

## Modes of interference / 3

Agostino Di Scipio

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# Modes of interference / 3

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## 1 Modes of interference / 3 :

- ... est une installation sonore fonctionnant en temps réel, dans l'espace réel (le son affecte l'environnement sonore, affectant ensuite le processus par lequel le son est généré) ;
- ... consiste en un réseau dynamique d'interactions sonores, en un système qui vit seulement grâce à la réinjection (*feedback*, sonorités de larsen), et régule son propre comportement d'après les sons qui émergent de la boucle de réinjection ;
- ... est un travail sur la guitare électrique en tant qu'icône détournée de la culture pop, porteuse d'un symbolisme phallique évident ;
- ... est, essentiellement, un travail sur la sonorité distordue et auto-alimentée de la guitare électrique, la déconstruction d'un instrument compris et expérimenté comme une sorte d'icône sonore détournée, consumée ;
- ... a été décrit dans la presse comme une œuvre d'art sonore « plus rigoureuse, mais pas moins agréable que les installations de Brian Eno » (*Il Manifesto*, 27/02/2007).

## 2 L'installation a eu lieu à :

- Naples, Festival Dissonanzen, février 2007 ;
- Berlin, Linux Audio Conference, mars 2007 ;
- Rome, Museo Laboratorio di Arte Contemporanea, janvier 2008.

## 3 Une version de concert a été jouée par le Zwerm Ensemble en Belgique à Bruges en novembre 2009 ainsi qu'en Autriche à Innsbruck, à Vienne et à Graz en janvier 2010.

## 4 La partition est proposée ci-dessous, avec l'autorisation du compositeur<sup>1</sup>.

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## 5 Agostino Di Scipio<sup>2</sup>

MODES OF INTERFERENCE / 3

feedback system with electric guitars,

combo amplifiers, and computer

2007

\*

- 6 **Modes of Interference / 3** follows from **Modes of Interference / 1** (feedback system with trumpet and electronics, 2005-06) and **Modes of Interference / 2** (feedback system with saxophone and electronics, 2006). It shares the overall concept of those works, but it's different in that it requires no instrumental performance: it is primarily a sound installation, that can be set-up in either rooms or semi-open places (courts, squares, etc.). Only with special arrangements it can become a performance piece (see last page of the present document).
- 7 For reasons of simplicity, the present document refers to the utilization of one only guitar (+ 1 amp + computer). However, in a real set-up, two or more guitars should be used (can be different brands), each with its own amp and its own connection to the computer.
- 8 **electric guitar** : 6-string electric guitar, better with humbucking pick-ups. Can be “bass guitar”, too, either with 4 or 5 strings.
- 9 **amplifier** : “combo” amplifier (amp, preamp, filters, speaker cone), valve or transistor. Should be at least 40 Watts. Higher wattage should be considered when presenting the installation in very large venues.
- 10 **computer** : equipped with AD/DA converters (“sound card”) and software for real-time signal processing. An implementation using PD (Pure Data, an open source software) can be requested from the composer.
- 11 Here's a list of guitars and amps utilized by the composer in the preparation and testing (this list is NOT AT ALL prescriptive, it is provided only for purposes of documentation): Ibanez SG470 with Polytone 50 watt, Epiphone SG with Polytone 50 watt, Fender Lead II with Roland Cube 40 watt, Cort 4-string bass guitar with Polytone 50 watt, Cort 5-string bass guitar with Ampeg 100 watt. Thanks are due to Mario Formisano, Giuseppe Renne and Massimo Scamarcio for their help testing these guitars in the occasion of the world premiere (Napoli, 23/02/2007).
- 12 In the following, you find:
- an **INTRODUCTION** explaining the compositional concept;
  - some **GENERAL INSTRUCTIONS** concerning the technical set-up;
  - a description of the **DIGITAL SIGNAL PROCESSING** (necessary unless you use the composer's original implementation, with the PD software);
  - a not on possible **EXTENSIONS** of the work.

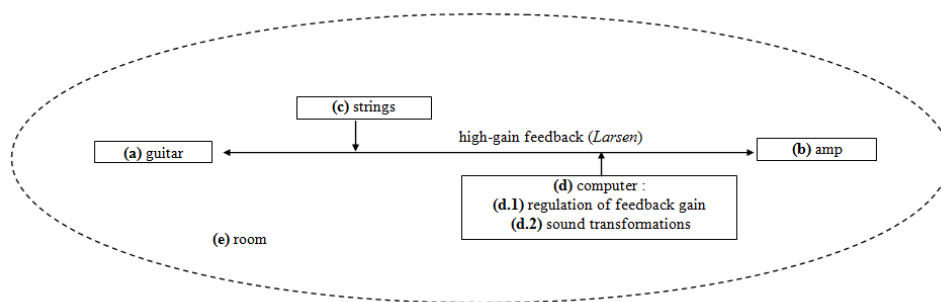
## Introduction

- 13 This work is a *composed dynamical system* entirely based on an audio feedback loop.
- 14 The two ends of the loop are **(a)** the electric guitar's pick-ups, and **(b)** the combo amp. The level must be loud enough as to cause the feedback loop to start resonating. The resonating feedback (also called “Larsen effect”) represents a technical problem in sound systems, but in this work it is the only sound source.
- 15 In between are **(c)** the guitar strings and **(d)** the signal-processing computer. The string vibrations determine principal and secondary resonances in the feedback loop (frequency of Larsen), depending on length, tension and mass. To some extent, they

also depend on the mechanical features and the electronic circuitry of the amp and the pick-ups. The computer dynamically adapts the feedback gain, trying to keep the overall system in equilibrium and avoiding sustained saturation (d.1). The computer also transforms all sounds (d.2), and the transformed sounds in turn enter the feedback loop and interfere with the Larsen tones. The whole process remains always subject to perturbations from the surrounding (e), mechanically mediated by the strings and the guitar's wooden body.

- 16 All efforts should be aimed at establishing, only with the available resources, an autonomous system dynamics capable of creating a flux of sound shapes changing over time.
- 17 Duration is indetermined.

Figure 1



(CLIQUER SUR « ORIGINAL » CI-DESSUS POUR VISUALISER LA figure)

## 1. General instructions

### 18 Guitar

- 19 The guitar should be in NO WAY played. It must stand vertically, maybe a little lifted from floor.
- 20 Strings must be of the smallest gauge available. Tuning could be as usual (e-a-d-g-b-e). Strings could also be slightly detuned, or tuned differently<sup>3</sup>. Anyway, they should be tensed enough to actually start vibrating when the high-gain feedback loop is working.
- 21 The pick-up closest to bridge should be selected. Alternatively, two pick-ups can be selected, one being the closest to bridge. The level regulation should be maximum. The regulation of “tones” (filters in the guitar circuitry) must also be maximum; only in case the acoustical process shows a strong predominance of one or few frequencies over all others, you should regulate the “tones”, in order to allow for a more varied situation.

### 22 Amp

- 23 Level must be high enough as to cause the Larsen effect. If two distinct controls are available (“Volume” and “Master”), you should keep the “Volume” at maximum level, and conveniently regulate the “Master”. The “tones” regulation should be flat (no eqing); in case the overall process shows a strong predominance of one or few frequencies over all others, you can regulate the “tones” in order to avoid that and

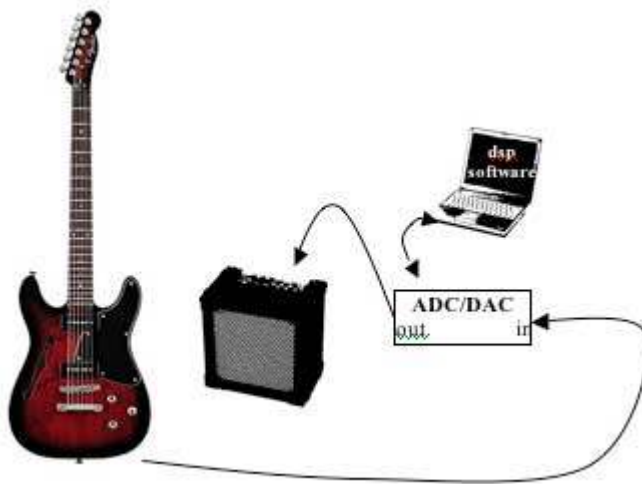
allow for a more varied situation. No other circuitry affecting sound should be operating (“reverb”, “overdrive” etc.).

#### 24 **Position**

25 The amp should be behind the guitar, maybe a little on a side (see below). However, you are invited to find yourself the most convenient position, one that may create a strong but varied feedback situation. The distance may range from few dozens of centimeters to several meters, depending on room size, actual amp level, etc.

#### 26 **Connections**

Figure 2



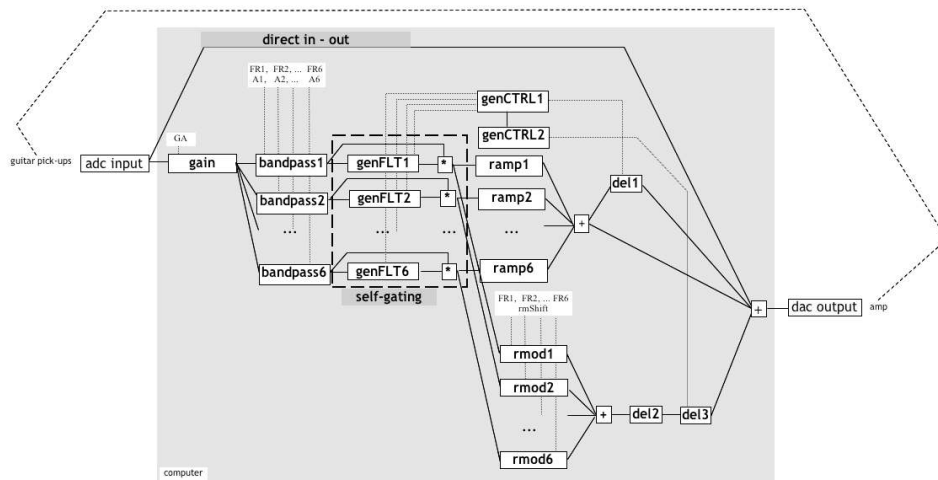
## 2. Digital signal processing

27 The following graphics illustrates the digital signal processing network. As many DSP networks are needed as guitars are used. Also, in the following, the input from one 6-string guitar is assumed (for a 4- or 5-string bass guitar, changes should be made where appropriate).

28 Audio signals are represented as continuing line connections, and are assumed to be bipolar signals, varying in the range  $[-1,1]$ . Control signals are represented as dotted line connections, and are assumed to vary in the range  $[0,1]$ .

29 A verbal description is also provided (next page), explaining the meaning of each module included in the graphics<sup>4</sup>.

Figure 3



(CLIQUER SUR « ORIGINAL » CI-DESSUS POUR VISUALISER LA figure)

### 30 direct input - output

31 the **adc input** is routed directly to the signal mixer that collects all signals and delivers them to the **dac output**. The **adc input** is also routed to the next module, **gain**.

### 32 gain

33 the gain factor **GA** must be fixed at the time and in the place of presentation (it will vary depending on numerous details, including pick-up sensitivity, amp level, distance between guitar and amp, physical features of the surrounding space, etc.). In any case, the gain factor must be large enough to let the feedback loop start resonating (Larsen effect).

### 34 bandpass (1-6)

35 a bank of 6 band-pass filters (each band-pass may be thought of as several cascaded 4<sup>th</sup>-order low- and high-passes). The mid frequency values are determined by variables **FR1, FR2... FR6**, corresponding to the fundamental frequency of the strings, depending on specific tuning<sup>5</sup>. Alternatively, these frequency values can be set to equal the first overtone (octave) of each string. Variables **A1, A2... A6** are switches: they are all “on” when a 6-string guitar is used; **A5** and **A6** are turned “off”, when a 4-string bass is used; only **A6** is turned “off”, when a 5-string bass is used.

### 36 genFLT (1-6)

37 amplitude follower (RMS of the signal amplitude, over time frames of 256 samples). The resulting low-frequency signal enters a delay unit with delay time = 15 msec, and feedback factor = 0.95 or greater, but smaller than 1. The delay output is then inverted (1-complement) and raised to the power of 4 (or any power greater than 2). The 6 low-freq signals thus created (**FLT1, FLT2... FLT6**) follow the amplitude of the corresponding strings (or their first overtone), but in an inverse proportion, and with some latency.

### 38 \* (multiplication)

39 the output from the band-passes is dynamically scaled by the control signals **FLT1, FLT2... FLT6**.

40 as evidenced in the graphics, the two preceding modules implement a kind of **self-gating** mechanism for each string: when a Larsen tone grows in amplitude, the feedback gain for the corresponding string (frequency) is lowered. That way, the Larsen effect is sustained but is not let to increase to a point of saturation.

41 **ramp** (1-6)

42 the 6 signals are dynamically scaled by 6 different low-freq triangle waveform signals (LFO envelopes). The triangle waveform cycle is thus determined:

- (1) = 10 sec ;
- (2) = 19 sec ;
- (3) = 28 sec ;
- (4) = 37 sec ;
- (5) = 46 sec ;
- (6) = 55 sec.

43 The resulting signals are routed to the final mixer and to the **dac output**.

44 **genCTRL** (1-2)

45 two low-freq signals (control signals) are generated:

46  $\text{CTRL1} = (\text{FLT1} + \text{FLT2} + \dots + \text{FLT6})/6$

47  $\text{CTRL2} = (1 - \text{CTRL1})^{0.5}$

48 **del1**

49 delay unit with delay time varying between 0 and 50 msec. The delay time is driven by the control signal **CTRL1**. The delay output is phase-inverted, and then routed to the final mixer and to the **dac output**.

50 **rmod** (1-6)

51 each of the 6 audio signals from the **self-gating** mechanism is multiplied by a different sine tone (ring modulation) of unit amplitude, whose frequency is dynamically determined in this way:

52 (1)  $\text{FR1} + (((\text{FLT1} * 2) - 1) * \text{rmShift})$

53 (2)  $\text{FR2} + (((\text{FLT2} * 2) - 1) * \text{rmShift} * \text{FR2} / \text{FR1})$

54 (3)  $\text{FR3} + (((\text{FLT3} * 2) - 1) * \text{rmShift} * \text{FR3} / \text{FR1})$

55 (4)  $\text{FR4} + (((\text{FLT4} * 2) - 1) * \text{rmShift} * \text{FR4} / \text{FR1})$

56 (5)  $\text{FR5} + (((\text{FLT5} * 2) - 1) * \text{rmShift} * \text{FR5} / \text{FR1})$

57 (6)  $\text{FR6} + (((\text{FLT6} * 2) - 1) * \text{rmShift} * \text{FR6} / \text{FR1})$

58 where **rmShift** is the ring modulation frequency for the lowest string frequency. Notice that, because **FLT2** is a control signal, the 6 ring modulators are in actuality continually gliding, following the Larsen amplitude of the corresponding string.

59 **del2**

60 delay unit, with delay time = 10 sec.

61 **del3**

62 delay unit with delay time varying between 0 and 75 msec. The delay time is driven by the control signal **CTRL2**. The delay output is phase-inverted, and then routed to the final mixer and to the **dac output**.

### 3. Extensions

#### 63 Two options to extend the installation set-up

- 64 1) If guitars and amps and properly positioned, the separate feedback loops may interfere among each other and create mutual sonic interactions.
- 65 2) Using very thin metal threads, or other very very light objects attracted against the strings in the pick-up magnetic field, may alter the system resonances, and may also add sonic interesting sonic by-products (intermittent contact with the vibrating strings). However, this option should be considered only in order to effectively enrich the overall system dynamics, and should not become the most prominent element of the installation.

#### 66 Performance

- 67 By disposing of a plan to experiment dynamically with the two options above, one can prepare a performance version of the work. In which case, one can also experiment with smooth changes of tuning and/or length of the strings, as well as with changes in signal processing variables (**rmShift, FR1... FR6**).
- 68 In NO WAY must the guitars be strung and the strings be plucked.
- 69 One or more performers can be involved, but the number should not exceed the number of guitars.

### NOTES

1. Traduction de l'anglais au français : Anne Sèdes.
2. Agostino Di Scipio est compositeur.
3. when using an alternative tuning, some variables in the digital signal processing must also be adjusted (see below).
4. technical details not explicitly illustrated here are left to experimentation, in a way possibly consistent with the overall technical design and the artistic concept.
5. With conventional tuning, the fundamental frequencies of the 6-string guitar are roughly the following: (E = 82.5 Hz) (A = 110) (D = 146.95) (G = 193.32) (B = 247) (E = 330). For the 4-string bass guitar: (E = 41.25) (A = 55) (D = 73.5) (G = 96.66). The low B of the 5-string bass is 30.8 Hz.

### AUTHOR

#### AGOSTINO DI SCIPIO

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