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Theory and Analysis of Melody in Balinese *Gamelan*

KEYWORDS: Balinese *gamelan*, melodic stratification, cyclic meters, symmetries

ABSTRACT: Like many other musics with a primarily cyclic approach to melodic and rhythmic organization, Balinese *gamelan* music of the court or court-derived traditions relies upon on symmetries of one kind or another for structural coherence. *Gamelan* genres originating in other Balinese historical or cultural contexts have different, often more asymmetrical, kinds of organizing principles. In this article a set of Balinese concepts of melodic motion are used to develop a theory useful for analyzing the variety of symmetrical and asymmetrical structures evident across the repertoire. Recordings and analytical reductions (in Western notation) demonstrate how the concepts may be applied to a broad range of Balinese *gamelan* music. The aim is to view structural and compositional processes in standard practice, and also to show how structure correlates with historical trends and technological developments.

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1. Introduction: Objectives, Repertoires and General Structural Characteristics

[1.1] The purpose of this article is to introduce some techniques for analyzing Balinese gamelan compositions, especially those of the gong-chime ensembles of the pre-20th century courts, and their popular village-based contemporary successor, the *gamelan gong kebyar*. In so doing I hope to establish a framework for perceiving the multidimensional structural coherence of the music in ways reflective of my lengthy experience performing, composing and listening to it. Therefore this is not, strictly speaking, an ethnographic venture. Although it takes concepts and terminology Balinese themselves use as a point of departure, it also adds to them, in order to explore perspectives that Balinese terminologies and classification schema do not attempt to account for.

[1.2] A variety of aesthetically compelling musical tensions exist in Balinese melodies and drum patterns. Expressed simply, these tensions derive from the competing influences of various technical, cultural, and historical factors at play in the music. Figure 1 lists these factors as a set of six parallel pairs of conceptual distinctions. The terms on the left side describe important features of the repertories of the large bronze gamelan developed since approximately 1600 A.D., under the strong influence of technology and culture imported from Java. Those on the right describe the older repertoires and ensembles associated with the centuries prior to that era. I shall briefly explain them in turn.

Figure 1. Descriptive term-pairs

Post-16th century music	Pre-16th century Music
1. Cyclic	Linear
2. Quadripartite	Additive (or free)
3. Instrumental	Vocal
4. Court tradition	Village tradition (earlier)
5. Bronze technology	Local technology
6. Symmetrical structure	Asymmetrical structure

[1.3] Cyclic, naturally, refers to *gamelan*'s signature use of gongs and drum patterns to divide repeating melodies into equal, hierarchic units; linear refers to the absence of gongs and drums or, as sometimes happens, to their decorative or coloristic use marking more freely structured melodies. The number of beats in cyclic melodies is normally quadripartite, that is, divisible by four, while additive refers to non- quadripartite melodies concatenated from units or phrases of differing lengths, or sometimes in unpulsed rhythm. Cyclic quadripartite melodies tend to be associated with instrumental music in the comparatively recent Javanese-influenced *gamelan*, while the less strictly structured melodies from earlier eras have been shown to have a vocal basis. The instrumental repertoires are associated with bronze casting technology for forging gamelan associated with the affluent Java-influenced courts, while vocal melodies and small ensemble repertoires that they spawned are associated with pre-Javanese village culture and local technology. Finally, and most significant from a music theoretic point of view, cyclic melodies, by virtue of their quadripartite structure, are inherently symmetrical, in that they can be thought of as rotating around the twin axes of their end/beginning points (marked by the large gong) and their midpoints.[1] Linear, vocally derived melodies are inherently asymmetrical in contrast.

[1.4] For the purposes of this study the meanings of the foregoing terms have been essentialized, and I am careful to state that dichotomies such as these need to be applied flexibly. Nor do I suggest that each of the terms is exclusively associated with one or the other group of repertoires, but rather that they constitute core identifying features of each. The tension that I depict between them is a result of historical and musical processes that enable each to permeate and affect the other. Court repertoires were strongly influenced by village developments, linear elements appear in cyclic music, vice versa, and so on. The commingling is most pronounced and assimilated in the repertoire of *kebyar*, a genre that first appeared ca. 1915. *Kebyar* picks and chooses its constituent structural elements from across the panorama of Balinese music history, interspersing them with the innovations of contemporary composers. Most importantly, it is the blending of symmetrical and asymmetrical qualities in *gamelan* melodies, perceptible at various levels of structure within any given melody, that is emphasized in the analytical report below.

[1.5] These processes of assimilation and combination have long been woven into Balinese melodic structure, but twentieth-century music has seen to their explicit surface prominence and juxtaposition. This is in large part due to composers' growing contact with the range of Balinese historical and regional musical genres (via recordings and direct access to once-remote villages and styles), and their intensified awareness of themselves as creatively autonomous. A strong political/social emphasis on modernization and cultural preservation in post-Sukarno Indonesia has been further impetus to explore and combine indigenous musical resources. As a result *kebyar* composition has traced a dramatic trajectory from the rough pastiche-like juxtapositions that gave it raw energy in the 1930s to the extended, complex, and practically through-composed 1990s works of composers such as Nyoman Windha and Gede Yudana.

2. Definition of Terms

[2.1] Balinese melodies of the court tradition are composed in one of the five-tone subsets of the seven-tone collection commonly known as *pelog*. Tones are referred to with the Balinese solfege names *ding*, *dong*, *deng*, *dung*, and *dang*. Melodies are strictly composed and entail, for our purposes, virtually no improvisation. All are orchestrated in a stratified fashion, in which several realizations of the same melodic idea are presented simultaneously at different rhythmic densities. Balinese musical instruments and their ranges, tunings, acoustic properties, and idioms, are all inextricably linked with these melodic variation procedures, which together constitute a special approach to the globally widespread practice of heterophony.

[2.2] The rhythmic densities of these layers are most often related by simple duple ratios. Each layer is assigned to one of four main instrument groups (see Figure 2 below). The densest one, usually at four notes per beat, is played by the highest-pitched metallophones and gongs. A common technique employed by these instruments is that of interlocking parts, or *kotekan*, which allows for rapid filigree to be played by pairs of musicians faster than any individual performer could. Though divided into rhythmically interesting separate parts, however, the composite *kotekan* proceeds in an unbroken rhythmic continuity and should be heard as a melodic component integral to the composition. Below this in the texture, at one or two tones per beat, is an embellished melody played on the leading instrument *trompong* or *ugal*. This melody has central importance: it is the most singable because of its register and comfortable rhythmic pacing, and serves as a point of orientation and leadership for others in the ensemble to follow. Reduced to a simple one-tone-per-beat skeletal form, I shall refer to this layer by the Balinese term *neliti*, which means "correct" or "precise." Below the *neliti*, customarily playing once every two beats, is the *pokok*, or trunk tones, of the melody, played by the metallophone *calung*. The *jegogan* play the deepest and sparsest part. In an eight-beat melody they may sound twice, every four beats, or in longer melodies they may sound less frequently still, at every eight, sixteen or even thirty-two beats. [2]

[2.3] In this strictly hierarchic and rhythmically predetermined structure, each stratum has its own points of metric stress, which also connote special structural relevance. In each stratum, such points of stress are measured backwards in groups of four tones from the final tone of the melody, which receives the strongest stress of all according to the way Balinese conceptualize it. This is where all parts converge and are supported by the stroke of the large gong.

[2.4] When two or more parts coincide vertically at a point of metric stress they are normatively restricted to playing the same tone of the scale. But the differing densities of the parts ensure that horizontally each part can be singled out for its own character, advantageously discussed in terms of its melodic contour.

[2.5] Contour analysis underplays the uniqueness of intervals and interval sizes, which may at first seem especially problematic where Balinese *gamelan* is concerned. Indeed such variability is a crucial factor that needs to be reckoned with, for *pelog* scale-steps are diverse not only within *gamelan* but among them. Though terms exist for interval classes, actual interval sizes vary widely. For example, a *kempyung* (the interval of three-steps-between or the so-called *pelog* fifth) can range from 627 to 966 cents within the same set of instruments. But the individual tuning

of *gamelan*, their varying overall pitch-level, and numerous other significant timbral variables make an analysis based on the qualities of the intervals themselves a speculative challenge, best not undertaken prematurely. One would have to account for the affective and acoustic discrepancies admitted by *pelog*'s non-standardization, and analysis would require far greater attention to individual *gamelan* pitch-collections than to *gamelan* compositions. Yet despite variance in pitch and tuning, the integrity of musical works is strongly affirmed by the Balinese, and contour theory provides an ideal heuristic for glossing interval discrepancies in the interest of exploring compositional function.

[2.6] Ultimately, then, it is contour more than interval size that determines the intrinsic compositional quality of a melody, as opposed to any extramusical or contextual attributes a melody may carry. By quality here I am referring primarily to the sense of motion and stasis (or progression and repetition), in other words, a melody's compositional flow or energy. Balinese use the terms *ngubeng* and *majalan* to describe this. The former, meaning literally to go around and around in the same place or to spin one's wheels, connotes something like stasis or immobility. *Majalan* is *ngubeng*'s complement: to go or progress in a certain direction. In most melodic situations the two qualities are in dialog, each rising periodically to predominance or striking a balance. They typically coexist on different levels of structure as well.

[2.7] To formalize the discussion of contour the concept of contour class (adapted from Friedmann) is helpful, abbreviated as CC.[3] A CC is an ordered, four-member set of integers showing the contour and interval relationships among four consecutive tones in a given stratum. The last of the four must be a stressed tone. Again, the stressed tones in each stratum are those obtained by beginning at gong and counting backwards to every fourth tone. The number of CC groupings in a stratum is thus equal to the number of tones in the stratum divided by four. A special, simplest kind of contour class including only two tones I shall refer to as the axis--the distance between the final tone of a melody and its midpoint. The scale-tone interval of a melody's axis bears heavily on its overall *ngubeng* or *majalan* quality. Owing to the special qualities of *kotekan* structure, to be discussed later, *kotekan* CC have eight members lasting two beats, and are referred to with the designation kCC.

Figure 2. Summary of *gamelan* terminology and analytical concepts

1. *kotekan*: interlocking parts; composite moves at 4 or (sometimes) 8 tones/beat
2. *neliti*: skeletal reduction of leading melody; 1 tone per beat

3. *pokok*: trunk tones; ordinarily 1 tone every 2 beats
4. *jegogan*: sparsest melodic layer; one tone every 4, 8, 16 or 32 beats, depending on the length of the melody
5. *ngubeng*: static; low rate of scale-tone change
6. *majalan*: kinetic; high rate of scale-tone change
7. axis: distance in scale tones between the midpoint and final tones of a melody
8. contour class (CC): ordered, 4-member set of integers showing contour and interval relationships among four consecutive tones in a given stratum; the last of the four must be in a metrically stressed position, and is set to 0 to provide a point of orientation
9. *kotekan* contour class (kCC): like CC, but restricted to a series of 8 consecutive tones (lasting a total of two beats) in the kotekan stratum

[2.8] In each CC the last member is set to 0, making the stressed tone a point of orientation. The first three members are integers measuring the scale-tone distance between each of the first three tones in the CC-group and the final one. Setting each final tone to 0 makes it possible to compare CCs in terms of their contour relationships, regardless of their stratum of origin or specific scale-tone content. Thus, a pair of identical CCs have CC-groups transpositionally equivalent, and CCs whose corresponding elements all sum to the same number are inversions. The length of a CC depends on the host stratum's distance in the cyclical hierarchy of densities from the *neliti*. *Neliti* CC last four beats. The *neliti* of an eight-beat melody has two CCs, but in the *calung* stratum, where there are only four tones, each lasting two beats, there is only one CC. Its members are two beats apart. Please refer to Figure 3.

Figure 3. Stratified metric stress, Contour Classes (CC) and *kotekan* contour classes (kCC) in an eight-beat melody. An upper-case X indicates the end of each CC, a point of metric and melodic stress in the stratum.

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    kotekan: xxxxxxxXxxxxxxxXxxxxxxxXxxxxxxxX = total of 4
kCCs
    neliti:     x   x   x   X   x   x   x   X = total of 2
CC(8)s
    pokok:          x       x       x       X = total of 1
CC(4)
    jegogan:                x               X = 1 Axis
relation
                                                      Gon
g
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3. First Analysis: *Pelayon* and *Wilet Mayura*

[3.1] To introduce the kinds of relationships that this cluster of concepts and terms is designed to explore, consider the eight beat *neliti* on the middle staff in Example 1. This well-known tune derives from an old court composition but is also commonly quoted by contemporary composers. As is appropriate for cyclic gamelan melodies, in all of the transcriptions rhythmic orientation is toward the end of the phrase, so that the strongest beat coincides with gong. I give Balinese scale-tone solfege names under each *neliti* tone, abbreviated to their constituent vowels, using capital letters for the lower octave and lower case for the upper one. In the analyses I retain the Balinese names, providing occasional reminders of their Western approximations. The five tones of the scale are indicated on the Western staff as follows:

C# for *ding/dIng*
D for *dong/dOng*
E for *deng/dEng*
G# for *dung/dUng*
A for *dang/dAng*

It is important to remember that going from E to G# or A to C# is step-wise motion in terms of the Balinese scale, even though it does not appear that way on the staff.

[3.2] In Example 1 the *neliti* tone coinciding with gong is *dIng* [C#], the lower of two *ding*s available on the instrument. The midpoint of the melody (*dAng* [A], 4th beat) receives the second-strongest stress and is reinforced by the *jegogan*, as is the final *dIng*. The axis of the melody is thus -1, as the midpoint tone is one scale step below the gong tone. The *neliti* contains two CC. The first, [3,2,1,0], ends at the midpoint, and the second, [0,-2,-1,0], continues to gong. The *pokok* stratum falls only on the even-numbered beats, adding moderate stress to the second and sixth tones of the *neliti* in addition to the final and mid-point ones. It has only one CC, [1,-1,-2,0]. The following five points can now be made:

[3.3] First, the *neliti* uses five pitches only, one of each scale tone. These are arranged symmetrically around the gong tone, two above and two below. Three of the scale tones are used once and only once (*dong*, *deng*, *dUng*) [D, E, G#] while the midpoint scale tone (*dAng*) appears twice and the gong tone (*dIng*) appears three times.

[3.4] Second, the tones in the *jegogan* stratum define a simple level of structural melodic movement: statement (*dIng*), downward displacement by one scale-tone (*dAng*), and return (*dIng*).

[3.5] Third, the two pairs of tones in the *calung* stratum are inversionally symmetrical with respect to one another, the first descending by two scale tones to the midpoint (*dong-dAng*; 1, -1) and the second ascending by two to the gong tone (*dUng-dIng*; -2,0). The stepwise moves linking the second note of each pair with the first of the next pair are similarly inverted.

[3.6] Fourth, the CC of the *neliti* are imperfect inversions of one another; that is, one would have to alter exactly one note in either half to make the symmetry exact. In this case the "maverick" note is the first in each group. One could, for example, change the first note of the first group (*deng*) to *dAng*, thereby changing the CC to [0,2,1,0] and perfecting the inversion. But doing so would undermine the symmetry mentioned in point 1 above and reduce the number of different scale tones used in the passage from five to four. One could also change the first note of the second group (*dAng*) to low *dEng*, but this would break the symmetry described in point 5 below.

[3.7] Last, parsing the eight tones according to recurrences of the scale tone *dIng* reveals a different kind of symmetrical organization. This segments the melody into three units, the first of three notes (*deng-dong-dIng*) [E, D, C#], the second of two notes (*dang-dIng*) [A, C#] and the last of three (*dUng-dAng-dIng*) [G#, A, C#]. Here the outer units are inversions of one another symmetrically arranged in time around the middle unit, and in pitch-space around their common tone, *dIng*. The 3+2+3 grouping is in conflict with the prevailing meter but its perception is strongly supported by the repetition of *dIng* at the end of each segment. Such stepwise motion in small irregular-length units around a repeating focal pitch produces a rhythmic phenomenon of syncopation or cross-rhythm that can be heard in contrast to the imperfect inversional symmetry described in point 4.

[3.8] Turning to the *kotekan*, I first need to point out that unlike the slower moving parts, which are more or less strictly determined by the *neliti*, *kotekan* may be composed in any of a number of styles (each of which has its own syntactic constraints). The style of the *kotekan* is an important aspect of the character of the composition as a whole. For the melody under discussion I offer two possible realizations, shown on the staves above the *neliti*.

[3.9] The upper one is taken from the conclusion of *Pelayon*, a metrically broad and lengthy court composition performed here in typically virtuoso style by musicians from Sanur village. This segment is heard at the climactic conclusion of the composition, at the peak of dynamics and tempo, after some twenty-five minutes of music. This closing, eight-beat melody is repeated many times, with a stroke of the large gong at every

rebeginning and a pattern of other gongs aligned with the melody through each repetition. The overall mood, as most any Balinese will attest, is one of turbulence and grandeur. The interlocking parts shown here, in a style closely associated with *gamelan* of the former courts, combine to create regular alternation between pairs of adjacent scale tones, which shift position to anticipate the arrival of every-other *neliti* tone. They follow the contour of the *pokok* exactly and are not articulated as an independent stratum, blending instead into the overall texture of the gamelan. Notice that the kCC (the eight constituents of each is bracketed above the staff) are all similarly shaped, differing only in transposition and the interval between the fourth and fifth tones of the pattern.

[3.10] The second *kotekan* is taken from *Wilet Mayura*, a 1982 composition for *kebyar* gamelan by Wayan Sinti and Nyoman Rembang, performed by the gamelan of Angantaka village. This segment uses an interlocking pattern in the style of the village bamboo *gamelan gandrung*, played here by eight metallophones. *Gandrung* music, now rarely heard on its original instruments, is occasionally adapted and transformed for the *kebyar*. Formerly the ensemble was used to accompany a recreational dance form, but musicians now think of it mostly as a source for unusually challenging drum patterns and interlocking parts. Nonetheless, such patterns retain the associative character of the *gandrung* dance, which was flirtatious and youthfully exuberant. The pattern shown here is more intricate than that of *Pelayon*, and not quite so firmly tied to the contour of the *neliti*, standing apart from it in a distinctive way. The combination of discontinuity, complexity and rhythmic independence shifts the locus of interest in the music so that it is shared between the lower parts and the interlocking parts (in a manner somewhat analogous to counterpoint). Each of its kCC is unique, a property which imparts a sense of variety and progression to the music even at the level of small subdivisions of the beat.

[Refer to Example 1 and Sound Files 1.1 (recorded March 1983 in Denpasar by Wayne Vitale. Used with permission.) and 1.2 (recorded April 1989 in Angantaka by the author). In Sound File 1.1 the transcribed *kotekan* is heard beginning at 0:24 and again at 0:52. In Sound File 1.2 it begins after six beats of a unison-textured melody.]

[3.11] Turning to the *qualities* of the various strata in Example 1, the *neliti* can be described as *ngubeng* at a high level in the *Pelayon* context because of its intense cyclicity. Reiterated, spiraling back to the tone *dIng* within the *neliti* makes it *ngubeng*, but in another way it is *majalan* because there is melodic change on all eight beats. The levels of *pokok* and *jegogan* are more *majalan* in character because they contain no pitch repetition at all.

[3.12] In *Pelayon* the music is fast, repeated many times, and each cycle is brief. The resonance of the gong is heard nearly continuously due to the temporal proximity of successive strokes, and this adds to the music's sense of throbbing immobility.[4] The repetitive character of the *kotekan* adds to this as well. In the *Wilet Mayura* context this is not the case, because the passage does not repeat. It can be thought of as linear and asymmetrical, a quality enhanced by the continually changing contour of the *kotekan*.

[3.13] Because of the stratified orchestral technique, the perceiver is encouraged to hear these structural characteristics simultaneously. Instead of thinking of the *pokok* and *jegogan* solely as providers of support for the *neliti* melody, they emerge to reveal dimensions of their own. Heard both in coordination and in opposition to them, the *neliti* demonstrates its own special features. In each case, the *kotekan* is correlated with the source gamelan style on which it is based, adding to the associative richness of the music.

4. Second Analysis: *Pengecet Lasem*

[4.1] Example 2 shows *Pengecet Lasem*, a 64-beat elaborated melody from the nineteenth century repertoire of courtly *legong* dances, along with a characteristic realization of its *kotekan*. *Pengecet Lasem* is particularly admired and canonical; most Balinese know it. It accompanies an abstract dance of young girls that is part of a larger, storied choreography said to have been revealed originally to a priest in meditation by divine angels. Its affect is a combination of numinous and refined with sensual and suggestively erotic. Example 2 shows a *neliti* part derived from this melody, along with the 32-tone *pokok* part, eight-tone *jegogan* part, and the axis. Sixteen-tone and four-tone levels of reduction, implied but not explicitly sounded in the texture, are also included.

[4.2] Unlike the short melody just discussed, the tight intertwining of *ngubeng* and *majalan* qualities loosens in extended cycles such as this. Like shifting planes, areas of stasis and motion come into focus more independently and show affinity for particular regions of the cycle. Gong punctuations and *jegogan* stresses exert "pull" or "gravity" on melodic motion, causing the music that leads up to them to be more *majalan* in character. The more important the arrival in relation to the overall meter, the more powerful the force exerted. Just after such arrivals the pull is weakest. The melody may then transform and become static, as if unable to budge from a single tone. As the next significant arrival approaches, motion gradually accelerates.

[Refer to Examples 2, 3 and 4 and Sound File 2 (performed by Gamelan Tirtha Sari and recorded September, 1982 in Peliatan by the author). In Sound File 2 the full melody is played twice; the first time without the *kotekan*.]

[4.3] In *Pengecet Lasem* we can identify strong *ngubeng* quality in the regions immediately following the gong (i.e., at the beginning) and the midpoint. In CC64s (1) and (2), the shape {1,2,1,0} is repeated note for note. This is mirrored after the midpoint at CC64s (9) through (11) with the inverted shape {-1,-2,-1,0}. Because the melody is Axis 1, this inversional symmetry is enhanced by its transposition up one scale step. CC64s (3,4) and (5,6) are paired, sustaining the sense of *ngubeng* while they repeat even as they double the length of the four-beat units in CC64s (1) and (2). CC64s (3,4) and (5,6) also provide a sense of increasing *majalan* quality by expanding the range of the tune, in the process touching on the low point *dEng* [E] and the apex *dang* [A], without, however, according metric stress to either. CC64s 7 and 8, reaching the midpoint, are through-composed and still more *majalan* than what led up to them. After the midpoint a sense of stasis returns, and the process of intensifying motion is replicated at CC64s 15 and 16 at the approach to gong. The last several *neliti* CCs explore the upper register with local focus on the tone *dung* [G#] at CC(64)13 and surrounding; this mirrors the low-register tessitura of CC64 (4) and (6) in a way characteristic of many similar melodies in the repertoire.[5]

[4.4] But that is only the surface; by listening at other levels new dimensions are exposed. Overall, the range of the *neliti*'s tones reaches more than an octave, from *dEng* to *dang*. A glance at the CC32 (*pokok*) level reveals that for all of the activity in the *neliti*, prior to the midpoint only three of the five tones in the scale are used, none of which is the midpoint tone itself. It is thus fresh when it arrives. The remaining two tones of the scale are filled in during the second half, but the initial three are retained, making the second half of the tune, at this level of structure, more *majalan* overall than the first.

[4.5] Though the *pokok* ends up using all five scale tones, the CC16 level omits *dang* altogether, and the CC8 and CC4 levels further omit *deng*. Each subsequent stratum, then, filters out more of the *neliti*'s pitch-saturated character. Each stratum also reveals different kinds of *ngubeng* and *majalan*. At the CC8 level *dIng* [C#] is prolonged without interruption all the way to the midpoint. In this context the move to *dung* [G#] in CC8(2) seems like a radical departure and the only appearance of any tone besides the gong tone *dIng* and midpoint tone *dong* [D]. In the CC4, strong contrast between the halves of the cycle is laid bare: the gong tone *dIng* is unchallenged until the midpoint, after which the pace

of tonal change doubles en route to gong. At the axis level, the structural background of the tune is revealed to rest on simple motion between *dIng*, the tone coinciding with gong, and dong, its scalar upper neighbor.

[4.6] The *kotekan* shown in the transcription is a relatively uncomplicated realization, one of many possibilities to be sure, but a commonly used one considered by Balinese to have a stateliness appropriate to the refined character of the melody and the dance it accompanies. Three preliminary points about its structure must be explained before the analysis:

[4.7] First, the basic unit of the *kotekan* is two beats long (see the first two beats of Example 3 and Example 4A). This repeating contour of two beats' duration emerges from the combination of the two interlocking parts and continues unchanged until the music requires a transpositional shift. In order to move, the *kotekan* substitutes one two-beat unit of a different contour--that shown in Example 4B--and then returns to either the original contour or a closely related variant at the new pitch level.

[4.8] Next, the *kotekan* is aligned with the CC16 stratum. The final (stressed) tone of each kCC is the same as the prevailing CC16 tone. Pattern 4B, applied two beats before any changes in CC16, is situated so that its final tone coincides with the change. Because pattern 4A is aligned with stasis I label it *ngubeng*; pattern 4B, because it precedes CC16 movement, is *majalan*.

[4.9] Finally, the simultaneous dyads generated by the alignment of the interlocking parts at positions 1, 4, and 7 in the kCC create interesting syncopated cross-rhythms. Melodically, however, the upper tones are less structurally germane, for several reasons. In the *kempyung* interval (*pelog* fifth) thus formed, the lower tone has acoustic dominance. And although in exceptional cases the upper note of a dyad may be structural, when singing the composite patterns (for teaching, etc.) Balinese opt for the lower rather than the upper tone. The latter are thus are not accorded a role in the melodic analysis, which is why I have placed them in parentheses in Example 4.

[4.10] To analyze the *kotekan* I proceed from the fact that each pattern is restricted to the narrow range of three tones. Special properties emerge if we imagine the three tones projected into three-dimensional space, as if lying 120 degrees apart around the surface of a cylinder. Facing the cylinder, "up" or "down" movement as on a scale is illusory. One step "higher" than the highest of the three tones "wraps around" to become the lowest tone again; and in the other direction, one step "lower" than the lowest tone is the highest tone.

[4.11] This is a mod 3 field. To see the symmetrical relationships between the two halves of the kCC we add corresponding elements and take the results mod 3. For the *ngubeng* pattern in 4A summing corresponding digits gives the result [-1 2-1-1]; the sums taken mod 3 are [2 2 2 2]. Since the numbers are all the same, the two halves of the pattern are inversions in the wrap-around system of mod 3 pitch-space. Summing corresponding members of the halves of the *majalan* kCC in Example 4B gives a markedly contrasting result: no sum is the same as the one that preceded it, meaning that there is full asymmetry of motion.

[4.12] The narrow three-tone range of the *kotekan* enhances our ability to perceive it as a phenomenon on the threshold between rhythm and melody. The restricted pitch choice emphasizes the percussive tone color of the notes rather than their function as members of the scale. The cross rhythms formed by the dyads further accentuate this. On the other hand, as the analysis shows, the contrasts between symmetry and asymmetry in *kotekan* compositional structure are consistent with similar processes in the lower strata. In fact, from a melodic standpoint the *kotekan* is more rigorously composed than they are.

5. Conclusion

[5.1] The foregoing analyses stress the rewards of perceiving Balinese *gamelan* multidimensionally in accordance with its special structural properties. I have tried to emphasize that there is no single good way to hear a Balinese tune, but that one can seek out and experience different structural tensions flowing together in the various layers of melody. This fertile intermingling of structural qualities can be heard both for structure alone and also with an ear towards the extra-musical connections it suggests. For as I proposed at the outset, the interplay between symmetry and asymmetry is symbolic of a historical process of blending old and new technologies, court and village traditions, cyclic and linear approaches to time, and so on. Rather than being an end in itself, this sort of analysis can provide insight into the society and culture that collectively developed and implemented that structure. Both ways of listening, the aesthetic and the contextual, are well worth cultivating.

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