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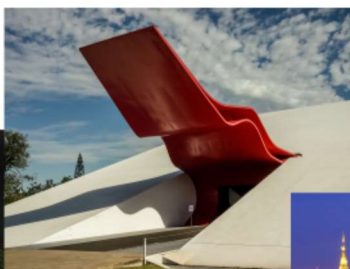
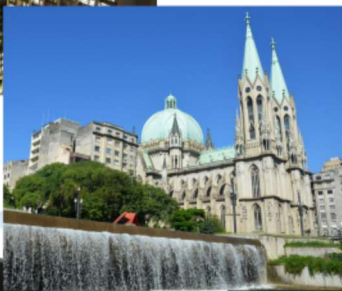
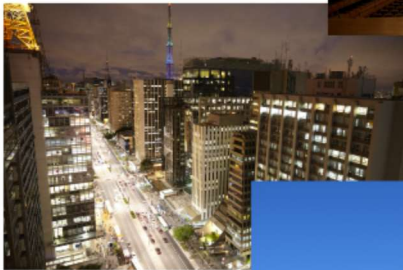
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# The Maxwell Demon: Comprovisation in Ecologically Grounded Creative Practice

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## Abstract

This paper aims to expand the research on ecological synthesis (Keller, 1999) through the inclusion of improvisation practice. We propose a formalization of creative processes in sonic improvisatory-compositional environments (targeting comprovisation), based on ecologically grounded creative practices. Our approach entails the use of socio-ecological models that deal with complex adaptive systems [Sibertin et al., 2011]. We developed a performance/experiment called The Maxwell Demon, as a case study. The observations done during the case study indicate that imitation is an important strategy for creative activities in socio-ecological systems. Improvisation may provide a relevant source of sonic content in ecological environments, enhancing their flexibility without losing consistency.

## 1. Introduction

This work deals with ecologically grounded creative practice targeting both composition and sonic improvisation (comprovisation). We take as reference complex adaptive systems due to the large number of variables embedded in this type of approach. The assessment of responses of complex adaptive systems to dynamically changing scenarios are usually approached from a modeling perspective [Barreiro and Keller, 2010]. Models can be employed to observe socio-ecological dynamics, such as the one proposed by Sibertin-Blanc et al (2011) to determine the qualitative processes in complex

adaptive systems. We discuss the alignments and deviations of this proposal with current eco-compositional and comprovisational practices. To account for the improvisatory elements involved in ecologically grounded creative practice, we expand the eco-compositional approach laid out by Keller (1999) with a Proposal of Modeling of Ecological Synthesis (PMES). Socio-ecological models were developed to design performances/experiments, conducted as case studies. Analytical notes include creative processes, interaction strategies, types of agents, and the production of relevant or disposable resources. We employed, tested and observed the outcomes of the model in a performance/experiment that uses ecologically grounded comprovisation, The Maxwell Demon (TMD). We use a model of adaptive complex systems to formalize the implementation of a proposal for ecological modeling (PESM) using improvisational resources.

## 2. Socio-Ecological Systems

Socio-ecological systems are complex adaptive systems that are characterized by self-organization and distributed control. In socio-ecological systems, social and ecological processes interact at various temporal levels. These reorganizations entail emerging structures and functions. Therefore, models usually encompass multiple agents with diverse and contrasting objectives, being observed at various spatial and temporal levels (Reed, 2008; Pahl-Wostl, 2007; Giampietro 2002). According to Sibertin-Blanc et al. (2011), a socio-

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## 5. Case Study: The Maxwell Demon: Materials and Methods

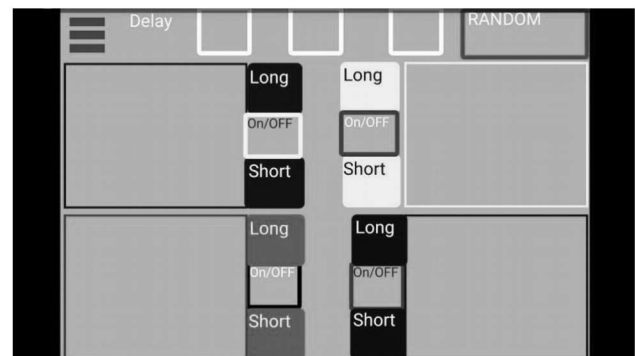
### 5.1 Proposal

The Maxwell's Demon (TMD) is a improvisation inspired by James Clerk Maxwell's 1871 experiment. In this experiment, the Maxwell Demon is an imaginary creature designed to contradict the second law of thermodynamics, the tendency of every system towards entropy. Maxwell's experiment can be represented as a box with a divider placed in the middle, separating it two compartments, left and right. This partition has a door that can be opened and closed by an imaginary being, called Maxwell's Demon. The demon opens the door to allow only the fastest molecules to flow to one side of the chamber. Only the slower molecules flow to the other side, gradually causing one side to warm up, while the other remains cool. Thus entropy is reduced. We use TMD as an artistic metaphor focused on sound (rather than thermodynamics) to simulate an imaginary being - in our case, a stochastic algorithm - that seeks to control the sonic outcome to increase or reduce its entropy. Conceptually, we treat stochastic algorithms as *Gelassenheit* entities [Heidegger, 1966; Koutsomichalis, 2011]. A *Gelassenheit* entity has an "independence" in time and space, its dynamics are established by stochastic processes.

### 5.2 Design/Implementation - Guidelines Plan and Contingency Plan

*Materials/Equipments:* We designed of a tool capable of producing sounds: 1) easy to manipulate; 2) accessible to all agents (through deployment on mobile platforms based on Android and IOS systems). All participants (musicians/non-musicians) were given a mobile phone with a *Pure Data* (PD) [Puckette, 1997] patch adapted for *MobMuPlat* [Iglesia, 2016]. The mobile screen features four rectangles that act as controllers of additive synthesis oscillators. Simultaneous control of up to four banks of oscillators is possible. Four FM synthesis oscillators feature control parameters

for frequency, duration and delay. Random processes are controlled by tapping the phone's screen and can be turned on and off at any time. The frequencies vary from 220 Hertz to 1320 Hertz. Frequency increments are associated with gestures from left to right. Beside each rectangle there are three oscillators switches (on/off buttons) and two envelope controllers. One with a condition of attack, decay, sustain and release short and another with envelopes in longer conditions. The left button at the top of the screen controls a stochastic algorithm connected to all the oscillators frequencies. This triggers random changes in each oscillator. The remaining three buttons control delay processing of the sound material. From left to right, there are fixed delay rates of 150 ms., 300 ms. and 750 ms.



**Figure 3. Interface of the The Maxwell Demon mobile patch.**

The computer running the automated algorithm is connected to four loudspeakers. The loudspeakers were placed at the four corners of the studio where the performance/experiment<sup>3</sup> took place. The agents moved around the perimeter of the environment. We developed a patch (PD) that runs on a desktop computer with similar sonic features as the algorithms for the mobiles. Rather than being controlled by the participants, stochastic automated processes determine when and how sound events will occur. With the touch of the green start button, the entire performance/sound experiment occurs in an automated way. At the ringing of the bell begins the artistic narrative finalizes.

*Sonic materials* - We use an emulated bell (based on FM) that plays at the beginning of the

3 - Experiments developed to assess artistic results qualitatively or quantitatively.

performance/experiment and ends it when it is heard again. This sound is triggered by a PD patch. The entire performance takes seven minutes. All sound content that occurs between the ringing of the bells are contingencies resulting from interactions and sound discovery.

*Location and participants* - The experiment was performed in a small-sized studio, approximately 10x07 meters. Having Maxwell's procedures as inspiration, we use two types of agents, those with traditional knowledge of music and those with little or no knowledge. Participants included five musicians and two non-musicians. All participants had college education. Non-musicians possessed familiarity with basic musical concepts but had no formal training. Among the non-musicians, there were three women - ages 25, 32 and 35. The musicians were four men, ages 26 to 58 and one woman (22 years old). Music training and previous musical experience varied from 10 to 30 years.

*Assessment* - Data was collected through interviews with the participants, on site observations and analysis of audio and video recordings. The objective was to assess the interactions among the agents and how the resources are used, and to expose the behavioral effects of the socio-ecological system, including: 1) initial state of the entities; 2) internal process dynamics; 3) impact of external processes on entities. The integrated assessment of the scenarios is performed by analyzing the values of the indicators derived from the performance/experience process and from the final state of the entities.

*Procedures* - Procedurally, TMD is a improvisation [Aliel et al, 2016]. Hence, we create a guideline plan and contingency plan to outline which events will be designed and tested (composed resources) and leave other aspects to occur in an unpredictable manner (improvised resources). The experiment adopts a socio-ecological approach where agents and algorithms relate sonically. The performance/experience is guided by the definition of scenarios [Sibertin-Blanc et al. 2011]. A performance/experiment is defined as a scenario featuring a free improvisation with

cell phones lasting approximately seven minutes. The only guidelines given to the agents are: "move through space and use mobiles to produce sounds". After ringing the first bell, the computer starts the pre-set parameters and selects the number of oscillators, pitches, dynamics, durations and delay processing.

## 6. Results of The Maxwell Demon Case Study

*Contingencies* - We consider interactions and behaviors leading to sound discovery as sources of contingencies. Much of the material produced in the TMD sessions was rarely repeated, providing conditions of low sonic pregnancy. The sounds produced by the algorithm were dynamically related to the actions of the agents. Nevertheless, a *Gelassenheit* entity produces sound content that may or may not be imitated by or contrasted with the outcomes produced directly by the agents. In this sense, this guideline seems to be analogous to Maxwell's imaginary entity.

*Behaviors* - The agents explored various material resources contained in the environment, generating new forms of interaction. Their mobility - in addition to the low dynamic range of the sounds produced by the mobile devices - provided a sonically dynamic and highly concentrated environment in which the focus of attention changed constantly.

*Musical Expertise* - Although there were disparities of musical knowledge among the agents, all showed similar technical ability while trying to produce sounds. We observed similarities in the three performances/experiments, involving intense agent interactions. The exchanges encompassed: algorithms x agents, agents x agents and agents x environmental resources.

*Imitation* - We observed that a large part of the interaction process was driven by imitation (a strategy pointed out by Mannis, 2014). Choices of processing types and dynamic changes of parameters were predominant. In general, there was a prevalence of imitation of processes suggested by musicians, but contents managed



by non-musicians were also present.

### 6.1 Implications of the Artistic Outcomes

*Socio-ecological systems* - By introducing ecologically grounded sound synthesis strategies in improvised contexts, we target unique conditions for each performance. The performance/experiment TMD thus integrates the electronic sound structures into socially dynamic forms of interaction, approaching the complexity of biophonic ecologies. When introducing an ecological synthesis model within a socio-ecological system, the sonic outcomes may follow deterministic rules (composition) or adopt strategies based on contingencies (improvisation). By adding resources such as sound synthesis and audio processing based upon the actions of agents within a sound ecology, we introduce material and cognitive resources that are characteristic of socio-ecological systems. Aligned with the improvisation methodologies, the PESM features material resources that can be used as guidelines or contingency plans.

*Exploratory behavior.* The materials collected in previous case studies [Aliel et al, 2015a and 2015b] indicate that the generation, maintenance and disappearance of sound material in improvisatory ecological contexts is linked to imitative cognitive exchanges [Mannis, 2014], exploratory or epistemic activities [Keller et al., 2010] targeting an increased knowledge of material resources by the agents. These exchanges may be limited by the adaptability of the behaviors indicated by Sibertin-Blanc et al. (2011) (see introduction).

### 7. Final Considerations

Taking into account the socio-ecological system prerequisites, we elaborated a Proposal for Ecological Synthesis Model (PESM) based on Keller's (1999) notes. While expanding the range of ecompositional applications, we highlighted the possibility of including improvisation in sonic ecologies. The PESM was applied in a case study called The Maxwell Demon. Three sessions were carried out with the objective of collecting information on the agents behaviors, the sonic resources and the

technological support. These observations yielded proposals applicable to ecologically grounded artistic works that target both musicians and non-musicians. Future studies may evaluate the actions of the agents while attempting to deal with unpredictable conditions, such as those found in alternative and outdoor venues.

### References

- [1] Aliel, L., and Fornari, J. Projeto Destino Pirlampo: Um Estudo sobre a Composição de Meta- Soundscapes em Música Ubíqua. *Música Hodie*, v.14, p. 105- 121. 2014.
- [2] Aliel, L. and Costa, R. . 'Sons sem Sino' - Abordagens Comprovisatórias em Instalações Sonoras. In: *IV Jornada Discente - ECA, 2016*, São Paulo. IV Jornada Discente - ECA, 2016.
- [3] Aliel, L.; Keller, D. ; Costa, R. ; Melo, M. T. S.; and Pinheiro da Silva, F.; Santos, L. A.. Eco-cognitive Improvisational practice: Two case studies. In: *VI Ubimus, 2015, Vaxjo*. Ubiquitous Musical Ecologie, 2015a.
- [4] Aliel, L.; Keller, D. and Costa, R.. Comprovisação Abordagens Desde a Heurística Estética em Ecomposição. In: *SBCM - XV Simpósio Brasileiro de Computação Musical, 2015*, Campinas/SP. SBCM - XV Simpósio Brasileiro de Computação Musical, 2015b.
- [5] Aliel, L.; Keller, D.; and Costa, R.; Perspectivas Teóricas para a Análise das Práticas Criativas Ecocognitivas. *Per Musi* (UFMG), 2016.
- [6] Barreiro, D. L. and Keller, D. Composing with sonic models: fundamentals and electroacoustic applications. In D. Keller & R. Budasz (eds.), *Criação musical e tecnologias: teoria e prática interdisciplinar, Vol. Criação Musical e Tecnologias: Teoria e Prática Interdisciplinar* (pp. 97-126). 2010.
- [7] Cardew, C. A Scratch Orchestra: Draft Constitution. *The Musical Times* 110 (1516), 617-619. 125th Anniversary Issue. 1969.
- [8] Chen, P. and Pin-Shanhan, P., The Entity-Relationship Model - Toward a Unified View of Data. *ACM Transactions on Database Systems*



1 (1): 9–36. 1976

[9] Curran, A. and Teitelbaum, R. *Musica Elettronica Viva. For MEV, program notes.* New York: The Knitting Factory. <http://www.alvincurran.com/writings/mev.html>. 1989.

[10] Di Scipio, A. The place and meaning of computing in a sound relationship of man, machines, and environment. In A. Georgaki & G. Kouroupetroglou (eds.), *Proceedings of the ICMC|SMC|2014*. Athens, Greece: ICMA. 2014.

[11] Ferraz, S. and Keller, D. Preliminary proposal of the MDF model of collective creation. *Cadernos de Informática* 8 (2), 57-67. 2014.

[12] Iglesia, D. The Mobility is the Message: the Development and Uses of Mob Mu plat. In: *PdCon16*. NYC. 2016. <http://www.danieliglesia.com/mobmuplat/IglesiaMobMuPlatPaper.pdf>

[13] Giampietro, M, Complexity and Scales: The Challenge for Integrated Assessment. *Integrated Assessment*, 3 (2–3), 247–265. 2002.

[14] Keller, D. touch'n'go: Ecological Models in Composition. Master of Fine Arts Thesis, Burnaby, BC: *Simon Fraser University*. <http://www.sfu.ca/sonicstudio/srs/EcoModelsComposition/Title.html>. 1999.

[15] Keller, D. Sonic Ecologies. In A. R. Brown (ed.), *Sound Musicianship: Understanding the Crafts of Music* (pp. 213-227). Newcastle upon Tyne, UK: Cambridge Scholars Publishing. (ISBN: 978-1-4438-3912-9.) 2012.

[16] Keller, D., Barreiro, D. L., Queiroz, M. and Pimenta, M. S. Anchoring in ubiquitous musical activities. In: *Proceedings of the International Computer Music Conference* (pp. 319-326). Ann Arbor, MI: MPublishing, University of Michigan Library. 2010.

[17] Keller, D., Lazzarini, V. and Pimenta, M. S.

Ubimus through the lens of creativity theories. In D. Keller, V. Lazzarini & M. S. Pimenta (ed.), *Ubiquitous Music* (pp. 3-23). Berlin and Heidelberg: Springer International Publishing. (ISBN: 978-3-319-11151-3.) 2014.

[18] Heidegger, M. *Gelassenheit*: HarperCollins. 1966.

[19] Koutsomichalis, M Site Specific Live Electronic Music: A Sound Artist's Perspective. *Proceedings of the Electroacoustic Music Studies Conference, Sforzando!*, New York. <[http://www.emsnetwork.org/IMG/pdf\\_EMS11\\_Koutsomichalis.pdf](http://www.emsnetwork.org/IMG/pdf_EMS11_Koutsomichalis.pdf)>. 2011.

[20] Latour, B. Reassembling the social: An introduction to Actor-Network Theory. Oxford, UK: *Oxford University Press*. 2005.

[21] Mannis, J. A. Processos Cognitivos de Percepção, Análise e Síntese Atuando no Processo Criativo Mimesis de Mimesis. In: *Encontro Nacional de Composição Musical de Londrina - EnCom* 2014. 2014

[22] Pahl-Wostl, C., Transitions towards adaptive management of water facing climate and global change. *Water Resources Management*, 21: 49-62. 2007.

[23] Reed, M. S., Stakeholder participation for environmental management: A literature review. *Biological Conservation*, 141: 2417-2431. 2008.

[24] Rhodes, M. An analysis of creativity. *The Phi Delta Kappan* 42, 305-311. 1961.

[25] Rotmans, J. and Asselt, M., Integrated assessment: A growing child on its way to maturity. *Climatic Change* 34 (3) 327. 1996.

[26] Sibertin-Blanc, C., Thérond, O. and Monteil, C., Mazzega, P.: Formal modeling of social- ecological systems. In: *European Social Simulation Association Conference, Cemagref* 2011.