

The Digital Intonarumori

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Workshop Mian – Padova, October 26 2007



Intonarumori

Invented by Luigi Russolo in 1913

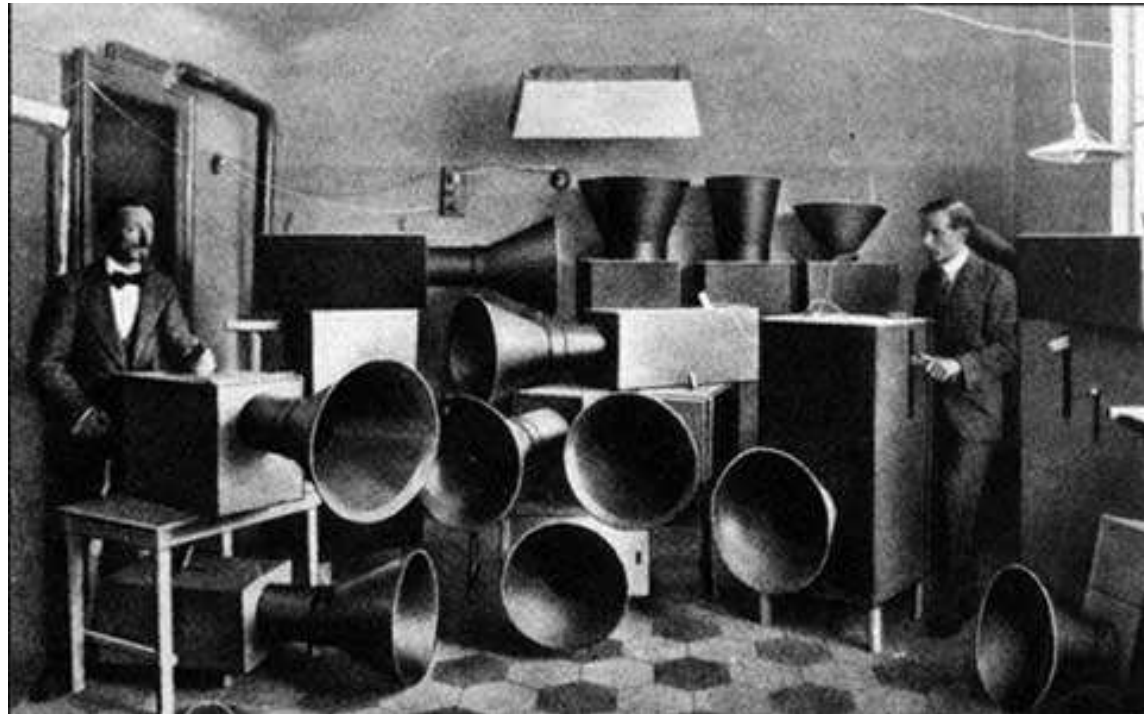
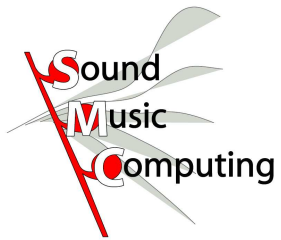


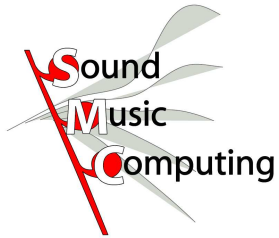
Figura 1: Russolo and his colleague Ugo Piatti playing the original Intonarumori



Russolo and the Art of Noise
Classification of everyday sounds
Characteristics of the Intonarumori
Sound and Light, Paris 2004
Gracidatore (Croaker) ed Ululatore (Howler)
Crepitatore (Crackler)
Risveglio di una città
The Croaker
Inside the Croaker
Sound synthesis
Mapping
An evolution
Conclusions



Russolo and the Art of Noise



- Futuristic manifesto on the importance of noise written in 1913.
- Need for the modern orchestra to take into consideration everyday sounds.
- Realization that noise was becoming an important part of everyday life.

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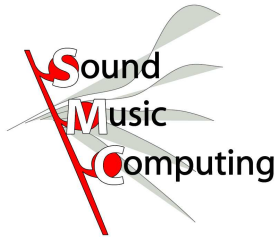
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Classification of everyday sounds



Family 1	Family 2	Family 3	Family 4	Family 5	Family 6
Rumbles roars explosions crashes splashes booms	Whistles hisses snorts	Whispers murmurs mumbles grumbles gurgles	Screeches creaks rustles buzzes crackles scrapes	Noises made by percussion on metal, wood, skin, stone	Voices of animals and man, laughs, howls, groans, screams, shouts, sobs
Roarer, Burster	Whistler Hisser	Gurgler	Croaker Crackler	Rubber	Hummer, Howler

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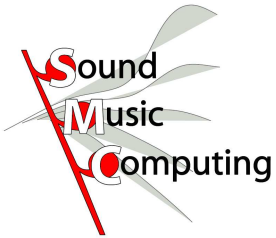
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Characteristics of the Intonarumori

- Similar external appearance
- Different excitation mechanisms
- One or two levers to control frequency
- One rotating crank
- The Intonarumori were played by moving the lever with one hand and rotating the crank with another hand



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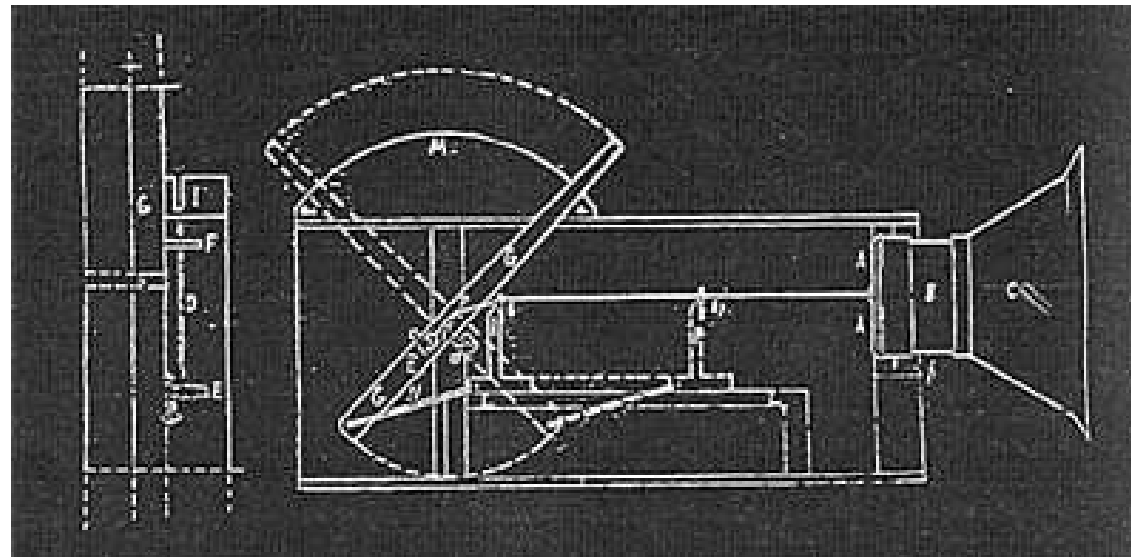
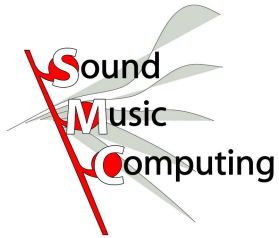


Figura 2: Intonarumori patent 1914



Sound and Light, Paris 2004



- The original Intonarumori got destroyed during World War II
- Reproductions of the instruments have been displayed at the exposition Sounds and Lights at the Pompidou Center in Paris in December 2004

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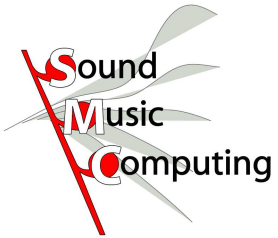
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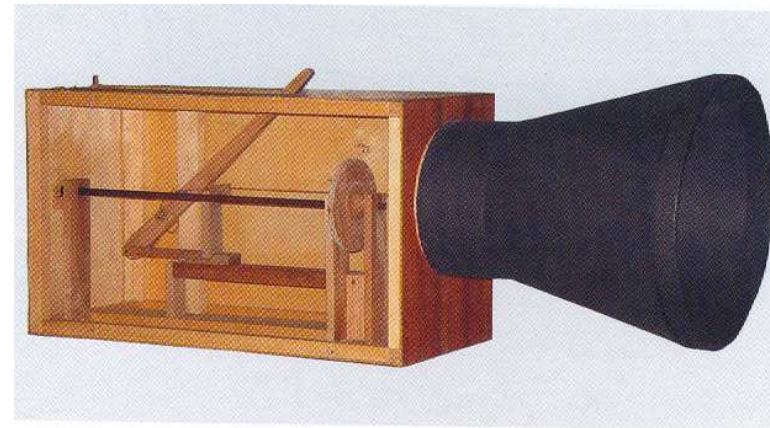




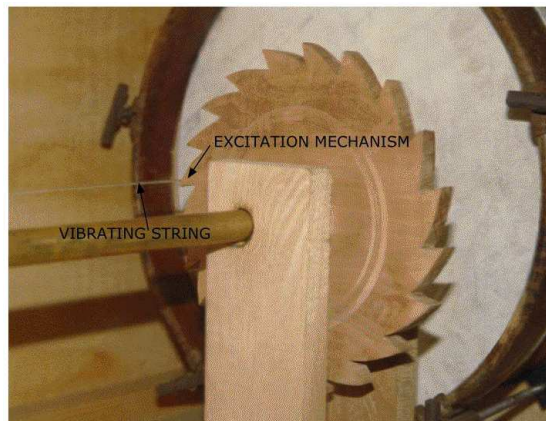
Gracidatore (Croaker) ed Ululatore (Howler)



Gracidatore 



Ululatore 



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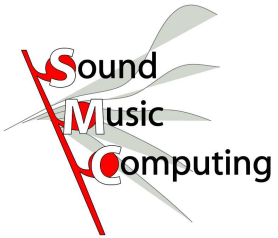
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Crepitatore (Crackler)

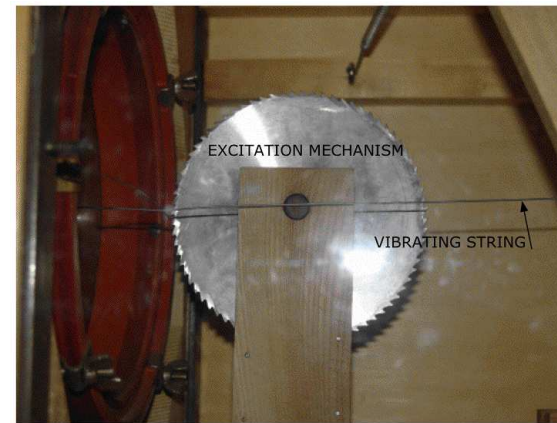
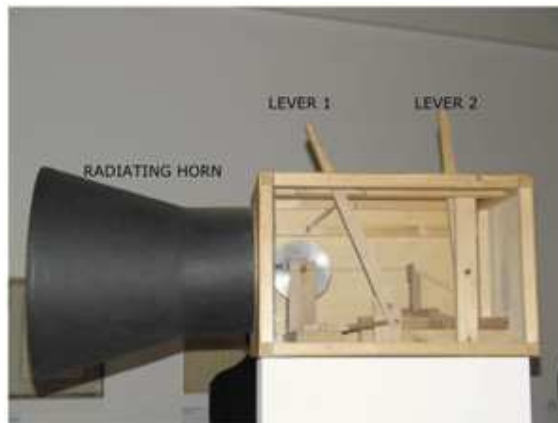
- Instrument with two levers
- Same idea used also in the Stropicciatore (Rubber)
- The motivation for having two levers is not known



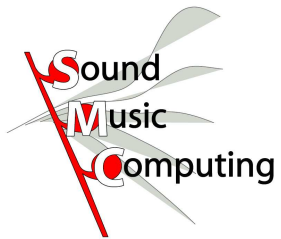
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Risveglio di una città



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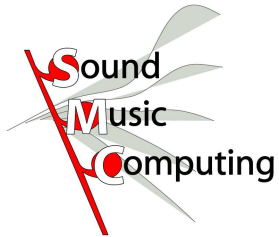
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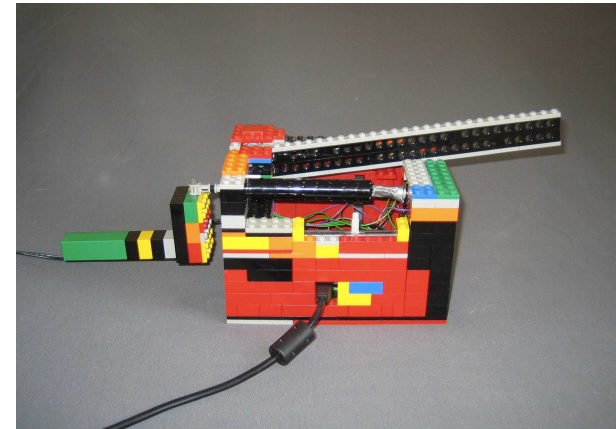
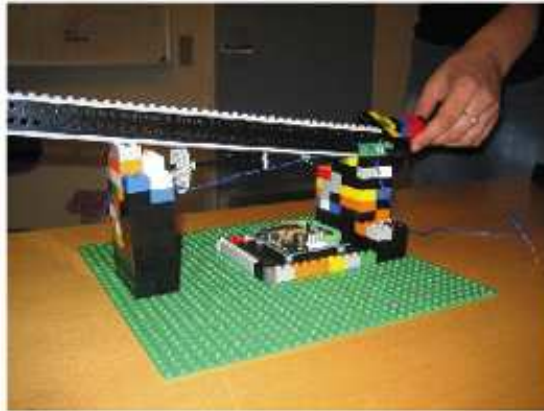
Dal « Risveglio di una città » per Intonarumori. - L. Russolo



The Croaker



Controller inspired by Russolo's Intonarumori

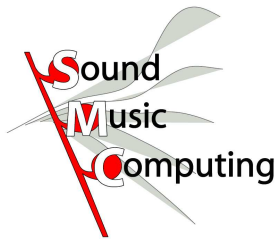


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- The vibrating system decomposed into exciter and resonator
- The string is excited by different mechanisms
- Different kinds of everyday sounds can be simulated (from scraping to laughing sounds)



Inside the Croaker



- One potentiometer controls the rotation of the crank
- Another potentiometer controls the position of the lever
- The sensors are attached to a microprocessor manufactured by Making Things
- The microprocessor is attached to the USB port
- The data captured by the sensors are sent to Max/MSP



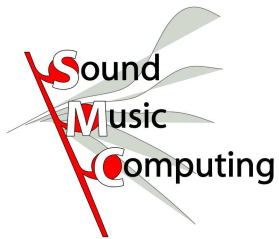
POTENTIOMETER 1
(ROTATION SENSOR)



POTENTIOMETER 2
(LEVER POSITION SENSOR)



Sound synthesis



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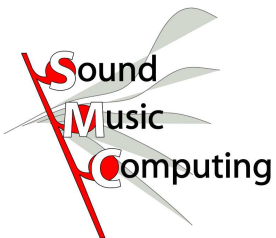
Conclusions

- Different physical models of everyday sounds were implemented as external objects in Max/MSP
- These models include croaking sounds (like in the original Croaker instrument) friction sounds, impact and rumbling sounds
- The physical models are based on the PhISM model by Perry Cook (1996) and friction models by Serafin (2004)
- **Scrapes and screeches:** the sustained excitation is modeled by the elasto-plastic friction
- **Rumbles, roars:** physically informed sonic model (PhISM) algorithm is used
- **Laughing sounds:** time domain formant wave function synthesis (FOF) technique used to generate different vowels by combining particles together

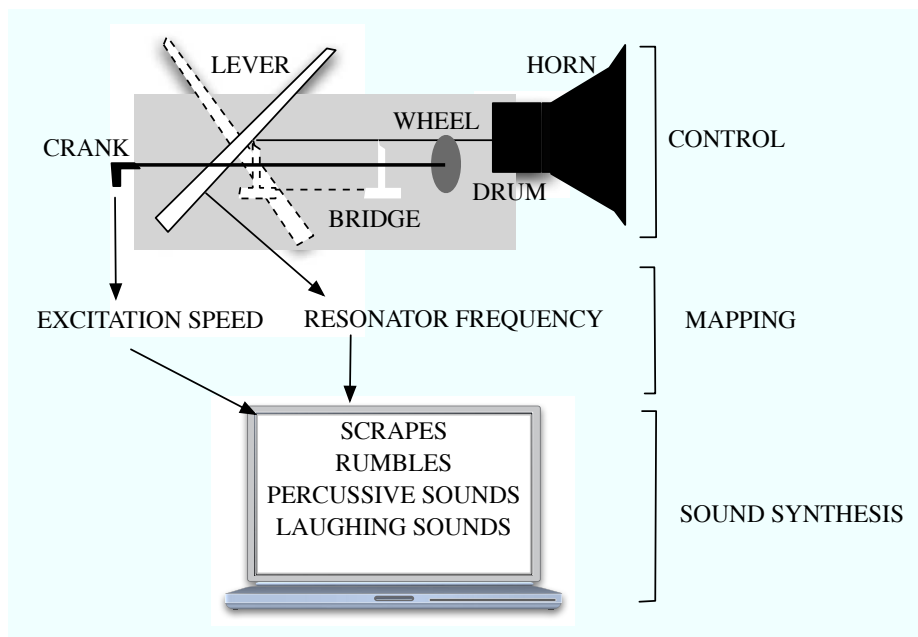


Mapping

- The mapping strategies for the Croaker are quite straightforward since they correspond to the mapping strategies of the original instruments
- The position of the lever controls the fundamental frequency of the different models
- The rotation of the crank controls the speed of the excitation

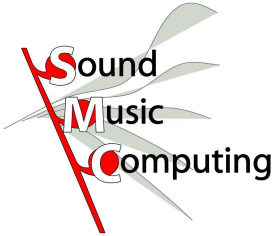


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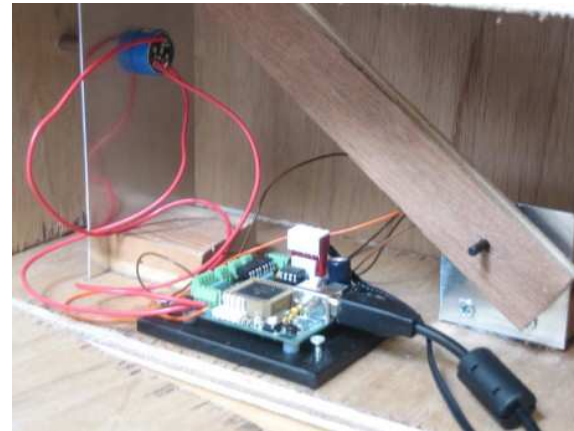
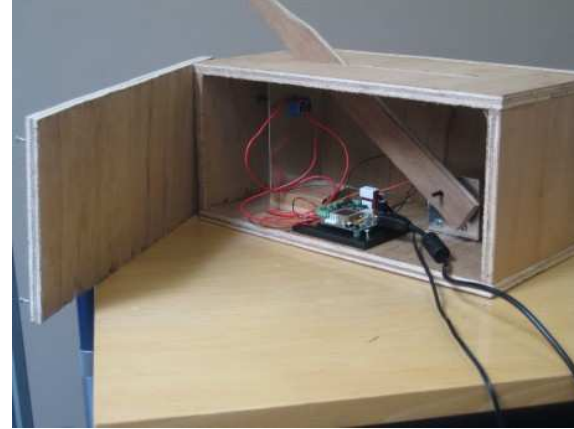
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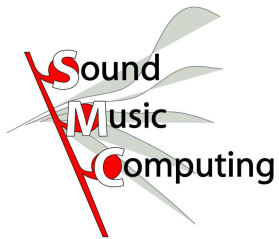


VIDEO 1

VIDEO 2



Conclusions



- The sound production mechanism of the different Intonarumori instruments is not completely documented
- Moreover these instruments are not easy to find and measure
- Being able to reconstruct them allows to preserve an important contribution to the 20th century Italian musical heritage

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