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TAKING SOUNDINGS A COMPOSERS` INVESTIGATIONS INTO TECHNOLOGIES OF NAVIGATION

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By YOLANDE HARRIS

Taking Soundings places musical composition and sound art in a space of navigation and landscape. It suggests that technologies of navigation contribute to forming our relationship to the natural environment. Through the media of sound, moving image and space, the research contemplates the artistic implications of navigation through a technological position of motion, instability and noise. This empirical approach highlights the contrasts between a bodily experience of a physical environment and technologies of invisibility and intangibility. Sound, in the meeting of its physical and musical guises, is the primary catalyst.

As a composer I advocate that musical composition can benefit from stepping outside its own formal systems in order to investigate how sound can operate within the larger context of image and space. Beginning with the musical score, which does not contain sound but encodes potential interpretations by a performer within its notation, I use this interpretative gap between image and sound to drastically expand the idea of the score. Building on my other formal training in architecture and moving image, I initially looked into sound in relation to landscape and new technologies, then focused on navigation techniques. Much like a score, these presented spatial and temporal concepts with a direct physical relationship to the person navigating. It also created a discourse around the map, chart, trace and the various levels of notated or linear images in relation to the environment.In attempting to chart as carefully as I can an illusive area between sound, image and space as we actively make it, or physically compose it, I take on the complex influences of technologies.

Whether navigation infrastructure, communication protocols or sound synthesis programming, these shape the forms of interaction between place, self and sound. In order to gain more than a surface level of understanding into these technologies, I have taught myself celestial navigation and experimented with GPS navigation in a practice made up of studio work, field work and

performances. Here I present both the concepts and experiences that have motivated me and give an overview of the basic principles of navigation. The central technical section provides the fundamentals for the compositional choices of Taking Soundings described towards the end of the paper. To breath, to walk, to swim, to rhythm.The yacht stops becalmed in the middle of the sea, I climb overboard and swim away, then return towards the bow and together we move forwards at the same speed through the water. The horizon stays at the same distance however far we move towards it. We are sailing forwards but remain in the absolute centre of a disk. Learning to swim front crawl taught me how to breathe, how to stop salt water flooding down my nose making me choke at every breath. I breath every two strokes, sometimes every three, whilst my view shifts from the underwater world, cuts through the crumpled surface light and sees the water level and the sky in a second before returning underwater.

Conscious of the responsibility that I am my own engine, as I breathe out through my nose the bubbles rise past my ears with a loud pressure.The sun is extremely bright around noon so I have to use all three shades on the sextant telescope as I pull down the sun to rest its lower limb on the horizon.Sleeping on deck … the sun sets, the moon rises, the moon sets, the planets follow it across the sky, the sun rises … the sun sets, the moons rises, the planets follow it, the sun rises, the moon sets …. the sun sets, the planets follow it, the moon rises, the sun rises, the moon sets …As I walk I remember, and the more I walk the more I remember incidents that I never thought memorable.I am performing with the sextant and take a sight on the pole star, just as a plane points to it with its floodlights, so I take the next sight on the next plane, a false sight moving fast across the celestial sphere.I pull down my sound until it disappears, but I notice that the audience remain completely intent on watching and listening, and so eventually I bring it back in.The ability of humans to adapt to environments on or underwater, in mid air or under conditions of micro-gravity, relies on technological support (Buread 2006).

Protective skins, breathing apparatus and many other systems such as a space suit with pressurizing, heating and cooling systems, and communication systems to converse with others, maintain a microenvironment suitable for humans in an artificially sustained environment. As humans we carry the desire and some ability to explore and adapt to circumstances that are extreme to our biological nature, where we have to technologically extend ourselves in order to survive (Saint-ExupŽry, 1942). However, this drive cannot be thought of on an exclusively technological level. To swim, surf or to float in a boat already forces an alteration of bodily state where the stability of land is replaced by the perpetual surface motion of the sea. I am interested in the human potential for adaptive expansion across two or more states (land, sea, air, underwater, micro-gravity) and the subjective, experiential awareness of environment and place that this entails. The physicality of sound and its dispersion through air and water have distinct effects on orientation. Physically moving within these different states requires adapting to specific problems of orientation and developing different techniques of navigation. How do technological extensions of orientation and navigation in (potentially or once) extreme environments, or those not suited to our physical human capacities, morph our perception of place and extend our horizon beyond the limits of a still very human body? And where does sound fit into this?My investigations of satellite navigation using GPS and celestial navigation using tables and sextant, revealed how we calculate a static position by observing objects in motion. Navigation is essentially a calculation of position, or location, derived from points of information in space and time, which are continuously updated to mark traces and define future trajectories. When navigating on land, these points or landmarks are fixed and we measure our motion by calculating our speed and direction in relation to these points. The development of navigation across open sea however, where there are no fixed marks, required a different strategy for locating position accurately (Deleuze & Guattari 1987).

Celestial navigation is the technique of navigating by measuring ones movement in relation to the movement of the sun, moon, planets and stars. It was used by small boats until the widespread

availability of GPS in the 1990Ős and is still used as a back-up system. This technique relies on a conceptually antiquated theoretical structure of an earth-centred universe surrounded by a celestial sphere. To understand the basics of celestial navigation, imagine two spheres, one smaller enclosed within the other larger sphere. The internal sphere represents the surface of the earth (the terrestrial sphere), the external sphere marks the surface along which the heavenly bodies move (the celestial sphere), both spheres are anchored to a point in the centre of the earth. I am somewhere at some particular time on the outside surface of the inner sphere and I want to locate myself precisely. To do this I observe the celestial sphere above me and, using a sextant, take a measurement of the angular distance of, for example, the sun above the sea horizon that I can observe, noting the precise time of the sight. I can enter these two pieces of information into the tabulated data of the Nautical Almanac and the Sight Reduction Tables, which give corrections for altitude and declination of the sun for a particular time and date, from which I can calculate a plotting line. With two or more sights taken over the course of a few hours I can combine them to produce a running fix to infer an area within which I am, or was, located.These measurements can only be made use of by superimposing a reference grid over the terrestrial sphere Ð the concepts of latitude and longitude. A geographic position is any point fixed on the earths surface by its terrestrial coordinates of longitude and latitude. This grid is wrapped around the sphere of the earth and the measurements represent the angular distance from a central point.

The unit of measurement is a degree, each degree divides into 60 minutes of space, and each minute into 60 seconds of space. Longitude takes the earths pole as the central point of the circle, marks an arbitrary starting line of 0 degrees, fixed now at Greenwich, and divides the circle into two halves of 180 degrees East and 180 degrees West. The coordinate of longitude is therefore given as how many degrees East or West of 0. Latitude makes an imaginary two-dimensional plane sliced at the equator and takes an imaginary point at the centre of the earth. The angular distance from this central point north or south of the 0 degree equator, and not more than 90 degrees which would be the poles, is the co-ordinate of latitude. In order to navigate by the stars this grid of longitude and latitude on the terrestrial sphere is extended outwards to the celestial sphere where the position of the sun or planets are located by coordinates. Celestial longitude is measured as 360 degrees West of 0, and is called the Greenwich Hour Angle (GHA), as longitude is related to the change over time as the earth spins (see time zones). Celestial latitude refers to the number of degrees North or South of the celestial equator, and is called the Declination. The observers Zenith is the projection of their terrestrial position on the celestial sphere, so that the declination of my zenith is the same as my latitude and the GHA of my zenith is the same as my longitude. (Cunliffe, 2001)This relation between the two spheres, both of which are in motion, is shadowed by the navigation satellites that now orbit the earth as the Global Positioning System. NMEA data (National Marine Electronics Association), the protocol used by the GPS to define the transmission of data between satellites and receivers, contains a large amount of information about the position of satellites and the strength of their respective signals. Although in everyday use we are only concerned with the resulting longitude and latitude, this raw data shows the underlying principles of navigation. It includes the precise time and date, longitude and latitude, the specified hemisphere, the number of satellites visible, their identification number, the strength of the signal, the altitude of the antenna, the elevation and azimuth of the satellite. The computation of position from this data is updated every second, which is the resolution with which the satellite sends out its information. Although the NMEA protocol shows a technical throwback to the concepts and terminology of celestial navigation the differences in technique present a significant change in our conscious awareness of space and position. If navigation is not only a way to position oneself with coordinates but also to locate oneself in direct relation to the surrounding environment this is important: the GPS system has effectively split the geographic position of navigation from the environmental location of navigation it has split the data from the meaning, much like how, with electronics, sound was split from the body as a production instrument.

This means that the GPS trace can exist without reference to the physicality of the place, the map of

position has an abstract existence that could refer to anything else and is not tied to the quality of land or sea over which it is laid. Whereas historical forms of navigation were specific to their environment – a compass and map needs landmarks, a sextant and tables need a sea horizon the satellite form of navigation can be used in the same manner on land, at sea, in the air.I have been thinking and experimenting with how to use this navigation information in composition, and the relation between navigation, physical orientation, sound and the map. Sound dissipates through air, water and solids over sometimes large distances. We can think of sound as a vibration or oscillation that we find audible within the physical constraints of human ears. Our experience of sound, even at the extremities of our hearing range, is tied to our physiological capabilities, and every inaudible or unheard sound must be brought into our range of hearing and therefore translated or altered considerably. We can listen to sound as information about the immediate environment, and a change in sound signals a change in situation.

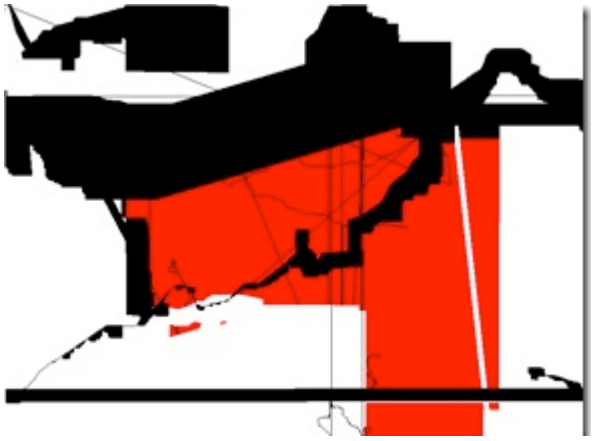
We don't actively listen to sounds that continue over periods of time, but we notice any change and link it to a change of state. This is not the same as ambient sound but is an informative state of listening through periods of non-attention. Given these ideas, in Taking Soundings I transform the satellite data from a GPS receiver into sounds. In the first phase of the project I treated the longitude and latitude as x and y coordinates on a flat plane, as if represented on a map, giving each a simple pitch to make two short simultaneous tones within audible range. Other data such as altitude and the number of connected satellites were presented as various clicks, and the spatialisation of the sound was determined by the inferred direction of movement. This first phase looked into coastal navigation and in particular lighthouse technology in contrast to GPS technology, where the signals of lighthouse flashes were presented as direct translations of waveform signals from light to sound (Harris, 2007) With these components a slowly evolving sound environment existed which I described as coastlines of sound.In the second phase of Taking Soundings I looked into celestial navigation as a way to understand more about the concepts and terminology behind satellite navigation. The longitude and latitude coordinates of recorded GPS traces of my movements, are treated as two audio signals whose waveforms are multiplied by each other, a ring modulation, creating one tone. The data therefore generates a sound with a distinct pitch and timbre that can become generally recognisable as a location whether in Holland or Portugal in the northern hemisphere, or Sydney in the southern hemisphere, and which subtly change with local movement in these areas. All other incoming data received by the GPS is used to describe the envelope (shape) of a sound over a very short period of time. This results in a click of varying timbre. Changes in altitude are mapped to the overall volume of the sound signal. The clock time in the data is used to drive the timing and rhythm of the sounds. These sounds are placed in space around the audience. The spinning spatialisation of the sound is described by the speed of orbit of the earth at the latitude of the location of the trace, the earth's surface spinning faster at the equator than at the pole. The resulting soundscapes, which can be generated with both recorded traces and live GPS data, occupy a position of ambiguity between sound as information and sound as music. I've set up a sound environment that can last for long expanses of time, or can describe an event, it can be emotionally distant or provoke subjective memories. My use of sound in these pieces consciously distances the practical use of the GPS for navigation, replacing it with a weightlessness of floating points of moving sound.In trying to chart a shifting state that exists between sound and image, as between land and sea, I notice tensions.

There is a tension that comes from the mapping of a curved multidimensional space onto a two dimensional surface, a tension of encoding information that can be interpreted by someone else at another time, and a tension of ownership or authorship where map-making is in some way a claiming of territory. These are also classic tensions between sound and image and can be found in the notation of a musical score, much the same as in a map or chart. I am trying to re-chart the idea of a score by using the boundary of environmental opposites such as coastlines or deltas. This is why lighthouses are extremely interesting as points/signals at the absolute boundary of landscape and for

the (now historical) technological progress they represent. In the first image, the trace of the GPS records the route of a sailing boat on a lake in Holland, an delta area where re-claimed land is often lower than water and below sea-level (Figure 1).

I like the confused inaccuracies of the trace as the boat appears to sail over and through the polders ignoring the solidity of land. In the second image, my collected traces of coastlines in different parts of the world are folded in together so that they fit within one degree of longitude and latitude (Figure 2).

This folding and overlapping generates lines of interruption and new spaces or holes between the combined contours of imaginary coastlines. The implied or potential sounds, as with the memories, are shaken together into a mess of charted territories. (Figure 3)



I am interested in a situation where environmentally I sit between two states, and a situation where musically and artistically I occupy two states. It is an investigation of the relation of the map to the process or progress, and the mapping of a territory, the chart of a trace. When does the trace become more than a subjective memory? Or can it never be more than a trace of someone's imagination? Given the impossibility of others accessing this memory that the line provokes, how much of public and private is encoded into a map or score, and how can it be interpreted? This navigating is a way of precisely ordering techniques to eliminate errors of position. But our direct experience is often of misalignments, approximations, instability and a noise generated by the tension between the theory and the practice, the abstract maths and calculations and the messy reality of physically being in the world. This gap between the calculated and the experienced and the striving for accuracy is where I locate composition.

The first stage of the project Taking Soundings was supported by an Artistic Fellowship at the Academy of Media Arts in Cologne March to November 2006, (http://www.yolandeharris.net/takingsoundings.htm) It is more formally described in my paper 'Taking Soundings: Coastal Navigations and Orientations in Sound' which I presented at the 4th International Mobile Music Workshop in May 2007, hosted by Waag Society and STEIM Amsterdam. A performance and installation were held in Cologne November 2006, and adapted for a sound installation at SNO galleries in Sydney March 2007. The second stage of Taking Soundings was supported by an Artistic Residency at STEIM in Amsterdam during June and July 2007. The work in progress was presented at Mediamatic as part of DNK series Amsterdam June 2007. This stage culminated in a solo outdoor performance, the first incorporating the sextant, as part of a New Music and Astronomy Festival in Catalonia August 2007.

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Yolande Harris, Amsterdam, September 2007

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