# Fibonacci series and the Arabic culture

It is fascinating to observe how Fibonacci series (1, 1, 2, 3, 5, 8, 13, 21, 34 etc.) has been implemented in the Arabic culture through the rhythm 'Samaii Thaqeel', the maqam 'Nawa Athar Kurd' (example 1) as well as through some of the architectural models in northern Africa as claimed by a Dutch musicologist who once mentioned to me that "the Arabs of North Africa tried to find their own Fibonacci series in their architecture. Therefore, one notices that the minarets of some mosques are longer than normal, while the building of those mosques are lower than normal." (example 2).

Regarding the rhythm 'Samaii Thaqeel' -though Turkish perhaps in its origin- this rhythm is widely used in classical Arab music. It consists of three types of beats: 'dum', 'tak' and 'es' (the names of these three units do not mean anything in Arabic as far as my humble knowledge goes). 'Dum' is a kind of bass struck/sound, 'tak' is a kind of tenor struck/sound, while 'es' is a rest, which is usually filled by Arabic percussionists with various types of ornamentations. As far as Fibonacci structure is concerned, it is worthwhile to notice that in this rhythm 'tak' happens twice, 'dum' happens three times, while 'es' happens five times. It is also important to notice that the rhythm is divided into two 5/8-units almost mirroring each other (with reference to the 'dum' and the 'tak' strucks:  3 - 2 / 2 – 3). Finally, one notices one further interesting fact that the 'dum' takes place on the 1$^{st}$, 6$^{th}$ & 7$^{th}$ beats: an equivalent relationship to a Fibonacci series (example 1A). Perhaps this is also an allegory to the Fibonacci special series used in the Moorish architecture as aforementioned, where the proportion between the minaret and the building draws the viewer's attention to the "longer than normal" minaret and the "lower than normal" building of the mosque (example 2).

Further interest arises as the Fibonacci series is also found in maqam 'Nawa Athar Kurd' when analyzed according to the pitch set-theory (example 1B). Actually, I humbly think that the theoretical origin of this maqam might be Carnatic, because the same pitches in the same order are 'Raga Subha Pantuvarali' (in Hindustani music theory 'Raga Thodi'). Anyway, the Western pitch set-theory analyses the intervallic content of a certain pitch-structure by mapping the structure thus by pressing the pitches inwards so that the outer-interval (i.e. between the first and the last pitches) is reduced to the smallest possible interval. That being said, one notices that in the original pitch structure of maqam 'Nawa Athar Kurd', the outer-interval is a major 7$^{th}$ (C-B), while after pressing the pitches inwards, the outer-interval becomes smaller, namely, a major 6$^{th}$ (B-Ab). Starting now from the first pitch, B, one analyzes the maqam's intervals, and gets a Fibonacci series (1, 1, 2, 3, 5, 8, 13) as in example 1B.

I hope that this humble analysis would open a horizon for further research possibilities with respect to finding similar fascinating structures within other domains such as Arabic calligraphy and Arabic visual arts among others.

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Example 1A



*Sama'i thaqeel* rhythm

| dum | es | es | tak | es | dum | dum | tak | es | es |
|-----|----|----|----|----|-----|-----|-----|----|----|
| [1] | 2 | 3 | 4 | 5 | [6] | [7] | 8 | 9 | 10 |

Example 1B



Nawa-athar Kurd

Mapping of the maqam
according to the set-theory

1    1    2    3    5    8    13

Example 2

## The Moorish architecture in North Africa