

Byron's Entropy: The Chaos of Hard Clay

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Abstract

The publications of Byron's *Childe Harold's Pilgrimage* and *Darkness* are bookended by two fundamental hypotheses: Amedeo Avogadro's reconciliation of atoms and molecules in 1811 and Georges Cuvier's proposition of *catastrophe theory* in 1825. Albeit describing phenomena at nearly opposite scales, these breakthroughs sought to explain the dynamics of the universe from atom to animal. They paved the way for modern statistical mechanics, culminating in Boltzmann's tantalizing equation

$$S = k_B \ln \Omega$$

relating *entropy*, S , to the number of *microstates*, W , through a constant, k_B , related to Avogadro's number (Greven, Keller, & Wernecke, 2003). Byron's thought displays a strikingly bidirectional correspondence with these precursors of modern thermodynamics. Through Harold, Byron composes a philosophical discourse on the geopolitical intermittency of human existence which aligns with both the scientific discoveries in the years surrounding *Pilgrimage's* publication as well as the intellectual trajectory extending into the next half-century. Motifs such as interruption and displacement offer a commentary on the burgeoning philosophies underlying statistical physics beginning with Avogadro. In *Darkness*, Byron expounds on his "dream", an apocalyptic vision where the materiality of his "Universe" is foregrounded, culminating in the "lump of hard clay" (Byron, 1921). One can draw obvious parallels to Cuvier's catastrophism, but there is a stronger connection to the generalized entropic concept. This connection prefigures the dominance of statistical mechanics in scientific progress up to the present day. Byron must be read as a poetic thinker whose work is intertwined with the scientific endeavor, a productive bridge between physics and poetics across temporal and spatial scales.

Preface

“Between each time interval there is still room for infinite time-points; therefore one could imagine a whole corporeal world, all furnished from one point, but in such a way that we bodies dissolve into interrupted timelines.”

–Nietzsche, *Time-Atom Theory*

As a scientist, I conduct experiments, and this work is no different. My hypothesis is that Byron's works are also experiments; they are theories on the innerworkings and interactions of Nature and Man. To test this hypothesis, I present three sections with individual themes. In combination, a broader theme and structure emerges: meaning through materialism, formal production through interacting particles.

The first section is a scientific-poetic discussion of Byron's 1816 poem *Darkness*. The poem illustrates that Byron is a theorist, developing thought experiments using poetry as a tool— as mathematics is a tool for physical theories. The second section develops scientific vocabulary to support connections between statistical mechanics and *Childe Harold's Pilgrimage*. The third section explores these connections with ties to the text. The conclusion discusses the experiment and highlights the outlook on this method of analysis-through-construction.

Equilibrium and Darkness

“We cannot think anything that is not sensation and representation. Therefore there is no pure existence of time, space, world without that which senses and represents. I cannot represent non-being. That which *is*, is sensation and representation.”

–Nietzsche, *Time-Atom Theory*

Darkness was published after the so-called “Year Without a Summer”, the result of the ash cloud produced by the eruption of Mount Tambora, an Indonesian volcano. An ash cloud is a macroscopic phenomenon stemming from the addition of many independent particles, combining to form a stratospheric blanket that scatters sunlight. The environment of the poet and of the scientist cloaked by dust. Byron begins the poem by proclaiming: “I had a dream, which was not all a dream.”

What is a dream? What is a theory? What is a poem? Ludwig Boltzmann laments the inherent difficulties of theory-creation, or perhaps the difficulties of subjectivity itself when he writes, “And how awkward is the human mind in divining the nature of things, when forsaken by the analogy of what we see and touch directly?” (Boltzmann, 1895).

The poem-theory is such a divination: a thought experiment. Amedeo Avogadro's mind wonders over the same mysteries as Boltzmann's and as Byron's— how do natural substances combine, how do they interact, and how do they relate to their environment? Avogadro's product is a “theory of gases”: singular atoms combining to form molecules in integer ratios, countable clumps of singular, perfect pieces of matter— particles of ash. Do these particles— an unfathomable material mechanism, an infinite clockwork— have any intrinsic connection to each other, and if so, how? What causes a cloud? What does a cloud's cover cause?

Nature's energy source, the Sun, is extinguished. Byron's experimental result:

The world was void,
 The populous and the powerful was a lump,
 Seasonless, herbless, treeless, manless, lifeless—
 A lump of death—a chaos of hard clay.

The world is a single macrostate of perfect stillness. Every particle is reduced to clay, an infinity of homogenous particles pressed into a single larger one— perhaps the solid form of ash— Greek *khaos*. There are no inputs, no outputs, no life and no thing: a Hellish equilibrium. The trajectory of the system through the course of the “dream” forms a causal chain, a food chain.

Not a Wordsworthian, blissful Nature of Joy this, but a Nature of consumption. Bestial bodies replace energy quanta— they become inputs, sustenance. Hunger is a “famine” which feeds “upon all entrails— men / Died, and their bones were tombless as their flesh”.

Corporeality is opened and inverted as entrails, the consuming organs, are themselves exposed for consumption. Barriers open and all is mixed by a lack of tombs, of formal rites, of Light. The “birds and beasts and famish’d men” become one unorganized, anti-hierarchical system: a “crowd” of desperation. As the directionality of energy dissipation through all Earthly systems unravels, intellect, too, is consumed and becomes a single entity: “All earth was but one thought—and that was death”. The poem concludes:

The winds were wither’d in the stagnant air,
 And the clouds perish’d; Darkness had no need
 Of aid from them—She was the Universe.

The hypothesis: life can only exist out of balance, far out of equilibrium. Man’s place in nature, or his place outside of it, is left to the poet, the scientist— the theorist. Heaven, hell, man, good, evil, politics, and particles are systems of the single life-system, lit and heated by the out-of-balance, just as the poem is a system of lines and language lit and heated by the minds of readers.

The scientist Boscovich devised a demon that knows the position and velocity of every particle in the universe. What else, then, does this demon know? There is no truly external agent within Byron’s experiment, but there may be a demon. Byron subverts Romantic introversion; poet-cum-demon interacts. He turns off the light.

Physics and Language

“The essence of sensation would consist in gradually sensing and measuring such time figures ever more finely; representation constructs them as a coexistence and explains the progress of the world according to this coexistence: purely the transference into another language, into that of becoming.” —Nietzsche, *Time-Atom Theory*

What are systems in relation to particles? Typically, abstraction circumvents problems with single-particle dealings. Particles are grouped, and their properties become collective. A large system of interacting particles has a myriad of possible states, each with

different energies and probabilities. Systems in equilibrium when they have the same collective properties. Systems fluctuate around equilibria in random, but not necessarily chaotic, ways.

Imagine a box full of gaseous particles. Assume that these particles are finite and interact through collisions with each other and with the boundaries of their container. It is the interaction with the boundary that gives rise to pressure, and the energy of the particle collisions *en masse* which gives rise to temperature. Like entropy, these properties are measures of interaction in time.

Entropy is the surprise one would have at observing a system in a certain state— how much information the observer would gain by learning its formation. Boltzmann's equation is the amount of entropy, or surprisal, S , as a function of the number of possible states, Ω :

$$S \propto \ln \Omega$$

What happens when we have observed all Ω ? Boltzmann writes:

“[My theorem] requires that only that in the course of time the universe must tend to a state where the average vis viva of every atom is the same and all energy is dissipated, and that is indeed the case. But if we ask why this state is not yet reached, we again come to a ‘Salisburian mystery.’” (Boltzmann, 1895)

What, then, is the probability of our existence? Boltzmann calls back:

“Assuming the universe great enough, the probability that such a small part of it as our world should be in its present state, is no longer small.” (Boltzmann, 1895)

The statistical thermodynamicist is an abstractor, a poet of equilibrium systems. Particles, “free particles”, are recognized and blurred together, linking arms to become lumps of matter with generalized properties. However, in most of the physical processes we come into contact with (discharging batteries, toasting bread, braking your car), systems are pushed out of, closer to, and farther from equilibria by external interaction— particles are less than free. Is this a model for life? Contemporary physicist Jeremy England writes:

“...it has long been considered challenging to speak in universal terms about the statistical physics of living systems because they invariably operate very far from thermodynamic equilibrium, and therefore need not obey a simple Boltzmann probability distribution over microscopic arrangements.” (England, 2013)

The statistical mechanician deals with the infinite possibilities of large, complex systems and their interaction with environments in order to understand how nature functions outside of equilibria. To ponder the current state of a system and its variegated inhabitants is to ponder the materialism of all things— of life.

Entropy and *Childe Harold's Pilgrimage*

"1) An effect of a sequence of time-moments is impossible: for two such time-moments would coincide. Thus every effect is *actio in distans*, i.e. through jumping.

2) How an effect of this kind in distans is possible we do not know at all."

—Nietzsche, *Time-Atom Theory*

From a scientific point of view, *Childe Harold's Pilgrimage* is the journey of a statistical mechanician collecting data from within a non-equilibrium system. It is a system of disparate elements which exhibit what Nietzsche calls "jumping" (Nietzsche, 1873). The work illustrates thematic and structural emergence— itself the theme and structure. With formal production through interacting particle systems, meaning is borne from materialism.

Harold departs from "His house, his home, his heritage, his lands"; a free particle, he is an intellectual spectre that Byron wields to highlight the "Havoc" of a material universe. The hero is not simply a misanthrope; he is consumed by, or perhaps the ultimate abstraction of, the interactions of the universe, diegetic and non-. Harold's purpose (or lack thereof) is his inability to "drink from Lethe's stream", to dream within his dream-journey, for "rapture is a dream" (LXXXII). That is, he is isolated by an overwhelming mindfulness.

In the same manner that the oracle Dodona activates the oak branches to sound bronze wind chimes, which Byron suggests that we cannot survive, these unforeseeable motions are cause and effect collapsed— impetus emerging from divine vibration. The oracular image relates occurrences that are simultaneously reduced to oscillating particles of bronze and expanded through the trajectories of the poet. The outcomes of microscopic interactions, the "marble or the oak", give rise to the histories of "nations, tongues, and worlds".

There are multitudes: "Slaves, eunuchs, soldiers, guests, and santons", "The Turk, the Greek, the Albanian, and the Moor..." all "mingled in their many-hued array" while "Flocks play, trees wave, streams flow" (II.LI,LVI-II). Byron's "accursed Time", to which even "the Queen who conquers all must yield", is the "Folly" of freedom: a singular commonality in the face of disparate elements dissipating towards equilibrium.

The agents of war and revelry alike are produced from land "which gave them nought but life". They fight individually; they are a "nerveless state" moving towards the certain freedom— the "Grave triumph"— of death. The reader consumes interruptions, displacements, Wars, and feasts piecemeal. Meaning emerges from the structured system of images that constitute the poetic universe— and, like that of Spain, how "strange her fate" (LXXXVI).

Byron demonstrates the sameness of poetics and physics— the connection between "battle and song", the "awful lore" which "sages venerate and bards adore". The abstraction and operation of the poet from a overwhelming collection of images, experiences, climes, and geographies shares a physicist's viewpoint. Pilgrims throng but Harold does not "mingle" or view them with "misanthropic hate"— he can merely struggle "against the demon's sway" (LXXXIV).

Results and Discussion

"We can only speak of time-points, no longer of time. The time-point has an effect on another time-point, thus dynamic characteristics to be assumed."

–Nietzsche, *Time-Atom Theory*

Byron proves to be a link between poetics and physics, and *Childe Harold's Pilgrimage* serves as a model for scientific-poetic theory production. The poem is a case study in exploring existence within the universal material system that is “dreamed” in the poem *Darkness*. We recognize that the act of poetic composition reflects the endeavor of the mechanician, and vice versa.

I hope to have provided a brief glimpse into the interaction of language that occurs when thinking simultaneously in terms of physics and poetics. *Darkness* is an entry point into reading Byron as a scientific thinker, as it provides an overt theoretical implication of the universe as a non-equilibrium material system. Byron's work, in general, is a signpost for an intellectual swerve, and his genius lies in an ability to produce poetry that is bidirectional, perhaps omnidirectional, between artistic and scientific systems.

So, how does a physicist read poetry, how does a poet practice theory-generation, and is their goal common? If a poem is an experiment, as I suggest, then the experiment of this work, following Byron's model, is to engage in the practice of scientific-poetic thinking. If the pilgrim is the abstractor, the removed sojourner hearing whispers of Reason or Truth, then poetics and physics will mutually benefit through collaboration.

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