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The Poetics of $E=MC^2$

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Though I personally admire the rolling meter of "S equals R Theta" and am even perversely attracted to the stolid but dogged determination of "D equals one-half A T Squared," I concede that no other mathematical formula enjoys such eloquent poetic features as Einstein's famous "E equals M C Squared." An equation that describes the paradoxical equivalency of matter and energy, $E=MC^2$ spawned other paradoxes, including one between the apparent simplicity of the formula and the fact that it was incomprehensible to most people. Furthermore, the poetics of $E=MC^2$ render in sound the paradoxical equivalency that the equation describes mathematically.

$E=MC^2$ brims with assonance (repeated vowel sounds, in this case repeated *E*-sounds) and alliteration (repeated consonant sounds, in this case repeated *S*-sounds). In general we can associate the higher-pitched vowel sounds with energy, both because of their comparative weightlessness and because in every syllable they are required to animate the consonants, just as energy invigorates mass. A consonant string is unpronounceable without a vowel; mass is inert without energy. Moreover, vowel sounds are made in the higher regions of the throat, while consonant sounds come from farther down within the body, often from the stomach. Consonants are thus more visceral, more weighty, more mass-like. The interplay between vowels and consonants forms the basis of the aural paradox contained within the formula.

The equation's rhythmic pattern also contributes to the overall effect. Metrically, the formula splits between *E Equals* and *M C Squared*. Both halves contain three syllables. In the first half the sequential assonant *E*-sounds are stressed. Appropriate to the weightless energy it describes, the symbol *E* is voiced with a pure vowel sound; it contains no mass-like consonants and is made in the upper part of the throat. It has a comparatively high pitch.

However, the next syllable, *quals*, lowers the pitch, creates a guttural sound not shared by any other syllable, and is voiced in the middle of the throat. By

dropping the stress and lowering the pitch, the unstressed, consonant-dominated *quals* syllable provides a brief moment of relaxation before the speaker moves to the other side of the equation. The sliding guttural action suggests transition, as the speaker becomes aware of the sound passing through the throat. Appropriately, the only "relaxed" moment in the expression appears in this "unstressed" syllable associated with equivalence. It suggests the balance and harmony implicit within the equality: the transition between matter and energy literally exists as a state of rest when we state the formula aloud.

The right side of the equation consists of three stressed syllables: *M C Squared*. *M* begins with an *E*-sound (ie.: *EM*.) Thus it raises the pitch and returns us to the *E*-sound that dominated the left side, thereby creating an aural equivalence between energy (*E*) and matter (*EM*), as both symbols make the *E* vowel sound. But the *M*-sound that concludes *EM* weighs down the syllable with a lower-pitched consonant, endowing the symbol for mass with the properties of mass as well as those energy. In this way the equation's spoken poetics reflect its mathematical and physical "content," or meaning, by expressing in sound the equivalency that the formula states.

If the high *E*-sound in *EM* assigns to mass the weightlessness of energy, then the low and heavily stressed *S*-sound repeated in *C Squared* assigns the density of matter to light (*C*), a form of energy. At the end of the equation the pitch drops from *CEE*, which begins low but moves up to a higher *E*-sound, to *Squared*, which starts low and stays low. The *S*-sound alliteration between these highly stressed, low-pitched final syllables unites them. Moreover, the *R* and *D* sounds that conclude *Squared* firmly set the right side of the equation in the ponderous realm of mass. *C Squared* thus anchors the formula's right side in the physical and the visceral, since the sounds literally are voiced from deep within the body.

However, just as the *E* and *M* sounds in *EM* endow the symbol for mass with characteristics of both mat-

ter and energy, the *S* and *E* sounds in *CEE* give the symbol for light the weightlessness of waves and the density of particles. In this respect *M* and *C* contain within themselves the complementarity of matter and energy that Niels Bohr later described.

In conclusion, stating "E Equals M C Squared" enables the speaker to experience the equivalency described by the equation: matter is energy and energy is matter, and simultaneously energy is energy and matter is matter. By assigning to the symbol for mass an assonant *E*-sound, the "poem" endows properties of energy to the concept of mass. Conversely, by assigning the more weighty *S*, *R*, and *D*-sounds to light, the poem gives to energy the characteristics of mass. In this way apparent opposites are shown to be equivalent when we speak the sounds that describe them

matter is energy, and energy is matter. At the same time opposite sounds literally divide the equation into two distinct halves: a left, vowel-dominated side that sounds like weightless energy, and a right side firmly anchored by consonants in a physical presence. The assonance in the first half and the alliteration in the second suggest that energy is energy, and matter is matter.

From a poetic standpoint, if not a mathematical one, we are fortunate that Einstein presented the equation as he did, instead of as he might have: "E Equals C Squared M," "M Equals E Divided by C Squared," or, my favorite, "C Equals the Square Root of E Divided by M." Without the rhythm, assonance and alliteration of "E Equals M C Squared" the formula might never have captured the popular imagination as it has.

I LOVE TO ADD

I love to add
It makes me glad
It's easy and fun
To add one plus one

And when I'm blue
There's two plus two
It fills me with glee
To put three with three

It's never a bore
To combine four plus four
It's a slam cool jive
When five's with five

It's like a magic trick
To add six and six
I go to heaven
Each time seven's with seven

I just can't wait
To add eight plus eight
It feels so fine
To add nine plus nine

You and me is us
A plus!
So whenever I'm sad
I sit down and add

Kyle Cotler

MATH RULES

Middle school is really cool.
And math class gives us the tools
To face the world unafraid,
Because we can make the grade.
We can now multiply, divide, add, and do subtraction.
With integers, metrics, decimals, and fractions.

We can tackle word problems and
come out on top,
As our skills progress our confidence doesn't drop.

And now with algebra on our class agenda,
We have exponents and order of operations to remember.

To solve for *X* requires some introspective,
As all my classmates turn into detectives.
If we keep the balance in each equation,
We celebrate the auspicious occasion.

Ms. Schaeffer is very patient and always kind,
She keeps us alert as we sharpen our minds.

So when all is said and done,
I think math is very fun.

Blake Mayer