



GRAY MATTER JOAN SERRÀ AND JOSEP LLUÍS ARCOS

# The Computer as Music Critic

THANKS to advances in computing power, we can analyze music in radically new and different ways. Computers are still far from grasping some of the deep and often unexpected nuances that release our most intimate emotions. However, by processing vast amounts of raw data and performing unprecedented large-scale analyses beyond the reach of teams of human experts, they can provide valuable insight into some of the most basic aspects of musical discourse, including the evolution of popular music over the years. Has there been an evolution? Can we measure it? And if so, what do we observe?

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In a recent article published in the journal *Scientific Reports*, we and our co-authors used computers to analyze 464,411 Western popular music recordings released between 1955 and 2010, including pop, rock, hip-hop, folk and

For each slice, our computers represented basic musical information with a series of numbers. For pitch, we computed the relative intensity of the notes present in every beat slice, thus accounting for the basic harmony, melody and chords. For timbre, what some call the “color” of a note, we measured the general waveform characteristics of each slice, thus accounting for the basic sonority of a given beat and the combinations of instruments and effects. And for loudness, we calculated the energy of each slice, accounting for sound volume or perceived intensity.

We then constructed a music “vocabulary”: we assigned code words to slice-based numbers to generate a “text” that could represent the popular musical discourse of a given year or age. Doing so allowed us to discover static patterns by counting how many different code words appeared in a given year, how often they were used and which were the most common successions of code words at a given point in time.

Interestingly, in creating a musical “vocabulary,” we found a well-known phenomenon common in written texts and many other domains: Zipf’s law, which predicts that the most frequent word in a text will appear twice as often as the next most frequent word, three times as often as the third most frequent, and so on. The same thing, we found, goes for music.

If we suppose that the most common note combination is used 100 times, the second most common combination will be used 50 times and the third 33 times. Importantly, we found that Zipf’s law held for each year’s vocabulary, from 1955 to 2010, with almost exactly the same “usage ordering” of code words

every year. That suggests a general, static rule, one shared with linguistic texts and many other natural and artificial phenomena.

Beyond these static patterns, we also found three significant trends over time. Again using pitch code words, we counted the different transitions between note combinations and found that this number decreased over the decades. Our analysis also indicated that pop music’s variety of timbre has been decreasing since the 1960s, meaning that artists and composers tend to stick to the same sound qualities — in other words, instruments playing the same notes sound more similar than they once did. Finally, we found that recording levels had consistently increased since 1955, confirming a so-called race toward louder music.

Did your parents tell you that today’s music is getting poorer and too loud? Well, maybe they were right. But we will offer a different hypothesis: what if it is all about economy of resources? If today’s music still satisfies listeners the same way pop music did 50 years before, then maybe its creators are simply better at crafting pleasing songs.

If music is a form of information and musicians are using fewer “words” to convey their message, maybe they’re getting more efficient.

Far from being in decline, perhaps pop music is on the verge of a golden age. Critics may disagree, and the qualitative debate may never be resolved. But the data, gleaned from massive music collections and computers, objective and detailed as they are, might just say otherwise.

## What technology can tell us about the evolution of pop.

funk. We first looked for static patterns characterizing the generic use of primary musical elements like pitch, timbre and loudness. We then measured a number of general trends for these elements over the years.

Common practice in the growing field of music information processing starts by cutting an audio signal into short slices — in our case the musical beat, which is the most relevant and recognizable temporal unit in music (the beat roughly corresponds to the periodic, sometimes unconscious foot-tapping of music listeners).

THE PUBLIC EDITOR MARGARET SULLIVAN

# He Said, She Said, and the Truth

IN journalism, as in life, balance sounds like an unassailably good thing.

But while balance may be necessary to mediating a dispute between teenage siblings, a different kind of balance — some call it “false equivalency” — has come under increasing fire. The firing squad is the public: readers and viewers who rely on accurate news reporting to make them informed citizens.

Simply put, false balance is the journalistic practice of giving equal weight to both sides of a story, regardless of an established truth on one side. And many people are fed up with it. They don’t want to hear lies or half-truths given credence on one side, and shot down on the other. They want some real answers.

“Recently, there’s been pressure to be more aggressive on fact-checking and truth-squading,” said Richard Stevenson, *The Times*’s political editor. “It’s one of the most positive trends in journalism that I can remember.”

It’s all a part of a movement — brought about, in part, by a more demanding public, fueled by media critics, bloggers and denizens of the social media world — to present the truth, not just conflicting arguments leading to confusion.

You’re entitled to your own opinion but not to your own facts, goes the line from Daniel Patrick Moynihan, made current again on the PressThink blog by Jay Rosen of New York University, a media critic who has pressed the fact-checking argument.

The trick, of course, is to determine those facts, to identify the established truth. Editors and reporters say that is not always such an easy call. And sometimes readers who demand “just the facts” are really demanding their version of the facts.

“There’s a temptation to say there are objective facts and there are opinions, and we should only use objective facts,” said David Leonhardt, the Washington bureau chief. “But there’s a big spectrum. We have to make analytical judgments about the veracity of all

kinds of things.”

What’s more, reporters and editors often have to make these calls on tight deadlines, as they did just after Paul Ryan’s speech at the Republican National Convention last month. That speech carried some assertions that have been shown to be misleading, and other speeches at both political conventions have become flash points for the fact-checking and false-balance discussion.

Particularly in this intensely political season, readers and media critics are calling for journalists to take more responsibility for what is true and what is not. What’s more, readers want it done immediately, not days later in follow-up articles.

“I take their point, but we have to be cautious, especially on deadline,” Mr. Leonhardt said.

Readers are quick to cite examples. Several who wrote to me thought there was an element of false balance in a recent front-page article in *The Times* on the legal battles over allegations of voter fraud and vote suppression — hot topics that may affect the presidential race.

In his article, which led last Monday’s paper, the national reporter Ethan Bronner made every effort to provide balance. Some readers say the piece, in so doing, wrongly suggested that there was enough voter fraud to justify strict voter identification requirements — rules that some Democrats believe amount to vote suppression. Ben Somberg of the Center for Progressive Reform said *The Times* itself had established in multiple stories that there was little evidence of voter fraud.

“I hope it’s not *The Times*’s policy to move this matter back into the ‘he said she said’ realm,” he wrote.

The national editor, Sam Sifton, rejected the argument. “There’s a lot of reasonable disagreement on both sides,” he said. One side says there’s not significant voter fraud; the other side says there’s not significant voter suppression.

“It’s not our job to litigate it in the paper,” Mr. Sifton said. “We need to state what each side says.”

Mr. Bronner agreed. “Both sides have become very angry and very suspicious about the other,” he said. “The purpose of this story was to step back and look

at both sides, to lay it out.” While he agreed that there was “no known evidence of in-person voter fraud,” and that could have been included in this story, “I don’t think that’s the core issue here.”

On other subjects, *The Times* has made clear progress in avoiding false balance.

The issue has come up frequently with science-related stories, particularly those involving climate change. *The Times* has moved toward regularly writing, in its own voice, that mounting evidence indicates humans are indeed causing climate change, but it does not dismiss the skeptics altogether.

Similarly, false balance became a topic a few years ago during the dispute over the teaching of “intelligent design” versus evolution. *The Times* responded by inserting language like this: “There is no credible scientific challenge to the theory of evolution as an explanation for the complexity and diversity of life on earth. Courts have repeatedly ruled that creationism and intelligent design are religious doctrines, not scientific theories.”

The associate managing editor for standards, Philip B. Corbett, puts it this way: “I think editors and reporters are more willing now than in the past to drill down into claims and assertions, in politics and other areas, and really try to help readers sort out conflicting claims.”

*The Times* does not have written guidelines for reporters on false balance. “How could you, since every situation is different?” Mr. Corbett said.

It ought to go without saying, but I’m going to say it anyway: Journalists need to make every effort to get beyond the spin and help readers know what to believe, to help them make their way through complicated and contentious subjects.

The more news organizations can state established truths and stand by them, the better off the readership — and the democracy — will be.

I invite you to follow me at [Twitter.com/Sullivan](http://Twitter.com/Sullivan) and to read my blog at [publiceditor.blogs.nytimes.com](http://publiceditor.blogs.nytimes.com).

ROSS DOUTHAT

# It’s Not About The Video

THE greatest mistake to be made right now, with our embassies under assault and crowds chanting anti-American slogans across North Africa and the Middle East, is to believe that what’s happening is a completely genuine popular backlash against a blasphemous anti-Islamic video made right here in the U.S.A.

There is a cringing way to make this mistake, embodied by the apologetic press release that issued from the American embassy in Cairo on Tuesday as the protests outside gathered steam, by the Obama White House’s decision to lean on YouTube to take the offending video down, and by the various voices (including, heaven help us, a tenured Ivy League professor) suggesting that the video’s promoters be arrested for abusing their First Amendment liberties.

But there’s also a condescending way to make the same error, which is to stand up boldly for free speech while treating the mob violence as an expression of foaming-at-the-mouth unreason, with no more connection to practical politics than a buffalo stampede or a summer storm.

There is certainly unreason at work in the streets of Cairo and Benghazi, but something much more calculated is happening as well. The mobs don’t exist because of an offensive movie, and an American ambassador isn’t dead because what appears to be a group of Cop-

*The unrest in the Islamic world is more about power politics than blasphemy.*

tic Christians in California decided to use their meager talents to disparage the Prophet Muhammad.

What we are witnessing, instead, is mostly an exercise in old-fashioned power politics, with a stone-dumb video as a pretext for violence that would have been unleashed on some other excuse.

This has happened many times before, and Westerners should be used to it by now. Anyone in need of a refresher course should consult Salman Rushdie’s memoir, due out this week and excerpted in the latest *New Yorker*, which offers a harrowing account of what it felt like to live under an ayatollah’s death threat, and watch as other people suffered at the hands of mobs chanting for his head.

What Rushdie understands, and what we should understand as well, is that the crucial issue wasn’t actually how the novelist had treated Islam’s prophet in the pages of “*The Satanic Verses*.” The real issue, instead, was the desire of Iran’s leaders to keep the flame of their revolution burning after the debacle of the Iran-Iraq War, the desire of Pakistan’s Islamists to test the religious bona fides of their country’s prime minister, and the desire of religious extremists in Britain to cast themselves as spokesmen for the Muslim community as a whole. (In this, some of them succeeded: Rushdie dryly notes that an activist who declared of the novelist that “death, perhaps, is a bit too easy for him” would eventually be knighted “at the recommendation of the Blair government for his services to community relations.”)

Today’s wave of violence, likewise, owes much more to a bloody-minded realpolitik than to the madness of crowds. As *The Washington Post*’s David Ignatius was among the first to point out, both the Egyptian and Libyan assaults look like premeditated challenges to those countries’ ruling parties by more extreme Islamist factions: Salafist parties in Egypt and pro-Qaeda groups in Libya. (The fact that both attacks were timed to the anniversary of the 9/11 attacks should have been the first clue that this was something other than a spontaneous reaction to an offensive video.)

The choice of American targets wasn’t incidental, obviously. The embassy and consulate attacks were “about us” in the sense that anti-Americanism remains a potent rallying point for popular discontent in the Islamic world. But they weren’t about America’s tolerance for offensive, antireligious speech. Once again, that was the pretext, but not the actual cause.

Just as it was largely pointless, then, for the politicians of 1989 to behave as if an apology from Rushdie himself might make the protests subside (“It’s felt,” he recalls his handlers telling him, “that you should do something to lower the temperature”), it’s similarly pointless to behave as if a more restrictive YouTube policy or a more timely phone call from the chairman of the Joint Chiefs of Staff to the anti-Islam film’s promoters might have saved us from an autumn of unrest.

What we’re watching unfold in the post-Arab Spring Mideast is the kind of struggle for power that frequently takes place in a revolution’s wake: between secular and fundamentalist forces in Benghazi, between the Muslim Brotherhood and its more-Islamist-than-thou rivals in Cairo, with similar forces contending for mastery from Tunisia to Yemen to the Muslim diaspora in Europe.

Navigating this landscape will require less naïveté than the Obama White House has displayed to date, and more finesse than a potential Romney administration seems to promise. But at the very least, it requires an accurate understanding of the crisis’s roots, and a recognition that policing speech won’t make our problems go away.