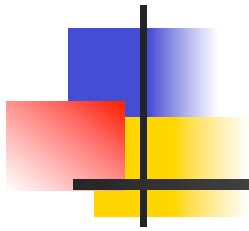
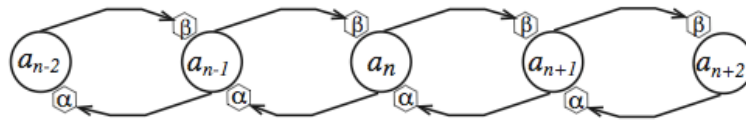


A connectionist-like account of the rhythmic of counting-out rhymes



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www.modyco.fr





Rhythm & phonological structure

- Formalistic approach

- Strong and weak position are always equivalent

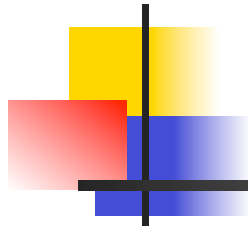
/ (XO)(XO)(XO)(XO) /;

- The rhythm is the by-product of the concatenation of symbols;
- Conflicts are resolved by adding empty positions or extrametrical beats (impossible to falsify);



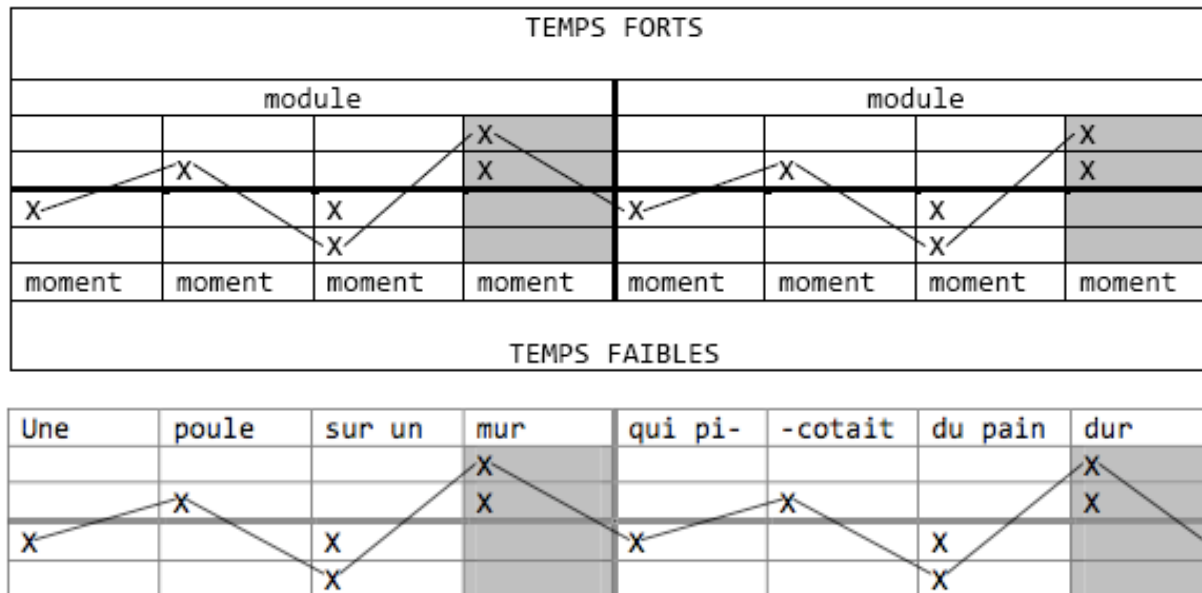
Rhythm & phonological structure

- Musical or dynamical curve approach
 - Inspired from musical theory and autosegmental theory
 - Autonomous isochronical structures organised in rhythmic *modules* and *moments* (2/4, 4/4, 7/4, etc);
 - The syllables are fitted in the different modules
 - Context sensible and deformable model
 - No clashes, no need to assume extrametricality



Modules and Moments

- An example of 4 beats curve equivalent to the 4/4 musical rhythm





Why counting-out rhymes?

- Related to movement - pointing a person;
- Learned by hearth before learning to read;
- They mix lexical and non-lexical material:
 - Am stram gram pic et pic et core gram bour et bour et ratatam am stram gram
 - Eeny, meeny, miney, moe, Catch a tiger by his toe, If he squeals, let him go, Eeny, meeny, miney, moe.
 - Eni beni riki paki turba urba senti brjaki mozhet vydet mozhet net vobshem *polny internet* (full internet = confusing situation);
- Complex rhythmic (to avoid predictability?);



This is the text we analyse

Am stram gram

X X X

pic et pic et cole gram

X X X X

bour et bour et rata tam

X X X X

Am stram gram

X X X



Grid: Three vs Four beats problem

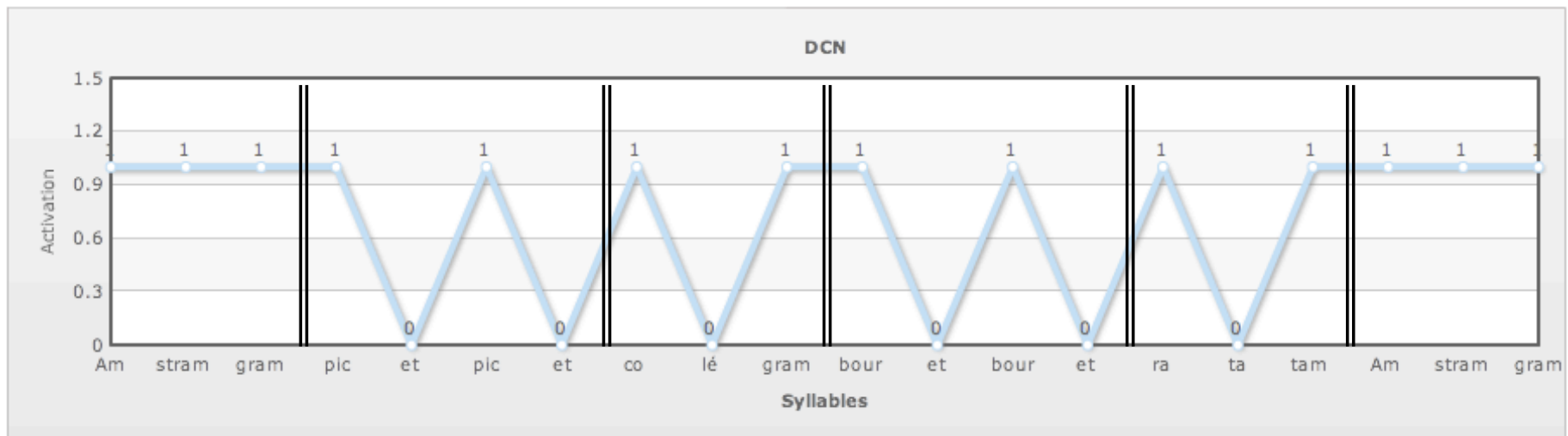
- 3 surfacing beats vs 4 phonological beats
- The empty beat is never attested in this position neither a compensatory lengthening

Am	stram		gram
[X	X	X	∅]
/X	X	X	X/

- rhythmic pattern is not always aligned with the end of the verse

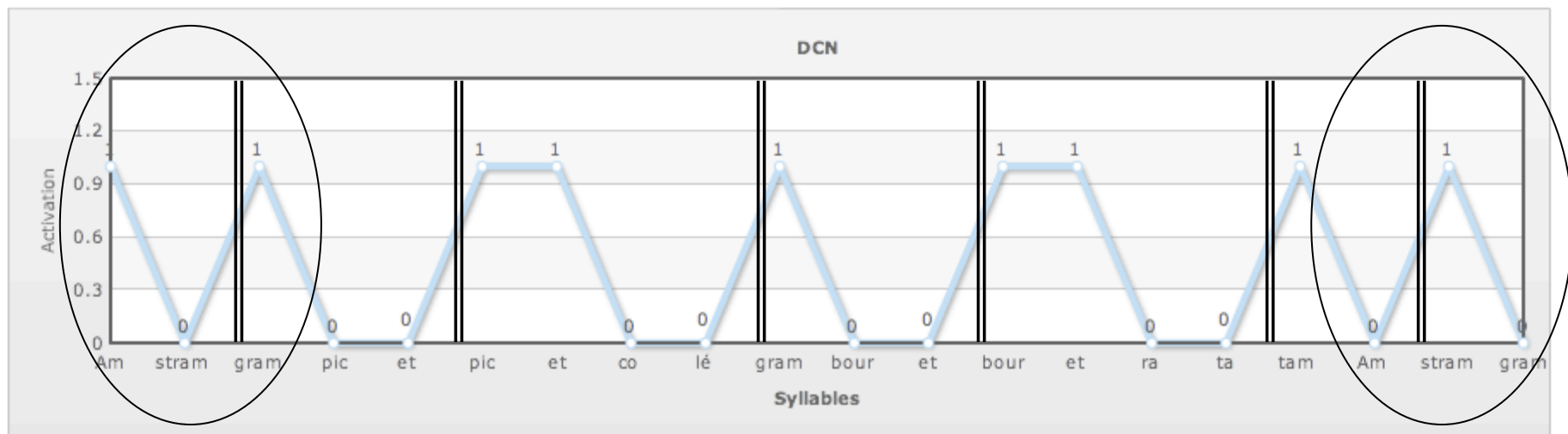
Am stram gram... 7/4 analysis

- One stress = one pointing gesture;
- 6 modules, 3 distinct syllabic patterns:
XXX, **X0X0**, **X0X**, **X0X0**, **X0X**, **XXX**
- *Aksak* = irregular rhythm (5/4, 7/4);



Am stram gram... 2/4 analysis

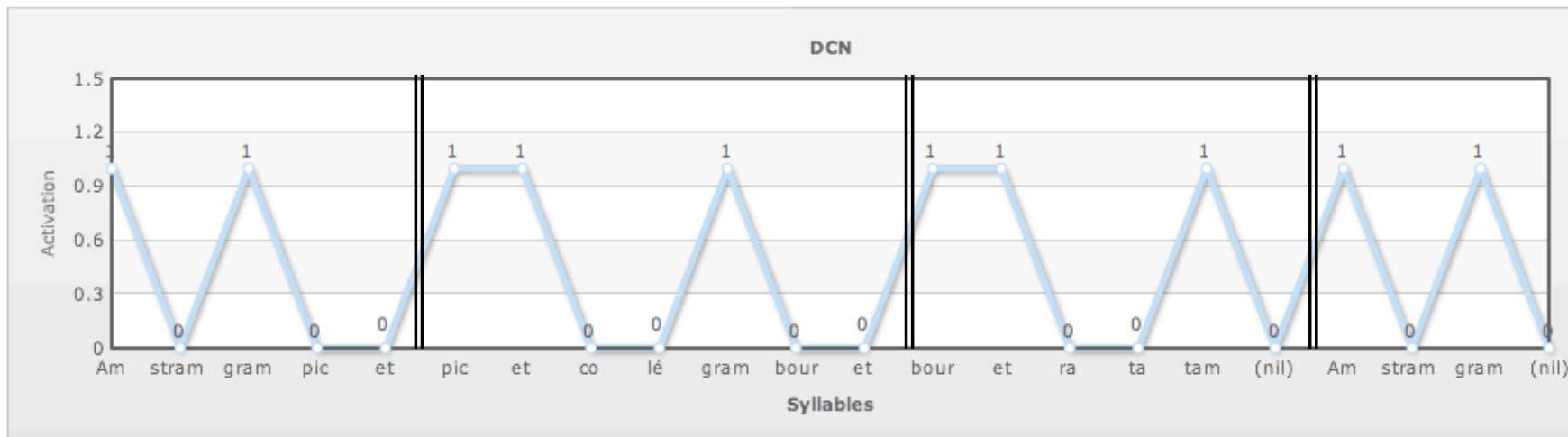
- 7 modules, 3 distinct syll. patterns, trochaic
X0 X00 XX00 X00 XX00 X0 X0
- Technically easier than 4/4, but verse-rhythm alignment is problematic



Am stram gram... 4/4 analysis

- Assumes empty beats (problematic but attested in those positions);
- 4 modules, 4 distinct syllabic patterns, 4 to 7 syllables per module:

X0X00 XX00X00 XX00X0 X0X0



1/26/09

CUNY conference on foot



Complexity and learnability

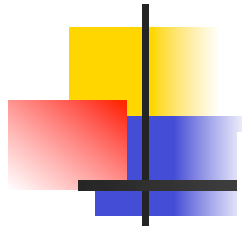
- Complexity :
 - $7/4$ less than $2/4$ less than $4/4$
- Learnability?

$4/4$	$2/4$	$7/4$
1010	10	111
10100	100	101
110010	1100	1010
1100100		

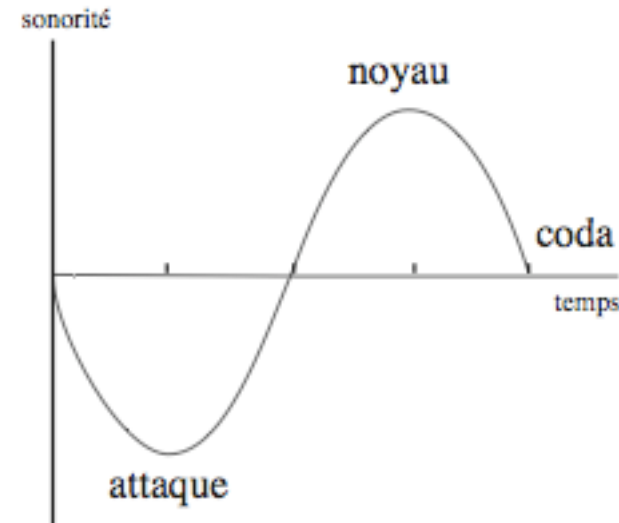
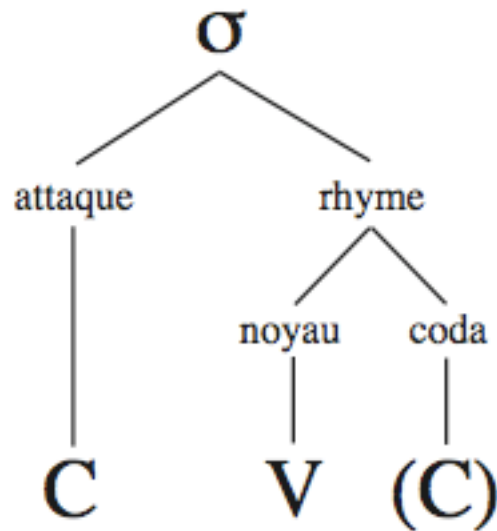


Waves vs Particles metaphor

- According to Pike (1959) there are two approaches in metrical phonology (as the dualistic approach to the matter in physics): waves and particles
- Metric phonology usually overstresses “the particles approach” with constituency and hierarchical structures;
- *Grid* and *Curve* models take *the wave* direction;



Particles vs Wave



Pike-Hockett-Fudge-Selkirk view:
syntactic model of *immediate constituents*. Phonological sequences are hierarchical structures of constituents.

The Panini-Saussure view:
Language is uttered in waves of increasing and decreasing sonority.



Computing the rhythmic curve

- Goldsmith : What kind of structure do phonological representations need?
 - They need to be able to identify *local peaks* and *global peaks* of two quantities: *sonority* and *accent*.
 - We need to build a model in which *that* computation is accomplished, and no other.
- And we need a *learnable* and *reversible* model both for parsing and generating phonological data

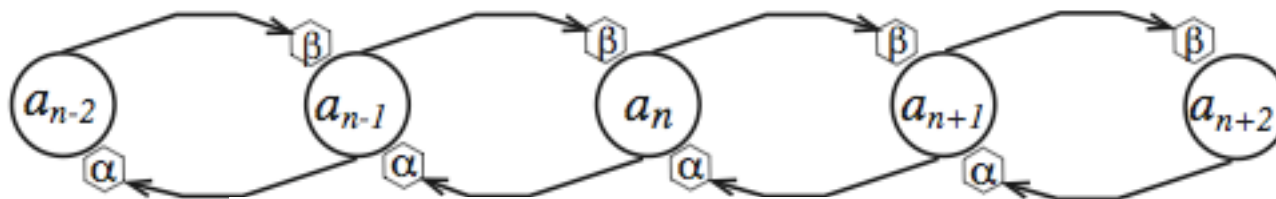


Dynamic Computational Nets

- Developed by Goldsmith (1990), Larson (1992), Laks (1994), also criticized by Prince (1991), recent works in the Chicago Linguistics Lab: *Linguistica 3* software 2008;
- A minimal computational model;
- Able to identify *local peaks* and *global peaks* of two quantities: *sonority* and *accent*;
- Learnable and inversable;

Dynamic Computational Nets

- A very simple connectionist like net with bilateral inhibitions;
- Units $a_n, a_{n+1} \dots$ representing segments
- Connections representing context influence



$$a_n^t = a_n^t I + \alpha \cdot a_{n+1}^{t-1} + \beta \cdot a_{n-1}^{t-1}$$



Syllables in DCN

- The phonemes in a syllable have activation which is a function of their *inherent* sonority (weight) and the sonority of the context:
- Derived sonority is modified by tweaking the net parameters (alpha, beta or the phonological knowledge):
 - Good account for the Tashlhiyt Berber where even stops can be syllable nucleus;
 - Resolves ST clusters /kon # strukt/ The derived sonority of the S is less than the derived sonority of the T;



Accents in DCN

- The accent on an element is a function of both its *inherent* accentability (weight of the syllable) and its context:
- The context:
 - A stressed syllable destresses syllables on either side;
 - An unstressed syllable stresses syllables on either side.

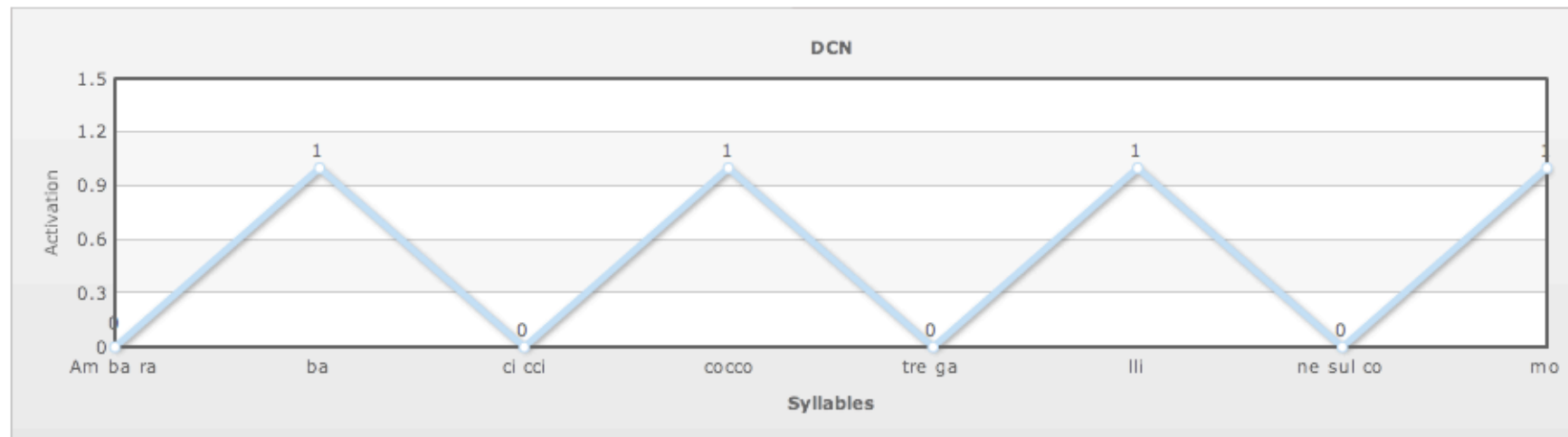


Accents in DCN

- The system has 4 parameters
 - Alpha = rightward ponderation = next segment context;
 - Beta = leftward ponderation = previous element context;
 - Initial weight;
 - Final weight;
- Penult syllable weight and bias are also possible in more elaborated versions of the model

Rhythmic curve in DCN

- Based on the accentuation net;
- But can't rely only on syllables to compute the output





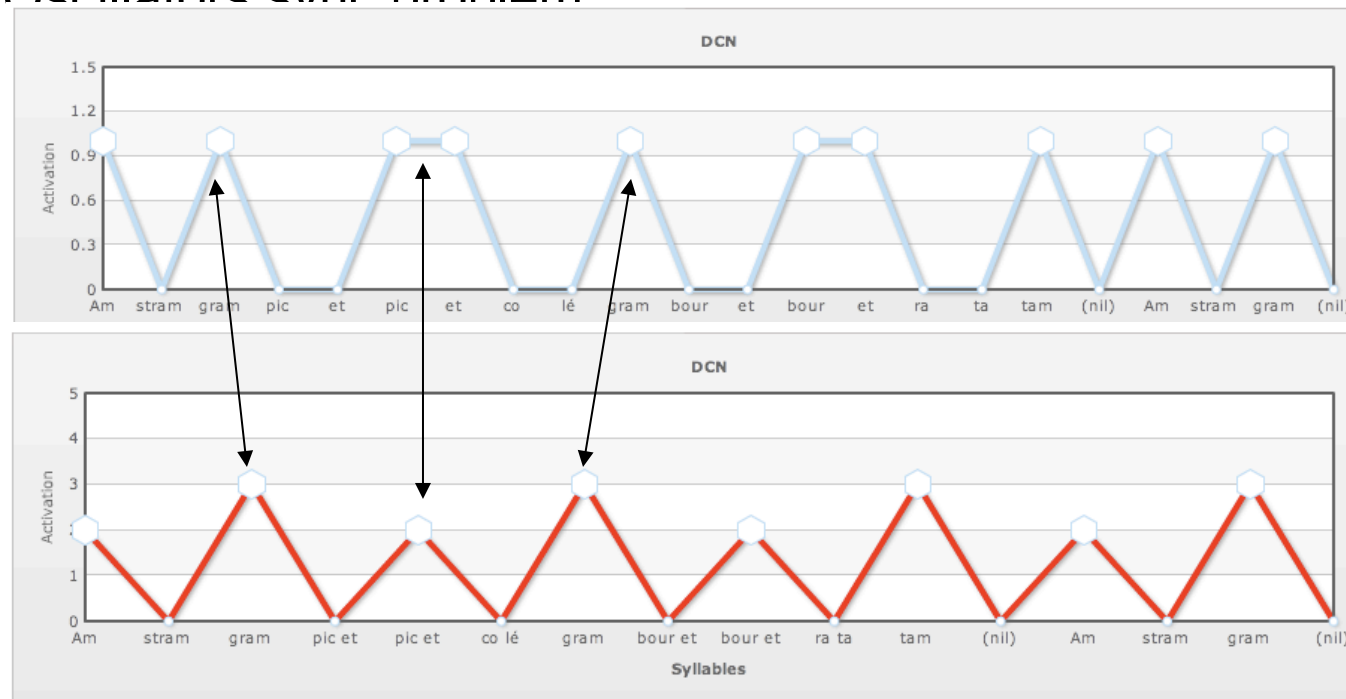
Coupling the stress network and the rhythm network

- The accent network is the interface to the syllables and the verse;

4/4 = 2 nets	2/4 = 1 net	7/4 = 1 net
1010	10	111
10100	100	101
110010	1100	1010
1100100	(Learning OK with <i>Linguistica</i> software)	(Learning OK with <i>Linguistica</i> software)

Coupling the stress network and the rhythm network

- The accent network is the interface to the syllables and the verse;
- Oscillators sync problem



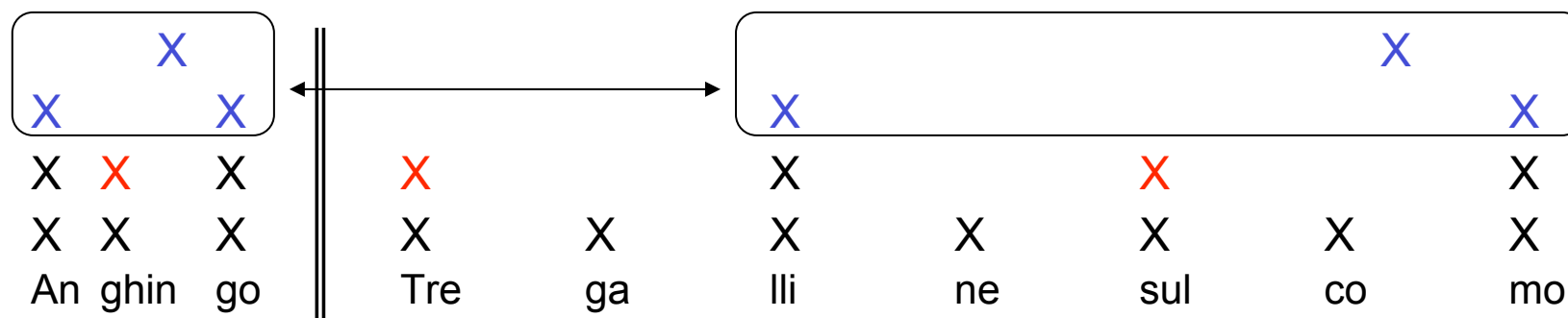


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- Linguistica Project software, <http://linguistica.uchicago.edu>

Grid: Frontiers & domain problem

- In the grid approach the grid is applied to each verse, not to the full counting-out rhyme



Che facevano l'amore
 Con la figlia del dottore
 Il dottore s'ammalo
 An ghin gò