhanced by the development and use of microphones embedded within the mediating contraptions. The operator would constantly filter between noise and information as they aurally sifted the skies for fighter planes. The process of locating objects continually shifted back and forth between aural and visual mapping.

iM Headphones brings together these trajectories of sound locative research with a different intention. In both sonar technology and sound locators, the role of sound reinforces or substitutes a visual means of mapping objects within space. However, as opposed to shifting between aural and visual, the feedback loop in iM Headphones is sound. This cycle begins with the sonar sensors emitting an ultrasonic frequency. The device then listens to the reflection and determines the resultant distance. This data is translated through an algorithm that emits a particular sound audible to the human ear. This then re-informs the body and the subsequent movements through space. The relationship between machine and human listening is therefore a continual cybernetic feedback loop that extends the use of sound beyond merely a locative means.

Through this process, a heightening and redefining of sonic relationships places the body in a constant state of mediation. The resultant map presents the surrounding environment in continual flux as opposed to a fixed constant. The cartographic mapping strategies employed thus unfold the spatial relationships between body, site and sound.

Figure 1. The design of the iM Headphones logo is a play on the simple aesthetics used in Apple marketing.

Design of the Device

iM Headphones is framed as an instrument that is both a a tool for measuring and also a device that emits sound. Through the design and construction of multiple prototypes, each aspect of the design of iM Headphones was refined in relation to aesthetics, functionality, mobility and comfort.

Each component of the physical apparatus of iM Headphones was a play off the small indiscrete iPod devices. In contrast, iM Headphones are large and bulky and are constructed of laminate plywood for both its acoustic properties and its tactile texture. The dimensions of the headphone end pieces were continually calibrated to fit comfortably around the ears. A single strip of laminate plywood was formed and bent to the curvature of the head. This band provides enough tension to hold the headphone end pieces in place. The sensors were embedded within a layer of plywood for protection.

A wooden box was designed and constructed to contain the netbook computer, GPS unit, and the Arduino microcrontroller. Particular details within the encasing added to the robustness of wire connections for the prototype. Two speakers with a resistance of 8 ohms were installed along with a pair of MaxSonar sensors with a range between 6 and 254 inches. A digital compass was situated within the headphones to measure directionality.

iM Headphone Compositions

To test the device, a series of compositions that explored relationships between sound and space were developed. Through these compositions, the data from the sensor inscribes the surrounding landscape into the individual's aural experience. Thus, a symbiotic relationship develops between the device and the user when traversing the physical landscape.

An Arduino miccrocrontroller was programmed to read the sonar distance measurements. This data was then gathered, stored and processed through the visual programming language Max/Msp. A patch, a Max program, was designed to emit a continuous sine wave that would construct particular relationships between the distance measurements and the frequency and amplitude. The composition was limited to these two conditions in order to create a direct and easily understood relationship between distance and sound.

Initial Algorithms

The initial two algorithms developed for the compositions were entitled "Claustrophobia" and "Agoraphobia." Each was developed to experiment with inverting existing spatial conditions of open and closed spaces. In the composition "Claustrophobia", open spaces would produce both high frequencies and volumes. An individual's walk into smaller spaces would

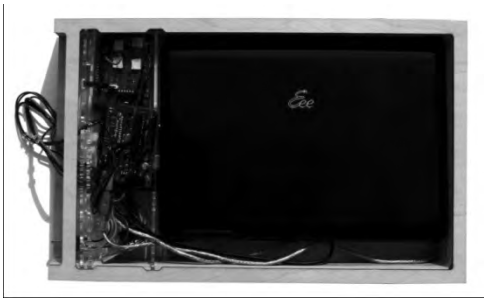

Figure 2. Photographs of the device and wooden box that contains the computer, Arduino microcontrollers and the GPS unit.

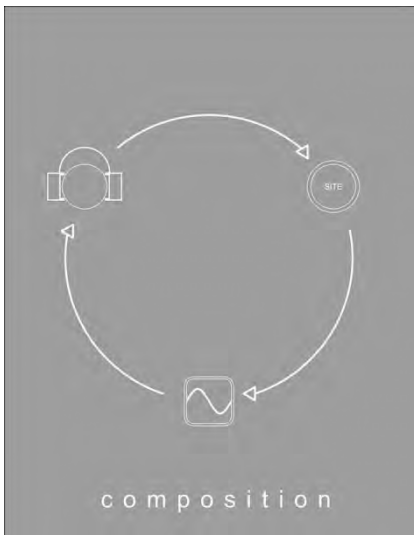

Figure 3. Diagram that demonstrates the relationship between the mediated body, the surrounding environment and the produced sounds.

have the reverse aural effect of the architecture, thereby opening up confined physical experiences sonically. The composition Agoraphobia had the inverse effect of Claustrophobia. When the individual walked through closed spaces, both the frequency and volume were much higher to create more uncomfortable and intense experiences.

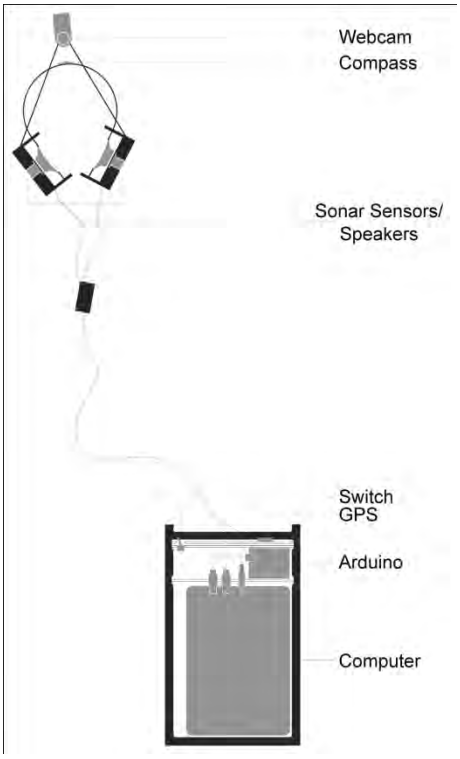

Figure 4. Components of iM Headphones and the box containing the sensors and computer.

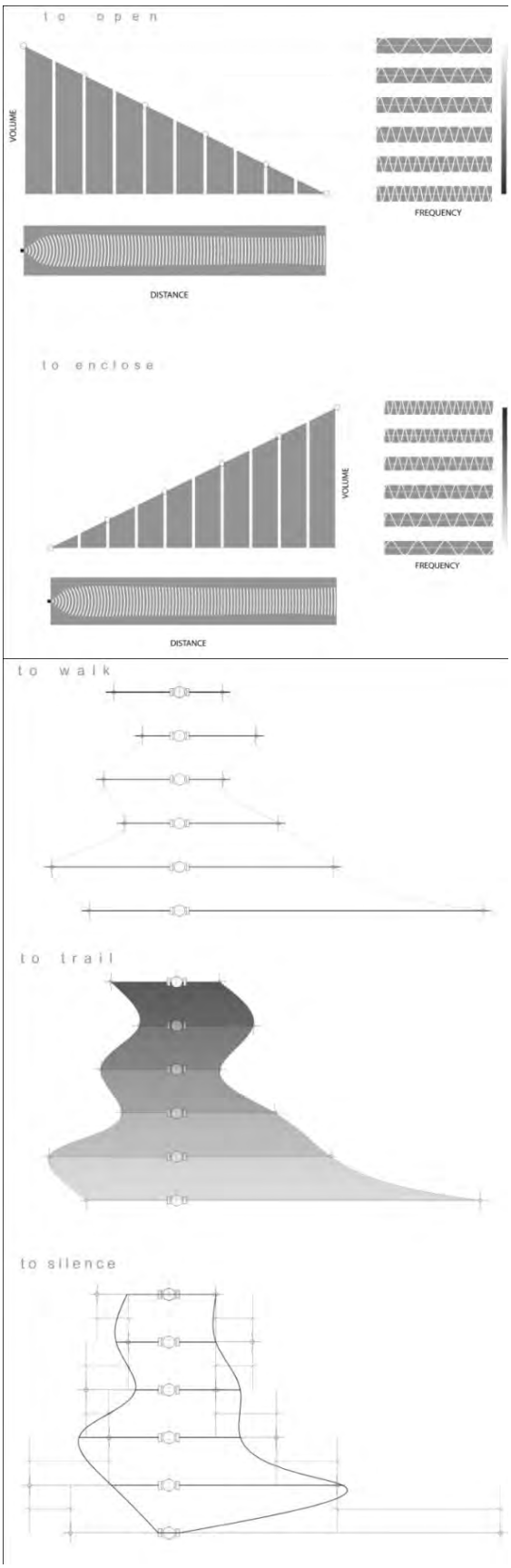

Figure 5. Diagrams of the operations for the compositions.

Operations for the Composition

Further development of algorithms reinterpreted the initial algorithms as part of a series of operations that could redefine a broader range of sonic spatial relationships. The initial titles "Agoraphobia" and "Claustrophobia" were replaced with five operative actions: to open, to enclose, to walk, to trail and to silence. These operations were interchangeable to provide a greater degree of flexibility and adaptability to different walks and site conditions. Experiments also followed with methods of aggregating particular operations.

Walking and Relational Listening Practices

A walk through the city today is almost unimaginable without the use of digital devices like the iPod. The mid-twentieth century Situationists' subversion of modern urban planning through the dérive – the practice of drifting through the city – is therefore critically reassessed in relation to contemporary modes of moving through the city.[2] Indeed, in relation to Michael Bull's discussion of the personal stereo, devices like the 1969 Sony Walkman have shaped personal control over aural space within an increasingly loud urban condition.[3] As a consequence, donning a pair of headphones and listening to personalized soundtracks have both reinforced and created new habits and routines within everyday life.

Particular mobile media practices have challenged the private personalized space of headphones by mapping the surrounding landscape onto the aural experience. In Layla Gaye's "Sonic City", both the movements of the body and real-time sensor input from the environment are mapped onto an individualized soundtrack.[4] In Christina Kubisch's "Electrical Walks", the sounds of her custom headphone devices are created through mapping the Hertzian space of the invisible electromagnetic spectrum.[5] In both projects, the actions and gestures of the body in walking through the urban fabric reflect a particular awareness of the urban condition.

iM Headphones is another approach to probing physical space through a mediating device. The physical walk sets in play the relationships between body, sound and space and provides a medium in which to construct an alternative practice of walking.

Initial Conducted Walks - the Mediated Drift

Early testing of the headphones took place in Buffalo, New York along Lake Erie. The Erie Basin Marina Observation Tower was chosen for initial experimentation because of the juxtaposition of two contrasting physical experiences. The building is open to the air and is constructed with cast-in-place concrete. The individual ascends the tower through a series of narrow stairs that are enclosed by rough exposed concrete on all sides. The climax of the experience is at the top of the stairs with a completely open and breathtaking 360 panoramic view that include the city of Buffalo, the convergence of Niagara River and Lake Erie, and a small glimpse of Ontario, Canada. The shift from complete enclosure to open exposure is directly linked to the physical architectural language of the design and construction.

The first walk used the algorithm Claustrophobia which was designed to sonically invert the dynamic sequence of experiences in the Observation Tower. The distance measurements would parallel the sounds created. The lower the measurement, the lower the volume and frequency would be and vice versa. On the 29th of October, 2010, my walk up the Observation Tower confirmed some of my assertions about the inversion of experiences. Walking up the completely enclosed spiral staircase, I could create some nuanced phasing effects that were not overwhelming and quite enjoyable. However, once reaching the top with the clear panoramic view, the sonic experience was almost painful. The spatial contrast shifted the aural senses from expansion to contraction. I eventually scurried around with my body low to the ground where physical obstructions were closer. The angled form of the concrete corners also provided moments of reprieve and rest. The experience was also influenced by sight in which I found myself locating particular elements in the physical environment to shield the headphones as well as peeking out through the handrails for views of lake.

I continued drifting through the surrounding landscape. I actively attempted to control my sonic comfort level by seeking out physical objects in the landscape, which included lampposts, garbage bins, handrails, benches, and exposed boulders. The site was vast and open with little in the environment which subsequently created extremely intense sonic experiences. Whereas one has the capacity to close the eyes when views are overwhelming, there is no possibility of closing the ears. I also avoided using my hands to control the sounds in thinking that this action would undermine the true use of the headphones. Instead, I was under the assumption that the sonic experience should be controlled through objects in the landscape and not through physical bodily interaction. The uncomfortable conditions afforded by the barren and open site therefore forced me to literally run from one point to the next. I was visually reading the objects within the landscape for specific spatial affordances. Whether crouching between a bench and a

Figure 6. Photographic series of a walk with the composition "Claustrophobia".

railing, pointing a sensor to the ground to relieve one ear, or sitting out on the beach between rocks and boulders, there were brief moments of reprieve that were quite enjoyable with beautiful views and phasing sound waves.

A separate expedition was conducted with the composition "Agoraphobia" which, as expected, had almost the opposite effect. The walk up the staircase was not too overwhelming as the distance between the walls created evenly spaced sonic phasing effects. However, upon reaching the completely open condition of the observation tower, the experience became immediately quiet. This was a strange sensation especially in relation to the other composition "Claustrophobia". There was no consistent feeling of sonic bombardment with this particular algorithm as it was much easier to navigate the landscape in a controlled manner. As opposed to the frenetic pace and physicality of the experience using "Claustrophobia", I began approaching objects out of curiosity. I was drawn to spatial conditions between walls, trees and railings to listen to the different sounds created. There were moments also when I stood amidst tree branches and made subtle turns with my head to experience particular movements of the branches in relation to the breezes and wind patterns. I became aware of the cone radius of the ultrasonic sound reflection in which the effect was only successful where the branches were furthest apart. This walk experience was more of an intimate play with the affordances in space.

Four Walks

The following four walks were conducted by an invited participant Anne Muntges, a local Buffalo artist. A particular language and narrative was introduced to communicate particular aspects of the walks. Also, as opposed to the highly loose paths in earlier studies, the four walks were designed and constrained in order to provide a succinct path for participants.

Narrative Strategies for the Four Walks

Both narrative and diagrammatic techniques were used in each of the walks to provide a clear framework as a guide. Each walk was conceived of with a title: "A walk along the waterfront", "A look out the observation tower", "A walk around the obelisk" and "A walk across the bridge". The title for each walk plays an important role in describing the event. The narrative qualities help provide specific spatial and temporal constraints. The limited trajectory or space of movement does not necessarily imply a reduced experiential opportunity. Instead, by paring down each walk to a set phrase, the individual is guided through a specific path.

The conceptual framework of the walks parallel the work of contemporary artist Richard Long in which he leaves particular visual remnants like simple lines carved into the natural environment. Many of his works, like "A Line Made By Walking" completed in 1967 provide a photographic and narrative framework in contextualizing the physical walks that took place.[6]

The diagrammatic qualities of the narratives for the walks also parallel twentieth century sound space sculptor Bernhard Leitner's sketches of movement for Soundcube. These drawings trace the pathway of sound through a grid of speakers.[7] Similar to these drawings, the titles of the four walks for iM Headphones provide a conceptual and abstract reference in tracing the designated paths.

However, in contrast to Leitner's movement of sound through a series of fixed speaker locations, the individual body moves through space in the walks of iM Headphones. The walk demonstrates the impossibility of recreating the specific formal drawings. The design of the experience therefore takes into account other qualities of walking that include subtle deviations from the path, the shifts of the head between each step and the act of pausing around particular objects in physical space. Rooted in Michel de Certeau's notion of walking as a spatial practice, the body deviates, drifts, and improvises spatial conditions.[8] In addition, as opposed to Leitner's highly controlled gallery installations, the four walks are conducted out in physical space to allow for different opportunities for chance and play.

iM Headphones uses a composite of these strategies in understanding the paths of the walks. Narrative plays a key role in understanding both the intended trajectory of the performance but also in recreating the experience through memory. The simple forms of lines, circles, spirals, or a combination thereof starkly contrasts the resultant maps of the physical walk. The body's movement through each site subverts these highly abstracted imaginary lines that are implied. Guided by listening, the individual investigates different interactions with physical objects in the landscape. At every moment, both conditions of drifting and wandering are reflected in the physical map.

Four Walks

Before the start of each walk, Anne Muntges and I played a simple game to introduce each selected composition. This allowed her to quickly understand the relationship between the sonar distance measurements and the sounds that it would produced. This game was done by

Figure 7. Pathway diagram of "A walk along the waterfront".

mirroring and following my actions that consisted of a series of movements in which I slowly covered my ears in different sequences.

"A walk along the waterfront"

The first walk was entitled "A walk along the waterfront". The performance was a straight path along a rock wall located outside the initial testing site of the Observation Tower. Elements of the site include a monotonous rhythm of lampposts as well as regularly spaced yellow trash receptacles that were neatly laid on their sides. This was chosen in part to provide a sparse visual canvas for Anne Muntges. The site was paired with the composition "to open" to complement the vast nature of the physical environment. This allowed for a much more nuanced spatial sonic experience where higher distance readings, which would encompass most of the walk, provided a quiet low frequency. This would therefore give Muntges an opportunity to get acclimated to the use of the headphones.

The immediate difference in her first walk with my previous experiences was the use of her hands to control her sonic experience. Indeed, this simple action was disregarded initially by my own predispositions of the headphone use. Throughout her walk, her gestures consisted of different stages of extending and contracting her arms and hands to help manipulate her sonic experience. She adapted very quickly to different elements of play. As she became more comfortable, she began interacting with the landscape by circling around lampposts, tilting her head to the side and moving her hands back and forth. She commented on a relative enjoyment of the sounds that were produced and controlled through the headphones.

"A look out the observation tower"

The second walk was entitled "A look out the observation tower" and mirrored my initial experience of the space. The path began at the bottom of the concrete staircase and spiraled upwards. The same composition "to open" was used to both increase her familiarity with the composition but also to set up the comparison between the open nature of the waterfront and the confined concrete structure of the staircase. This contrast provides an understanding of the different spatial qualities in relation to the sonic experience that was generated. Before she began her ascent, she immediately understood the intensity of the sounds that were to accompany her. Though she recounted afterwards the uncomfortable nature of the enclosure, she physically continued to test the spatial sonic qualities produced by turning her head and using her hands. As part of the experiment, she tolerated the intensity of the sounds. However, I could sense her relief at the top of the stairs and in the complete open. Muntges, after ascending the tower and standing in the open panoramic 360 view of the observation tower, discussed her feelings of discomfort throughout the climb up the concrete staircase as she reflected on the sharp difference between the first and second walk. As we began to descend the staircase, realizing the device was still on, she politely asked me to turn it off.

"A walk around the obelisk"

Material interactions with the sensors also came into play in the next performance "A walk around the obelisk". We discovered that, as the temperature dropped, her gloves absorbed the emitted ultrasonic waves. The presence of the hand therefore to control the headphones was circumvented by the absorbent materiality of the glove. In addition, this walk was paired with the composition "to close" in which being completely in the open created intense high frequencies and volume. Muntges would decide eventually to forgo the gloves altogether in an effort to better control the resultant sounds directly with her hands. These particular nuances therefore re-inform the relationship between site conditions and the device itself. These discoveries provide scenarios that are open to chance and unpredictability.

As Muntges began circling the obelisk, she also began crouching next to particular architectural elements of stone railings, seating and the fountain. Other moments of play also surfaced as she began testing the limitations

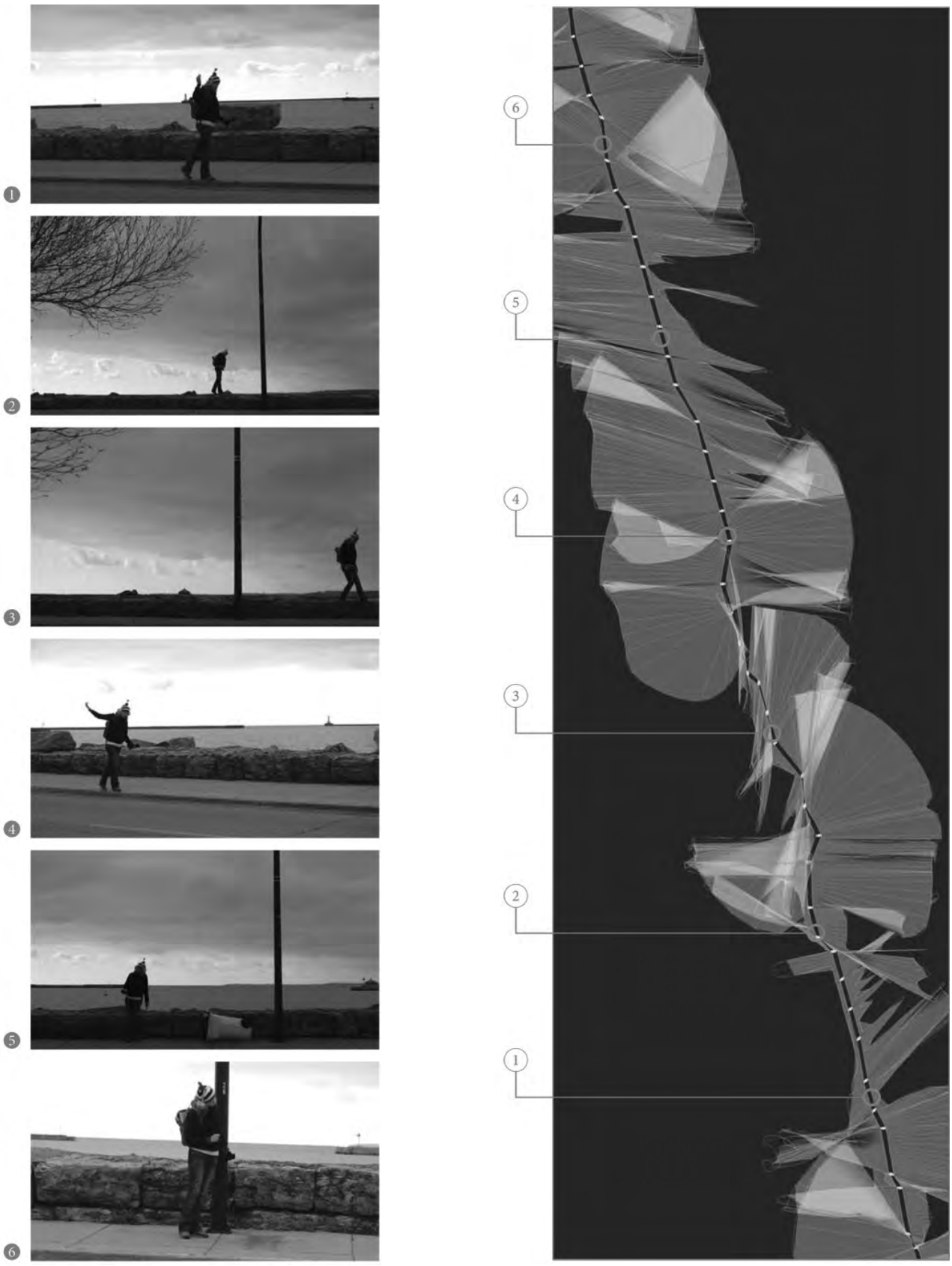

Figure 8. Photographic series and map drawings of "A walk along the waterfront".

Figure 9. Photographic series of "A look out the observation tower" depicting the concrete enclosed staircase and the open panoramic views.

of the device. There were points in which she began walking backwards while slightly angling the headphones behind her. She later recounted that she was trying to see if she could use the device to navigate backwards.

"A walk across the bridge"

The last walk was entitled "A walk across the bridge". The composition paired "to close" and "to trace" in an experiment to combine the various spatial sonic relationships. The sonic experience amalgamated several frequencies by using the most recent three sonar distance readings. The most recent measurement would be the loudest. Each of the previous sonar reading would fade in volume intensity. If the distance readings continually changed, then the sound experience would be layered and often cacophonous. However, if the distance readings remained relatively constant, then the experience would fluctuate slightly between a steady frequency to moments of slight phasing effects. This experience seemed the most enjoyable for Muntges. As she moved around the ramp of the pedestrian bridge, she would also test walking backwards while using her hands to gauge the different sounds produced. There were also points where she tilted her head toward the highway underneath in an effort to see if she could capture the passing of cars. The range was perhaps too far or fast because she was unable to detect the cars.

Figure 10. Photographic series of "A walk around the obelisk" where Anne Muntges begins to walk backwards.

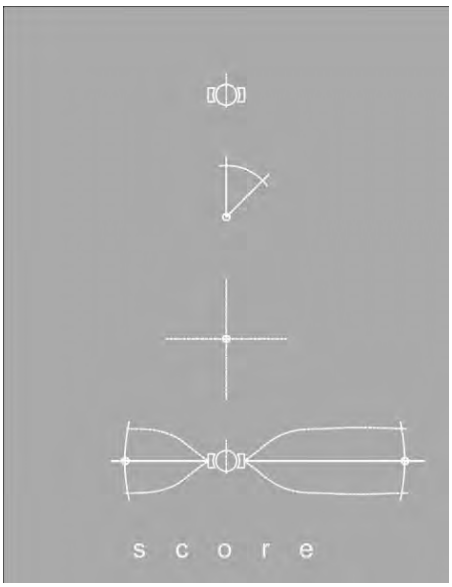

Figure 11. Diagram for the score that breaks down the components of the map into the body, the direction derived from the compass, GPS coordinates and the sonar measurements.

Drawing Maps of the Walks

The ephemeral qualities of walks were documented and mapped onto a series of drawings in an attempt to re-construct abstracted components of the sonic experience. The intent of creating these maps was to move beyond video documentation of the event. Instead, the map is a translational tool to examine, compare and understand the ephemeral and transient performance of the different walks. Thus, the score provides a two dimensional graphic register to explore both the physical embodied experience as well as investigate abstractions within the constructed map.

Different maps of walks have also been explored by other artist including Jeremy Wood in which he draws particular words with the use of a GPS device. Small deviations in his drawings reveal physical barriers in the environment that include fences, dogs, and buildings.[9] The GPS location maps of Esther Polak's "Amsterdam RealTime: Diary in Traces" also utilizes trace as a means to overlay the everyday paths of pedestrians.[10] Starting with a black projection canvas, each walk etches a ghostly line within the map. Over time, the layered collective walks reveal the physical world through the outlining of streets, roads, and buildings.

Mapping Incongruities – Abstractions in Translation

The maps of iM Headphones incorporate GPS coordinates and directional compass readings with the data from the sonar sensors. This information is stored in a separate digital file through Max/Msp. Using this information, digital drawings were then constructed using the parametric plug-in Grasshopper for the nurbs modeling software Rhinoceros. Possibilities of layering these drawings would provide a method in which to compare experiences.

A walk around the Observation Tower with the algorithm "Claustrophobia" was the first test in drawing the map. GPS data and compass directional data were collected along with sonar sensor information. However, the overall experience of the walk was highly different than previous walks. The sonic experience was also affected by the GPS device which could only gather information approximately once a second. This then shifted the pace in which sonar data was gathered. The experience felt sluggish and slow. Accordingly, the body's reaction also slowed in relation to the decreased temporal resolution of the sounds. The gradient and shifts between spaces felt more like stepped square waves as opposed to smooth transitions. In another parallel analogy, one cannot understand or interpret a digital image if the pixels are too large in relation to the overall picture.

The set of drawings created for this walk shows specifically the discrepancy in the translation between GPS data to the physical map (fig. 13). This gap was the result of the inability to convert longitude and latitude coordinates to a Cartesian grid. In addition, the GPS device at times would fail to grab coordinates, and resulted in moments in the animation where it appears as if the individual spins around the x,y coordinates of

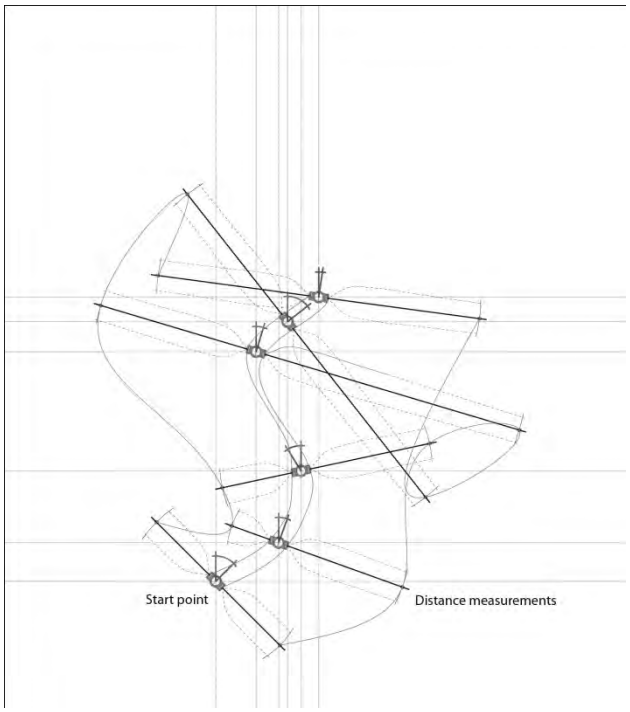

Figure 12. Conceptual diagram for the map drawings.

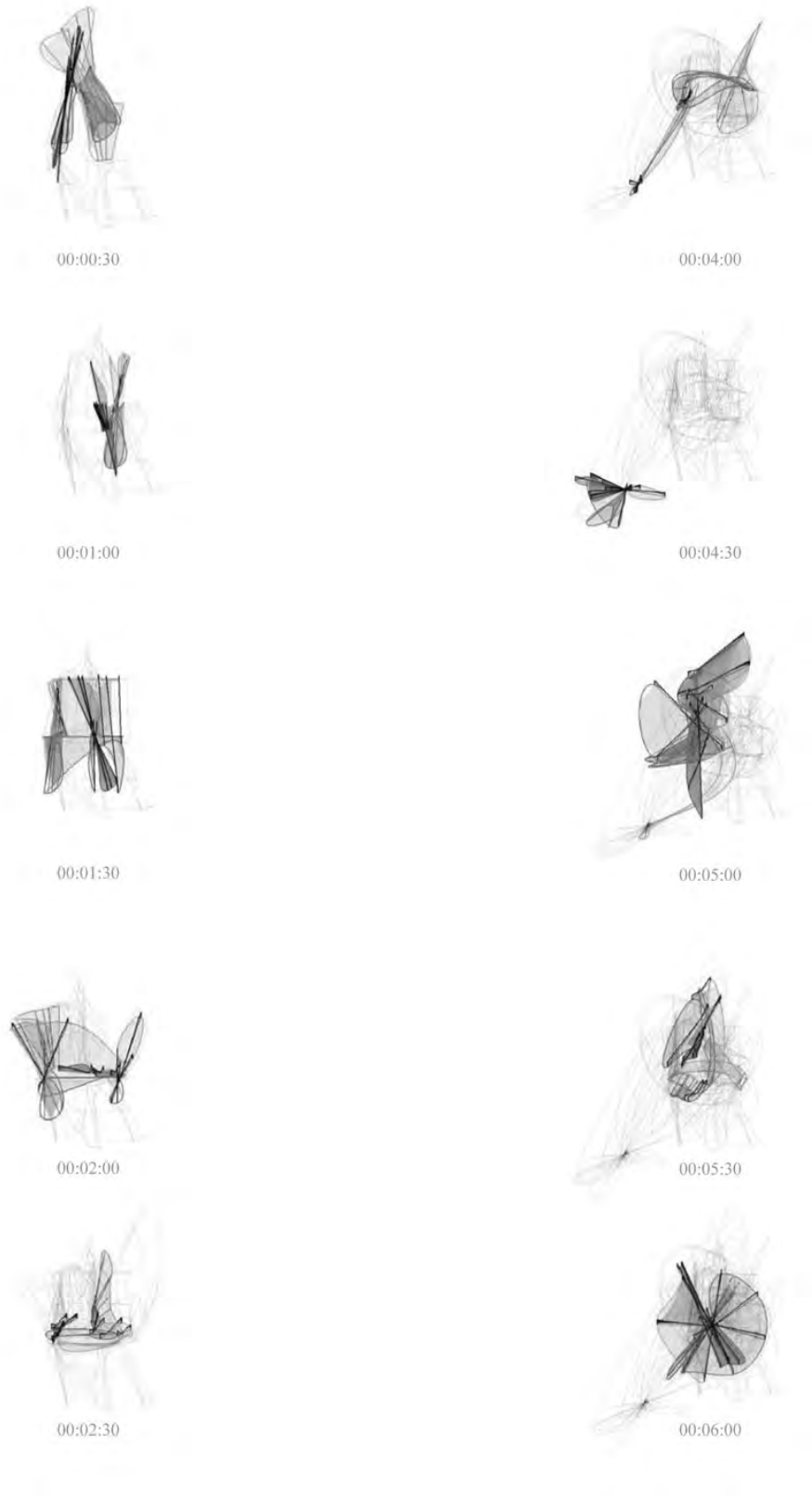

Figure 13. Selected segments of the first map animation for the walk "Claustrophobia" that show the problems in translating the data.

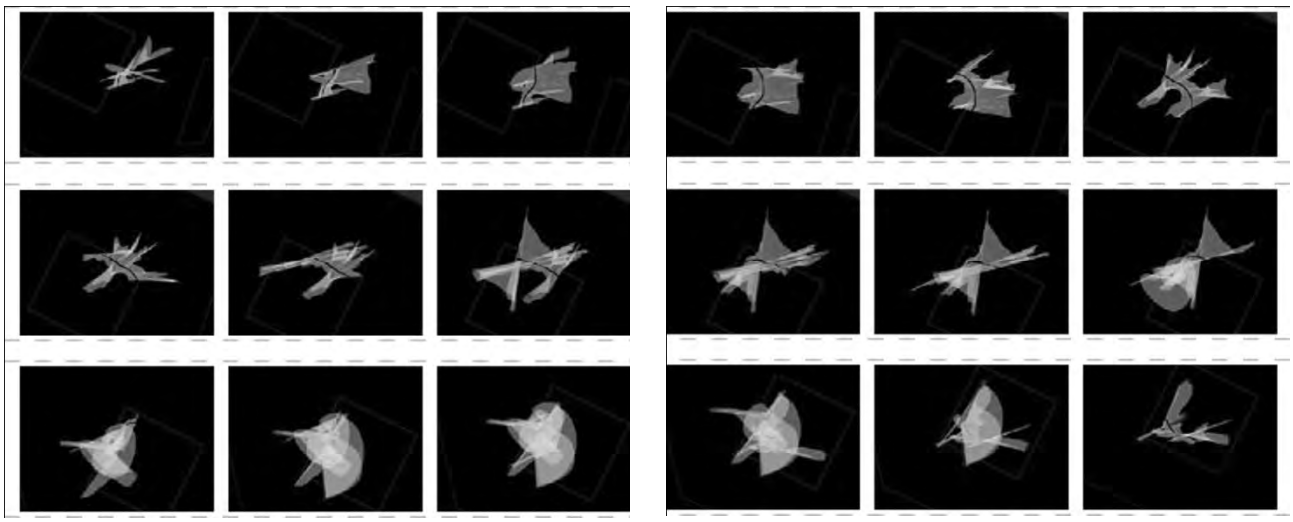

Figure 14. Map of "A look out the observation tower" as Anne Muntges spirals up the concrete staircase.

0,0. The colors of green and orange were meant to convey left and right sensor readings. Early experiments also tested three dimensional volumetric studies that attempted to move beyond a plan view of the event. However, these elements only added another layer of confusion in the map. In terms of cartographic legibility, the map failed to convey the resemblance of the walk.

In the subsequent maps for the four walks, an additional Arduino microcontroller was introduced to create a more real-time experience of the sonar readings. The GPS line that followed the walk was also highly manipulated and reconstructed for clarity. The points were plotted first in google earth and then were retraced and drawn. In addition, extraneous formal elements including the volumetric studies and the color were simplified. Each step was an attempt to develop the cartographic legibility needed to understand the walk as a line inscribed in space when viewed from above (fig. 14).

Between the Mapping and the Map

Despite the increasing cartographic legibility of the walks, there is an inevitable gap between the embodied experience of the mapping process and the abstractions of the maps and animations. Select information of location, direction, and distance measurements reveal just enough to reconstruct a partial understanding of the walk itself. The animations begin with a black background that is then inscribed with a white trace produced from the collected data. The individual viewing the animation is displaced from the landscape both physically and temporally.

The sonic dimensions of the walk are lost in the visual representations alone. This aspect however can be re-visited by pairing the animation with reconstructed sounds from the walk through the program Max/Msp. The individual in viewing the animation reads the movements of the lines as well as listens to the sonic shifts. The sounds therefore offer a partial understanding of the sonic relationships set up in the composition and play a crucial role in the visual cartography of the drawings.

However, there still exists a particular discrepancy between the mapping and the map. Indeed, contemporary understanding of maps has been highly constructed through the use of tools like Google maps that present an infallible omnipresent view from above. This relationship between maps and reality are explored by contemporary landscape architect and theorist James Corner as he argues for both a critical analysis of the mechanisms behind mapping and an exploration of its creative and productive capacity.[11]

The rift between the map and the real is even more heightened in the mapping of sound. Aural visualization, as discussed by Barry Blesser and Linda Ruth Salter presents the inherent contradictions in mapping sound visually.[12] In the attempts by contemporary architect Matteo Melioli to map sound propagation of the Basilica San Marco in Venice, he argues that the constructed sound propagation maps serve to demonstrate the experiential gap between the visual and the aural experience of the space.[13] For twentieth century composer John Cage, his notion strategies playfully engage highly constructed means of reading and writing music.[14] Each of these precedent studies point to a particular understanding of the sound maps as beyond merely a locative tool.

The map is poised as a medium in which to reveal particular biases in cartographic language. In contrast to treating the physical landscape as a constant, the

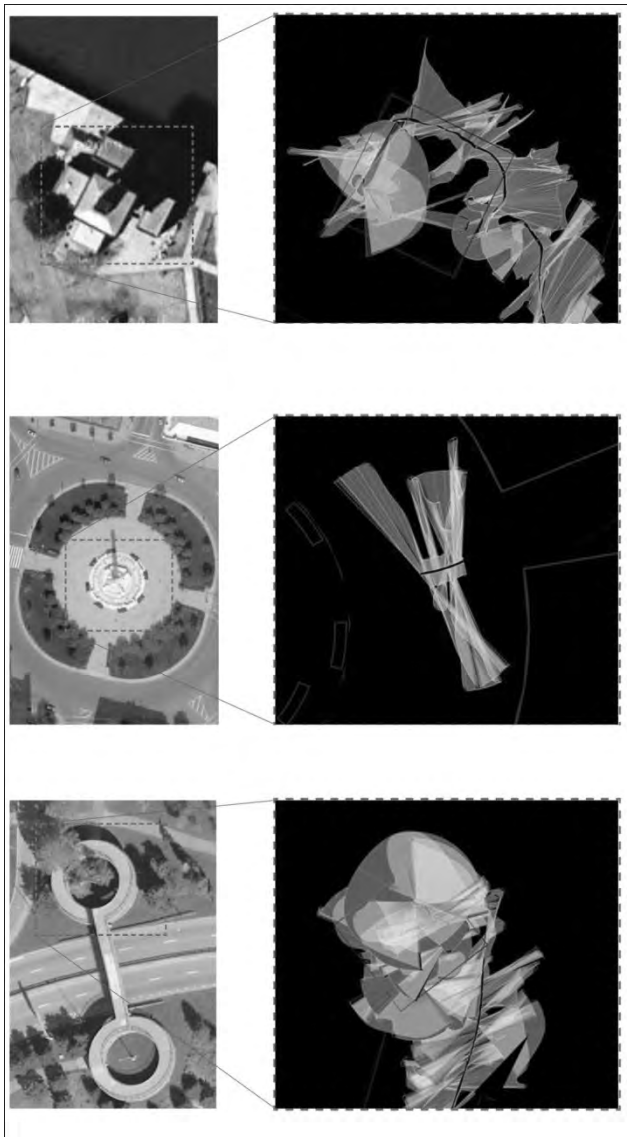

Figure 15. Partial segments of the maps for the three walks “A look out the observation tower”, “A walk around the obelisk” and “A walk across the bridge”.

mapping in iM Headphones presents the surrounding site as continually shifting in relation to the body. The role of the map is both to present an abstraction of the performance but also to heighten the tension between the embodied experience and the resultant artifact. This particular space between the mapping and map is explored in the final performance.

My Apologies for Being Late

“My apologies for being late” was a performance that attempts to exacerbate the discrepancies between the animation maps and the embodied experience. The performance was designed for the final review of my architecture thesis under the pretense of running late. I began my review in a separate building five minutes away from the designated room. In the presentation, a projector displayed a real-time animation of the map on a horizontal table that was set up with a sheet of mylar. Two speakers were set up on opposite ends of the table. The projector was wirelessly connected to a computer in the room that was also directly communicating and storing information through User Datagram Protocol (UDP) from the netbook within iM Headphones.

Joey Swerdlin, a fellow colleague, introduced the project and then alerted me to the start of the performance. I turned on the headphones and began my walk toward the final destination. During this time, the data from the headphones was continuously sent to the computer in the presentation room. The projector displayed a real-time graphic animation of the map of my walk while the speakers played the sounds in relation to the sonar measurements. Throughout the walk, I took the liberty of turning, spinning, and swirling around to add more dynamism to both the map and the resultant sounds created.

Architecture reviews are highly constructed spectacles of academic exchanges between students, professors and visiting critics. Generally set within a presentation room, students use various methods of conveying ideas, including pinning up drawings, organizing study models and projecting images that help describe the process and concepts of the individual. Students introduce and discuss their work for a brief moment before engaging with critics in dialogue, questions and further clarification of the particular project. Most important of all, presenters must be on time (better yet, it is a good idea to be fifteen minutes early).

The conditions set up by “My apologies for being late” engage traditional notions of beginning an architecture thesis review. Being late is an experience that is understood, if not shared, by all. Through this narrative, the performance extended the sonic experience beyond the individual and toward the larger collective. Previously, iM Headphones had only been directly communicable and embodied by the individual wearing the headphones.

The Max patch developed for the performance also took previous compositions a step further by amalgamating several operations. Defined more by the aural aesthetics, I designed the composition to “pause” when there were no changes in the real-time collection of data, and to “pick up” after registering change. This created more moments of phasing effects as well as shifting the rhythm of the sounds produced. The sonic experience and the composition therefore moved beyond a strict one-to-one mapping of physical space. The possibility to invent and recombine aural spatial relationships was therefore specific to this performance.

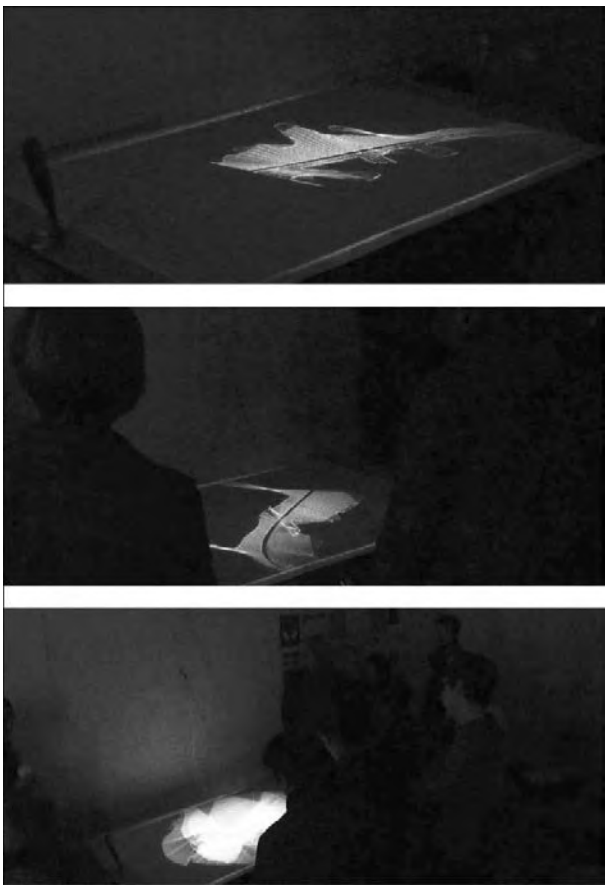

Figure 16. Photographic stills taken from video documentation of "My apologies for being late".

Mind the Gap

"My apologies for being late" utilizes the cartographic mechanisms of the real-time animation to establish the relationship between the developed representations and the performance. The only way into the embodied experience by the viewers in the room is an abstracted map projection and the resultant sounds of the composition. This event heightens the inability to reconcile harmoniously the view of the map and the embodied experience. At stake in this moment is the tension between the map and the performance as well as the audience and the performer. The real-time transmission of the data provides a window into the walk that cannot be directly physically experienced. The viewers removed and standing in the dark room from an omnipresent position, watch and listen. Through the narrative of the title as well as the introduction, the audience is not completely lost, yet, cannot truly orient themselves. It is at the precise moment of the entrance into the room that breaks down the relationship between the performance and the map. The audience is pulled down from their view from above and crosses the gap into the embodied experience.

Figure 17. Photographic stills of the entrance into the room taken from video documentation of "My apologies for being late".

Conclusion

iM Headphones has elicited a wide array of atypical movements and experiences within the physical landscape. These experiences have been translated and used to draw maps. The gap between the embodied walk and the map has also been explored as a creative potential. iM Headphones has been developed both as a means to test behaviors and interactions in different walks as well as an instrument adaptable to different sites and performances. The framework and trajectory of this research is a continual series of performances that problematize different relationships between body, sound and space.

Future projection of possible development of iM Headphones would be to catalogue a more comprehensive library of walks that can then be overlaid and compared. In addition, a networked walk between several participants could provide interesting opportunities in interactions within a collective. Also, the development of the composition beyond a direct translation of the measured distance readings could be explored to create more diverse sonic experiences. The overall ambition of iM Headphones, however, is still to propose alternative modes of understanding spatial qualities and experiences through sound.

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[Abstract in Korean | 국문 요약]
i측정 헤드폰: 음파탐지 기능이 결부된 청취 탐구

알버트 차오

i측정 헤드폰은 공간의 지각과 관련된 특정한 소리를 재생하는 음파 탐지 기능이 결부된 헤드폰이다. 이 연구는 사람의 몸과 소리, 그리고 공간 간의 관계를 재구성하는 새로운 형태의 청취 방법을 제안한다. 이에 일련의 실험을 통해 i측정 헤드폰을 탐구해 보고자 한다. 음파를 매개로 한 청취 실험을 통하여 몸의 움직임을 물리적 상황과 연결하는 장치로 이 헤드폰을 탐구할 것이다.