Hydro-Magnetic Catalyst Part I:
Qualia, Quantillium and Stream of Consciousness
A new paradigm for neuroscience with preliminary experimental data.

Carlino Christian Francesco
No affiliations

chcarli@libero.it

Abstract

Following work deals with the realization of an experimental setup called Hydro-Magnetic Catalyst (HMC) which has allowed to provide early experimental results useful for the study of the origin of consciousness and subjective experience.
The proposal starts by two main assertions: 1) neurons are not binding for the presence of consciousness and are not repositories thereof; 2) water content distinguishes living systems from non-living systems and, interacting with low intensity magnetic fields, can leads to particular emergent features.
Experimental results demonstrate that:
- the interaction between vicinal water and magnetic fields oscillating with frequency in the alpha and beta range is fundamental for the qualitative perception of stimuli from the external environment (qualia). This perception can be measured by means of a new index called Quantillium (Ql).
- neurons and neuronal networks are not the repositories of consciousness and subjective experience. They constitute the information decoding hardware. This decoding is mostly digital, but passive properties of the neuronal cells and their interconnections allow for a digital-to-analog reconversion of the signal with a system similar to the r-ladder one. This analog signal could be responsible for the transmission of information to the aqueous environment, for their amplification through feedback phenomena, and for the perception, during waking state, of qualia and continuous thought flow.

Introduction

In recent decades many researchers, and even some Nobel laureates, have devoted their efforts to the study and interpretation of consciousness mistery. But every theory born from the fatigue of these great scholars has never received experimental confirmation [1].
The currently dominant position seems to be that of physicalism, based on which mental processes can be traced back to the set of physico-chemical processes that take place in the highly integrated neuronal networks of our brain.
John R Searle offered an alternative view, with the theory of Causal Agency which postulates the existence of a Causal Power inherent in the physical structure of the brain [2]. This Causal Power would originate, in a way that is not yet clear, from the order of nature and would allow the brain to initiate free mental processes with real subjectivity.
Until now, the theory of Causal Agency has seemed impracticable because is it not yet known what physical phenomenon could be at the origin of the Causal Power and how mental processes can act on the physical world creating perception of the subjective mental activity and of the surrounding world.
Following work deals with the realization of an experimental setup called Hydro-Magnetic Catalyst (HMC) which should provide early experimental results useful for the study of the origin of

consciousness and subjective experience, with a look at Causal Agency theory and foundations on some hypotheses arising from experiential observations and experimental data.

Fundamental hypotheses

Hypothesis 1); the number of neurons and their connections is not binding for presence of consciousness.
Observation 1
In the animal kingdom the brain of each species has a different and peculiar neuronal content (e.g. about 530 million cortical neurons for dogs, 250 million for cats and 16 billion for humans) but it is considered undeniable the presence of a content of consciousness for many of them.
Observation 2
As far as humans are concerned, there are pathological conditions characterized by a marked reduction in the number of neurons (i.e. ischemic insults, traumatic events or large surgical resections) anyhow associated with an adequate level of consciousness. On the other hand, there are also pathological conditions characterized by the absence or marked reduction of the content of consciousness even in the presence of limited or focal neuronal damage.
Observation 3
The cerebellum has a higher number of neurons than the supratentorial brain parenchyma, but is devoid of any "imprint" of consciousness. In fact anomalies or acquired lesions of more or less large portions of the cerebellum do not compromise state of consciousness.

Hypothesis 2); neurons and, more generally, neuronal activity, are not the repositories of consciousness.
Observation
Neurons represent the "hardware" needed to process information that reaches the brain. Absurdly, a brain deprived of consciousness can still act as an information processor even though it is not able to attribute semantic, emotional and experiential meaning to what is perceived.

Hypothesis 4); in the interaction between water and oscillating magnetic fields of low intensity could be hidden the singularity from which consciousness originates.
Observation 1
90% of the brain is made up of water.
Observation 2
The brain has an oscillating electromagnetic activity, variable in frequency and intensity, according to the state of consciousness [3].

Methods

The experimental verification of the fundamental hypotheses previously set out necessarily involved the creation of an experimental model called Hydro-Magnetic Catalyst (HMC), made up of the following elements (Fig.1):

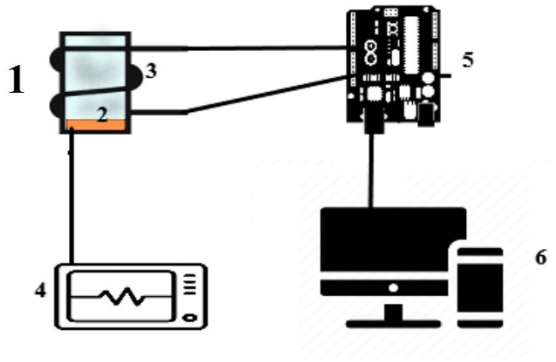


Fig.1: basic structure of HMC

- the core (1) with the stimulation coil (2) and the external recording coil (3)
- the function generator (4)
- the microcontroller with ADC (5)
- the data processing and storage and spectral analysis system (6)

Core (1)

The core consists of a 150cc glass container filled with gelled water. A copper coil (2) (10 coils of enamelled copper with R=2 cm) is immersed in the base of the container. The dimensions and the number of turns of the coil are calculated in such a way as to generate, at the passage of current, an oscillating magnetic field with an intensity of a few microT (10-20 microT)

The external surface of the core is covered with 100 enamelled copper turns that make up the recording coil (3).

Function Generator (4)

The stimulation coil of the Core is connected to a wave function generator (FeelTech FY3200S Dual Channel) programmable in order to obtain an oscillating magnetic field of the desired frequency. The intensity of the magnetic field generated by the coil is also determined by the amount of current that flows when the function generator is activated (about 30 mA).

Microcontroller and ADC
Microcontrollers inserted in HMC are two Arduino Uno boards. These microcontrollers are able to convert any analog information perceived in the core environment into digital format and transfer it to a PC for displaying on the screen, mathematical processing and digital storage. The Arduino microcontrollers can also be programmed in C to perform numerous operations on the detected data.
One Arduino Uno is connected to the coil on the external surface of the core while the other can be associated to an electric probe submerged in the aqueous environment of the core.

Signal processing system
PC is used ro record signals detected by the microcontroller and for their processing, for spectral analysis and to programme the microcontrollers in C.

Vicinal Water
The most important element of the HMC is vicinal (or interstitial) water.
In recent years, studies and experiments conducted by Prof Gerald Pollack about the characteristics of water, strongly demonstrated that water contained in tissues of living organisms (vicinal water) has properties that are quite distinct from those of bulk water [4].
In proximity to organic, hydrophilic surfaces, which tend to be negatively charged, water molecules are arranged in such a way as to create a layer of negative charges, in contact with the organic surface, due to the "like likes like" phenomenon and consequently creating an accumulation of remote positive charges in the bulk water.
The negative aqueous layer is referred to as the Exclusion Zone (EZ) as it rejects virtually any solute. Furthermore, the subdivision of the positive and negative charges in the interstitial water volume actually means that, in presence of oscillating magnetic fields, movements of these electrical charges can occur, due to the effect of Faraday's law, and if these moving charges cross the internal surface of a coil they can induce a measurable Electromotive Force.

First experiment

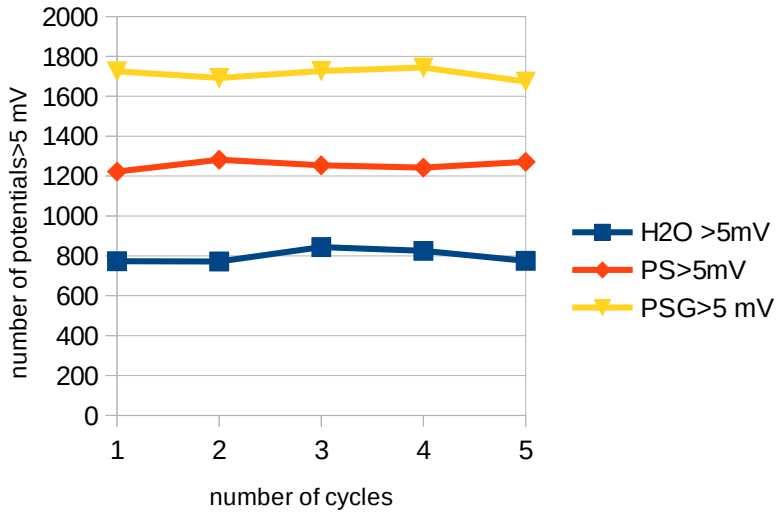
This experiment analyzes what happens to the hydro-magnetic catalyst in the presence / absence of water and in the presence / absence of an oscillating magnetic field.
For subsequent experiment microcontroller Arduino Uno has been programmed in cycles of 10,000 loops of 1 msec each. Microcontroller has also been equipped with a sum algorithm capable of increasing by one every time a valid action potential is perceived (regardless of the intensity) and thus returning a total every 10,000 detection loops (= 1 Cycle).
To summarize: every 10 sec (10000 loops=1 Cycle) the microcontroller returns the sum of 10000 detections where, in case of potential> 0 the number returned is 1 while in case of potential = 0 the number returned is 0 (e.g. if the number of potentials> 0 is 50% the microcontroller will return the number 5000). Each loop restarts after 10 msec.
To obtain a statistically significant number of data for each experiment, 100 consecutive cycles were taken in order to obtain 10^6 detections every 20 min approximately (see Sketch 1 in Appendix 1).

Results

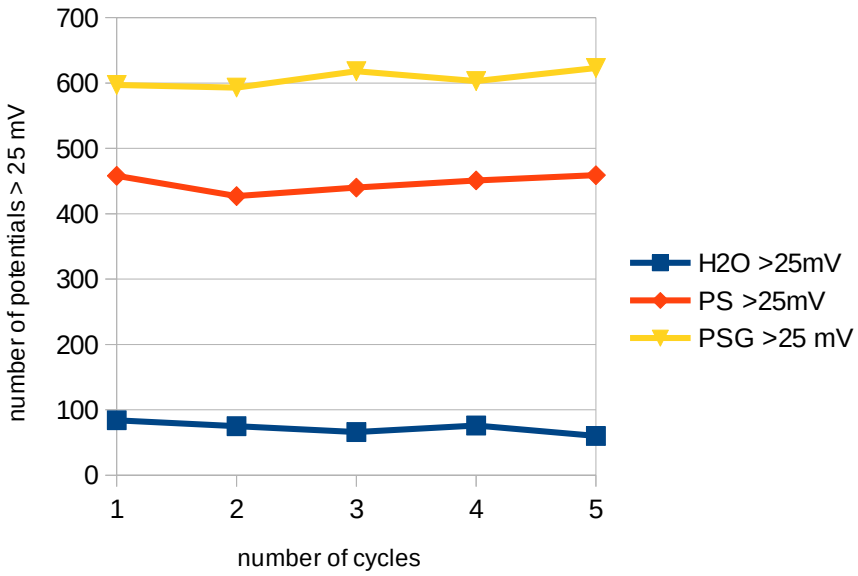
1) In the absence of H_2O the microcontroller does not detect any information, both in the presence and in the absence of an oscillating magnetic field.

2) In presence of H_2O and oscillating magnetic field, the Arduino Uno microcontroller allows to detect rather chaotic variations in field potential, probably related to the movement of charges in the aqueous medium and through the inner surface of the coil 3.

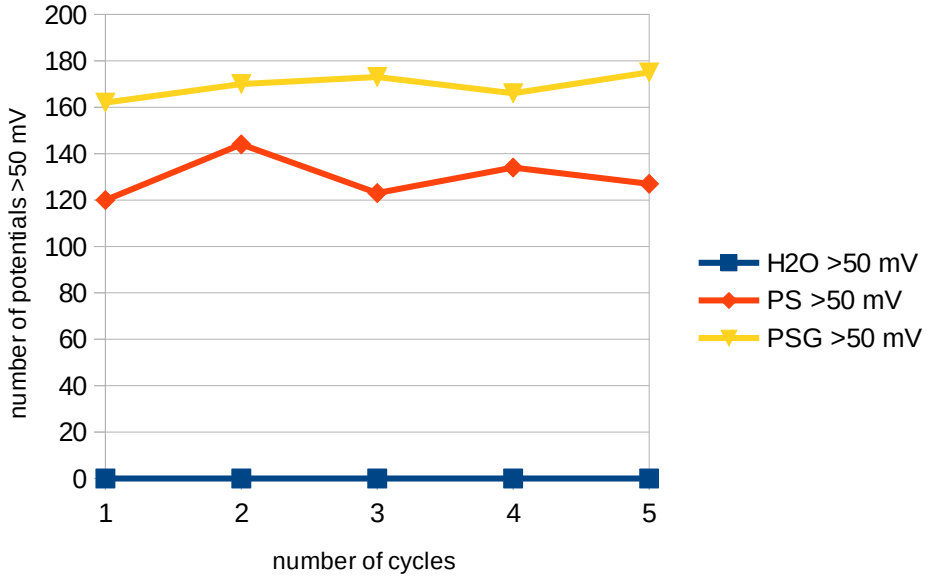
Graphs 1,2 and 3 show the variation of number of potentials (>5mV, >25 mV, >50 mV) detected by the microcontroller, under the same frequency of stimulation (8Hz), in three samples of water: demineralized water (H2O), physiological solution (P.S.)and physiological solution gelled (8% solution of cornstarch) (PSG).



Graph 1: Number of potentials > 5mV in various samples of water (8Hz stimulation)



Graph 2: Number of potentials > 25mV in various samples of water (8Hz stimulation)



Graph 3: Number of potentials > 50mV in various samples of water (8Hz stimulation)

Number of potentials definetely increases when water samples have been supplemented with salts (i.e. ions) and, according to Pollack, when have been gelled (probably due to an increase of the exclusion zone).

It is also interesting to note that only stimulation with oscillating magnetic fields is able to determine production of electric potentials. In fact, if we replace the oscillating magnetic fields with magnetic fields generated by stimuli of different nature (e.g. noise or music), the number of detected potentials does not undergo significant variations compared to the baseline in the absence of magnetic stimulation (Fig.2).

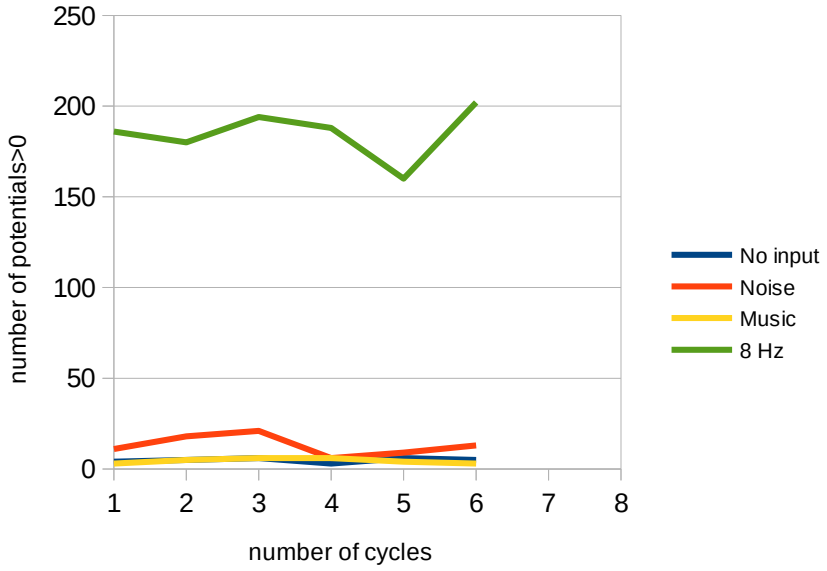


Fig 2: detected potentials with different stimulations

Second experiment

In this experiment, both Arduino boards was used, programmed in the same way (see Sketches 1 and 2 in Appendix1).

The second Arduino Board (7) was connected to an electric probe introduced directly into the aqueous environment of the core (Fig. 3).

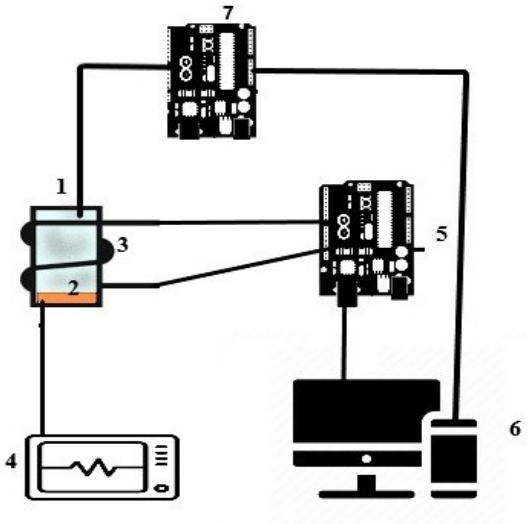


Fig.3; Arduino Board (7) connected to electric probe in the core (1) of the HMC

Both microcontrollers send the detected data to the PC.

This experiment analyzes what happens according to the stimulation modalities and the presence or absence of an aqueous environment inside the core.

Results

Case 1: absence of stimulation and water
The external microcontroller (Arduino Uno), connected to the coil on the HMC surface, does not detect any potential.The microcontroller connected to the electric probe inside the core, in the absence of water, since it records from a constantly open analog pin, in a nonreferenced measurement sytem configuration, reports the detection of numerous potentials related to environmental electrical noise (floating source).

Case 2: presence of an oscillating magnetic field and absence of water.
A situation very similar to that of case 1 occurs.
In fact, the external microcontroller does not detect any potential while the internal probe of the core, in the absence of water, still reports the recording of numerous potentials related to the environmental electrical noise.

Case 3; presence of oscillating magnetic field, with variable frequency, and gelled water in the core.
Both microcontrollers detect electrical potentials due to the interaction between water and oscillating magnetic fields.
Furthermore, analyzing potentials obtained it can be deduced the existence of two kinds of energy that are produced by the interaction between water and oscillating magnetic fields of low frequency and low intensity.
First type of energy is detected inside the core, it is linked to the formation of electrical charges and therefore an electric field within the medium, and is not very sensitive to the variation of the stimulation frequency of the magnetic field. We can define this energy as Intrinsic Causal Power (ICP).
Second Type of energy is due to the movement of electrical charges through the internal surface of the external coil of the core. Furthermore this energy is much more sensitive to the variation of the magnetic field frequency and has been defined as the Extrinsic Causal Power (ECP) of the Hydro-Magnetic Catalyst.

Third Experiment

In this experiment, the composition of the HMC, used in experiment 2, was modified by the introduction of following elements (fig 4):

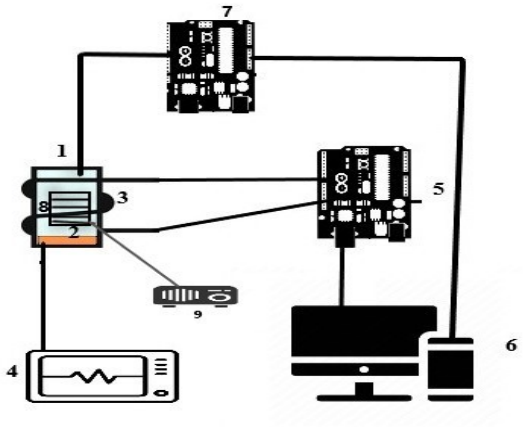


Fig. 4: HMC implemented with audio player (9) connected to the coil (8) inside the core (1)

- an audio player (9)
- an additional stimulation coil, inside the core (in the aqueous environment), connected to the output of the audio player (8)

The aim of the following experiment will be to evaluate whether the Causal Power previously detected can somehow be at the basis of the subjective perception of external reality. For this purpose both the Intrinsic Causal Power and the Extrinsic Causal Power of the HMC were evaluated in the presence of electromagnetic stimuli of different nature; a musical audio file (Nocturne in E minor Op. 72 n ° 1 by Chopin) and white noise.

Results

In spite of a low variability of the ICP, for any type of frequency and stimulus, the variation of the ECP instead undergoes considerable variations both based on the stimulation frequency and depending on the type of input coming from the external environment (the audio player).

If we analyze for each single stimulation frequency the variation of the ICP according to the type of stimulus from the external environment and we relate it to the variation of the ECP according to the type of stimulus from the external environment, we can obtain an index, that has been called Quantillium (Ql):

Ql = | ICPb - ICPx | / | ECPb - ECPx |

Where:

ICPb = Intrinsic Causal Power (number of optentials detected by internal probe in dt) without environmental stimulus

ICPx = Intrinsic Causal Power (number of optentials detected by internal probe in dt) with environmental stimulus (Noise or Music)

ECPb = Extrinsic Causal Power (number of optentials detected by external coil in dt) without environmental stimulus

ECPx = Extrinsic Causal Power (number of optentials detected by external coil in dt) with environmental stimulus (Noise or Music)

This index actually expresses the extent of the variation of the ICP compared to the variation of the ECP and has a rather peculiar behavior.In fact, it has been observed that the Ql, for stimulation frequencies between 8 and 17 Hz, associated in vivo with the alpha and beta states of alert consciousness, has significantly higher values for external stimuli of a musical type (M) compared to stimulation with noise (N) (Tab.1).

	Hz	ICP	ECP	Ql	% approx
	3	7457	1870		
N		7348	4418	0,043	4
M		7491	2268	0,085	8,5
	5	7218	2220		
N		7224	4300	0,003	0,3
M		7250	1960	0,12	12
	8	7364	1669		
N		7345	4419	0,007	**0,7**
M		7456	1891	0,41	**41**
	10	7463	1894		
N		7310	4427	0,06	**6**
M		7427	1973	0,455	**45,5**
	13	7382	1936		
N		7169	4428	0,085	**8,5**
M		7397	1977	0,365	**36,5**
	17	7038	1963		
N		6824	4409	0,087	**9**
M		7050	2008	0,267	**27**
	21	7554	1854		
N		7416	4385	0,055	5,5
M		7551	1887	0,09	9
	34	7606	1815		
N		7460	4465	0,055	5,5
M		7612	1889	0,08	8
	40	7602	1940		
N		7445	4370	0,065	6,5
M		7605	2039	0,03	3
	100	7617	1928		
N		7440	4410	0,07	7
M		7627	2024	0,10	10

Tab 1

In Tab 2 are also reported results obtained with Type 1 musical input (M1; Amazing Grace instrumental with harmonica), Type 2 musical input (M2; Eruption electric guitar solo by Van Halen), Noise (N) and Classical Music (M3; Nocturne in E minor Op. 72 n ° 1 by Chopin).

Hz	ICP	ECP	Ql	%approx
3	7305	525		
M1	7282	566	0.56	56.00%
M2	7286	658	0.14	14.00%
N	7247	606	0.71	71.00%
M3	7301	531	0.666	67.00%
8	7563	549		
M1	7551	574	0.48	**48.00%**
M2	7550	666	0.11	11.00%
N	7572	622	0.12	12.00%
M3	7565	551	1	**100.00%**
10	7555	522		
M1	7543	556	0.35	35.00%
M2	7536	625	0.18	18.00%
N	7526	605	0.349	35.00%
M3	7531	545	1.04	**104.00%**
13	7513	540		
M1	7535	573	0.666	**67.00%**
M2	7501	679	0.086	9.00%
N	7491	637	0.22	22.00%
M3	7523	549	1.11	**111.00%**

Tab 2

According to data recorded and reported in Tab 1 and 2 we can infer that sensory inputs endowed with some positive emotional value (particularly classical music in our experiments) seem to determine a greater perturbation of the aqueous environment of the core compared to sensory stimuli endowed with a negative emotional value or devoid of emotional value.
For this reason, Quantillium (Ql) can be considered a good indicator of the perception of the qualitative / subjective aspects of conscious experiences (qualia).
Finally it is interesting to note that Ql can be defined only for analogic inputs.

Consciousness flow and neuronal activity
Neurons are digital structures as they can assume only two configurations, on-off, from which inhibitory or excitatory behaviors and any feedbacks then follow [5].
So how can a continuous stream of thoughts, an analogical perception of reality, originate from a discrete neuronal activity?
Furthermore, if the Ql can only be obtained with analogue information, how can informations, digitally processed by neuronal networks, reach the vicinal water retaining most of their qualities?

Connections between neurons can develop in various ways, such as the following (Fig. 5):

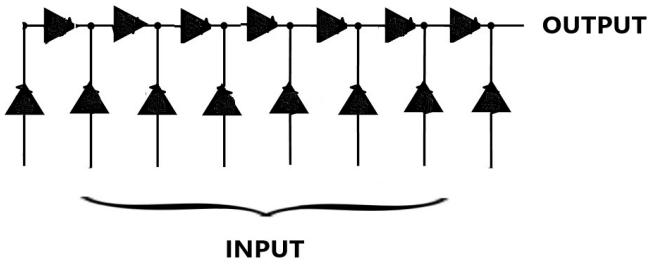


Fig.5: a simple scheme of connections between neurons

Each neuron, however, is characterized by its own electrical resistance, varying from 10^4 to 10^9 ohm depending on whether the fibers are non-myelinated or myelinated. The previous image can then be modified as follows (Fig. 6):

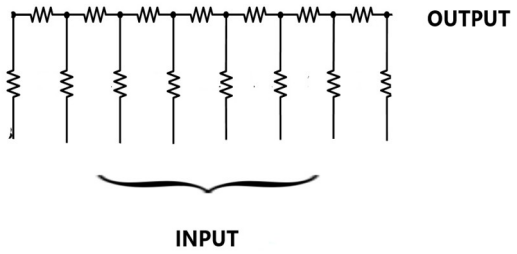


Fig.6: a simple scheme of connections between neurons with electric resistance

However, if we look closely at this scheme we can notice an apparent analogy with a particular electronic circuit called R-ladder which is nothing else than a digital analog converter [6](DAC; Fig. 7).

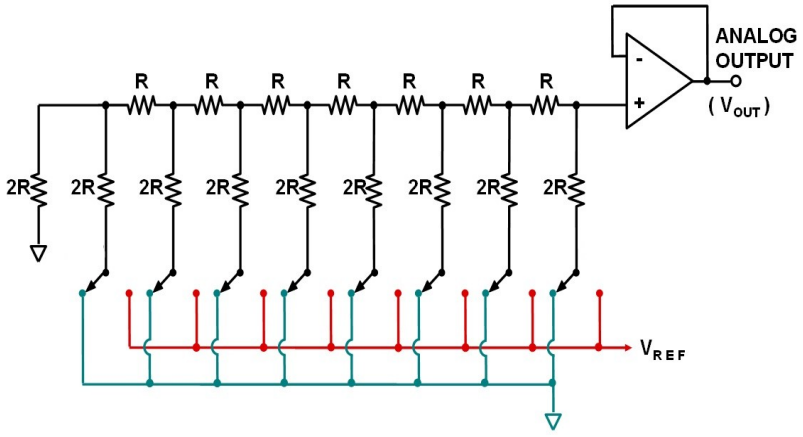


Fig.7: DAC scheme

Arduino technology allows us to create an 8-bit R2R ladder which can then be integrated into the HMC system according to the following scheme (Fig. 8).

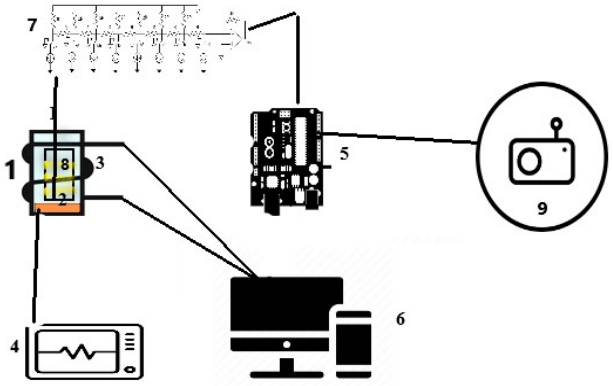


Fig.8: HMC with DAC

At this point, the sensory input to the aqueous core of the HMC is no longer provided by direct connection between the internal stimulation coil and the audio player, but by the R2R DAC (7) inserted at the output of the microcontroller. In this case the audio impulse (9) is fed into the Arduino (5) through an analog pin, converted into a digital signal (as in fact the brain neurons would do) and subsequently reconverted, by the 8-bit neuronal system, in an analog signal which is then sent to the core through the internal stimulation coil (8).
The analog signal that thus reaches the core can allow to evaluate the Ql, index, as we have seen previously, of the qualitative / subjective perception of sensory input.
Furthermore, if we introduce a feedback system, where the output of coil 3 is sent not only to the PC but also to the microcontroller (Fig. 9, red lines), we get an important amplification of the analog input (in this case audio input) without energy consumption (Fig.10 and Fig.11).

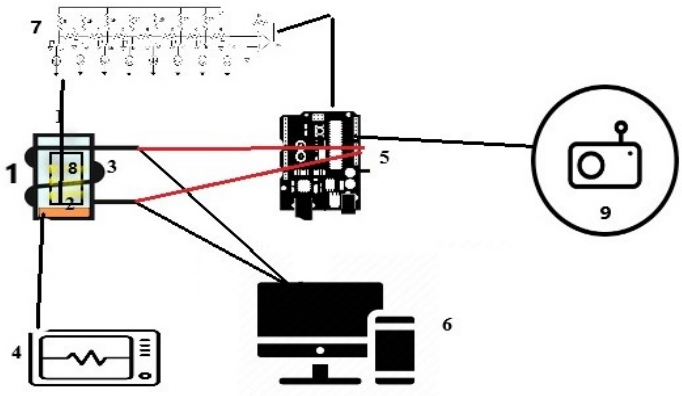


Fig.9: HMC with DAC and feedback

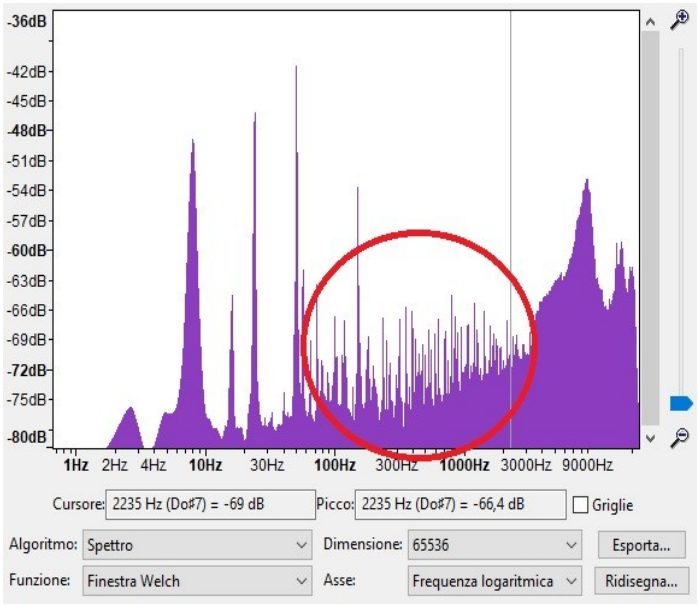


Fig.10: R-ladder without feedback

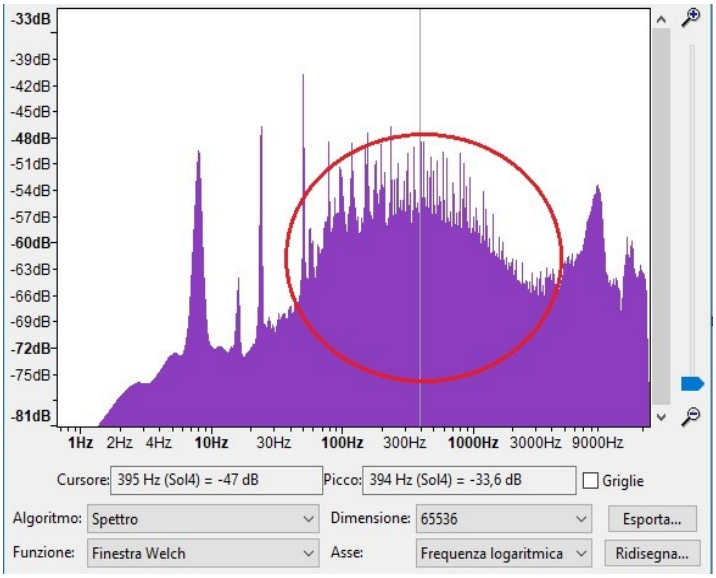


Fig.11: R-ladder with feedback

For completeness in Appendix 2 are reported the power spectrum variations of an analog audio input under different frequency stimulation and different configuration of the HMC, and we can still see how the definition of the analog input spectrum is much better using feedback circuit and stimulation frequencies included in the alpha and beta range.

Obviously the poor computational power of the microcontroller used in our experimental model (8 bit) allows a rather spartan processing of the audio input, but we can well imagine the efficacy of a high computational power like that of human cerebral cortex made up of billions of interconnected neuronal cells.

Discussion

Despite the publication of numerous theories the origin of conscious experience remains one of the greatest mysteries of the scientific and philosophical world
Moreover, failure of computer and cybernetic sciences in the development of an artificial entity endowed with consciousness is evident to everybody [7].
Extremely intelligent machines have been created, capable of independently learning the game of chess or go, at levels such as to embarrass even the most skilled human being.
But they remain the equivalent of logical schemes, devoid of any emotional and experiential content.
Machine is not pleased with its result or frustrated by failure; it simply waits for another task.
Machine does not design its own future; it simply applies more or less complex algorithms.
Machine does not dream, does not feel pain, hunger, desire for freedom, fear of death; it does not tend to exceed its limits. It processes the symbols, but remains devoid of any intentional semantic capacity towards the surrounding world.
Machine does not possess sensations, objective values, motivations and purposes; it is devoid of individuality. Any machine can be replaced by another completely identical one.
Machine effectively measures quantity but is totally ineffective in assessing quality.
Hence the failure of all those sciences that converge in the broader term of Artificial Intelligence brings us back to the living brain. In it, obviously, there must be a hidden something in which resides one of the greatest mysteries of the universe.

The experimental setup described in this report has allowed the valuation of the real energetic power of vicinal water stimulated by oscillating magnetic field.
Vicinal water is the main constituent of every living being and particularly of brain. The interaction between vicinal water and brain waves activity could be at the origin of a sort of Causal Power, an emergent property, postulated by John Searle, that could solve the notorious hard problem of David Chalmers: how can rise subjective experience from a physical structure of any complexity?
Results reported allow to infer the following conclusions:
- the interaction between water and magnetic fields oscillating with frequency in the alpha and beta range is fundamental for the qualitative perception of stimuli from the external environment (qualia). This perception can be measured by means of an index called Quantillium (Ql) which represents the ratio between the excitability variation of the aqueous medium (core) with respect to the excitability variation of the computational system, following the application of stimuli of various kind.
- neurons and neuronal networks are not the repositories of consciousness and higher brain functions. They constitute the information decoding hardware. This decoding is mostly digital, but passive properties of the neuronal cells and their interconnections allow for a digital-to-analog reconversion of the signal with a system similar to the r-ladder one. This analog signal is probably responsible for the transmission of information to the aqueous environment, for their amplification through feedback phenomena, and for the perception, during waking state, of continuous thought flow and semantic experiences.

Conclusions

Compared with other much more relevant theoretical studies this work deals with the development of a physical system (HMC) that could be useful for the experimental investigation of a new paradigm of neuroscience, where interaction between water and magnetic fields, not neurons, is the repositorie of conscious experience and subjectivity.
Other experimental set up relating to the potential of HMC are in progress and the author is open to any collaborations and partnerships.
If this new paradigm will receive other experimental confirmations it will probably provide a huge push forward not only in the technological field, but above all in the epistemological, gnoseological and ethical fields, providing a key to a profound interpretation of the relationship between mind and body, between phenomenal reality and subjective reality, between Universe, Life and Man.

References

1) Zeman, A. Consciousness. *Brain*. **124**,1263-1289 (2001).
2) Warfield, T.A. Searle's Causal Power. *Analysis.* **59**, 29-32 (1999).
3) John, E.R. The neurophysics of consciousness. *Brain Res Review*.**39,**1-28 (2002)
4) Pollack, G.H. *The Fourth Phase of Water*. Ebner and Sons (2013)
5) Debanne, D., Bialowas, A. & Rama, S. What are the mechanisms for analogue and digital signalling in the brain? *Nat Rev Neurosci* .**14,** 63–69 (2013)
6) *https://en.wikipedia.org/wiki/Resistor_ladder*
7) Haikonen, P.A.O. On Artificial Intelligence and Consciousness. *J.AI. Consci*.**7**,73-82 (2020).

8) APPENDIX 1: Arduino Sketches

9)
10)
11)
12)
13)
14) SKETCH 1: External Causal Power (ECP)

```
15)
16) void(* resetFunc) (void) = 0;
17)
18) int x = 1;
19) byte tot[10000] = {};
20) long somma = 0;
21) byte contatore = 1;
22)
23) void setup() {
24)
25)    Serial.begin(9600);
26) }
27)
28) void loop(){
29)
30)
31) for(x; x <10000; x++){
32)
33) int A = analogRead(A0);
34)
35) if (A >= 4 ){
36)    A = 1;
37) }
38) else {
39)  A = 0;
40) }
41)
42) tot[x] = (A);
43) somma = (somma) + (tot[x]);
44)
45)  delay (1);
46)  }
47)
48) Serial.println(somma);
49)
50) delay (10);
51)
52) resetFunc();
53) }
54)
```

55)
56)
57) SKETCH 2: Internal Causal Power (ICP)
58)
59)
60)
61) void(resetFunc) (void) = 0;*
62) int x = 1;
63) byte tot[10000] = {};
64) long somma = 0;
65) byte contatore = 1;
66)
67) void setup() {
68)
69) Serial.begin(9600);
70)
71) pinMode(15,OUTPUT);
72) pinMode(16,OUTPUT);
73) pinMode(17,OUTPUT);
74) pinMode(18,OUTPUT);
75) pinMode(19,OUTPUT);
76) }
77)
78) void loop(){
79)
80)
81) for(x; x <10000; x++){
82)
83) int A = analogRead(A0);
84)
85) if (A >= 1){ //change this parameter to reduce noise effects
86) A = 1;
87) }
88) else {
89) A = 0;
90) }
91)
92) tot[x] = (A);
93) somma = (somma) + (tot[x]);
94)
95) delay (10);
96) }
97)
98) Serial.println(somma);
99)
100) delay (1);
101)
102) resetFunc();
103) }
104)

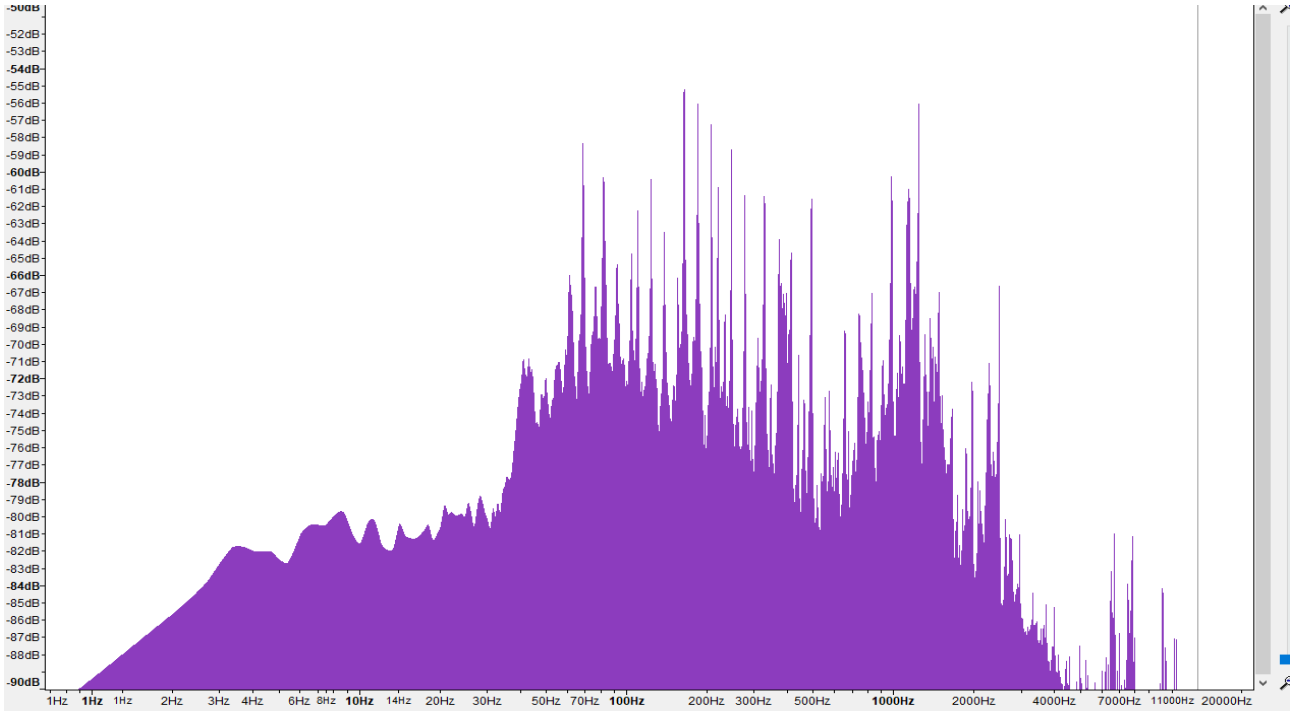
105)
106)
107)
108) ***SKETCH 3: R-Ladder (with two inputs; see fig.14)***
109)
110)

```
111)  void setup() {
112)    for (byte i=0;i<8;i++){
113)      pinMode(i,OUTPUT);
114)    }
115)
116)  }
117)
118)  void loop() {
119)    int A = analogRead(A0);
120)    int B = analogRead(A2);
121)    int C = (A + B +1)/4 - 1;
122)    if (C < 0){
123)      C = 0;
124)    }
125)  PORTD = C;
126)  }
```

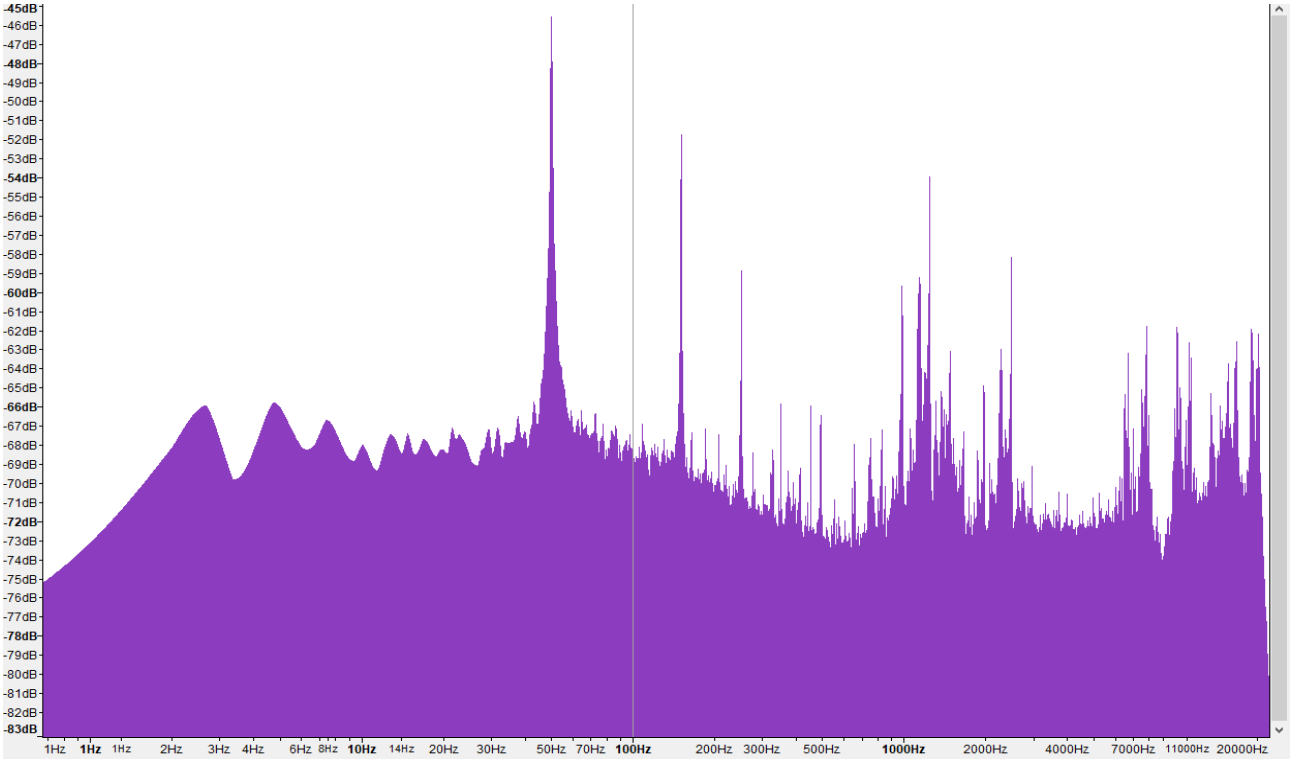
127)
128)

129) APPENDIX 2: Spectral Analysis of audio input

130)
131)
132)
133)
134)
135) N.B: INPUT= Amazing Grace by Buddy Green's Harmonica
136)
137)

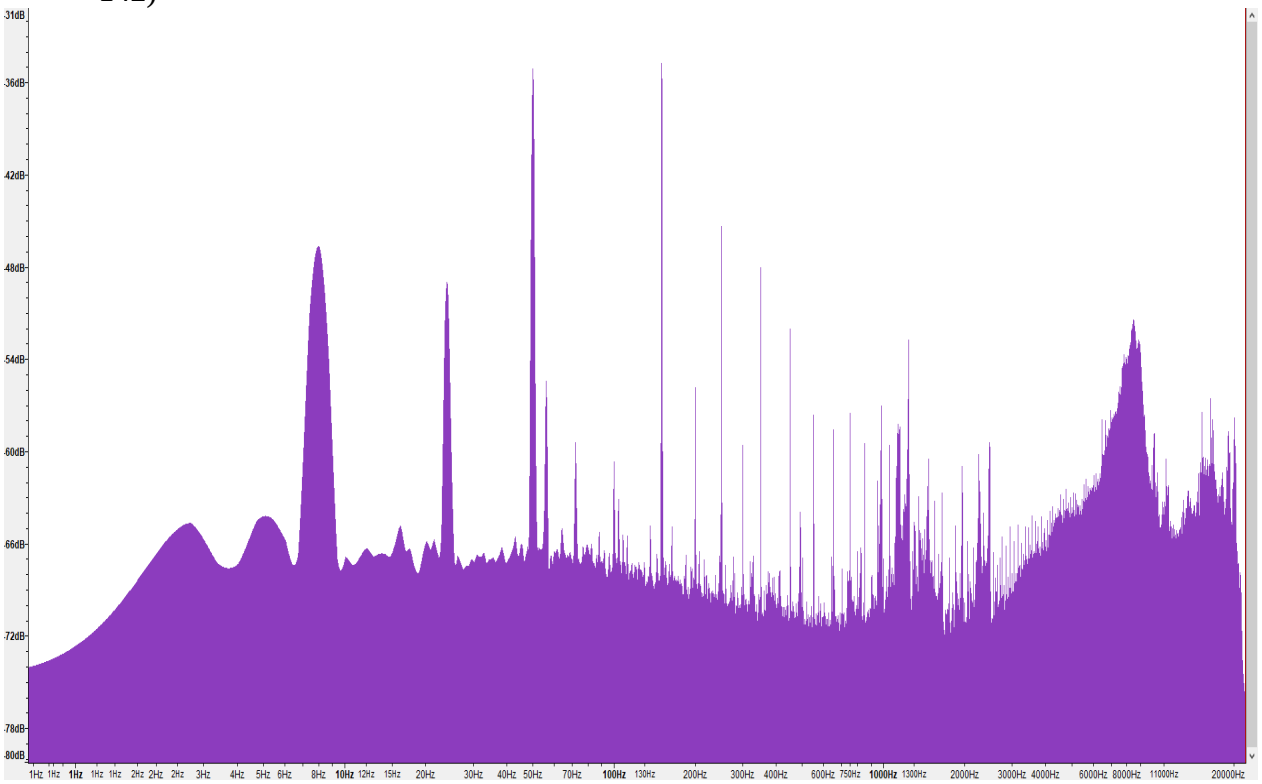


138)
139)
140) HMC + R-Ladder + Input- No Hz stimulation



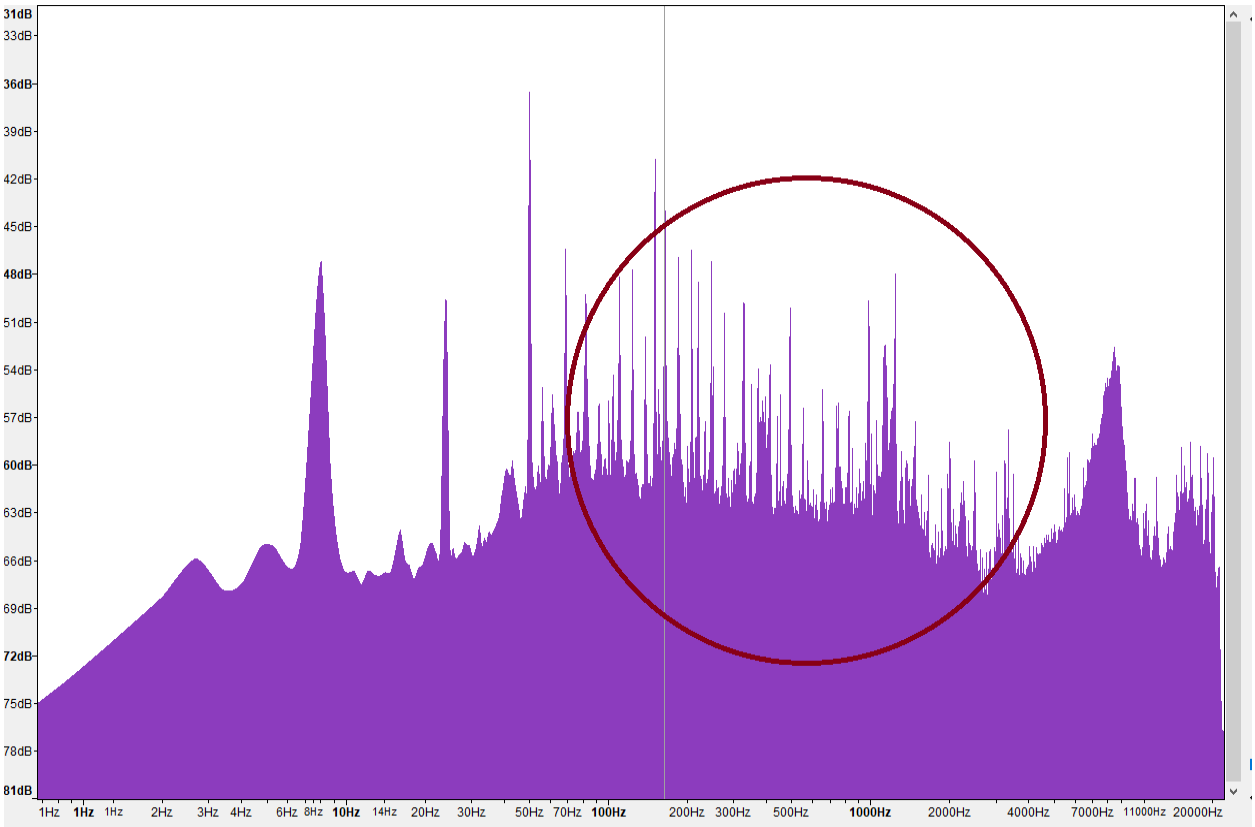
141) HMC + R-Ladder + Input + 8 Hz stimulation

142)

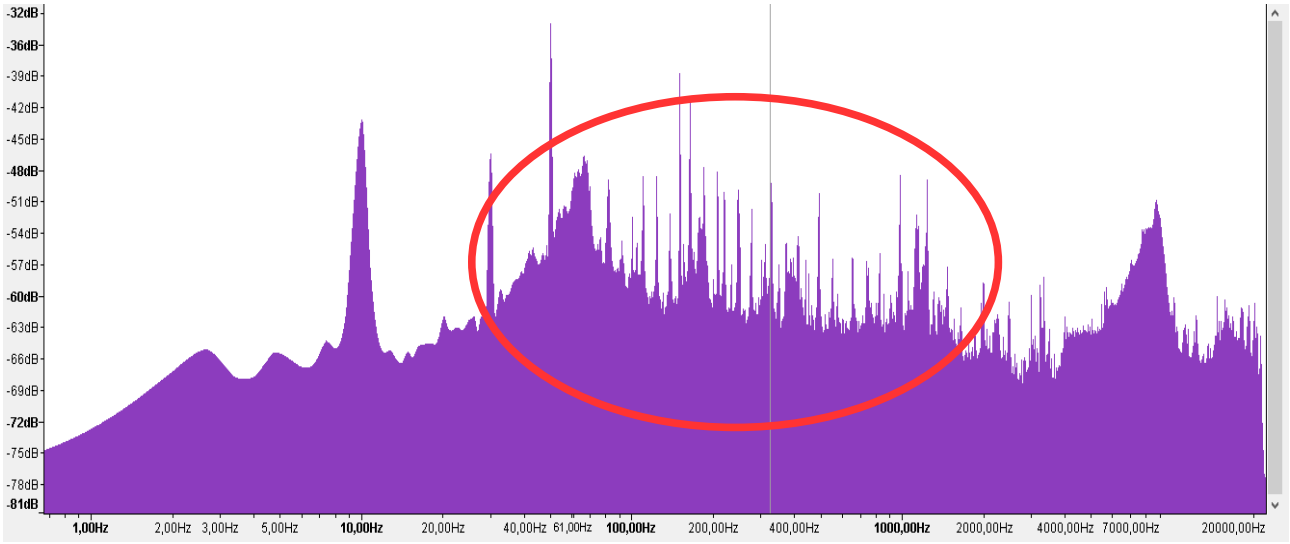


143) HMC + R-Ladder + Input + 8 Hz stimulation + feedback

144)

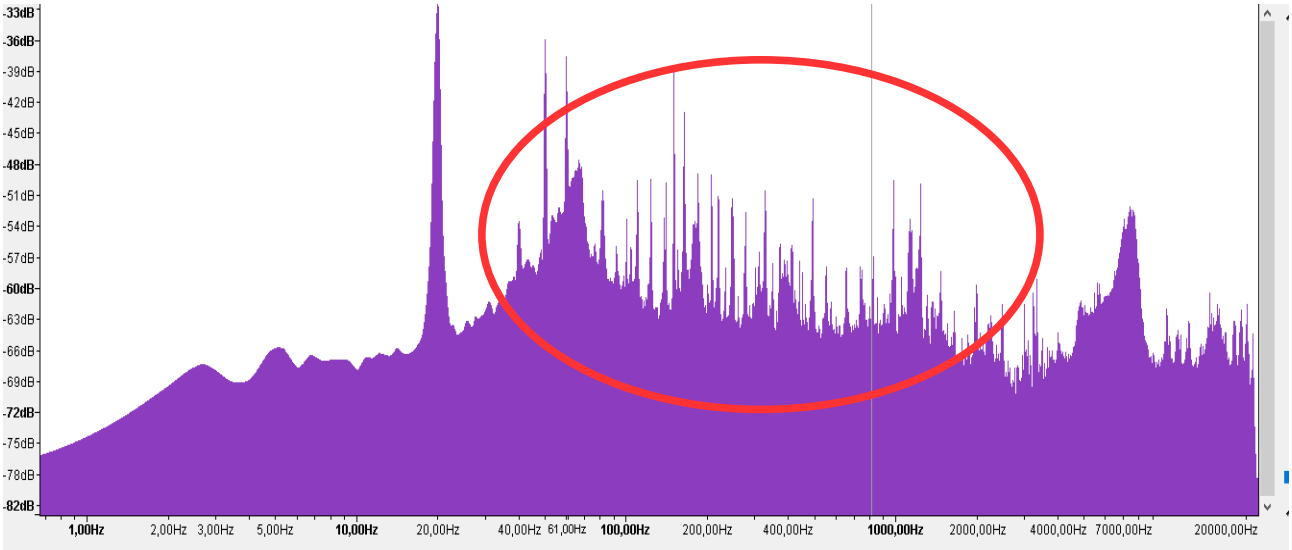


146)
147) HMC + R-Ladder + Input + 10 Hz stimulation + feedback



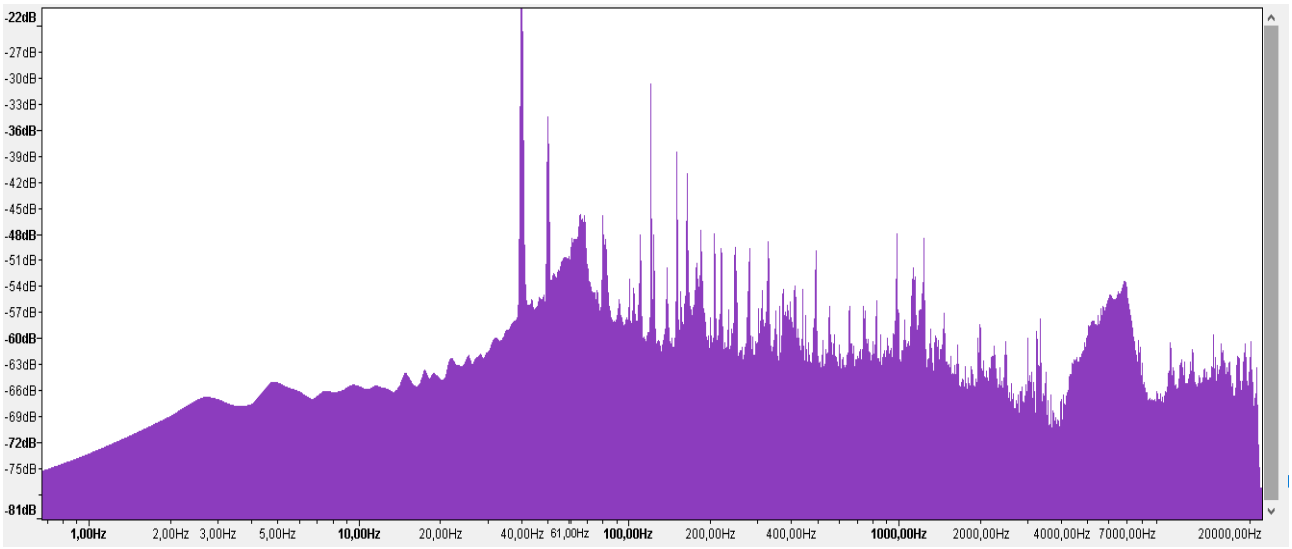
148)
149)
150)
151) HMC + R-Ladder + Input + 20 Hz stimulation + feedback

152)
153)



154) HMC + R-Ladder + Input + 40 Hz stimulation + feedback

155)

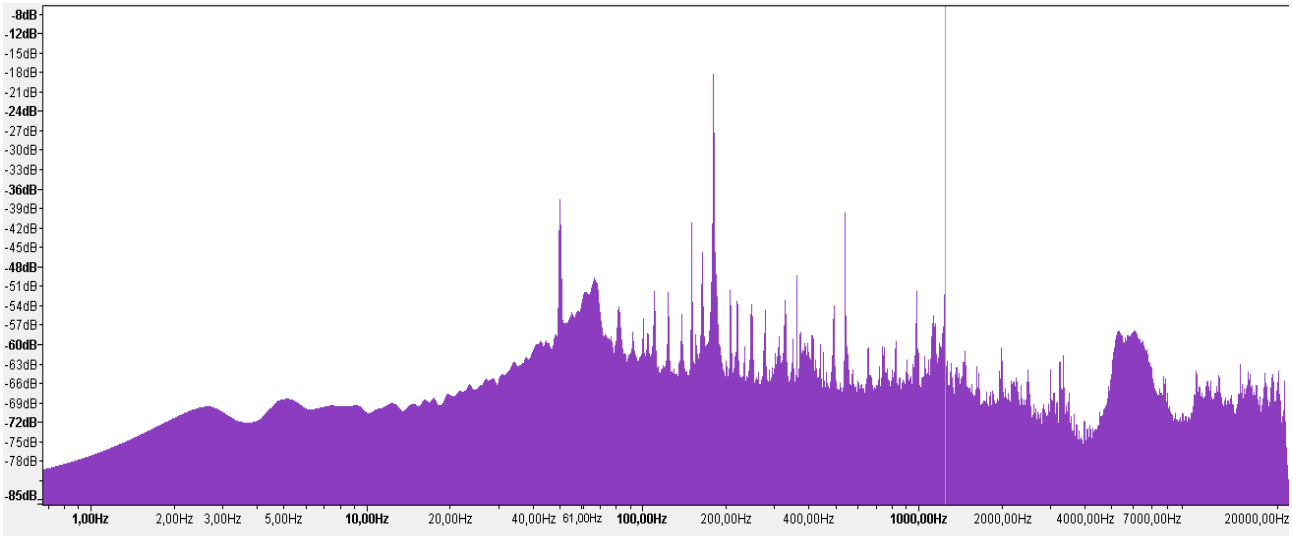


156)

157) HMC + R-Ladder + Input + 180 Hz stimulation + feedback

158)

159)



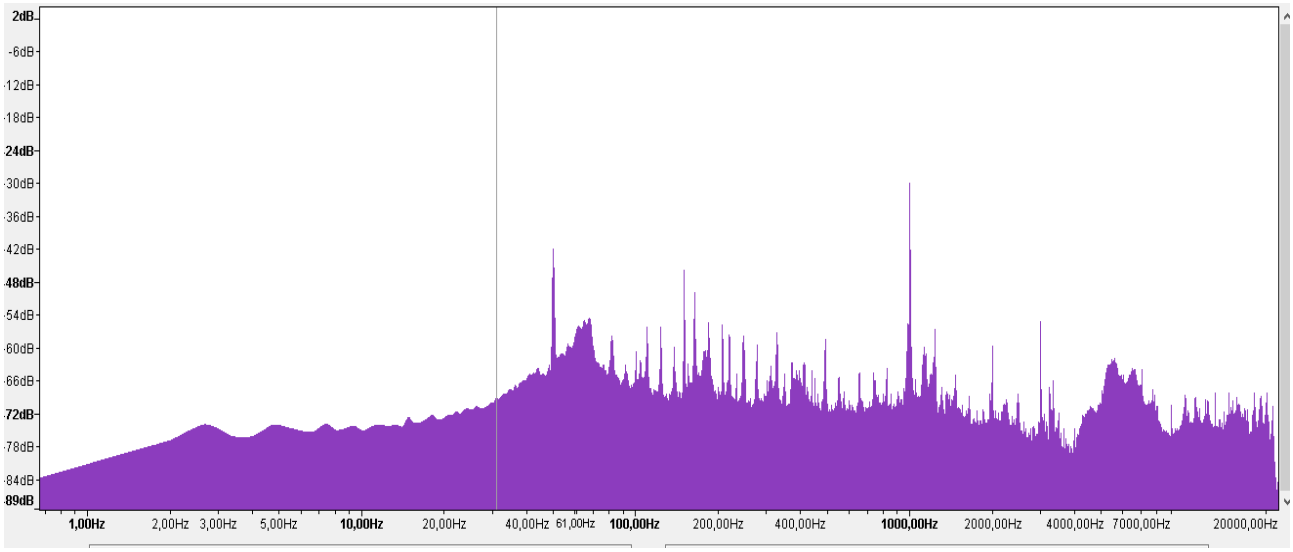
160)

161)

162)

163) HMC + R-Ladder + Input + 1 KHz stimulation + feedback

164)



165)

9) HMC + R-Ladder + Input + 3 Hz stimulation + feedback