1 Introduction

Every evening at about 8 o'clock, a group of men assemble at the temple of Dattātreya in the town of Bhaktapur, Nepal, to sing sacred songs. They are farmers, who live in the nearby streets of the town and go out to work in their fields by day. It is their pleasure, and they also regard it as their duty, to sing for two hours every evening, throughout the year without exception, accompanying themselves on cymbals, drum and natural trumpet. They sing a minimum of 5 or 7 songs, and by singing every line repeatedly, each song is extended to many times its original length. Preliminary and concluding rituals, and breaks for conversation between songs, mark the event as both a sacred and a social interaction.

Ex. 1

This style of sacred singing is called *dāphā*. How might the musicologist attempt to understand what is happening in dāphā performance? We might approach it anthropologically as a form of social behaviour, a tradition maintained by the local community in the interests of social cohesion and identity. Or we might look at it historically, linking it with earlier palace culture and present ethnic identity-politics. We might examine the song-texts, which express humble devotion to various deities, or record mythological or historical events, in the name of former

royal patrons. Or we might analyse the structure of the music, by which I mean the musical system that unifies the repertoire, and the organization of musical events successively in the performance of each song. The roles of singers and instrumentalists, and their interactions in performance, also demand attention, as does the integration of music and ritual with the annual cycle of religious festivals and agricultural seasons.

All these approaches help us to understand the many levels of meaning embedded in the musical genre *dāphā*. But even in combination they are perhaps an incomplete answer to the question: *why* do the singers perform this music? Why do they *enjoy* performing? What kind of experience does it provide for them? And what is the role of musical structure and sonic performance in engendering that experience?

Later in this talk I'll come back to dāphā and suggest some tentative answers to these questions. First I want to introduce the notion that analysing the structure of this or any other music is not an arid formalistic exercise, insulated from the dynamics of daily life, but takes us to the heart of human cognitive experience, and links music with other realms of cultural meaning such as social identity or religious devotion.

While the "meanings" of music may be culture-specific, there is reason to believe that many cognitive abilities involved in music are shared cross-culturally, even

universally: for example the capacity to entrain to a rhythmic pulse, or to learn melodic, rhythmic, formal and stylistic schemas. Indeed, such capacities are not necessarily unique to music, but may also play their part in other domains of human behaviour and experience, such as physical action, visual perception or language. We know from experience that unfamiliar music can still "make sense" to us, can appear meaningful rather than random, though we may be unsure what the meaning is: repeated experience of the unfamiliar can teach us its structures, especially if its structures resemble something more familiar. Conscious awareness of this process is no more necessary than it is for children learning their native language. The ability to decode musical structure, to make implicit sense of music, presumably underlies the global spread of certain genres such as Bollywood film music, Indian classical music, and Western popular and classical music, to say nothing of cross-cultural transmissions at earlier periods of history. In Nepal, dāphā is itself the result of such a transmission, of the *prabandha* tradition of mediaeval Indian court and religious song.

My aim today is to report on three ongoing investigations into South Asian music, involving three different aspects of musical cognition:

1. incidental or implicit learning of musical structure

2. recursion in language, music and visual art

3. foundational schemas and the psychology of "flow"

The relevance of cognitive research to ethnomusicology, and of ethnomusicology to cognitive research, is increasingly accepted in both disciplines; scholars including Judith Becker, Francesca Sborgi Lawson, Martin Clayton and Ian Cross have already transcended this disciplinary boundary in their recent work. Such a cross-disciplinary perspective, I will suggest, is relevant to the study of music in particular cultural environments, such as South Asia; to cross-cultural perspectives on the meanings of musical structure; and ultimately to the study of the cognitive capacities underlying all human music making. In the words of ethnomusicologist John Blacking:

> "The whole point of understanding music *as* music is that we carry in our bodies the cognitive equipment to transcend cultural boundaries and resonate at the common level of humanity."

[776 wds]

[6:00]

2 Implicit learning of melodic grammar

Implicit learning is the process by which we acquire knowledge or skills unintentionally and unknowingly. We do this all the time, whether learning to ride a bicycle, speak our native language, or recognize a particular composer's music. Sometimes we have some awareness of our knowledge without being able to say how we know it: for example we may feel sure that a particular English sentence is grammatically incorrect without being able to explain *why* it is incorrect. This is called *judgement knowledge*, and the process of acquiring it is called *incidental* learning; *implicit* knowledge remains inaccessible to conscious reflection.

Implicit learning has been empirically demonstrated in the context of Western music. My collaborator, Martin Rohrmeier, and I decided to examine whether it could also be demonstrated in the case of Indian classical music, using volunteers from a Western cultural background who had no previous familiarity with Indian music. We hypothesised that through implicit or incidental learning, our subjects should be able to distinguish between two rāgas on the basis of their different melodic grammars.

In Indian classical music a rāga is a set of melodic conventions within a given scale that generate composed and improvised melodies. We looked for two

rāgas that have the same basic scale but clearly differ in melodic conventions; and we chose rāgas Toṛī and Multānī, because the scale they share is distinctively different from the scales of Western music, and would thus be unfamiliar to our subjects. As always in Indian classical music, the scalar pitches are heard against the background of a repeated pitch-reference or drone defining the tonal centre.

- speak to slide: pitch hierarchy

- speak to slide: melodic pathways

- audio clips

An important part of the performance of a rāga is ālāp, an improvised, free-rhythm exposition in which the notes and phrases of the rāga are gradually revealed and developed. It is here that the emphasised pitches and melodic pathways are articulated most clearly, without the need to conform to any metrical framework. The ālāp may be followed by a second exposition, *joṛ*, in which the same melodic process is repeated in a different rhythmic style, with a clearly-defined rhythmic pulse.

- examples of ālāp and joṛ

Of course, the underlying melodic rules are the same in both ālāp and joṛ styles; we wanted to know whether our subjects could internalize these rules while listening to ālāp, and then recognize them when listening to joṛ.

For our experiment, we asked the distinguished sitarist Dharambir Singh to record an ālāp and joṛ, each lasting 5 minutes, in each rāga. We divided our subjects into two groups, and played the ālāp in rāga Multānī, twice, to group A, and that in rāga Toṛī, again twice, to group B, without telling them the object of our experiment. In the next phase of the experiment, each subject heard short samples from the *joṛ* of both rāgas, in random order, and we asked them to say whether each clip came from the joṛ of the rāga that they had previously heard. We also asked them to say, for each clip, how confident they were about their answer, on a 5-point scale between "completely sure" and "completely guessing".

Given that each participant had previously heard only one of the two rāgas, for a total of 10 minutes only, and given that the joṛ examples were stylistically different from the ālāp they had initially heard, I confess I was doubtful whether our subjects would be able to pick out those clips showing the melodic grammar of the rāga with which they had acquired such limited familiarity. The task seemed just too hard. The results were however statistically significant: those who had heard the ālāp in Multānī endorsed the Multānī joṛ samples marginally more frequently than those who had listened to Toṛī, and vice versa; musicians scored slightly better than non-musicians. Moreover, we also found a correlation between correct responses and level of confidence: our subjects were more confident of their answer when giving the *right* answer. This indicates that they had acquired a degree of *judgement knowledge*, an awarenes of the knowledge

they had gained, rather than completely implicit knowledge, in which case they would have stated that they were guessing.

We concluded from our data that our participants, both musicians and non-musicians, had in some measure learned the rules of an unfamiliar melodic grammar. They did so incidentally, without intending to do so, but they had acquired some judgement knowledge. They did so rapidly, with only 10 minutes of exposure to the grammar of one of the two rāgas. And they did so on the basis of ecologically valid material, that is, recordings of genuine performances by a master musician, not the synthetic stimuli so often used in music psychology experiments.

Our results clearly need to be replicated and if possible extended, and indeed a neuroscience team led by Michael Ullmann at Georgetown University, Washington DC have recently taken up that challenge, and are attempting to verify the processes of incidental rāga-learning with the aid of fMRI technology. But pending their confirmation or otherwise, our findings indicate that the cognitive ability to learn musical structure from the sound of music alone is not confined to members of the culture concerned, but is available cross-culturally. It is part of what Blacking calls "the cognitive equipment to transcend cultural boundaries and resonate at the common level of humanity".

This provisional conclusion becomes even less surprising when we bear in mind that the explicit *purpose* of ālāp in Indian music is precisely to make the unique structure and aesthetic character of the rāga clear to the listener, to saturate consciousness with the Gestalt or "image" (*svarūp*) that makes the rāga distinct from all other rāgas, before going on to materials in other styles in which the rāga image may be temporarily obscured—for example, by rapid ornamentation. In the words of the great 13th century theorist Śārṅgadeva, ālāp is a "manifestation" (*prakaṭīkaraṇa*) of the rāga.

We can surmise, then, that in ālāp, performers exploit the human capacity for incidental learning. And one of the main ways in which they do so, beyond simple repetition of notes and phrases, is by enlisting another cognitive capacity, the capacity for recursive embedding.

[c. 10]

3 Recursion in language and music

Like incidental or implicit learning, recursion is not confined to the musical domain. It denotes the embedding of one structure inside another, especially within a structure of the same kind; or as Pinker and Jackendoff put it, "a procedure that calls itself…or a constitutent that contains a constituent of the same kind". The picture of a cocoa packet, containing a picture of a similar cocoa packet, itself containing another cocoa packet and so on, illustrates the concept.

Recursion is a feature not only of pictures and computer programmes but of normal language. The sentence "The dog bit the cat" comprises a noun phrase (the dog) followed by a verb phrase (bit the cat), but the verb phrase itself contains another noun phrase (the cat). By replicating this structure recursively we can extend the sentence indefinitely (The dog bit the cat that chased the squirrel that climbed the tree…). This is called tail recursion. Alternatively, in centre embedding, one sentence is embedded in the middle of another, instead of at the end. Thus "the cat the dog bit chased the squirrel" embeds "the dog bit the cat" inside "the cat chased the squirrel". Further embedding becomes hard to understand however: in real life, as opposed to papers on syntax theory, we are unlikely to say "The squirrel that the cat that the dog bit chased climbed the tree". Note however that we don't have the same difficulty with the cocoa packet. And Steven Levinson has pointed out that recursion is a feature of communicative

interaction that occurs frequently in everyday conversation, where smaller subdialogues regularly intervene between a question and its answer.

In recent years ambitious claims have been made for the significance of recursion as a human cognitive capacity. Linguists of the Chomsky school attribute the limitless number or "discrete infinity" of previously unspoken but grammatical sentences to the hierarchical, generative and recursive organization of the language faculty (Hauser, Chomsky and Fitch 2002). The psychologist Michael Corballis regards recursion as "the primary characteristic that distinguishes the human mind from that of other animals", a capacity that

> "underlies our ability not only to reflect upon our own minds, but also to simulate the minds of others. It allows us to travel mentally in time, inserting consciousness of the past or future into present consciousness" (2011).

He concludes that recursion has led to the complexities of human civilization, the extinction of fellow large-brained hominins like the Neandertals, and our species' supremacy over the physical world.

This may seem a lot to attribute to just one cognitive capacity. But given that recursion has been identified in almost all human languages, it would be surprising if it did not also occur in music. And indeed it has been identified in Western tonal music. In Schenker's analyses of tonal music, the same procedures can occur at foreground, middleground or background; in their *Generative theory of tonal music*, Lerdahl and Jackendoff write that

any abstract grouping pattern could stand equally for local or global levels of musical structure… **grouping structure is *recursive*: that is, it can be elaborated indefinitely by the same rules**. (1996:16)

Similarly, Martin Rohrmeier has argued that modulation and prolongation in Western tonal music are equivalent to tail recursion or centre embedding in language. But the music of the rest of the world remains unexamined from this point of view. Martin Rohrmeier and I decided, therefore, to investigate whether recursion, like incidental learning, could also be demonstrated in Indian classical music.

The obvious place to look was, again, in ālāp. In preformance, ālāp is normally structured as a gradual ascent of the middle octave, from 1 to 1', periodically punctuated and finally concluded by returns to 1. In addition, the lower octave may be briefly introduced near the beginning, and the higher octave near the end of this process. An ālāp can be made longer or shorter by the performer, but the overall contour must be retained.

I had in fact already argued, in an article published in 1981, that the underlying developmental process in ālāp is what I called "internal scalar expansion". That is,

"A rising and falling phrase is expanded at successive repetitions, by adding higher and higher notes at the apex."

The slide shows the hypothetical underlying model for ālāp in any rāga. Each string, from a to e, results from the recursive application of the same process of Internal Scalar Expansion to the previous string: 1 2 1, 1 2 3 2 1, 1 2 3 4 3 2 1 etc. In real music, this abstract and symmetrical model is modified to reflect the scale structure, pitch hierarchy and melodic conventions of the chosen rāga; and the performer is free to elaborate each stage in the process of internal scalar expansion, by repetition and variation of the string, in whole or parts. This process is known to performers as *vistār* or *baṛhat*, both meaning "expansion".

To explore further how this recursive process underlies ālāp performance, we analysed the ālāp in rāga Multānī that Dharambir Singh had recorded for our Implicit Learning experiment—choosing this example because it was conveniently short, and recorded for an unrelated purpose. Multānī is distinguished by an ascent–descent pitch schema in which scale-degrees 1 and 5 are strongly emphasised, while b2 and b6 are omitted in ascent, and only lightly articulated in descent. The rāga can be recognised immediately by the key phrase (*pakaṛ*) 7 1 b3 b2 1.

The slide shows an analysis of the ālāp, which you'll hear in a moment, designed to highlight the recursion process. This analysis is a simplified outline, so that the whole ālāp can be seen at once: in performance, each stage (a, b, c etc) is repeated, in whole or part(s), with variations of emphasis, ornamentation etc.,

and at several points Dharambir backtracks to an earlier stage and repeats part of his development, again with variation. This will be made visible as we listen.

At Stage a, Dharambir begins with the key motif of Multānī, 7 1 3 2 1. This motif informs the connoisseur that the rāga is Multānī. It is also the source of the recursive process in this performance.

After stage a, Dharambir briefly improvises in the octave below the starting-point. This is omitted in the present analysis as it doesn't form part of the recursive upward expansion.

The Key Motif is then expanded through Internal Scalar Expansion to include pitch #4, in Stage b, and 5 in Stage c.

In stage d, having reached 5, the Internal Scalar Expansion process begins again, taking 5 instead of 1 as the starting-point. As the sitarist himself expressed it, "5 becomes a new 1" at this point, and the descending line 5 4 3 2 1 is deferred for the time being. Accordingly, in Stage e, the Multānī Key Motif is transposed within the rāga scale to end on 5 instead of 1: #4 5 7 b6 5. This motif is thus recursively embedded within the expansion of itself, and becomes the subject of further expansion in the following stages.

In stage f, the transposed Key Motif is expanded to reach upper 1'. This pitch now becomes the basis for further expansion, and again the descent from upper 1' back to 5 is deferred.

In stage g, the Key Motif is again transposed, this time by an octave, so it is now doubly embedded within expansions of itself. In stage h, the transposed Key Motif is itself expanded by Internal Scalar Expansion to reach upper 5, followed by descent to 1'. Stages g and h are repeated, and form the climax of the ālāp.

Stage i is the descent from 1' to 5, which was deferred from stage f; and similarly the descent from 5 to 1, deferred from stage d, is completed in Stage j. As a coda (*saṃcārī*), Dharambir briefly recapitulates the whole ālāp, and ends, as he began, with the Multānī Key Motif.

[10:00]

Ex. [iAnalyse]

Martin Rohrmeier and I believe that the structure of this ālāp demonstrates recursion. According to Lerdahl and Jackendoff, recursion is the application of the same set of rules at different levels of structure. Martin Rohrmeier suggests that just two rules are sufficient to describe the example we've just heard: Prolongation, where a pitch is expanded by repetition of itself; and Preparation, where a pitch is expanded by approaching it from another pitch. The tree diagram on the right shows how successive implementation of these two rules

generates the Multānī Key Motif, 7 1 b3 b2 1. By successive expansions of the mid-point, applying Prolongation and Preparation rules alternately, we can generate the next two stages of the ālāp (reading the outermost leaves of the tree): 7 1 3 4 3 2 1, and 7 1 3 4 5 4 3 2 1. And so on. Martin has proposed that these same two rules can also generate the chord sequences of tonal harmony in Western music.

When I discussed these ideas with the performer, Dharambir Singh, he interpreted the structure of ālāp in terms of the embedding of the human individual within successively expanding cosmic realms. This idea is traditionally represented in Indian art in the form of a cosmic diagram, the *maṇḍala*, in which the universe is represented as a series of concentric areas, of circular, square or triangular geometry, populated by gods, goddesses and other divine beings. The central, smallest area can stand for the most powerful deity, a region of the earth, a town or city, a temple or shrine, or the body of the worshipper himself, whereby the individual sees himself in relation to the cosmos as a whole. Similarly recursive forms occur in South Asian architecture, literature and ritual.
[12:30]

It seems that recursion is not only a feature of language and music but is a fundamental human cognitive capacity, one that is particularly characteristic of South Asian cultural forms, where it tends to be invested with particular spiritual and philosophical meanings and symbolisms. This conclusion suggests that

engagement with the workings of musical structure should not preclude

consideration of wider cultural perspectives and meanings. Rather, a cognitive

perspective may help us to understand the *relationships* between structure,

function and meaning in music.

4 Connecting analysis and culture: schemas and flow

A cognitive

After an exceptionally long singing session, lasting some three hours, I asked the

Dattātreya dāphā group whether they felt tired after so much singing. They

replied enthusiastically that they did not. When I asked whether they felt happy,

they asserted loudly that they did.

Unlike the highly professionalised art of Indian classical music, dāphā singing is

"participatory": open to those of modest musical abilities, it prioritizes the intensity

of religious devotion expressed rather than artistic refinement. Thomas Turino,

referring to the work of the psychologist Csikszentmihalyi (1990/2002), argues

that participatory music generates for its participants a specific type of

psychological experience that he calls 'flow', and that this indeed is the objective

of such musical activities:

> *Flow* refers to a state of heightened concentration, when one is so intent on the
>
> activity at hand that all other thoughts, concerns and distractions disappear and the
>
> actor is fully in the present. The experience actually leads to a feeling of
>
> timelessness, or being out of normal time, and to feelings of transcending one's
>
> normal self. Regardless of how intense the activity is … people find flow experience
>
> restful and liberating, because the problems and aspects of ourselves that
>
> sometimes get in our way from reaching a clear, open state of mind disappear during
>
> intense concentration. (2008: 4)

While flow can result from many kinds of activity given the appropriate conditions,

music, along with other cultural activities such as religious rituals and games, is

seen by Csikszentmihalyi as designed specifically in order to generate flow (2002: 72 ff.). Most of these flow-inducing activities involve the collaboration of a number of people; interaction between them is a major stimulus to the shared experience of flow. This experience, Turino suggests, is particularly associated with *participatory* musical performance (2008: 34).

There are good reasons to think that flow occurs in *dāphā*. First, *dāphā* offers many of the conditions in which flow is said to occur: for example, performers show signs of deep concentration and absorption in the present moment, and an altered sense of time in which two or three hours pass without effort. Secondly, performers describe some of the characteristics of flow experience, such as forgetting temporarily the cares and concerns of everyday life. And thirdly, the structure of *dāphā* performance seems designed to generate flow.

This last claim could be illustrated with any item of the dāphā repertoire, but I've selected the song "Lokapanca", one of the shortest, but one of the most important songs in the repertoire of the Dattātreya dapha group. Sung only by this group, the lyrics urge the singers to "sing regularly" (as they do, every day), and they pray for protection both to the goddess Nātheśvarī and to a former patron of the group, King Rājendra Shāh of Kathmandu (ruled 1816–47). The song is one of the first to be taught to beginners, and is sung whenever the group hold a feast.

The song comprises two verses of two lines each. The first line of each verse (line A) is set to a melody called *pad*, the second (B) to a melody called *nhyāḥ*.

In performance of this song, or any dāphā song of the same type, each line of each verse is repeated several times, alternately by the two sides of the singing group, according to a standard pattern that the singers have to learn. The two sides never sing simultaneously, but they collaboratively construct a continuous musical performance through equal contributions. [This practice is unique, in Bhaktapur, to the *dāphā* style of singing, and indeed name *dāphā* may be derived from *dāpā* meaning "exchange".]

This alternation of balanced sides of the singing group mirrors the co-operation between individuals and groups of equal status that is necessary within a small farming community: major agricultural tasks must be shared on a reciprocal basis, and a willingness to accept mutual dependence and fulfil mutual obligations is seen both as a moral good and as essential to social and economic survival in this closely-knit urban community (Parish 1994). Indeed music is valued in this society precisely because it is seen as leading to the enculturation of male members into appropriate patterns of reciprocal social and moral behaviour. In *dāphā*, the notion of everyone taking a turn, of making an equal and fair contribution, is enshrined not only in the musical alternation of Right and Left sides, but also in the allocation of onerous or expensive tasks (for example,

organizing a feast) on a rota basis; the rotas are strictly enforced, and failure to take one's due turn, or even to attend the feast, is punishable by fine.

In the first verse of *Lokapañca*, performance begins with four repetitions of the A line (*Pad*), by right and left sides alternately, at slow tempo. Each repetition concludes with an instrumental ending pattern, which temporarily disrupts the metrical structure. On the last repetition of A this closing pattern leads into the B line (*Nhyāḥ*), which begins at slow tempo but quickly accelerates to double speed. This speed is then maintained without change through four alternate repetitions of B. In the *Nhyāḥ* there are no instrumental closing patterns between repetitions; each group starts singing immediately the other has finished, without gap or pause. Only after the fourth repetition of B do the instruments interrupt the rhythm and tempo with an ending-pattern.

Thus the *Pad* and the *Nhyāḥ* contrast not only in tempo, but in the degree to which the music 'flows' uninterruptedly: this is minimal in the *Pad*, but maximal in the *Nhyāḥ*, once the tempo has accelerated to the fast speed. The melody of the two sections reflects this change in continuity: in the *Pad* the melody makes repeated short ascents to the upper **1˙** and **3˙**, but remains at that level; in the *Nhyāḥ*, after a final ascent to **1˙**, it tumbles in a rapid octave descent. This is a regular feature of *nhyāḥ* melodies.

This pattern of antiphonal repetition, ending patterns and change of tempo is a performance schema that is applied to most dāphā songs. It can be can be linked, I suggest, with the concept of flow as a psychological experience. In the *Pad*, repeated efforts to establish musical momentum are thwarted by the slow tempo, the instrumental interruptions which disrupt the metrical continuity, and the repeated ascending movements of the melody. In the *Nhyāḥ*, rhythmic acceleration and ascending melody at the outset lead to a flow of rhythmic and melodic continuity—fast tempo, repeated octave descent, immediate take-over from side to side—accompanied by fast rhythms on the accompanying instruments.

It seems reasonable to assume that an experience of psychological flow is generated in the *Nhyāḥ*, and all the more effectively because of the effortful way in which resistance to flow in the *Pad* has been overcome. Indeed the Newari noun *nhyāḥ* comes from the verb *nhyāyegu*, 'to move on, flow', as of a river, a god-chariot, etc. In the case of a heavy object like a god-chariot, *nhyāḥ* or momentum is only achieved after much repeated pulling and interrupted effort, especially if opposing teams are pulling in opposite directions at the same time.

After the Pad and Nhyāḥ sections, the A and B lines of verse 1 are again repeated but in a more complex pattern of alternation, called "mixed-up" (*thalāḥ–kvalāḥ*). This section begins with an instrumental interruption and a drop to slow tempo for A, but the fast tempo is quickly resumed and continues to the end of

the section without further interruption. At this point so much momentum has been established that the second verse, which is the last verse in this song, follows without interruption or change of tempo: its A and B lines are sung to the *thalāḥ–kvalāḥ* pattern at fast tempo throughout, accompanied by rapid instrumental patterns, and ending with an instrumental ending pattern that brings the the flow of the song to a halt like a brake on a runaway vehicle.

[10:30]

[Ex.]

I said earlier that engagement with the workings of musical structure should not preclude consideration of wider ethnographic perspectives; and that a cognitive approach may help us to understand the *relationships* between structure, function and meaning in music. I have illustrated this by showing how the structure and performance of dāphā songs can be linked both to reciprocal social relations within the farmer community, and to the generation of flow.

Dāphā thus illustrates two cognitive capacities that, like the capacity to learn musical structure implicitly and the capacity for recursive thought, can be demonstrated cross-culturally and in both musical and non-musical domains. The connection between musical and social reciprocality is what cultural anthropologists such as Bradd Shore or Maurice Bloch might term a *foundational schema* or a *cultural model*: a pattern of thought and behaviour that appears in

two or more, apparently unrelated cultural domains. Thus anthropologist Jerome Lewis has argued that foundational schemas underlie both the polyphonic musical practices of the Pygmies of Central Africa, and aspects of their social interaction and hunting techniques essential for survival in the rainforest.

Secondly, the psychological state of "flow" is claimed to be a universal experience in participatory music-making, shared with many other activities, especially activities that involve collaboration by a social group; in dāphā, musical structure seems designed to generate a "flow" state that would account for the endurance, dedication and enjoyment of the singers.

A cognitive ethnomusicology would thus entail reconciling the unique culture-specific meanings revealed by ethnography with cognitive capacities that are limited neither to specific cultures, nor to the musical domain, but which may underlie thought, feeling and experience universally. This I take to be what John Blacking meant by "the cognitive equipment [that we have in our bodies] to transcend cultural boundaries and resonate at the common level of humanity".

[13:00]

A cognitive schema is a structure in long-term memory in which a number of items or categories are arranged in a set of relationships—often spatial or temporal relationships. The categories may be variable and some may be optional. Thus the English verb "to write" evokes a schema in which an individual draws an implement across a surface, to leave a trace that symbolically represents language. The implement may be a pen, pencil, chalk or brush, the surface may be paper, a wall or a computer screen, the trace may be letters or ideographs, written horizontally or vertically, from right to left or left to right, and any human language with an orthography may be so represented. The single word "write" brings this entire complex to mind. Such schemas enable us to have expectations: seeing someone put pen to paper, we expect them to write a message.

Music is highly dependent on specialised schemas: for example scales, metres, modes, formal plans etc. A rāga is evidently a kind of schema, in which pitch categories are ordered according to certain melodic conventions; and the overall contour of ālāp is a formal schema that can be combined with any rāga. Thus musical schemas are inherently flexible and can be flexibly combined with each other. (In his article "Schemas not syntax", Justin London has argued that the search for musical equivalents of linguistic syntax is misguided, and that the more flexible concept of schemas fits the case of music cognition better. The

case of ālāp, however, suggests that a formal schema can grow out of syntax, and that the two concepts are not incompatible.)

Schemas are not limited to music, but are in constant everyday use as we negotiate our complex world. It should not surprise us to discover that some schemas appear to be common to a number of different cognitive domains, including music. Cognitive anthropologists refer to such cross-domain schemas as *foundational schemas* (Shore 1996) or *cultural models* (Bloch xx), but they did not consider any musical evidence for them. Recently Jerome Lewis has argued that foundational schemas underlie both polyphonic musical performance practice among the Pygmies of Central Africa, and aspects of social interaction and hunting techniques essential for survival. Tom Solomon has pointed out that during the 1980's and 90's, some ethnomusicologists were interested in homologies between musical structures and other cultural forms, but these apparent resemblances are now discredited, except in cases where the culture-bearers themselves recognize the parallel (as Feld discovered that the Kaluli do). But foundational schemas are not homologies. They are our way of saying that the same pattern of thought or behaviour is essential to two or more different kinds of activity, and is equally constitutive of both.

5 Conclusion