

COGNITIVE PROTOTYPES IN RAGAS OF INDIAN MUSIC

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Abstract : Irregularities in hierarchical organisation pertaining to taxonomy have drawn the attention of specialists from various fields of research such as linguistics, psychology, neurology and related disciplines. Among major findings of their investigation, we come across the theory of typicality, as described by Eleanor Rosch, or else the metonymical process of *Motivation* : examples belonging to the same category cannot be equivalents; they are found distributed according to a more or less fit (or inadequate) representativity beginning with a particular representation called Prototype. The *mélakartâ* system in Indian music conceives of 72 heptaphonic scales, each of them a *genitore* of a number of hexa- and penta-phonic scales (Râgas). This traditional phenomenon seems to demonstrate very aptly the above-mentioned cognitive theory of our times. In the process of Motivation, we have a total of 483 Râgas per genitore and, at least theoretically, 34.776 + 72 = 34848 potential Râgas out of 72 *genitores*.

Keywords : *Genitore*, Mélakartâ, Motivation, Râgas, Representativity, Taxonomy, Typicality.

1. THE BACKGROUND, A GLANCE.

Towards the end of the 19th century, Oriental studies - eager to put an end to a certain Europe-centred complacency - seemed to be keen in setting objects of its studies in their proper social contexts : objects recognised to be literary, religious, artistic and scientific heritage, too often dependent upon oral transmission. That was precisely the period when the philologist and mathematician A.J. Ellis in his work, *Tonometrical Observations on some*

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Existing Non-Harmonic Scales (1884) proved that other nations in the world, especially, the 'Arabs' and the 'Hindus', possessed in all legitimity, systems of musical scales founded, upon principles distinct from those known in Europe. Enriched by the experiences of such pioneering figures in comparative musicology, the recent science of ethnomusicology seems to be much indebted to the indispensable tools (including the computers) that modern technology has equipped it with. Hence, being part and parcel of all socio-cultural life, ethnical music becomes accessible to research scholars; the latter consider it to be one of the very components of a society : a witness, a gleam, even a vehicle of all its essential values and concepts and history. Closely related to the ethnolinguist, the ethnomusicologist, too, proceeds through speech, assisted by tonality and rhythm. Beyond all fragmentary and imperative analyses, the ethnomusicologist reaches the very heart of the 'native' life, in order to define the characteristic criteria of a given culture and to restore the values of specificities thus obtained.

2. COGNITIVE SCIENCES.

A bunch of articles published in the *Courrier du CNRS* (special issue on Cognitive Sciences, Paris, October 1992), precises that since about 1950, on the basis of theoretic studies on several branches of knowledge and of conceptual, technical and experimental data, the 'fragmentary informations' (on language, reasoning, perception, action, memory and apprenticeship) have but one single ambition : that of constituting a common language, building a theory of the mind (distinct from that of the cerebral functionings) with a view inventing artificial means of amplifying *the powers* of intelligence. Neurobiology, experimental psychology and logic (including computers) seem to have been the fields of predilection for this exploitation.

2.1. The Basic Level.

Specialists in psycholinguistics and other related disciplines have observed some irregularities in conceptual structures at the very "basic level" (a privileged stage) in hierarchical organisation of reference that is taxonomy. This cognitive research considers certain examples belonging to the same category to be more representative than others...

No category ever contains examples which are equivalent : they are found distributed according to a more or less fit (or inadequate) representativity or typicality beginning with a particular representation called Prototype. This aims at expressing the possibility of verifying how far one can group together - under the same scheme - various sciences that process knowledge data.

It is expected that the day somebody will explain the signification of a speech or the very content of a thought - without referring to other signification whatsoever - that will obviously bring about the awaited Cognitive Revolution. And then alone will be discovered the missing link between the humanities and the natural sciences.

3. TAXONOMY IN INDIAN MUSIC.

My project at the CNRS on Comparative Investigation of Râgas Practised in the Music of the North and the South of India has presently to deal with about 5000 râga-names known by these two systems - respectively Hindustâni (H) and Karnâtic (K) - grouped under 72 modes

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(*mélakartâ*) in the South and 10 modes (*thât*) in the North (all of which are contained in the above 72).

Derived from Sanskrit – « that which provokes passion » - râga has sometimes been described as a continuum having for extremities scales on one side and, on the other, a vast melodic potential (Powers, 1980). In order to examine exclusively the scalar aspect of the râgas, I had to reduce them to diatonical semi-tones, inventing the game of undoing the intricacies of the traditional machinery and, thus, sacrificing subtle and delicate considerations such as the microtonal elasticity (*shruti*), distinctive flourish on given degrees of the particular scale (*alamkâra*), emphasis on melodic tonality (*jâti-svara; vâdi/ samvâdi*) and much of the typical phrases (*pakâd*) specifically associated with the melodic aspect. In order to avoid all "equivalent examples", I classified the distinct scales that, on one side, bear the same name; and inversely, the distinct names given to some scales that are merely identical in their sound perception. I had also to question the justification of classifying certain scales traditionally under certain modes for reasons purely aesthetic.

3.1. Methodology.

Hence, I chose to measure all the râga-scales with the semi-tone as unit. For instance, the râga and mélakartâ Dhîra-Shamkâbharana of the south or Bilâval of the North (C Major mode in the West) described as tone/ tone/ semi-tone/ tone/ tone/ tone/ semi-tone

is numerically represented as 2/ 2/ 1/ 2/ 2/ 2/ 1/.

By the process of mûrchanâ or modal sliding (translation), I obtained the following scales representing the first six thât (out of the ten known in the North) :

2	2	1	2	2	2	1	2	2	1	2	2	2	1	Bilâval/ K.29
	2	1	2	2	2	1	2							Kâfî/ K.22
		1	2	2	2	1	2	2						Bhaïrava/ K.8
			2	2	2	1	2	2	1					Kalyâna/ K.65
				2	2	1	2	2	1	2				Khamâj/ K.28
					2	1	2	2	1	2	2			Asâvari K.20

Having thus sifted numerically a good number of râgas in my collection (out of the above mentioned corpus), I grouped them together according to the degrees serving as Common Denominators (CD) for the lower tetrachords of all the scales. This step led me to the famous Twelve Cycles described by Venkatamakhi in 1620. Stripped of the shruti implications, the skeletons looked like an ascending chromatic progression, i. e. :

(a) WITH F MAJOR :

i.	1	1	3	2
j.	1	2	2	2
k.	1	3	1	2
l.	2	1	2	2
m.	2	2	1	2
n	3	1	1	2

(b) WITH AN AUGMENTED F :

o.	1	1	4	1
p.	1	2	3	1
q	1	3	2	1
r	2	1	3	1
s.	2	2	2	1
t	3	1	2	1

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For the upper tetrachords, I obtained the following CDs, thus completing the octave :

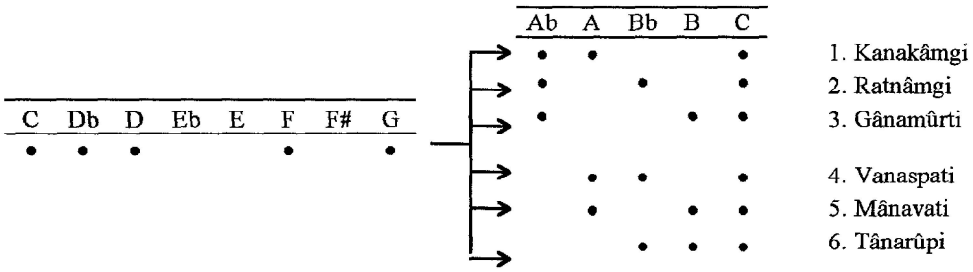
I	1	1	3	*IV*	1	2	2
II	1	3	1	*V*	2	1	2
III	2	2	1	*VI*	3	1	1

By combining the 12 lower tetrachords with the 6 upper ones, I rediscovred the 72 mélakartâs, I considered these 72 mélakartâ to be the Prototypes mentioned in cognitive terminology ; distributed in 12 Cycles (each Cycle composed of 6 Prototypes according to the intervals they possess as CD), these structures represent at the « basic level » a certain number of scales or Samples - that is to say râga, both principal (heptatonic) and secondary (hepta-, hexa-, penta-, phonic and tonic) - in no way equivalents within the framework of the category ; these Samples are distributed according to a more or less good - or bad - representativity or Typicality, having for model a Prototype (Dubois, 1991) . We come to demonstrate convincingly this validity inside the hierarchical organisation of râga (which are, in cognitive terminology, mere conceptual structures observed on the gradient of typicality).

4. ILLUSTRATION 1

Let us take for example the ascending/ descending curves of the scale derived from the râga Kanakâmgi of the system K. It is not only a « principal » râga composed of 7 degrees, i. e. (C db D F G ab A C'), but, moreover, the very first on the list of the 72 mélakartâs (« parent structures ») or Prototypes, belonging to Cycle I wich has for common denominator C Db D F G. The 6 Prototypes of Cycle 1 are :

TABLE 1



While descending, these scales use the same degrees. According to formulas in the Mélakartâ chart, these Prototypes are :

Kanakâmgi	(C	Db	D	F	G	Ab	A	C'/C'	A	Ab	G	F	D	Db C)
Ratnâmgi	(C	Db	D	F	G	Ab	Bb	C'/C'	Bb	Ab	G	F	D	Db C)
Gânamurti	(C	Db	D	F	G	Ab	B	C'/C'	B	Ab	G	F	D	Db C)
Vanaspati	(C	Db	D	F	G	A	Bb	C'/C'	Bb	A	G	F	D	Db C)
Mânavati	(C	Db	D	F	G	A	B	C'/C'	B	A	G	F	D	Db C)
Tânarûpi	(C	Db	D	F	G	Bb	B	C'/C'	B	Bb	G	F	D	Db C)

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Let us now compare a Sample belonging to Category .1, with its Prototype : **Kanakâmbari** (Table 2, L2) is a « secondary » râga (hexaphonic, i.e. C Db F G Ab C' while ascending ; heptaphonic in descending, similar to the Prototype, i.e. C' A Ab G F D Db C). Likewise, **Vâgîshvari** (Table 2, L3) is another « secondary » râga (C Db D F Ab A C'/ descending curve similar).

TABLE 2

	C	D b	D	Eb	E	F	F#	G	A b	A	Bb	B	C'	B	Bb	A	A b	G	F#	F	E	Eb	D	D b	C
1	•	•	•			•		•	•	•			•			•	•	•		•			•	□	□
2	•	•				•		•	•				•			•	•	•		•			•	□	□
3	•	•	•			•			•	•			•			•	•			•			•	□	□

ascending movement descending movement

5. ILLUSTRATION 2

Let us now turn to the ascending/ descending curves of the scale derived from the above mentioned « principal » (heptatonic) râga **Bhaïrava** of the North (Table 3, Line 1)

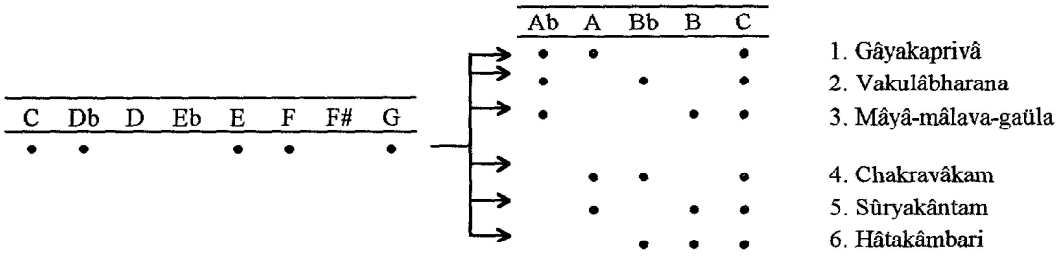
TABLE 3

C	D b	D	Eb	E	F	F#	G	A b	A	Bb	B	C'	C'	B	Bb	A	A b	G	F#	F	E	Eb	D	D b	C
•	•			•	•		•	•			•	•	•	•			•	•		•	•			•	•
•				•	•		•				•	•	•	•				•		•	•			•	•
•	•			•			•	•				•	•				•			•					
																		•			•			•	•
•	•				•		•	•				•	•				•	•			•			•	•

ascending movement descending movement

It is equally popular in the South as Mâya-Mâlava-Gaüla, classified N° 15 among the Prototypes (Cycle III) :

TABLE 4 :



While descending these scales use the same degrees. Accordingly, these prototypes are :

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1. Gâyakapriyâ	(C	Db	E	F	G	Ab	A	C'/C'	A	Ab	D	F	E	Db C)
2. Vakulâbharana	(C	Db	E	F	G	Ab	Bb	C'/C'	Bb	Ab	G	F	D	Db C)
3. M.m.gaûla	(C	Db	E	F	G	Ab	B	C'/C'	B	Ab	G	F	D	Db C)
4. Chakravâkam	(C	Db	E	F	G	A	Bb	C'/C'	Bb	A	G	F	D	Db C)
5. Sûryakântam	(C	Db	E	F	G	A	B	C'/C'	B	A	G	F	D	Db C)
6. Hâtakâmbari	(C	Db	E	F	G	Bb	B	C'/C'	B	Bb	G	F	D	Db C)

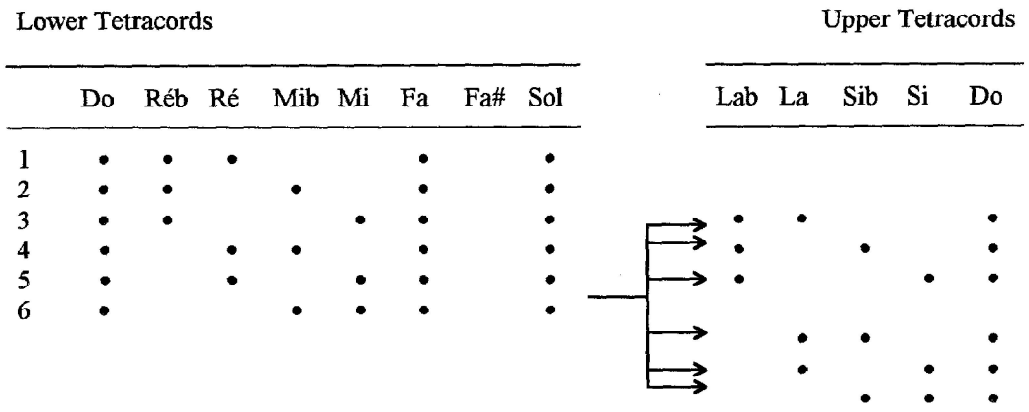
Let us compare with the Prototype (Sample N° 3) :

a) Jaga-mohini (Table 3, Line 2), a scale representing the secondary râga of the same name it utilises, while ascending, C E F G B C' and, while descending, C' B G F E Db C.
b) Mârga-déshi, a scale representing the secondary râga of the same name ; it utilises, while ascending, C Db E G Ab C' and, while descending - in a zigzag line - C' Ab F G E Db C.
c) Sâlamga-nata, a scale representing the secondary râga of the same name ; it utilises while ascending C Db F G Ab C' ; descending : C' Ab G E Db C.

6. CONCLUSION

The search for similarity between the traditional taxonomy of Indian musical scales and the contemporary theory of typicality in cognitive sciences can be thus summarised :

a) there exists in both the systems of Indian music, a vast number of scales known as principal and secondary râgas ; they may be : hepta-/ hepta-phonic, hepta-/ hexa-phonic, hepta-/ penta-phonic (-tonic) ; hexa-/ hepta-phonic, hexa-/ hexa-phonic, hexa-/ penta-phonic (-tonic) : penta-/ hepta-phonic, penta-/ hexa-phonic, and penta-/ penta-/ penta-phonic (-tonic) ;
b) they can all be grouped together according to their appurtenance to one of the 72 mélakartâ or Prototypes ;
c) these latter can be assembled by groups of six, each group forming a Cycle ; there are obviously, twelve Cycles ;
d) the lower tetracord of each Cycle is made up of a set common denominators (semi-tones in an ascending progression) ; they look like twelve distinct tree trunks having, all of them, the same and invariable crown composed of the six upper tetracords or branches



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	Do	Réb	Ré	Mib	Mi	Fa	Fa#	Sol
7	•	•	•				•	•
8	•	•		•			•	•
9	•	•			•		•	•
10	•		•	•			•	•
11	•		•		•		•	•
12	•			•	•		•	•

Finally, accepting each of the heptatonic genitore scales or Prototypes as referee, we obtain by the cyclical process of ellipses - a given number of motivations or « representations » nearest to the features of the referee. This enables us to explore the extrème limits of the theoretical potential of these 72 Prototypes : they can produce upto 34.776 + 72 = 34.848 new scales .

Beyond both the descriptive and the normative aspects of this project that deserve attention of anthropologists and musicologist, it offers to music-lovers and composers of an avant-garde temperament a feast of scale potentials. For instance, in response to the quest of pentatonic scale hunters, I have demonstrated how a single Prototype of Indian music can beget 225 pentaphonic and authentic pentatonic scales ; multiplied by 72, this figure turns into 16 200 scales composed of five degrees of an octave.

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