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# Machine-man Co-improvisation: Incursion of Djazz in Flamenco

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Flamenco is a traditional Spanish music from Andalusia. Based on oral tradition and transmission, traditional Flamenco, has implicit rules that allow musicians and dancers to interpret complex patterns without previous rehearsal. The experiments described here attempt to discover these rules by setting a musical improvisation program to play in the flamenco style and by analyzing the reactions of expert musicians listening to it. There are numerous styles or "palos" in Flamenco, however some general guidelines can be extracted. Here we focus on two general rules: i) During improvised musical developments where one partner takes the lead, musicians "resolve" together through a "remate" ii) The underlying common pattern is rhythm

We tried to determine the minimal conditions to provide "acceptable Flamenco" through the DJazz environment developed by IRCAM and EHESS. We examined typical "palos": *Tangos* (binary), *Fandangos* (ternary) and *Bulerias* (mixed). The acceptability of the DJazz productions were tested by i) submitting the improvisations to musicians and listen to their advice, ii) co-improvising with musicians. In a first attempt, a "letra" (song) of Fandango was investigated. No grid was imposed. The results were unacceptable, as neither the harmony nor the rhythm and the remate were distinguishable. Then, a harmony pattern (chords) was applied. It was again not satisfactory, as the same chord in different places has not the same role. Thus, harmony and rhythm must be considered. We then focused on the rhythm aspects of *Bulerias*, using "palmas" (hands clapping). The acceptable grid was the one, where the "remate" is clearly identified. Additionally, we could define the statistical fingerprint of the *Bulerias* palo and compared the DJazz production to that of musicians. The conclusion of the study on *Bulerias* was directly applied to a live improvisation with musicians on *Tangos*, without preliminary tests, but we directly imposed a grid where the remate is clearly identified. DJazz production was satisfying for two criteria: the palo was respected and the musicians (guitar, dance) could co-improvise upon the DJazz Proposals.

## What is Flamenco ?

Plenty of definitions, historical, cultural, esthetical, sociological and sacred\* aspects., e.g. « gitano » vs « payo », « duende »\* \*Federico Garcia Lorca, *Jeu et theorie du duende*

Here we focus on the balance between constraints and freedom in traditional flamenco improvisation («tablao » or « fin de fiesta », and the dialog between musicians. Here, the dancer is considered in a first attempt as a percussionist instrument.

Plethora of Flamenco Styles. They are classified in « compas » families

All « palos » have in common the « Remate »



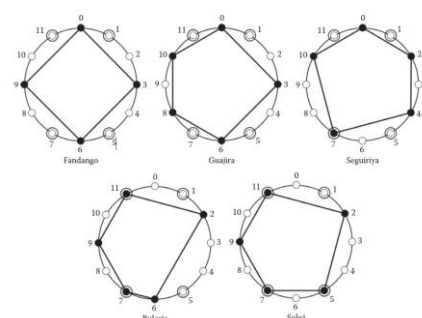
« Compas »

3-3-3-3

2-2-2-2

3-3-2-2-2

2-2-2-3-3



« Remate »

3-3-3-2-l

2-2-2-1-l

3-3-2-2-l-l

2-2-2-3-3

The « Remate » closes a part and indicates a new part to begin : it is a main element of communication in improvisation

## DJAZZ

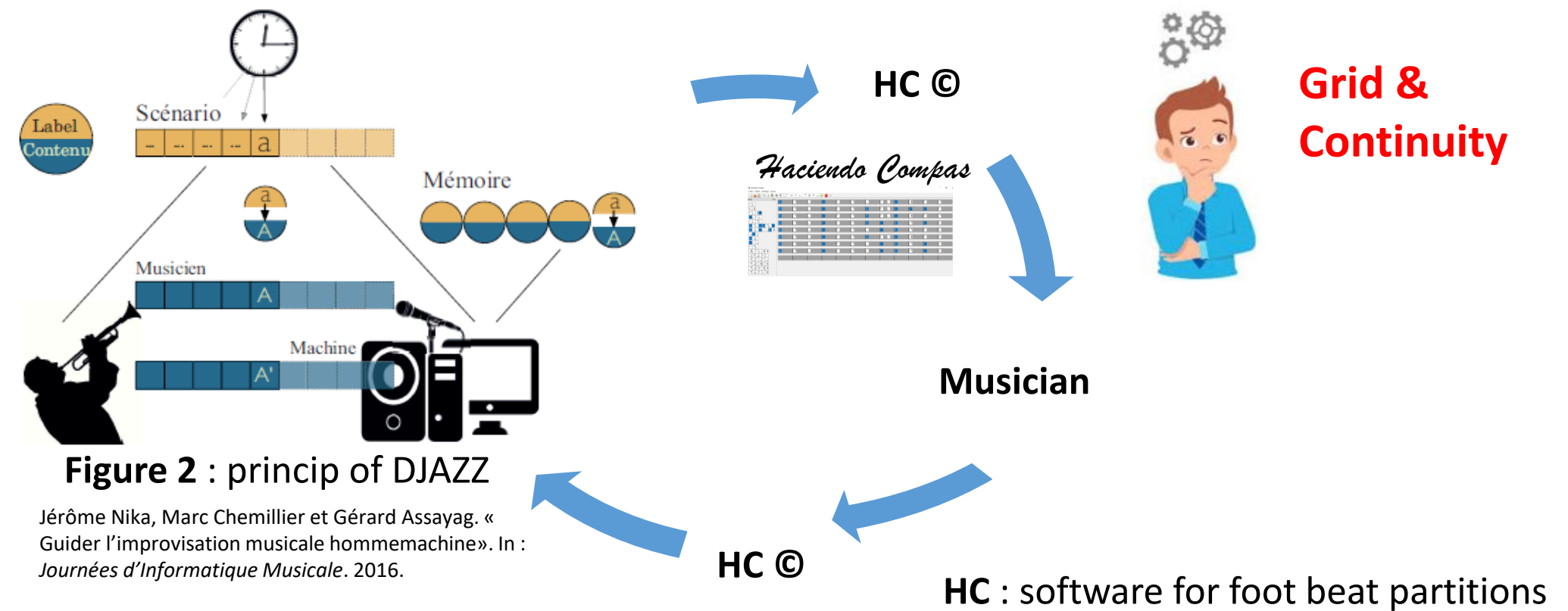


Figure 2 : princip of DJAZZ  
J r me Nika, Marc Chemillier et G rard Assayag. « Guider l'improvisation musicale hommemachine ». In : Journ es d'Informatique Musicale. 2016.

Figure 1 : a) Flamenco « palos »: the different families are classified according to the « compas », a cyclic pattern b) polygon representations of the « compas » of the main families of « palos », from G. Toussaint, the geometry of musical rhythm

## Does DJAZZ play Flamenco ? In silico study

Preliminary tests with Fandango: Free grid : abcabcabcabc grid: but difficulty to handle both rhythm and melody

i) System Simplification: **rhythm only: Palmas**

« Palmas » for bulerias :

Comparison of several grids

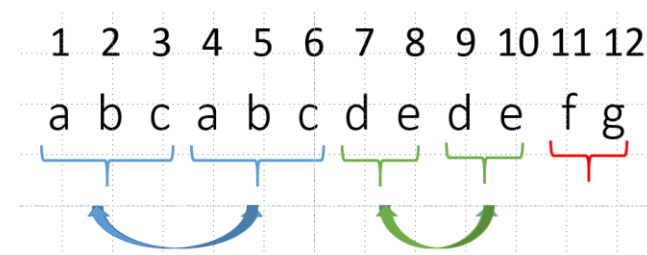
abcabcdedfg:

(the « remate » is a singularity)

HC   allowed us to plot the beats and beat intensity in the musical measure (bar) of one « compas »; We thus have a fingerprint of the strong beats and weak beats, that give the benchmarks of the « palo of bulerias ».

In addition, we remark an accumulation of beats at the end of the « compas »: this is the fingerprint of the « remate ».

The grid that reproduces better the strongest beat, the time « 3 », the time « 10 » is the abcabcdedfg grid. In addition, it allows the occurrence of contratiempos at the end of the « compas ».



[. . x . . x . x . x .] — sole a  
[. . x . . x x . x . x .] — buler a  
[x . x . x . . x . . x .] — seguiriya  
[x . . x . . x . x . x .] — guajira

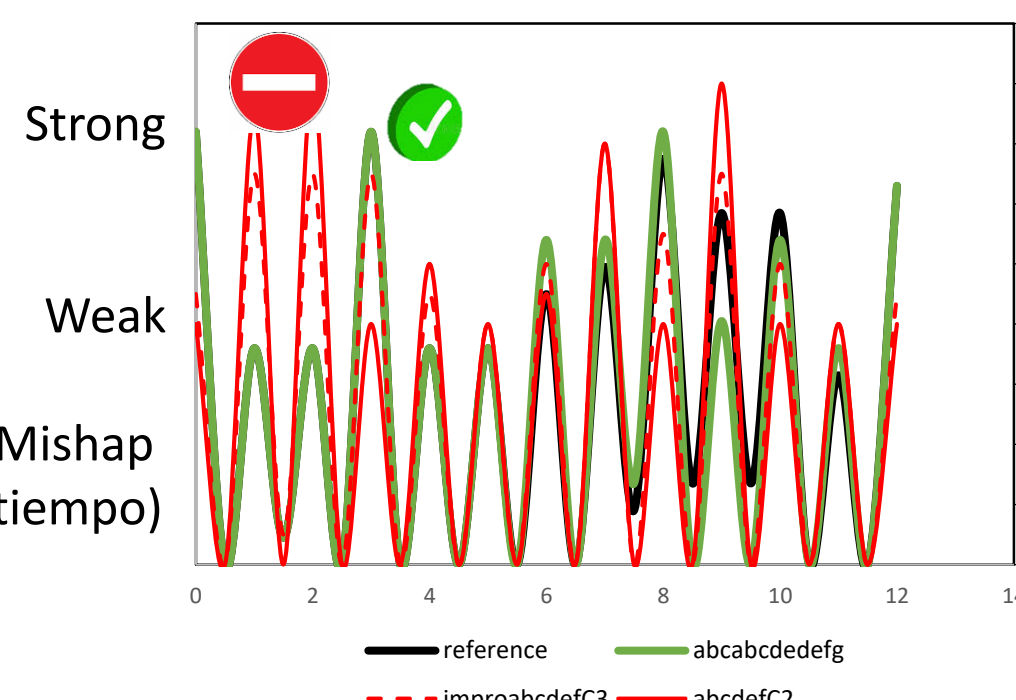


Figure 3: Comparison between the model and the DJAZZ Improvisation : Occurrence and intensity of beats in one 12 times mesure

ii) Application to guitar « falsetas »

choice criteria of idiomacy: do we recognize the « compas » ?

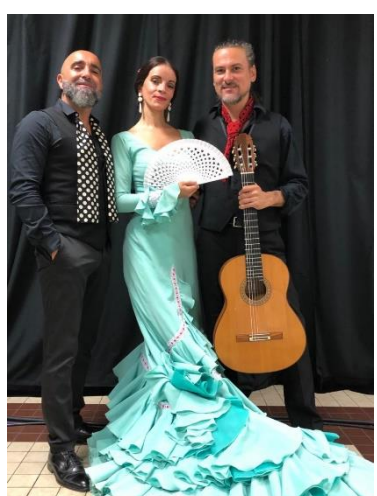
abcabcdedfg + continuity :

occurrence of « medio compas » !

**Versatility of the grid : it could be possible to navigate between « compas » and « medio compas »; this is a very important aspect in flamenco improvisation.**

## In vivo experiment

The conclusions of the *in silico* study are applied to the choice of the grid, which is abcdbace



Cristobal Corbel, guitar,  
Sophia Sena, baile,  
Alberto Garcia, cante

Guitar solo

Foot solo

Cante solo

DJAZZ guitar impro

DJAZZ foot impro

DJAZZ cante impro

DJAZZ guitar + guitar

DJAZZ foot + guitar

DJAZZ cante + guitar

DJAZZ foot + DJAZZ guitar

**Conclusion :** Guitar : respect of rhythm and melody, Feet : respect of rhythm, Both : coherence, Cante : non relevant



## Conclusions and Perspectives :

It was possible to produce improvisations that respect the rhythmic pattern and the strongest beats. In the future, it is possible to improve the respect of melody and anticipate the « remate ».

Body movement recognition could also be explored.

Glossary:  
compas ; medio compas.  
Fin de fiesta: dernier palo interpr t  lors d'un spectacle, il doit normalement  tre festif. C'est la buler a le palo qui est choisi pour faire un fin de fiesta.  
Remate: fonction de fermer une  tape.  
Palmas; Falseta