

NAVEGAR É PRECISO, VIVER NÃO É PRECISO

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1. ABSTRACT

This paper describes our submission to the ICAD 2006 Concert 'Global Sound – The World By Ear'. We chose to combine the given dataset containing current (2005) social data of 190 nations with a time/space coordinates dataset of considerable historical significance: The route taken by the Magellan expedition to the Moluccan Islands from 1519-1522, the first circumnavigation of the planet Earth.

2. NAVIGATION

The world data provided by the ICAD 2006 Concert Call are a-historic, and thus free of any notion of time. Also, the choice of which variables to include in the sonification, and how, must be based on theoretical assumptions which are not easy to formulate on this level of aggregation, where we are speaking of 6 513 045 982 individuals (the number of people estimated to have populated this planet on April 30, 2006 [1]). The data do provide detailed spatial information, so we decided to choose a form of data organization that seems a familiar combination of time and space: the journey.

Traveling can be defined as moving through both time and space. While the time dimension as we experience it is unimpressed by the desires of the traveler, s/he can decide where to move in space. The art and science that has enabled mankind to find out where one is, and in which direction to go to arrive somewhere specific, is known as Navigation.

Navigation as a practice and as a knowledge system has exerted major influence on the development of the world. The world has changed drastically by the consequences of the journeys led by explorers like Christopher Columbus or Vasco da Gama. The first successful circumnavigation of the globe, led by Ferdinand Magellan, proved beyond all scholastic doubts that the earth is in fact round. This would not have happened without the systematic cultivation of all the related sciences in the school for navigation, map-making and ship-building founded by Henry the Navigator, King of Portugal in the 15th century. For all these reasons, Magellan's Route became an attractive choice for temporal and spatial organization of this work.

3. THE ROUTE

Leaving Seville on August 10, 1519, the five ships led by Magellan (called *Trinidad*, *San Antonio*, *Concepción*, *Victoria*, and *Santiago*) and after some short stops, crossed the Atlantic Ocean to anchor near present-day Rio de Janeiro five months later [2, 3, 4]. Looking for a passage into the

ocean later called the Pacific, they moved further south, where the harsh winter and nearly incessant storms forced them to anchor and wait for almost six months.



Figure 1. Magellan's route. Source: wikipedia.org.

While exploring unknown waters for this passage, the *Santiago* sank in a sudden storm, and the *San Antonio* deserted back to Spain; the remaining three ships succeeded and found the passage in the southernmost part of South America which was later called the Magellan Straits, in late October 1920.

The ships then headed across the 'Mar del Sur', the ocean Magellan named the Pacific, towards the archipelago which is now the Philippines, where they arrived four months later. Seeking the mythical Spice Islands, Magellan and his crew visited several islands in this area (Limasawa, Cebu, Mactan, Palawan Brunei, and Celebes); on Mactan, Magellan was killed in a battle, and a monument in Lapu-Lapu City marks the site where he supposedly died.

In spite of their leader's death, the crew decided to fulfil their mission. By now diminished to 115 persons on just two ships (*Trinidad* and *Victoria*), they finally managed to reach the Spice Islands on November 6, 1521. Due to a leak in the *Trinidad*, only the *Victoria* "set sail via the Indian Ocean route home on December 21, 1521. By May 6, 1522, the *Victoria*, commanded by Juan Sebastián Elcano, rounded the Cape of Good Hope, with only rice for rations. Twenty crewmen died of starvation before Elcano reached the Cape Verde Islands ... [Portuguese enemy country] where he abandoned 13 more crewmen on July 9 in fear of losing his cargo of 26 tons of spices (cloves and cinnamon)" [2]. On September 6, 1522, more than three years after she left Seville, *Victoria* reached the port of San Lucar in Spain with a crew of 18 left. One is reminded of a song by Caetano Veloso, who, pondering the mentality and fate of the Argonauts, wrote: "Navegar é preciso, viver não é preciso" – "Navigating is necessary, living is not" [10].

4. THE DATA

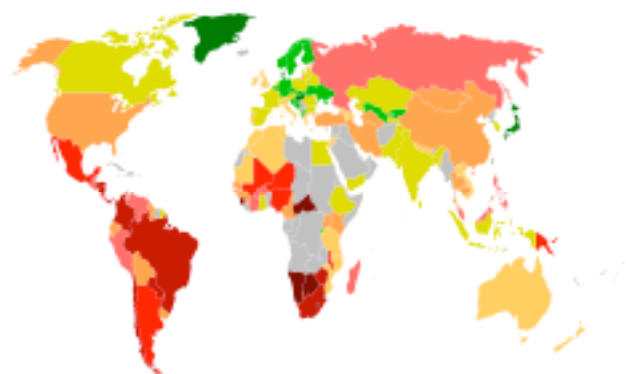
The explorers in the early 15th century were interested in spices (which Europe was massively addicted to), gold, and the prestige earned by gaining access to good sources of both. Nowadays, other raw materials are considered premium goods. What would someone who undertakes such a journey today hope to gain for his or her exertions? What is as precious today as gold and spices were in the 16th century?

Today's conquistadores (or globalizadores) would likely ask first about economic power: how rich is an area? Second, they would check geographical potential; and chances are that if any one resource will be as central to economic activity in the future as spices were centuries ago, it will be drinking water resources. Water might well become the new pepper, the new cinnamon, even the new gold. (As the Gulf wars showed, oil would have been the obvious current choice; we found the future perspective more interesting.)

Thus we chose to focus on two main dimensions: one depicting economic characteristics of every country we pass, and another informing us about its inhabitants' current access to drinking water.

4.1. Economic characteristics

The variable 'GDP per capita' included in the data set provided by the ICAD06 organizers provides some insights in the overall economic performance of a country. Obviously, the 'GDP per capita' variable lacks information about the distribution of the income; it only says how much money there would be per person if it were equally distributed. This is never the case; on the contrary, scientists find that the rich get richer and the poor get poorer – both in intra-national and international contexts. E.g. in the US of 1980, for instance, the head of a company earned 42 times as much as an employee – by the year 1999, this ratio was more than ten times higher: a company leader earned 475 times more than an average employee [5].



Color	Gini coefficient
■	< 0,25
■	0,25 - 0,29
■	0,30 - 0,34
■	0,35 - 0,39
■	0,40 - 0,44
■	0,45 - 0,49
■	0,50 - 0,54
■	0,55 - 0,59
■	> 0,60
■	NA

Figures 2 & 3. *The countries of the world and their Gini coefficients. Source: wikipedia.org.*

A measure that captures aspects of income distribution is the Gini coefficient on income inequality [9]. Developed by Corrado Gini in the 1910s, the Gini coefficient is defined as the ratio of area between the Lorenz curve of the distribution and the curve of the uniform distribution, to the area under the uniform distribution. More common is the Gini index, which is the Gini coefficient times 100. The higher the Gini index, the higher the income differences between the poorer and the richer parts of a society. A value of 0 means perfectly equal distribution, while 100 means that one person gets all the income of the country and the others have zero income. However, the Gini index does not report whether one country is richer or poorer than the other.

Our sonification tries to balance the limitations of these two variables by combining them: We include two factors that go into a Gini calculation; the ratio of the top and bottom 10% percentile of all incomes in a population, and the ratio of the top to bottom 20%. In Denmark, at Gini index rank 1 of 124 nations, the top 10% earn 4.5x as much as the bottom 10%, for the UK (rank 51), the ratio is 13.8:1; the US (rank 91) ratio is 15.9:1; Namibia, at 124, has 128.8:1.

Missing values in these variables are replaced by a dense cluster of near-center values, which is easy to distinguish acoustically from the known occurring distributions.

4.2. Access to drinking water

An interesting variable provided by the ICAD06 Concert data set is 'Estimated percentage of population with access to improved drinking water sources total'. Being part of the so-called "Social Indicators" [6, 7, 8], the data are reported to the United Nations (UN) Statistical Division by the national statistic agencies of the UN member states.

Unfortunately, though, this indicator has a high percentage of missing values (46 of 190 countries, 24.2%). This percentage could be reduced to 16.3% (31 countries) by excluding missing values where the countries are not touched by our Magellanian route. Still, the problem is massive and must be coped with. The strategy we chose therefore was to estimate the missing values on the basis of the data value of the neighboring countries. We are aware that this procedure does not satisfy scientific rigor. In certain cases, though, we claim that our estimates are likely to match reality: for instance, it is very likely that in France and Germany (as in in most EU countries), 100% of the population do have access to drinking water, and that this fact is considered too obvious to be statistically recorded.

5. MAPPING CHOICES

We deliberately chose rather high display complexity; while this requires more listener concentration and attention for maximum retrieval of represented information, hopefully a more complex piece invites to repeated listening – which audiences tend to do with pieces of music they enjoy.

Every country is represented by a complex sound stream composed of five resonators; all parameters of this sound stream are determined by (a) data properties of the associated country and (b) from the navigation process, i.e. the ship's current distance and direction towards this country.

At any time, the 15 countries nearest to the route point are heard simultaneously. This is both to limit display complexity for the sake of clarity, and to keep the sonification within CPU limits for realtime interactive use.

The mapping choices in detail are:

(Population density of country: density of (random) attack triggers in the sound stream

- < GDP per capita of country: frequency center (and most prominent resonant pitch) of the stream)
 - < Ratio of top to bottom 10% percentile of incomes: pitches of the outermost two 'satellite' resonators
 - < Ratio of top to bottom 20% of incomes: pitches of the inner two satellite resonators (Missing values for these two become dense clusters.)
 - < Water access: decaytime (short tones mean less access (drier), long tones mean more access to water)
 - < Distance from the navigation point: volume and attack time (far away streams are softer and more 'blurred')
 - < Direction: the spatial direction of the stream in the loudspeaker rendering (North is kept constant)
- The movement and conditions of the navigation are represented very directly, as follows:
- < Ship speed, direction, storm and calm: spatial direction, brightness, intensity, and liveliness of wind-like noise

6. POINTS OF ORIENTATION:

The following table provides some points of orientation that can be recognized while listening to the piece.

Time	Location
0:00-0:10	Very slow move from Sevilla to San Lucar
0:20-0:26	Cape Verde: very direct sound (i.e. near the capital), rather low, dense spectrum (poor country, unknown income distribution)
0:54-1:00	Uruguay/Rio de la Plata: very direct sound, passing close by.
1:05-2:40	Port San Julian, Patagonia: very long stasis, everything is far away, 4 + 2 months long winter break in Magellan's travel
2:45	Moving into Pacific Ocean: new streams, many dense spectra; unknown income distribution
3:20	Philippines: very direct sound (near capital), high satellites: unequal income distribution ... Moluccan Islands
4:00	Brunei: very direct, high, dense sound: very rich, unknown distribution ... Moluccan Islands
4:50	East Timor: direct, mostly clicking, only very low frequency resonances (very poor, little access to water, unknown income distribution)
5:15	into Indian Ocean: 'openness', sense of distance
5:50	approaching Africa: more lower centers, with very high satellites: poor, with very unequal distributions (but at least statistics available)
5:55	Pass Cape of Good Hope: similar to East Timor
6:10	Arrive back at San Lucar, Spain

Table 1. *Stations of the sonification*

7. ACKNOWLEDGEMENTS

Special thanks go to Peter Jakober for timeline research, and to Marianne Egger de Campo for suggesting the Gini index.

8. REFERENCES

- [1] U.S. Census Bureau: "World POPClock Projection" <http://www.census.gov/ipc/www/popclockworld.html>.

- [2] Wikipedia article, "Magellan". <http://en.wikipedia.org/>. Last visited March 3, 2006.
- [3] Antonio Pigafetta, *Mit Magellan um die Erde. [Magellan's Voyage: A Narrative Account of the First Circumnavigation.]* Edition Erdmann, Lenningen, Germany, 2001. First published Paris, 1525.
- [4] Stefan Zweig, *Magellan – Der Mann und seine Tat*. Frankfurt am Main, 1983. First ed. Vienna, 1938.
- [5] "L'histoire: PDG surpayés", *Libération*, March 20, 2001. Cited in: Horst Afheldt, "Nachwort [Epilogue]" to Barbara Ehrenreich, *Arbeit Poor. Unterwegs in der Dienstleistungsgesellschaft. [Nickled and Dimed. On (Not) Getting By in America.]* Rowohlt, Reinbek bei Hamburg, Germany, 2003. 237.
- [6] United Nations Statistics Division, "Social Indicators". <http://unstats.un.org/unsd/demographic/products/socind/default.htm>. Last visited March 3, 2006.
- [7] United Nations, *Towards A System of Social Demographic Statistics*. 1975. Available online at [3].
- [8] United Nations, *Handbook on Social Indicators*. 1989. Available online at [3].
- [9] http://en.wikipedia.org/wiki/Gini_coefficient, last visited March 3, 2006.
- [10] This saying has a long history. Plutarch ascribes it to General Pompeius, and Veloso may well have read it in a poem by Fernando Pessoa. Here are Veloso's lyrics:

Os Argonautas

O barco, meu coração não aguenta
Tanta tormenta, alegria
Meu coração não contenta
O dia, o marco, meu coração, o porto, não
Navegar é preciso, viver não é preciso

O barco, noite no céu tão bonito
Sorriso solto perdido
Horizonte, madrugada
O riso, o arco, da madrugada
O porto, nada
Navegar é preciso, viver não é preciso

O barco, o automóvel brilhante
O trilho solto, o barulho
Do meu dente em tua veia
O sangue, o charco, barulho lento
O porto silêncio
Navegar é preciso, viver não é preciso

The Argonauts

The ship, my heart cannot handle it
Such torment, happiness
My heart is discontent
The day, the limit, my heart, the port, no
Navigating is necessary, living is not

The ship, night in the beautiful sky
The free smile, lost
Horizon, morning dawn
The laugh, the arc, of morning
The port, nothing
Navigating is necessary, living is not

The ship, the brilliant automobile
The free track, the noise
Of my tooth in your vein
The blood, the swamp, slow soft noise
the port - silence
Navigating is necessary, living is not

(Literal translation: Alberto de Campo)