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## Techno hits basic beat

Musical analysis unveils a hierarchy of sophistication.  
7 January 2004

PHILIP BALL



Gamelan music is sophisticated but not as good for dancing as techno beats.

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A form of music known as Javanese Gamelan has won one of the top prizes for rhythmic complexity, according to a novel kind of musical analysis<sup>1</sup>.

Heather Jennings of the Federal University of Alagoas in Brazil and her colleagues conclude that Gamelan - an Indonesian style of music featuring gongs, drums, wind and string instruments - is as sophisticated as Western classical music in terms of its variations in volume. And both of these styles tower in complexity over modern techno tracks and Forró, a form of traditional dance music from Brazil.

Jazz, rock and roll and Brazilian pop music lie between the two extremes, the researchers say. They are "complex enough to listen to, but periodic and rhythmic enough to dance to", they write.

But music snobs shouldn't think that complex music is necessarily better than simpler varieties. Both techno and Forró have a strong, regular rhythm that is perfect for dancing, the paper points out.

Measuring the rhythmicity of music might seem a simple matter, but in fact it's surprisingly tricky.

Acoustic scientists studying complex sounds typically measure their 'power spectra': a measure of the patterns with which volume changes over time. For music with a thumping, regular rhythm, for example, the loudness power spectrum would have a peak corresponding to the main beat.

But power spectra are rather crude measures, Jennings and colleagues say, and can hide some of the complexities of different musical forms. For one thing, a power spectrum might not distinguish a series of sequential changes in rhythm from several overlapping rhythms.

To get around this, the researchers fed four-minute stretches of music into a more sophisticated technique, called detrended fluctuation analysis (DFA).

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This has been used in the past to study complicated signals in economic, genetic and heartbeat data.

The method produces a number, denoted alpha that quantifies the complexity of patterns in a signal - in this case, the volume of music. A low alpha (less than 1) indicates relatively non-complex music, whereas more complex musical signals have a value of alpha closer to 1. Music with alpha larger than 1 will tend to have long patches of loud and quiet, and will tend to be quite boring, says coworker Plamen Ivanov of Boston University in Massachusetts. But for alpha=1, the sound will probably be judged more interesting and pleasant, he says.

Gamelan has average values of alpha closest to 1, as does what the researchers characterize as 'new age music'. The averages for Western classical and Hindustani music are slightly higher.

Curiously, jazz and rock and roll have virtually identical average alpha values of about 0.9, challenging the notion that the latter is in some ways a debased, simplified version of the former. But then, in music, rhythm isn't everything.

#### References

1. Jennings, H. D., Ivanov, P. Ch., Martins, A. M., da Silva, P. C. & Viswanathan, G. M. Variance fluctuations in nonstationary time series: a comparative study of music genres. Preprint, <http://xxx.lanl.gov/abs/cond-mat/0312380> (2003). **[Article]**

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