Bi-musicality at the age of artificial intelligence

Marc Chemillier (EHESS, Center for Social Analysis and Mathematics)
CIRMMT, October 16, 2023

Djazz improvisation software

Evaluation of the output of the program

Djazz playing trance music from Madagascar

Djazz improvisation software

Let us begin with a video of renowned Malagasy citharist Justin Vali (who played with Peter Gabriel and Kate Bush) making a duo with Djazz improvisation software.

http://digitaljazz.fr/2023/06/19/videos-djazz-avec-justin-vali/#masoala

*We are developing a family of improvisation software based on **machine learning**. They capture what a musician is playing and recombine the recorded sequences.*

*Djazz is one of them, based on a **regular pulse***
*• either a **manual beat** (slow motion at the end)*
*• or a **click** from Ableton Live's groove*
*Beats are grouped on the Launchpad interface to **align Djazz** with live musicians:*
• bars (square buttons)
• chapters (verse/chorus) on the right

The software can make **hybrids** by mixing in its improvisation various databases captured with several different musicians. In the previous video, the solo at 2:50 comes from a transcription of Joe Zawinul's concert at Munich Piano Summer in 1985 (at 13:03, Partie I) :

https://www.youtube.com/watch?v=6WQfeplhzT4&t=783s

Our challenge is to get a result that is **acceptable** in a given **cultural context**.

Collaborations
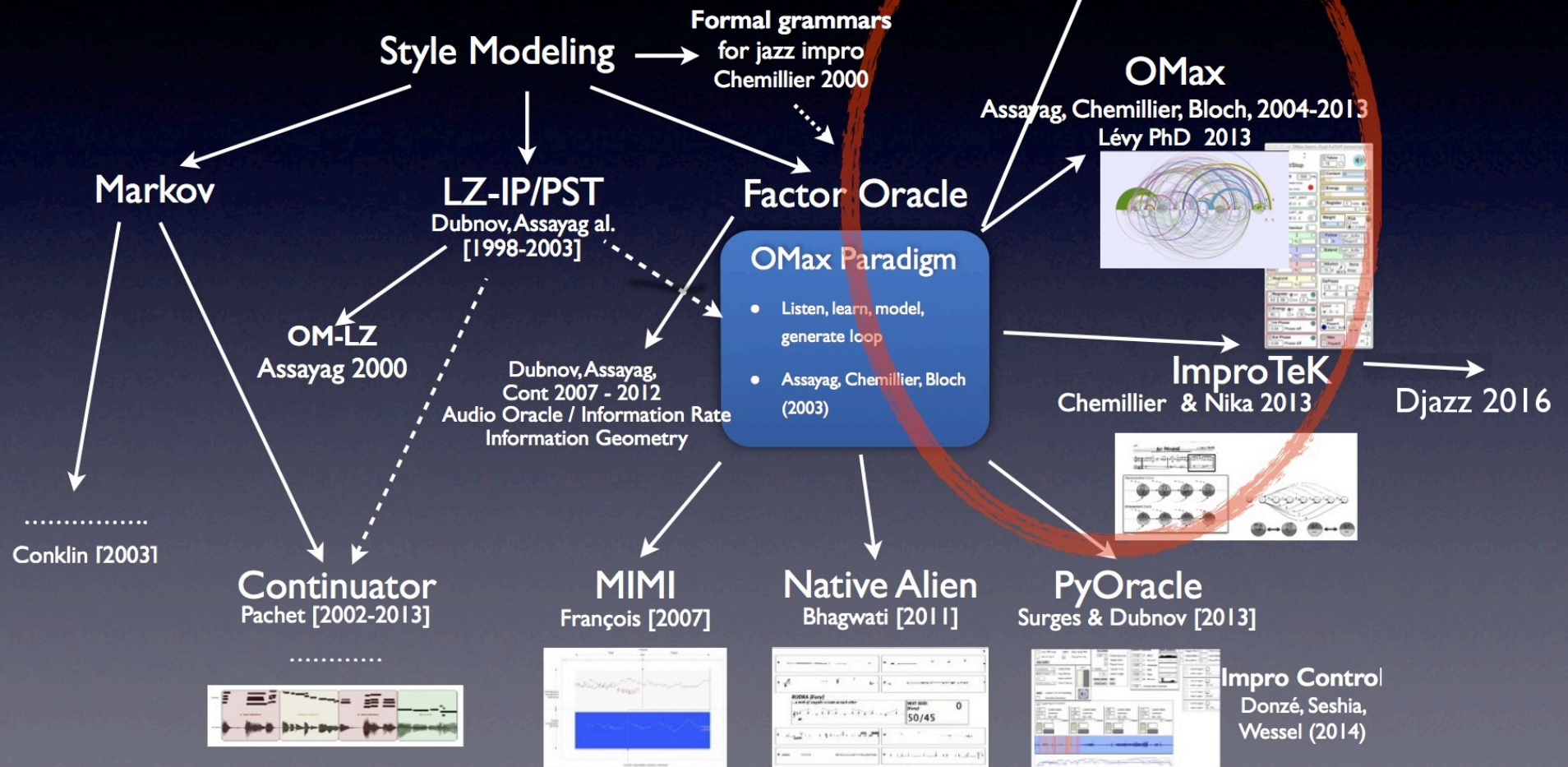- *improvisation project started in 2000 at IRCAM*
- <u>*AI*</u>*: collaboration at IRCAM supervised by Gérard Assayag, at UCSD by Shlomo Dubnov*
- <u>*AMT*</u>*: collaboration at LAM, Sorbonne University supervised by Olivier Adam*

Personal Background
- *musician, degrees in ethnomusicology, computer science, mathematics, philosophy*
- *School for Advanced Studies in Social Sciences in Paris (EHESS)*

*This gives a **social science** orientation to my work on the design of Djazz focusing on **bi-musicality**: can Djazz play in a non-Western context?*

The OMax Paradigm
& family

Style Modeling

Formal grammars for jazz impro Chemillier 2000

SoMax Bonnasse-Gahot, Assayag, Bloch 2013

OMax Assayag, Chemillier, Bloch, 2004-2013 Lévy PhD 2013

Markov

LZ-IP/PST Dubnov, Assayag al. [1998-2003]

Factor Oracle

OMax Paradigm
- Listen, learn, model, generate loop
- Assayag, Chemillier, Bloch (2003)

OM-LZ Assayag 2000

Dubnov, Assayag, Cont 2007 - 2012 Audio Oracle / Information Rate Information Geometry

ImproTeK Chemillier & Nika 2013

Djazz 2016

Conklin [2003]

Continuator Pachet [2002-2013]

MIMI François [2007]

Native Alien Bhagwati [2011]

PyOracle Surges & Dubnov [2013]

Impro Control Donzé, Seshia, Wessel (2014)

*Djazz can capture what a musician is playing **live** (video of Bernard Lubat, great French pianist and drummer who played with Stan Getz). It recombines the recorded sequences on the fly, taking into account **rhythm** and **harmonies**.*

https://www.youtube.com/watch?v=J52SEoHvx1o
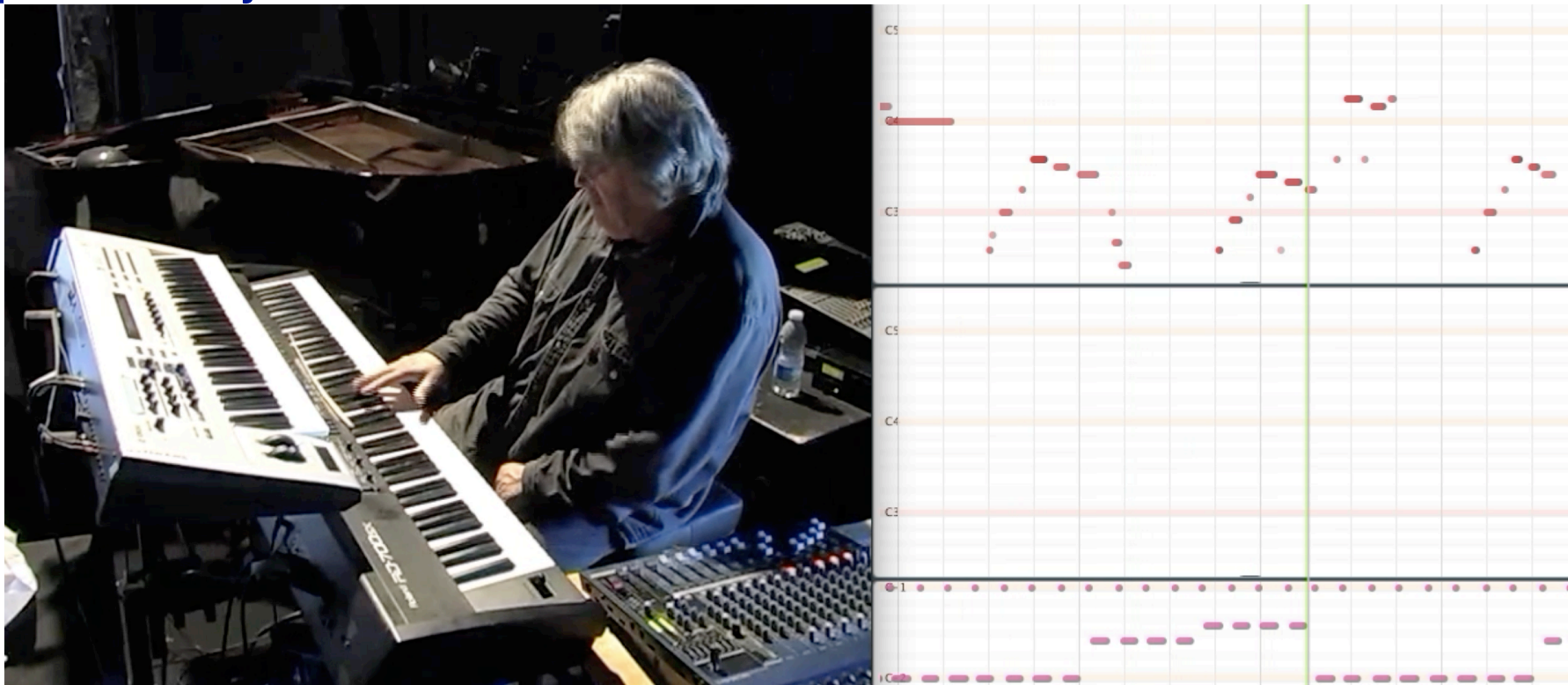
*The Djazz model is **<u>purely combinatorial</u>** (finite automata, pattern-matching algorithms). Its calculation is **<u>traceable</u>** and **<u>reproducible</u>** (no deep learning). It is developed in Max/MSP with the Antescofo object for beat following and an OpenMusic Lisp library for recombination (Jérôme Nika's thesis at IRCAM, 2015). It's now being rewritten in Max and Python by Daniel Brown.*
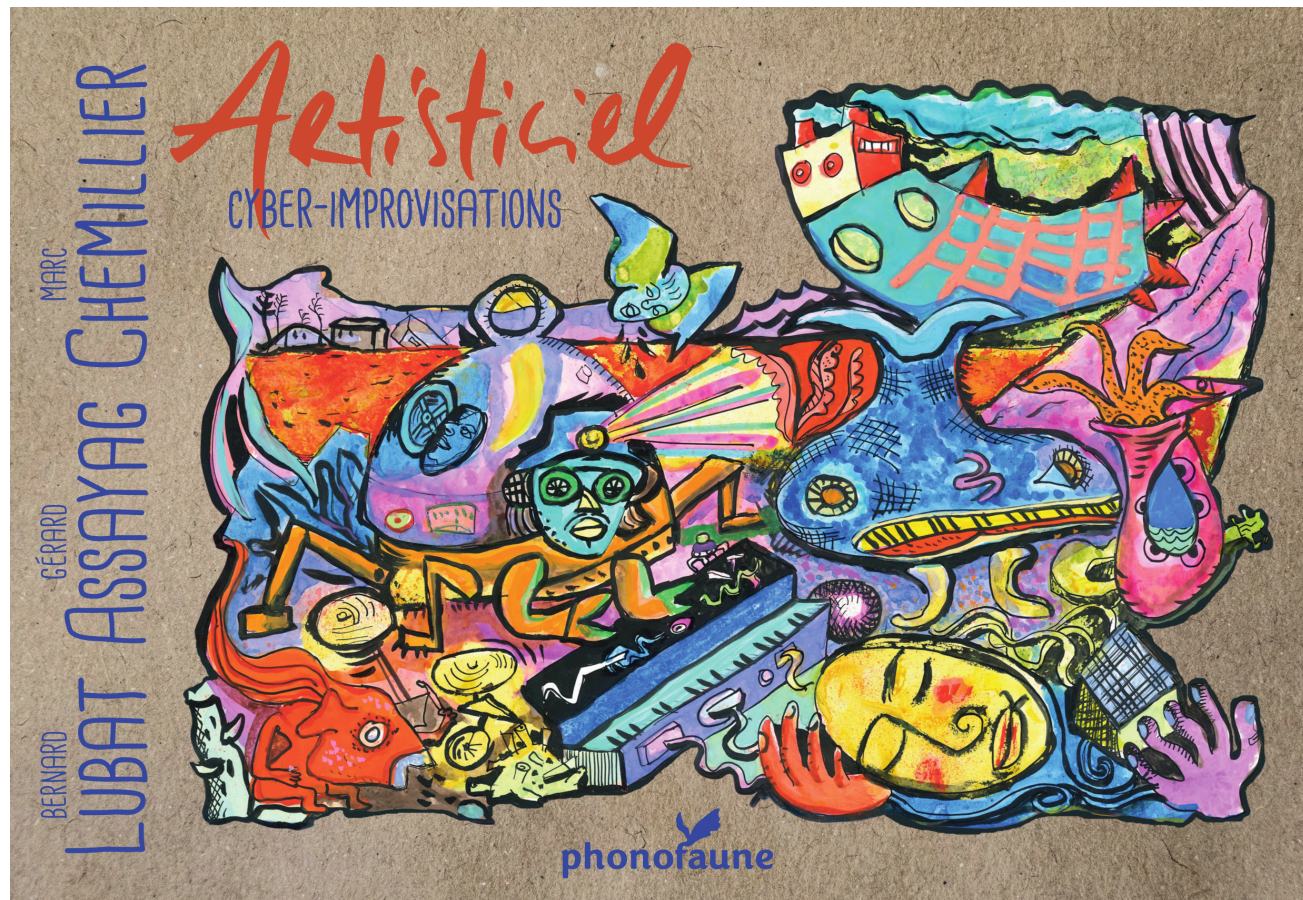
dacadabrabrac

*It has **<u>very little musical knowledge</u>** (just an input sequence marked by beats and labels that may correspond to chords or whatever), so it can adapt to very different contexts.*

*Djazz can also "forget" the beat for **<u>free improvisation</u>** (an arbitrary beat is set, which serves as the **<u>grain</u>** for recombination):*

http://digitaljazz.fr/2021/05/27/artisticiel/

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Evaluation of the output of the program
*To take into account criticisms of what Djazz produces, we carry out **field surveys**.*
Example of acceptability test with an avatar of Toots Thielemans on "Body & Soul" (Bill Evans).
*• **source separation** algorithm for the harmonica solo (Shlomo Dubnov & Ke Chen, UCSD)*
• test carried out at Toots centenary conference at KBR library in Brussels in 2022
*Can Toots' improvisation be distinguished from Djazz's improvisation? Mixed answers... Djazz's **manual effects** helps identification.*
https://www.tiktok.com/@digitaljazz/video/7061712025054940421

There are two layers in Djazz :
* *one **<u>automatic</u>** (recombination process),*
* *one **<u>manual</u>** (Launchpad interface)*

*The latter enables the user to take instant action during improvisation (**<u>reactivity</u>**):*
* *time setting (bar / chapter keys)*
* *recombination control (keys for changing memory zone)*
* *real-time transformations (looping / acceleration / register jump keys).*

*According to co-creativity, Djazz is an "**<u>intelligent instrument</u>**" (not an "autonomous agent"). Manual interactions were **<u>encouraged by Bernard Lubat</u>**.*

https://www.youtube.com/watch?v=WHQaHkd5koM

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<u>Djazz playing trance music from Madagascar</u>
*The Marovany zither from Madagascar is played in possession trance rituals for hours on end. The study of improvisation on this time scale led us to use MIDI **<u>sensors</u>** on the zither.*

Automatic music transcription *(AMT) of the zither into MIDI (supervised by Olivier Adam at LAM):*
- ***piezo pickups*** *placed between strings and bridges (PhD by Dorian Cazau, 2015)*
- *hidden Markov models (former version), neural networks (current work in progress)*
- *semi-automatic with* ***manual correction***
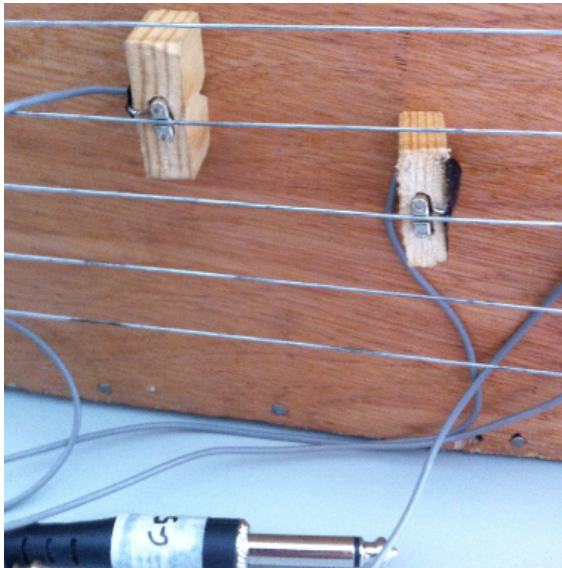
*Djazz was trained with Velonjoro's data. The acceptability criterion concerning Djazz's output was to be able to play in duet with citharist Velonjoro (**bi-musicality**) :*

https://www.youtube.com/watch?v=fJXLcTmDnXs

*From a **decolonial perspective**: is the use of AI excessively Eurocentric?*
AMT into MIDI:
• diatonic scale influenced by 19th-century missionary
• rhythmic precision of a millisecond (MIDI)
*AI algorithm: the recombination process is something that can be **shared** between*
• the traditional musician (searching for spirits)
• the Western ethnographer (testing algorithms)

Velonjoro passed away in January 2017. Several years later, Justin Vali listened to Velonjoro's recordings and was inspired to play with him: http://digitaljazz.fr/2023/06/19/videos-djazz-avec-justin-vali/#sojerina *Justin's comment on the "spirit" of Velonjoro is related to Malagasy conception of death.*

Conclusion and further questions

This raises complex questions about the post-mortem use of digital data. This is a much-discussed topic in research dealing with AI social impacts (**digital life after death**). It's also an important issue related to **artifacts used in live music** and to the idea of "presence" in music (who plays? playback, holograms, virtual stars, voice synthesis imitations of singers).

These important topics are beyond the scope of this talk. I let them as open questions.

Thank you for your attention