DELAYED DYNAMIC IN GENRE EMERGENCE

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Abstract

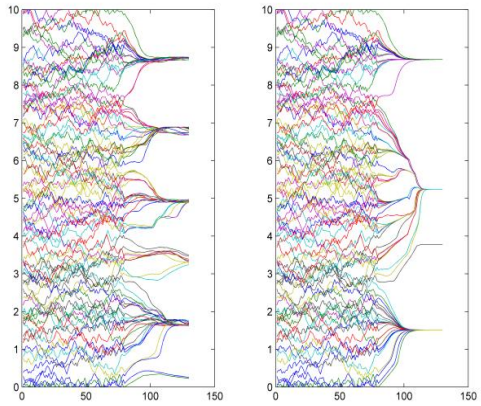
We present a model of style emergence based on flocking models. The system stabilizes in states with several non-interacting genres or style clusters, and the delayed dynamic yields more styles than the non-delayed ones. (Keywords: flocking, evolution, networks, musical genres).

In the second half of the 19th century several new popular music genres emerged across the Americas, like Blues, Tango, Candombe, Habanera, and Samba. All of them display a mixture of characteristics from European and African music, see Schuller [6], Tully [7], and Vega [8]. Here we present a model of genres evolution with temporal delays, based on consensus models, see [2], [3], [9]. We take a set of N agents, and agent i has its own initial style $x_i(0)$, a real number in the interval (0,10) assigned at random. A style may correspond to a single musical feature such as the relative frequency of patterns of three consecutive notes determining two specific intervals among all such three notes patterns in the music, which has been used recently to distinguish Baroque from Classical and Romantic styles, see [5]. Several features can be considered in a multidimensional model, with similar results.

Two agents are connected whenever the difference between their styles is less than some threshold value r. This accounts for the fact that only those features of African and European music that were similar took part in the hybridization process that gave origin to new genre. This condition defines a network which evolves in time, the evolution produces local consensus, disconnecting the network in several groups.

A crucial aspect in this model is the existence of *temporal delays*, reflecting that, when musicians interact, they interchange some characteristics not just of their present style but also of their past styles and their musical traditions. Moreover, in the process of the emergence of African-American musical genres, African musicians were forcibly removed from their native geographic and cultural environments; in this context, it is reasonable to assume that they experienced a certain stylistic drift due to isolation from their cultures of origin. So, we fix an integer d and each agent has a random trajectory $x_i(k)$ for k=1:d with a mean value r of their random excursions. Temporal delay makes no sense in opinion dynamic models, since nobody will try to reach a consensus over an opinion that he had had in the past. Delayed interactions were studied in flocking models in [1], [4], since coordination of robots for exploration must consider communication delays.

Fig. 1. Evolution of styles. Left panel: delayed dynamic. Right panel: non delayed dynamic.



We use the variable k to index the temporal steps, and for each step $k > d$, we update the values of each agent according to the following rule:

$$x_i(k+1)= x_i(k) +\sum_{j \neq i} c_{ij}\, g(x_j, x_i, d_j, d_i)\, f(|x_i(k)-x_j(k)|)$$

where $f(s) = 1$ if $|s| < r$, and zero otherwise, and g defines the dynamic. Different dynamics were used in our simulations, with similar results. The non-delayed dynamic $g = x_j(k)-x_i(k)$ gives a mean of 4.49, with both median and mode equal to 4. When $g = x_j(k-d_j(k))-x_i(k)$, and each agent j has a randomly assigned delay at each step, the mean number of genres was 5.02, with both median and mode equal to 5. In Figure 1 we have used $g = x_j(k-d_i)-x_i(k)$, that is, a fixed delay d_i is assigned to agent i, and used in the interactions (here, the mean was 5.03, and both median and mode were equal to 4).

References and Notes

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