Transduction of The Laws of Logomachy: Metastability, Simondon, and the Heraclitean Lógos

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Introduction:

This article has two overlapping aims, one specific and the other general. Specifically, it will demonstrate how the thermodynamic concept of metastability, as it distinguishes itself from thermodynamic stability and instability, may offer philosophical semantics (the philosophy of meaning, reference, and its related issues) the theoretical means with which to formulate or *transduce*, the laws of a novel logic or art of sense called logomachy. The general aim is, therefore, to introduce this logic of sense so that the article may then serve as a propaedeutic for further work in logomachy.

Transduction, as a method of philosophising, first proposed by the French philosopher of technology Gilbert Simondon,[1] should be understood as Cécile Malaspina defines it in her *An Epistemology of Noise*; that is, as a method whereby "the structuration of one field of knowledge […] transduces its guiding principles, concepts or problems, across academic divisions and institutional boundaries, into other fields of knowledge."[2] In the case of logomachy, thermodynamics is the field of knowledge that provides guiding principles, concepts, and problems for, in this instance, logic. In many ways, the specific task of this article could be understood as an experiment in transduction since it *aims to determine something previously untested* by placing two fields in relation to each other. Transduction is more than analogical since it aims to produce something else, something *third* from this experimental encounter, rather than merely determining conceptual similarities and differences.

The necessity and justification of formulating a novel logic transduced across thermodynamics take specific inspiration from Simondon. As Simondon consistently pointed out throughout his work, the laws of thought, as inherited from Aristotle and developed throughout the history of philosophy,

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1   What Simondon strictly means by transduction is perhaps not exactly what I meant by it, in so far as I have extended its meaning beyond the stricter meaning that Simondon uses, which is as an operation by which two or more orders of incommensurable realities enter into resonance and become commensurable. See Isabelle Stengers "Résister à Simondon ?" *Multitudes* 18, no. 4, (2004): 55–62 for a critique of the notion as well as an overview of the method itself.

2   Cécile Malaspina, *An Epistemology of noise*, (London: Bloomsbury, 2018), 94.

most notably in the middle of the 19th century and into the 20th century by figures in the history of Analytic philosophy such as William Stirling Hamilton, George Boole and Bertrand Russell, do not hold good once *thermodynamic states of being* such as metastability are taken into consideration. Indeed, Simondon suggests the "rejection" of them. If Simondon is right and thermodynamic states such as metastability in their differentiation to stable and unstable states *of being* require the rejection of these logical laws, the question arises: what laws might replace them, if any? More generally, what is it about thermodynamics that complicates logic? And could there be such a thing as a logic transduced *through* thermodynamics that, similar to some of the more general aims of process philosophy, more adequately accounts for judgments concerning the energetic transformations of things in the world? Logomachy hopes to be the answer to many of these questions by providing a logical framework for how things are thermodynamically in the world, what I will call later in the article: the *quamity* of things. Indeed, logomachy, as a logic, positions itself as between Cratylean process philosophies of pure becoming, where the world is seen as purely unstable and Aristotelian-inspired substance-attribute philosophies, where strict ontological independence of particulars is affirmed. In other words, since the universe is not absolutely unstable or absolutely stable, a logic that deals with the world as it energetically flows and changes but also as it settles and slows is needed.

The article will begin by outlining what is generally meant by logomachy in so far as it is a *logic* or *art* of sense, that is, a *techne* of *logos*. It will then explore the concepts of metastability, stability and instability in thermodynamics as well as how metastability is understood by Simondon, for whom it is a central concept. The purpose of exploring metastability is that it will then serve as one-half, so to speak, of the forthcoming transduction. The article will then outline what is commonly understood by the laws of thought. It will briefly outline their formulation in Aristotle, before moving to the debate in analytic philosophy concerning their relation to ontology and thus how they ground valid reasoning. I will then look at Simondon's rejection of these laws. This section will then serve as laying the ground for the second half of the transduction. Before outlining the laws of logomachy, which is to say, the result of their transduction, the article will revisit the presocratic philosopher Heraclitus. The intent is to demonstrate how, for Heraclitus, the *lógos*, as a logic of sense, is fundamentally concerned with the metastability of the *objects of sense*, i.e., not their stability nor their instability. Since it is not uncontroversial to read into Heraclitus, a presocratic philosopher, thermodynamic theories concerning metastability, energy, and entropy, concepts that were not fully outlined until the 19th century, my claim that a logic of metastability can be found in specific key Heraclitean fragments is interpretatively supported by the work of French classics scholar and philosopher Clémence Ramnoux whose work endorses an understanding of the Heraclitean *lógos* as fundamentally thermodynamic, which is to say, concerned with the dynamics of energy, heat and fire.

The affirmation of a thermodynamic Heraclitus is, also, theoretically motivated by a secondary intention: to reconceptualise the *lógos* and, in doing so, detach the meaning of *lógos* from the meaning it has been given by the Derridean critique of logocentrism (the most dominant of the post-war continental conceptualisations of this Greek term after Martin Heidegger's). The initial turn to Heraclitus as a potential source for the development of logomachy was also equally motivated by Simondon's statement in *L'Individuation à la lumière des notions de forme et d'information* that metastability, though somewhat present in the Ionian school of thought, was more generally ignored or forgotten by the ancients.[3] By showing how the concept of thermodynamic metastability is present in the fragments of Heraclitus, especially the *kykeôn* (posset) fragment (DK.22 B125), the idea is to scrutinise Simondon's train of thought concerning the Ionians—of which Heraclitus is a later representative. As Ludovic Duhem writes, "Simondon was acutely aware that Heraclitus took much of the physicalist thought of the Ionians and transduced this thought into a logic rather than an ontology."[4] Heraclitus, thus, in many ways, serves as the closest example of a logic of sense that resembles logomachy, specifically as it concerns the objects of sense.

Logomachy as a Transduced Logic of Sense:

While I shall not explore in depth the etymological and conceptual history of the Greek word λογομᾰχῐ̄α nor its subsequent translations into Latin, *logomachia*, or, logomachy, I shall, nonetheless, now briefly outline the two major moments in the concept's history so that what is at stake in logomachy's philosophical *recovery* as a logic of sense is elucidated. The first time that λογομᾰχῐ̄α is used *conceptually* in the Western philosophical tradition is in Plato's *Cratylus*. That is, while Plato does not formulate the term λογομᾰχῐ̄α (this is by the Apostle Paul, see below), he nonetheless uses the Greek words "μαχώμεθα ἐν τοῖς λόγοις" to signify something akin to λογομᾰχῐ̄α qua *a conflict in and about sense*. Indeed, having arrived in the *Cratylus* at the contradictory etymological meaning of knowledge (*epistémē'*) either as "stasis" (*histesi*) or "movement" (*hepetai*) of the soul in its relation to things, Socrates opts to orient the meaning of *epistémē'* toward the contemplation of the Forms. It is also at this moment that Socrates suggests that returning to the problem, that knowledge might be anything other than stable, would result in a "μαχώμεθα ἐν τοῖς λόγοις" a conflict (*makhómetha*) in sense (*lógois*), a λογομᾰχῐ̄α, logomachy.[5]

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3   Gilbert Simondon, *L'Individuation à la lumière des notions de forme et d'information* (Grenoble: Millon, 2013), 26.

4   Ludovic Duhem, "Apeiron et physis ; Simondon transducteur des présocratiques", *Cahiers Simondon* no. 4 (2012).

5   *Cra*. 430 c–d.

Socrates declares that logomachy is not fit for friends and henceforth must be avoided to maintain peace and prevent civil war among words. Similar to this use by Socrates, logomachy's first cited use as a compound neologism, λογομᾰχῐᾱ, is biblical and can be found in 1 Timothy, 6:4. The Apostle Paul is counselling Timothy against supporting those of his parish who spread false teachings and desire to debate the Law over simply following it. The logomachy that Paul wishes to avoid potentially threatens the Church's purity and the *lógos* qua the Word of God.[6] These first Greek uses of λογομᾰχῐᾱ should be kept in mind since they reveal to what extent logomachy as a Greek concept inherited into Latin, the Romance languages and then English is concerned with the movement or operations of sense and the conflicts that arise in sense due to these movements. That is, to what extent sense is stable or unstable? Beyond these Greek origins, logomachy's other major meaning is something akin to a "dispute over the meaning of words" or a sophistic "conflict waged *only* as a battle of words;" that is, "*just semantics.*" Outlined most definitively by the 17th-century Swiss theologian Samuel Werenfels in his *De logomachiis eruditorum*, written in Latin in 1988 then translated into English in 1702, Werenfels desires to apply a philosophical "Remedy to a most pernicious Distemper, which has long afflicted the Learned World […] The contending about words (logomachy)."[7] For Werenfels, there exist both good words, and bad words, both a good *logos* and a bad *logos*; the task once again, like Socrates and Paul, is to put an end to debate concerning sense. Logomachy opens up, therefore, the problem of what Lyotard might call the *différend*. That is, the question of how and why disputes about sense arise as well as the practical and political implications of sense-making, sense-destroying and sense-maintaining to paraphrase Walter Benjamin from *Critique of Violence*. The application of logomachy so that it might investigate how sense is made, destroyed and maintained, I name *logomachics*.[8]

Having now briefly outlined what is meant by logomachy, it is also apposite to discuss what is meant by a *logic* of sense since the definition of logic itself could open a logomachy. I take a *logic* of sense to mean two things. Firstly, as it is formally understood, I take logic to mean the formal principles in accordance with which it is possible to assess the appropriateness of reasoning or judgment: why certain things can and cannot be said to *make sense*. In this regard, a logic is not too dissimilar to a technical grammar in so far as a technical grammar determines the constraints and limits of a language as it is used. Logomachy, as a logic or as a technical grammar of sense, likewise aims to draw-out the limits and constraints that

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6   *The Bible: New Revised Standard Version*, eds. Zaine Ridiling (National Council of Churches, 1989), 451.

7   Samuel Werenfels, *A Discourse of Logomachys: Or Controversys about Words, So Common Among Learned Men. To which is Added, a Dissertation Concerning Meteors of Stile, Or False Sublimity* (Cheapside, London: J. Darby, 1711), 1.

8   Indeed, Lyotard offers many useful concepts in this regard; one would need to also look at "paralogy" as the contestation of an instituted *logos*. Jean-François Lyotard, *Le différend*, (Paris, Éditions de Minuit, 1983).

sense is bound by. These constraints could likewise then be called laws or principles since to overstep them would constitute an infringement. Secondly, then, logic is understood as the operations through which sense emerges and functions. In this regard, the notion of logic follows Georg Wilhelm Friedrich Hegel's logic as well as Gilles Deleuze's treatise on Stoic logic, how sense emerges as an expression. Moreover, in the same way that Simondon's theory of ontogenesis, as Jean-Hugues Barthélémy writes in a note to Simondon's "The Position of the Problem of Ontogenesis": "is no longer an onto-*logy* in the strict sense of the term," the *logic* of sense that I call logomachy is not a logic that understands the *logos* as "exterior to what it knows; nor is it "an *ob*-jectifying *logos*."[9] Logomachy is closer to being a logo-*genetics* of sense since its *logos* emerges—or is *generated*—through the metastable system or logic that constitutes and maintains it. John Stuart Mill's famous definition from *System of Logic* summaries these two sides of logic. He writes: "Logic, is the science of the *operations* of *the understanding* which *are subservient to the estimation of evidence*: both the *process itself* of advancing from known truths to unknown, and all other intellectual operations in so far as they are *auxiliary to this*. [my emphasis]"[10] Logic is, therefore, the process or operation of the understanding in so far as it is subservient to a set of laws that govern it. These laws are not, however, arbitrary, but, as Mill writes, they are subject to the estimation of evidence. The key difference between logomachy and other logics, even Deleuze's, is that it turns to the science of thermodynamics and the notion of metastability as key to the transduction of its laws. That is, in so far as the operations of sense are subservient to evidence, this evidence is furnished by what is and what is not thermodynamically possible. In this sense, one could likewise call logomachy a critique, in the Kantian sense of the term since it is concerned with the conditions of possibility of sense and how these conditions furnish limiting laws. With Mill's definition in mind, logomachy could, therefore, be understood as inverting the usual inquiry of philosophy of technology that explores the *logos* of *techne* so as to explore the *techne* of the *logos*, with *techne* here understood in its widest sense as *a treatise on the means through which something may come into being*—what is sometimes simply understood as an art. Art, here, is, therefore, meant in the same way that Kant's third *Critique* is a critique of the art or power of judgment: a *Kritik der Urtiels-kraft*, with *Kraft* holding both the meaning of an art or a technical treatise as well as the power through which something comes into being. Outlining, or transducing, the laws of logomachy might then be understood as outlining the *art of sense* as, indeed, the Port-Royal Logic describes itself, that is, as *l'Art de Penser*.

Succinctly, then, logomachy as a logic or art of sense seeks to determine 1) how sense emerges (through what systems); 2) in accordance with what laws; 3) the boundaries or limits of these laws; and 4) the

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9   Jean-Hugues Barthélémy "Note 2", in Gilbert Simondon, "The Position of the Problem of Ontogenesis," trans. Gregory Flanders, *Parrhesia* 7, (November 2009): 14.

10   John Stuart Mill, *A System of Logic: Ratiocinative And Inductive (Vol. 1 of 2)* (London: John Parker, 1851), 18

practical and political implications of them. As far as (1) is concerned, logomachy is said to be a metastable system of sense that is comprised of (at least) three constitutive metastable systems of meaning or reference (*Bedeutung*, as it would be for Frege): a metastable system concerning the objects or referents of sense, the perception, representation and internal and external memory of these objects, and the semiotics or signification of these objects through signs or strings of signs. Together, these metastable systems form a metastable *system of systems*, the synthetic metastability of which is a priori and conditions the emergence of sense.[11] As indicated above, the leading question for this specific article is: Is it possible to transduce logical laws that more adequately account for how things are thermodynamically in the world? By the end of the article, I will have answered this question by thermodynamically transducing the laws of logic or thoughts—the law of identity, the law of contradiction, and the law of excluded middle—so that they accord with thermodynamics states of being such as thermal equilibrium, instability, bifurcation and metastability, thereby offering working definitions of the logical laws of logomachy. That is, I will have outlined (2) transduced the laws of logomachy through a reflection across thermodynamics, Simondon, Heraclitus and the laws of thought, with each "domain" providing guiding principles, concepts, and problems that, when thought together, will enable the formulation of the laws in accordance with which sense emerges. As far as (3) and (4) are concerned, that is, the limits of these laws and their practical and/or political application, what I have started calling *logomachics*, these will not be outlined in any detail in this article; however, I nonetheless hope that what is practically at stake will begin to emerge as the other points are theoretically dealt with.

Stability, Metastability, and Instability in the Natural Sciences:

Metastability, understood as an energetic system state that is in-between, *meta*, stability (thermal equilibrium), and instability (system bifurcation), for example, a ball stuck in a trough, sand piles and glasses, has seen increased use in contemporary philosophy primarily due to the renewed interest in the work of Simondon. It is, however, a term that finds its conceptual origins in chemistry (mostly metallurgy and mineralogy), thermodynamics, cybernetics, and other systems theories. One of the first complete theoretical discussions of metastability was formulated by Norwegian-American chemist and Nobel prize winner Lars Onsager. In 1931, the term "steady-state systems" was used by Onsager to

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11   Like Frege, it is possible for sense to emerge without objective reference. For example, in literature, there are no actual references only significative references. It is also possible for sense to emerge without signification, for example, the recognition of an object of sense without a sign.

describe a process akin to thermodynamic metastability.[12] Doron Sagan and Eric D. Schneider write that Onsager discovered that "an open system with moderately steep gradients will slow to a steady state of minimum entropy production."[13] In the presence of ample available energy, an open thermodynamic system may maintain a relatively constant state without falling into a state of permanent stability, otherwise known as thermal equilibrium. In contrast, in a closed system, the entropy of the system (the dissipation of energy between two thermodynamic systems with different initial internal energies) will inevitably increase to the point that work is no longer possible. As entropy increases, both the past (exhaustion of energy differences) and the future (quantity of energy differences remaining to produce work) unfold as the system moves from the difference: $T_h \neq T_c$ toward the identity: $T_h = T_c$.

While this overall tendency toward stable thermal equilibrium (the second law of thermodynamics) cannot be violated—the universe consists of a closed adiabatic thermodynamic system since the total quantity of internal cosmic energy remains identical (the first law of thermodynamics)—"open systems" can follow a temporal structure that allows for the local deferral of thermal equilibrium. In short, an open system means that the "metastability" of the difference between the two actual energies that produce work can be maintained, and a system can remain in a persistent state that is *not* the "state of least energy." Sagan and Schneider give the following example of an open metastable system: "a simple example of metastability is a Ping-Pong ball suspended in the air by a column of air blowing from a vacuum cleaner exhaust. Such a demonstration can be seen in the appliance departments of some large stores. The white ball wobbles slightly, floating on a stream of air blowing up from beneath."[14] The difference between higher energy states and "state of least energy" is likewise essential when defining what a metastable system consists of. If we take Sagan and Schneider's example, when the ping-pong ball is floating, the ball is said to have a higher energy state than when the ball falls to the ground. This higher energy state is achieved due to the relative space-time position that the ball possesses. When floating, the ball is in a relatively higher energy state than when on the ground due to the potential energy supplied by the vacuum cleaner (which gets its energy from a chain of entropic displacement that goes from the plug in the wall to the burning of fossil fuels via the spinning of a generator). What *maintains* this metastable state locally (the fact that the ball remains floating) is the continued energy transfer of the air from the vacuum cleaner exerted against the ball. If the vacuum cleaner were to disappear, or if the ball were pushed, it would inevitably fall to its "state of least energy", equalising the difference between the relative position of the ball in the air with the ground. For this reason, a metastable system can be described as a system that is *not yet in a state of least energy* since once it

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12   Dorion Sagan and Eric D. Schneider, *Into the Cool: Energy Flow, Thermodynamics, and Life* (Chicago: University of Chicago Press, 2006), 80.

13   Sagan and Schneider, *Into the Cool*, 80.

14   Sagan and Schneider, *Into the Cool*, 79.

reaches this state of least energy, it becomes absolutely stable.

Two other scientific concepts comparable to metastability are "*homeostasis*", coined by American biologist Walter B. Cannon in 1932, and Nicolis and Prigogine's "dissipative structures", formulated in the 1970s.[15] Its use in Simondon (from 1954 onwards), and thus the textual source of its use in contemporary philosophy, is Norbert Weiner's seminal 1948 *Cybernetics: Or Control and Communication in the Animal and Machine*. Here, Weiner uses the concept of "metastable" and "homeostatic" to mean more or less the same system state.[16] Before going on to Simondon's conceptual usage of metastability, it is important to consider these three sources since they clarify the rationale behind metastability's distinction between stability and instability in the sciences. This is done in order for this logic to later present the concepts and issues necessary for its application to philosophical semantics.

Cannon, in the introduction to *The Wisdom of the Body*", states that he wishes to use the term "*homeostasis*" to refer to biological states that remain "relatively constant" but that is also distinct from stable or "stagnant" "closed systems" at equilibrium:

> The constant conditions which are maintained in the body might be termed equilibria. That word, however, has come to have fairly exact meaning as applied to relatively simple phyisco-chemical states in closed systems, where known forces are balanced. The coordinated physiological processes which maintain most of the steady states in the organism are so complex and so peculiar to living beings – involving as they may, the brain and nerves, the heart, lungs, kidneys and spleen, all working cooperatively – that I have suggested a special designation for these states, homeostasis. The word does not imply something set and immobile, a stagnation. It means a condition – a condition which may vary but which is relatively constant.[17]

Though unfamiliar with Onsager's work on steady-state systems, Cannon uses conceptual terminology similar to Onsager. Homeostasis is a coordinated system of open biological processes that maintain an organism in a "steady state" that is *not* at equilibrium. Cannon documented that such a state of non-

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15   Walter B Cannon, *The Wisdom of the Body* (New York: W.W. Norton and Company, 1932); G. Nicolis and I. Prigogine, *Self-Organisation in Nonequilibirum Systems: From Dissipative Structure to Order through Fluctuations* (New York: Wiley, 1977).

16   Norbert Weiner, *Cybernetics: Or Control and Communication in the Animal and Machine* (Cambridge: The M.I.T Press, 1948), 58–59. While there is no evidence that Simondon found the term in Jean-Paul Sartre's 1943 *L'être et le néant*, it is worth noting that Sartre uses "metastable" to mean comparably a "precarious" psychic structure that, while still "durable," is nonetheless subject to collapse. Jean-Paul Sartre's 1943 *L'être et le néant* (Paris: Gallimard, 1943), 84.

17   Cannon, *The Wisdom of the Body*, 24.

equilibrium—one where all forces were *not* "balanced" (i.e., not at maximum entropy)—could only be maintained by an available energy source external to the organism: "food" and "oxygen" for organic systems. Due to the biological nature of these investigations, Cannon also recognised that homeostatic systems need to be maintained "relatively constant" to guarantee the organism's survival. As Weiner argues in *Cybernetics*, homeostatic consistency is vital to the "healthy" functioning of the organism.[18] Extreme fluctuations in specific processes—for example, the internal temperature of the organism— would result in the collapse of specific biological systems.

Similar to the logic at work in both Onsager's "steady-state systems" and Cannon's homeostasis, Weiner distinguishes metastability (again, the examples are biological) from stability: "We may well regard living organisms, such as Man himself, in this light. Certainly, the enzyme and the living organism are alike metastable: the stable state of an enzyme is to be deconditioned, and the stable state of a living organism is to be dead."[19] Metastability is here distinguished from stability, with stability signifying the organism's death and metastability, like homeostasis, ensures the maintenance of life and the deferral of death.

Related to the maintenance of life, Weiner's use of "metastable" also concerns what he describes as the capacity for enzymes to decrease or slow down the rate of entropy (with entropy here equivalent to the movement toward stability qua death). Using Maxwell's demon as an analogy, he writes: "There is no reason to suppose that metastable demons do not exist; indeed, it may well be that enzymes are metastable Maxwell demons, decreasing entropy, perhaps not by the separation between fast and slow particles but by some other equivalent process."[20] Metastability is, as such, for Weiner a condition of the *continuation of the organism's sameness through time through the deferral of entropy increase.* As he puts it, "catalysts and Man alike have sufficiently definite states of metastability to deserve the recognition of these states as relatively permanent conditions."[21] That is, metastability is the condition of possibility of *relative sameness* of the system, which means that the system maintains an energetic internal difference that sustains the system as *relatively permanent through time,* i.e., it is not in *a stable state of equilibrium,* where the system collapses nor is it in an *unstable state of system bifurcation.*

Considering stability, metastability *and* system bifurcation, G. Nicolis and Prigogine accomplished the conceptual and mathematical generalisation of open thermodynamic systems in the late 1970s. During his 1977 Nobel Prize lecture, Prigogine describes "dissipative structures," his analogical concept for

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18   Weiner, *Cybernetics*, 114.

19   Weiner, *Cybernetics*, 58.

20   Weiner, *Cybernetics*, 58–59.

21   Weiner, *Cybernetics*, 58–59.

steady-state dissipative systems. Again, like homeostasis and Weiner's metastable demons, Prigogine distinguishes them from structures at equilibrium:

Thermodynamic equilibrium may be characterised by the minimum of the Helmholtz free energy defined usually by:

$$F = E - TS$$

Are most types of "organisations" around us of this nature? It is enough to ask such a question to see that the answer is negative. Obviously, in a town, in a living system, we have a quite different type of functional order. To obtain a thermodynamic theory for this type of structure we have to show that non-equilibrium may be a source of order. Irreversible processes may lead to a new type of dynamic state of matter which I have called "dissipative structures".[22]

For Prigogine, therefore, "dissipative structures" are structures, both living and non-living, that are far from equilibrium (far from stability), but which irreversibly exchange energy with their environment to maintain their structure—"non-equilibrium may be a source of order". Like metastability and Onsager's steady-state systems to which Prigogine often refers, these structures are "ordered" to the extent that structures such as towns and organisms can be delimited. Still, their organisation derives from irreversible entropic processes that increase the disorder external to them—structure comes at the expense of destructuring. Or, to cite the title of Isabelle Stengers and Prigogine's book, there is *order out of chaos*.[23]

Critical for Nicolis and Prigogine, these structures are subject to thermodynamic "fluctuations" that oblige them to *bifurcate*. As they write in their ground-breaking 1977 *Self-Organisation in Nonequilibrium Systems: From Dissipative Structure to Order through Fluctuations*:

The purpose of bifurcation theory initiated by Poincaré and developed further by Andronov and his school, Hopf, Krasnosel'skii, and others, is to develop methods enabling one to: (a) demonstrate rigorously the existence of branching of solutions for certain critical values and (b) construct, in an approximate fashion, analytic and convergent expressions for certain

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22   I. Prigogine, "Time, Structure and Fluctuations," Nobel Lecture, 8 December, 1977.

23   While dissipative structures are mostly understood by Prigogine as *far from equilibrium*, metastability is a state property that refers to a system state that is not at equilibrium. That is, a system can be referred to as metastable both near to and far from equilibrium is a certain stability is achieved between system inputs and outputs.

important types of solution emerging at the bifurcation points.[24]

There are two points concerning bifurcation theory that Nicolis and Prigogine highlight, the first relates to the "existence of branching solutions", and the second relates to the "types of solution" that occur at the bifurcation points. The existence of branching solutions refers to the fact that systems whose structures are metastable are often subject to alterations or fluctuations regarding incoming values, whether those values constitute an increase or decrease in energy flows, the addition of chemical products that alter the thermodynamic properties of the system (enzymes for example), or the system's movements in spacetime (something that changes the potential energy of the system). When these values reach a critical point, the system's metastability is faced with a "problem"; the system's structure bifurcates to "solve" the alteration in the values. Following the second law of thermodynamics, the system restructures itself so that energy can continue dissipating. The clearest example of system bifurcation, also used by Simondon, is the introduction of a crystal germ into a supersaturated solution. The saturated solution is in a metastable state, and the alteration in the system—the critical point qua problem—occurs when an external chemical product is introduced into it. The system reorganises itself through dissipation into the new crystalline form to solve this problem.[25]

In his Nobel prize lecture, Prigogine writes that "bifurcation introduces in a sense "history" into physics."[26] Suppose the system's stability at thermal equilibrium equates to the end of this history. Metastability then means the deferral of the system's internal movement along the arrow of time. Time's arrow is stretched. While it might appear as though the necessity of the movement from difference to identity can be interminably halted, metastability and the deferral of equilibrium *always comes at the expense of exergy*. Exergy is a very useful term introduced by Zoran Rant in 1956 to mean something equivalent to Gibbs free energy, energy-not-yet-dissipated, or negentropy.[27] It is useful because it terminologically allows us to split energy into *exergy*, not-yet-dissipated and *anergy* already-dissipated-energy. The metastability of any local open system pushes that which is external to it, the exergy that feeds the metastable system further along its own temporal arrow. Entropy is *displaced* to an external system to maintain an internal system; *entropic displacement* occurs via the destruction of negentropic exergy and the production of entropic anergy. Time moves not in a circle nor a line but as a conical

24   Nicolis and Prigogine, *Self-Organisation in Nonequilibirum Systems*, 77.

25   Though it must be mentioned that Simondon, as Stengers points out, does not discuss the dissipative nature of this "jump". Indeed, Simondon is rather quiet about entropy and dissipation in general, preferring "degradation". See Esra Atamer "Dissipative Individuation," *Parrhesia* 12, (2011): 57–70.

26   Prigogine, "Time, Structure and Fluctuations".

27   Zoran Rant, "Exergie, Ein neues Wort für 'technische Arbeitsfähigkeit,'" *Forschung Auf dem Gebiete des Ingenieurwesens* 22, (1956): 36–37.

spiral, each turn constituting the exhaustion of the exergy necessary for the line to continue along its vector. Upward local spirals always come at the expense of a larger general downward spiral.

Metastability in Simondon:

As mentioned, metastability is a fundamental concept in the work of Simondon that most likely textually derives from his reading of Wiener.[28] The importance of turning to Simondon before moving to Heraclitus is, as also mentioned in the introduction, Simondon explicitly questioned how a metastable logic of sense might be formulated, affirming that metastability renders the law of identity and the excluded middle null and void. Summarising many of the points about metastability from above, Cécile Malaspina writes, "Metastability is the dynamical suspension of a system between two forms of equilibrium, between entropic dispersion and structural inertia. It was Gilbert Simondon's merit to have introduced the concept of metastability to the philosophical corpus by making it the cornerstone of his theory of individuation."[29] The most concise description that Simondon gives of metastability can be found in the "Introduction" to *L'Individuation à la lumière des notions de forme et d'information*. Here, an ontological description is given:

> Individuation could not be adequately thought out and described because only one form of equilibrium was known, stable equilibrium; metastable equilibrium was not known; being was implicitly assumed to be in a state of stable equilibrium; yet stable equilibrium excludes becoming, because it corresponds to the lowest possible level of potential energy; it is the type of equilibrium that is reached in a system when all possible transformations have been achieved and no more force exists; all potentials have actualised, and the system, having reached its lowest energy level, can no longer be transformed again. The ancients only knew instability and stability, movement and rest; they did not clearly and objectively know metastability. To define metastability, it is necessary to involve the notion of the potential energy of a system, the notion of order, and that of increasing entropy; it is thus possible to define the metastable state of being, which is very different from stable equilibrium and from rest, which the Ancients could not involve in the search for the principle of individuation because no clear physical paradigm could for them enlighten its use.[30]

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28 After consulting with Jean-Hughes Barthelemy, the conclusion we came too was that Simondon's first published citations in 1954 of "métastabilité" come from Weiner and are most likely the source. See Gilbert Simondon, "Prolégomènes à une refonte de l'enseignement" in *Sur la technique (1953-1983)* (Paris : Presse Universitaire Paris, 2014), 233.

29 Malaspina, *An Epistemology of noise*, 73.

30 Simondon, *L'Individuation*, 26.

In this summary of metastability's conceptual history (or lack thereof), Simondon argues that the ancients only had concepts for stability and instability since no physical paradigm was offered to them that might enlighten and demand the invention of a third in-between term. In the note to this paragraph, Simondon relaxes his argument by adding that there did "exist, for the ancients, intuitive and normative equivalents" to metastability. As can be gleaned from the following unpublished summary of *L'Individuation*, the ancients referred to in this note by Simondon are the Ionian presocratics:

> This system state—unknown to the Ancients, or somewhat forgotten after having been sensed by the Ionian Physiologues in the doctrine of *phusis*—is that of a metastable equilibrium. Metastability differs from stability and instability in that it is rich in potentials and cannot be thought as being completely given in an instant, simultaneous through a relation with itself.[31]

For Simondon, then, the conceptual difference between stability and metastability should be understood as the difference between a stable system where transformation is no longer possible because its preindividual "potentials" have been exhausted and a metastable system where (as Simondon writes in the notes to the above paragraph) "information understood as negentropy" can metastabilise the difference between actual energies, maintaining the system.[32] A metastable system is, therefore, between (*meta*) system stability (thermal equilibrium) and instability (system bifurcation). Metastability constitutes the maintenance of being through becoming. It temporally differs from entropic collapse qua stability and system bifurcation qua instability. Discussing Simondon's example of crystallisation, the physical model that he uses to base his transductive analysis of individuation, Daniela Voss writes: "The condition for the emergence of a crystalline structure is the metastability of the system, which can be defined as the maintenance of an energy state that is different from the resting state in that it allows for processes of transformation under certain energetic conditions."[33]If metastability allows for "transformation under certain energetic conditions", this is because preindividual potentials, what

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31   Simondon "Summary of Individuation" in Nathalie Simondon, "Some Reflections on the Life and Work of Gilbert Simondon," trans. Joe Hughes and Drew Burk, http://gilbert.simondon.fr/content/biography, accessed 10th October 2022.

32   Simondon, *L'Individuation*, 26. While the notion of information used by Simondon is complex and deviates from its theoretical (Information Theory) and common usage, it should be noted that, here, information functions negentropically as exergy. It is also fairly evident from the introduction to Simondon's *On the Mode of Existence of Technical Object*s that Simondon subscribes to the idea that information may not only metastabilise local open systems but that it may offer some form of an answer to how the universal tendency toward thermal equilibrium may be avoided. As above, if one were to mount a criticism of Simondon, it would be here.

33   Daniela Voss, "Simondon on the Notion of Problem: A Genetic Schema of Individuation," *Angelaki*, 23, no.2 (2018): 97.

could be thought of as exergy, have yet to be exhausted. That is, within a metastable state, bifurcation from the current individualised metastable state to another metastable individualised state is still possible because the system is not yet at its lowest energy state. Preindividuality could thus be thought of as a set of possible individuations that may still be individualised, and this possibility is grounded on the no-yet-exhausted nature of the exergy inherent to the system.

One of the reasons why, as Malaspina writes, metastability is at the heart of Simondon's theory of individuation is that it offers a conception of the individual as a transformative "operation" not as an "individuated being", whether that be a substantial individual (a unity in and of itself) or a hylomorphic individual (an individual individuated through the coming together of matter and form). Metastability is an ontological concept that can conceive both the *being* and the *becoming* of the individual as partaking of the same energetic system.

Simondon, Metastability and the Laws of Thought:

Critical to the question of whether a logic of sense can be constructed from metastability, Simondon consistently, throughout his work, suggests rejecting the three laws of thought as put forward by the history of logic (the law of non-contradiction is not included but can be inferred from the other two). For instance, Simondon writes:

> A deepened thought of metastability as a condition of individuation requires the rejection of the principle of the excluded middle and the logic of identity; the complete being, which is to say, the preindividual being, is more than a unity and more than an identity, it is other than itself. The logic of the excluded middle and of identity is a logic of stable states, able to intervene only after individuation; it does not bear on the complete being, but on an impoverished being, dephased in relation to itself, the individuated being as individual.[34]

Simondon's reference to the laws of thought here is more than likely Aristotelian given his extensive engagement with Aristotle's metaphysics, particularly his attack on Aristotle's hylomorphism in *Individuation*. While it might, therefore, seem appropriate to cite Aristotle's formulations, I have instead chosen to quote Russell since his definitions are by far some of the easier to grasp in so far as Russell outlines what is at stake both logically and *ontologically*. Moreover, while Simondon repeats the claim

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34   Simondon "Summary of Individuation," http://gilbert.simondon.fr/content/biography

that logic of the excluded middle and of identity do not hold once metastability is considered, there are no extensive citations of Aristotle to back his claims. I will, nonetheless, place Aristotle's formulations in the footnotes for ease of referencing. If metastability and thermodynamics, more widely, is to be transduced into a novel logic, it is important that what things are actually like in the world has its influence on logic that outlines the laws pertaining to what propositional claims can be said about how those things actually are in the world and he laws that govern those claims.

In his 1912 *The Problems of Philosophy*, Russell defines the three laws of thought in natural language. Though related, these definitions should be distinguished from the earlier eight primitive principles, as laid out by Russell and Whitehead in Volume 1 of the 1910 *Principia Mathematica,* since they do not serve as a minimum set of axioms for formal logic.[35] Written in natural language, these laws of thought describe the ontological "fact concerning the things in the world:"[36] (1) *The law of identity*: "Whatever is, is."[37] (2) *The law of noncontradiction*: "Nothing can both be and not be."[38] (3) *The law of excluded middle*: "Everything must either be or not be."[39] Formally or *logically*, the law of identity is written as a=a or x:

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[35] Bertrand Russell and Alfred North Whitehead, *Principia Mathematica* 1 (Cambridge: Cambridge University Press; 1967), 91.

[36] Bertrand Russell, *The Problems of Philosophy* 72, (Oxford: Oxford University Press, 1997), 40.

[37] "First then this at least is obviously true, that the word "be" or "not be" has a definite meaning, so that not everything will be 'so and not so.' Again, if 'man' has one meaning, let this be 'two-footed animal'; by having one meaning I understand this:—if 'man' means 'X', then if A is a man 'X' will be what 'being a man' means for him. (It makes no difference even if one were to say a word has several meanings, if only they are limited in number; for to each definition there might be assigned a different word. For instance, we might say that 'man' has not one meaning but several, one of which would have one definition, viz. 'two-footed animal,' while there might be also several other definitions if only they were limited in number; for a peculiar name might be assigned to each of the definitions. If, however, they were not limited but one were to say that the word has an infinite number of meanings, obviously reasoning would be impossible; for not to have one meaning is to have no meaning, and if words have no meaning our reasoning with one another, and indeed with ourselves, has been annihilated; for it is impossible to think of anything if we do not think of one thing; but if this is possible, one name might be assigned to this thing." Aristotle, *Metaphysics*, Book IV, Part 4 (translation by W.D. Ross).

[38] "It is impossible, then, that 'being a man' should mean precisely not being a man, if 'man' not only signifies something about one subject but also has one significance [...] And it will not be possible to be and not to be the same thing, except in virtue of ambiguity, just as if one whom we call 'man,' and others were to call 'not-man'; but the point in question is not this, whether the same thing can at the same time be and not be a man in name, but whether it can be in fact." Aristotle, *Metaphysics*, Book IV, Part 4.

[39] Russell, *The Problems of Philosophy*, 41. 'But on the other hand there cannot be an intermediate between contradictories, but of one subject we must either affirm or deny any one predicate. This is clear, in the first place, if we define what the true and the false are. To say of what is that it is not, or of what is not that it is, is false, while to say of what is that it is, and of what is not that it is not, is true; so that he who says of anything that it is, or that it is not, will say either what is true or what is false.' Aristotle, *Metaphysics*, Book IV, Part 7.

x=x; it defines self-identity. That is, for all things that are x, x is x. This is not logically equivalent to x=y since while x and y might refer to the same thing, they are not symbolically identical and cannot be reduced to x. The law of noncontradiction (LNC), formally, ~ (p. ~ p), negatively forbids an identity between p and not p. Logically, this means that contradictory propositions "*p is the case*" and "*p is not the case*" cannot be concomitantly true. The law of excluded middle, formally ~p ∨ p, is a law of bivalence and can be derived from LNC. Logically, p is either true or not true. Its bivalence distinguishes it from LNC because one of two cases must be true: if p is true, then not p is not.

The philosophical problem these laws pose concerns whether there is an identity between their logical and ontological expressions (this is the same in Aristotle). For Russell, at least in the *Problems of Philosophy*, truthful thinking relies on the mutual accordance of the premises and the thing to these laws, rendering these laws ontologically deductive. Russell writes, "when we think in accordance with them, we think truly."[40] Therefore, any proposition concerning worldly things that do not logically and ontologically conform to these laws is false. Regarding this accordance between logic and things in the world, Frege agrees. For example, in "On *Sinn* and *Bedeutung*", he concludes that "the truth value of a sentence" is concerned only with the relation to its objective "*Bedeutung* [referent]".[41] This mutually shared position concerning the necessity of a mediated correlation between object and proposition is called, after Saul Kripke, the mediated reference theory or the "Frege-Russell view."[42] Its importance for philosophical semantics is that it enables one to distinguish between, for example, proper names and propositions that refer to existing things and names and things like Ulysses, which do not refer to any existing thing but that can be spoken of with meaning.

In distinction to a theory of the laws such as George Boole's, where "the knowledge of the laws of the mind does not require as its basis any extensive collection of observations, and it is not confirmed by the repetition of instances,"[43] a mediated theory of reference relies to a certain extent on epistemology. What can be said to be true about things in the world is contingent on what is known to be true. While this can lead to an extreme form of anti-realism or intuitionism where truth is contingent on sense perception, the insistence that logic and ontology should not be separated assists in developing a metastable logic of sense in so far as what is at stake for Simondon is the extent to which things in the world can be said to accord with the classical laws of thought as laid out above. Even though the Frege-

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40   Russell, *The Problems of Philosophy*, 41.

41   Gottlob Frege, "On *Sinn* and *Bedeutung*,"in *The Frege Reader*, edited Michael Beaney (Blackwell Publishing, 1997), 157.

42   Saul Kripke, *Naming and Necessity* (Oxford: Blackwell, 1980), 27

43   George Boole, *An Investigation on the Laws of Thought* (Cambridge: Cambridge University Press, 2009), 3.

Russell view requires material mediation, it also takes the *stability* of the objects of sense as a given. For example, in contrast to Frege's notion of sense and idea (*Vorstellung*), reference (*Bedeutung*) designates the "same thing" in the world regardless of the signs or string of signs used.[44] A famous example is that of the morning and evening stars. For Frege, there is no consideration that the difference in time and space between morning and evening might affect the truth value of the *Bedeutung.*

For Simondon, again, most likely via as his engagement with Aristotle, these laws must be rethought since they can only be applied to things in the world that are stable individuals devoid of preindividual potential or any capacity for bifurcation. They apply, therefore, only to stable systems that are at equilibrium. That is, identity is the state of an individual that no longer has any capacity to transform and whose preindividual potentialities are exhausted. It is an individual that is identical to what it is (1) and excludes any possibility of being anything else (3), that is, being what it is not (2). An individual in such a state that conforms to the three laws of thought has reached the end of its history. That which it was ever going to be, it has become. Only at the point of its nonbeing does it concord with these laws. Paradoxically, according to these laws of thought, things in the world are thought truthfully or refer with validity only when they are no longer. If, however, an individual, according to Simondon's ontogenetics, is understood as being concurrent to its process of individuation, one must include into any complete notion of "being" preindividuality, since preindividuality pertains to the individual's possible posterior and ulterior phases as well as its participation in other transindividual realities. *Therefore, being is more than its unity, identity, and other than itself.*

Simondon's rejection of the laws of thought raises the question, initially introduced in the introduction: Is it possible to formulate a logic of sense that pertains to things in the world as metastable? I argue that by returning to the work of Heraclitus, and especially his notion of *lógos,* such a logic of sense can be recovered and then reformulated. As Scottish Australian philosopher, John Anderson writes in his *Lectures on Greek Philosophy*:

> If we take logic to deal with the processes of thought or with reasoning valid and invalid on the part of persons, then we should have to admit that Heraclitus and his predecessors were not concerned with logic. But if we realise that logic has to deal with the conditions of existence and that it is only on the basis of such a theory that we can distinguish between sound and unsound reasoning, then we can see that physical objects are also logical objects and that a discussion of their characteristics may well be a logical discussion. [45]

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44 Frege, "On *Sinn* and *Bedeutung*," 157.

45 John Anderson, *Lectures on Greek Philosophy* 1928 (Sydney: Sydney University Press, 2008),

In agreement with Anderson, I will demonstrate in the rest of the article that at the inception of the history of *lógos*, a logic pertaining to the physical objects of sense as metastable was thought. This thought will aid in the transduction of the laws of logomachy.

The Heraclitean *Lógos*:

The *lógos*'s etymological relation to logic has meant that its conventional definition has come to mean something akin to *valid rational thought expressed in words.* Indeed, *lógos* is often translated as each one of these words individually: "validity", "reason", "thought", "expression", and "word." Consequently, the *lógos*'s conceptual history has been reduced to its relation to propositional truth concerning the stability of being. Indeed, it has much to do with Jacques Derrida's notion of logocentrism that the *lógos*'s multifaceted and complex meaning has come to be disregarded. This reduction to something like logical propositional truth can be seen at work in the exergue to *Grammatology*: "*The history of metaphysics* which, despite all the differences, and not only from Plato to Hegel (passing even through Leibniz), out of its apparent limits, from the pre-Socratics to Heidegger, has always assigned to the logos the origin of truth in general."[46]

Derrida's definition of *lógos* as the "truth of truth" or "truth in general" obviates the different uses and conceptualisations of *lógos* that have existed throughout the history of philosophy. This preclusion of different philosophical understandings of *lógos* has meant that the *lógos* in continental thought post-Derrida, as Simon Wortham defines it, has come to mean simply "the desire for an ultimate origin, telos, centre or principle of truth which grounds meaning" and little else.[47] It is by returning to the notion of *lógos* as it is understood by Heraclitus, a figure whom Derrida never rigorously engaged with but who was the first to conceptualise *lógos*, that a different notion of *lógos*, and from this a logic of sense, can be conceived. As I will demonstrate, Heraclitus' *lógos* can be understood as thermodynamic. It points toward logomachy, a logic of sense that considers metastability.

To begin, it must be noted that Heraclitus' varying use of the word *lógos* makes it challenging to discern what it pertains to in the fragments beyond syntactic and semantic ambiguity. Even in fragment DK1,

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46 Jacques Derrida, *De la Grammatologie* (Paris: Minuit, 1967), 1–12.
47 Simon Wortham, *The Derrida Dictionary* (London: Bloomsbury, 2010), 89.

which is often translated as the *lógos* is "forever," *aiei*, the predicate "forever" in Ancient Greek, could quite as quickly pertain to the ignorance of those that pretend to listen to it and not the *lógos* itself.[48] Aristotle, in *Rhetorics*, was the first to point this out. Commentary on this fragment has often chosen one or the other interpretation. Summarising this interpretive contention, Charles H. Kahn writes (citing much of the literature on this topic):

> What Aristotle noticed, in one of his rare comments on another philosopher's style, was that the word *aiei* 'always, forever' in this opening sentence can be construed either with the words that precede ('this *lógos* is forever') or with those that follow ('men always fail to comprehend'). Aristotle offers no opinion on the construction beyond the appropriate remark that such ambiguity makes Heraclitus hard to read (*Rhet.* III.5, 1407bllff., = DK 22.A4). But modern scholars have felt obliged to take sides, either in favor of the former construction (which was long predominant, and has been defended recently by Gigon, Verdenius, Frankel, Guthrie, and West), or in favor of the latter (which was urged by Reinhardt, Snell, Kirk, Marcovich, and Bollack-Wismann, among others). [49]

Instead of choosing a side, Kahn argues that "what this division of opinion shows is that, as Aristotle observed, there is good reason to take the predicate 'eternity' both ways."[50] Challenging interpretations such as Eva Brann's, where the *lógos* is said to "bring everything to unity, to oneness", any simple unity of the *lógos* is undermined by the very meaning of the Heraclitean *lógos* itself. The *lógos* cannot merely be synonymous with substantial unity or metaphysical stability since it pertains to an ambiguous plurality of significations. As Kahn writes, the *lógos* can be said to pertain to "the discourse of Heraclitus, the nature of language itself, the structure of the psyche and the universal principle in accordance with which all things come to pass."[51] The fact that the Heraclitean *lógos* refers to the conflictual linguistic structure of the fragments themselves (*lógoi*) also undermines any claim that the Heraclitean *lógos* is comparable to Parmenides' Being or Plotinus' One (both of whom reject language as a means of expressing Being). As Nietzsche points out in his *Philosophy in the Tragic Age of the Greeks*, children playing at building and destroying sandcastles know more about the *lógos* through "play" than philosophers do through "metaphysical thoughts."[52] The *lógos* refers, instead, to a mode

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48   Charles H. Kahn, *The art and thought Of Heraclitus: An edition of the fragments with translation and commentary* (Cambridge: Cambridge University Press, 1979), 29. I am using Kahn's English translation of the fragments, citing the page in the footnotes. However, as is common practice, I am including the Diels-Kranz fragment number in parentheses. Heraclitus is DK 22. and is followed by either A "Life and Doctrines," B "Fragments," or C "Imitations."

49   Kahn, *Heraclitus*, 93.

50   Kahn, *Heraclitus*, 93.

51   Kahn, *Heraclitus*, 94.

52   Nietzsche, *Philosophy in the Tragic Age of the Greeks*, trans. Marianne Cowan (Washington, DC: Eagle

of thinking or writing that is neither strictly "rational", "unified", nor "determinedly" truthful (as per the Russell-Frege view) but instead takes the very equivocality and conflictuality of language as the so-called "truth" of its medium. As Blanchot writes, Heraclitus' *lógoi* "does not say *(oute legei)* nor hide *(oute kruptei)* but indicates *(semainei)*". [53] And that which it indicates is conflict.

Since *polemos* and *eris* function as synonyms for *lógos,* the Heraclitean fragments on war (primarily DK.22 B53 and DK.22 B80) determine how the *lógos unifies* through conflictuality. Heraclitus writes, "One must realise [*eídomai*] that war is shared, and Conflict is Justice, and that all things come to pass (and are ordained?) in accordance with conflict [*éris*]" (DK.22 B80).[54] Realising (*eídomai*), the same verb that Plato used for knowing the Forms (*eidoi*), is conditioned by conflict (*éris*). For Heraclitus, unity and conflictuality are concomitant. It is the conflictual relationship between separation and unification that enables a representative understanding of such opposites as death and life (DK.22 B88), youth and age (DK.22 B69), night and day, war and peace, and finally, winter and summer (DK.22 B47).[55]

While it might be possible to determine a Hegelian feature to this thought, Heraclitus's insistence on the primacy of conflict radically distinguishes him from such a recuperation. For Heraclitus, the *lógos* qua war determines the quality of the *lógos* itself. War is not just the reflected moment of the movement of the Concept toward absolute knowledge. To grasp the *lógos*, one must grasp the fundamental conflictuality of nature. As Nietzsche writes, "the one overall Becoming is itself law; *that* it becomes and *how* it becomes is its work."[56] This "how" of the "law" of the *lógos* is the conflictual work that the *lógoi* perform so that sense may appear. The Heraclitean *lógos* is, thus, comparable to the Saussurian claim that "in languages, there are only differences without positive terms."[57] In the *lógos* of Heraclitus, there are no determinate terms before the conflictual difference that constitute them. Only if Saussure's "structuralism" presents language as a static time-slice, then Heraclitus's flows. Indeed, if the war of opposites is to be taken to mean precisely that—war—then this conflictuality must be understood as subject to the energetic laws of exhaustion and resistance.

Publishing, 1998), 62.

53   Maurice Blanchot, "Préface", in Ramnoux, *l'homme entre les choses et les mots*, xix.

54   Kahn, *Heraclitus*, 67.

55   Kahn, *Heraclitus*, 71.

56   Nietzsche, *The Pre-Platonic Philosophers*, trans. Greg Whitlock (Urbana and Chicago: University of Illinois Press), 63.

57   Ferdinand Saussure, *Cours de linguistique générale* (Paris: Payot, 1971), 166.

Quamity or Howness: The *Lógos* as Thermodynamic System State:

For Clémence Ramnoux, as it is for certain other classics scholars such as Theodoros Christidis, Heraclitean fire (*pyr*), that which is synonymous to the operations of the *lógos*, is understood as being thermodynamic in nature. Werner Heisenberg goes so far as to argue that "If we replace the word fire with *the word energy, we can almost repeat [Heraclitus'] statements word for word from our modern point of view.*"[58] In her book-length study of Heraclitus, *Héraclite ou l'homme entre les choses et les mots*, Ramnoux argues that the long-standing debate in Heraclitean exegesis concerning the *pyros tropai*, the "reversals of fire" (DK.22 B31) can be resolved if *pyr* is understood as adhering to a transformative, energetic law.[59] Explicitly, she argues that the *pyr* is the *lógos* and that, as and thermodynamic logic, it "enounces a principle of conservation," which is to say that it articulates the first law of thermodynamics.[60] She continues, "And we must distinguish what is conserved: 1° A quantum of fire (*pyr*) engaged in the circulation under several metamorphoses … 2° A quantum of each form in circulation and a constant proportion between them."[61] From this, the "quanta of fire" are thus called "quanta of energy" and constitute the manner through which the world is either "warmed-up" or "cooled down".[62] Ramnoux interprets, therefore, DK.22 B30 and DK.22 B 1 with quanta of energy in mind. Thus DK.22 B30, "The ordering, the same for all, no god nor man has made, but it ever was and is and will be fire ever living, kindled in measures and measures going out,"[63] becomes the general energetic law of the cosmos itself; and DK.22 B31, "The reversals of fire: first sea; but of sea half is earth, half lightning storm"[64], becomes understood as the transformative process of quanta of energy/fire changing phase. Although Heraclitus writes that these transformations are reversals (*tropai*), one way of understanding them would be perhaps as transformations of different energy flows. Different *logoi* or *proportions* (*lógos* likewise has this meaning, as Euclid uses it in the *Elements*) of the quanta of energy transform into other phasic qualities of matter/energy by either adding or subtracting heat/energy, thereby metastabilising into different phasic equilibria: solid (earth), liquid (sea), or gas (lighting).

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58   Werner Heisenberg, *Physics and Philosophy* (London: Penguin, 1989), 51.

59   Lassalle is considered too Hegelian by Ramnoux. As such, he has a visible and invisible notion of fire, which she does not support: "c'était en effet une idée de Lassalle que pyr désignait une forme invisible du feu, tandis que prestèr désignait de la flamme en circulation." Ramnoux, *l'homme entre les choses et les mots*, 78; Kirk's intervention is likewise considered too linear, "Si on choisit le schéma linéaire de G. S. Kirk, on ne distingue plus un Feu-fonds et des vapeurs incandescentes. On ne distingue donc plus un niveau de la circulation et un niveau de la révélation." Clémence Ramnoux, *Héraclite, ou l'homme entre les choses et les mots* (Paris : Société des belles lettres, 1959), 84.

60   Ramnoux, *l'homme entre les choses et les mots*, 78.

61   Ramnoux, *l'homme entre les choses et les mots*, 83.

62   Ramnoux, *l'homme entre les choses et les mots*, 83.

63   Kahn, *Heraclitus*, 45.

64   Kahn, *Heraclitus*, 47.

Therefore, the *lógos* in Heraclitus is analogous to what, in thermodynamics, is called a *metastable thermodynamic system state*. Thermodynamic system states describe *how* the system is (in what condition it is in) at any given time, not *what* the system is, since it considers that things depend on a set of energetic variables. For example, ice as a system state of water is not ice for any strict ontological reason but because the relation between pressure, volume, entropy, and internal energy are so that water has metastabilised into such a state and remains as such for a given period. Since the emergence of the phasic state of water is contingent on the relation between different internal state variables (one could even talk of a *différance* between internal state variables), the system that constitutes the object water can only be said to offer meaning or reference concerning itself if certain energetic conditions remain metastable. Indeed, water as a chemical compound is likewise only a metastable state of the system, hydrogen and oxygen. And one could follow this logic down to the elemental particles themselves. This is why the ontological question "what is it" for things in the world, objects of sense, should be replaced with the transcendental question "how is it": how is it that such and such emerges and remains as such? In this case, *sameness*, the criteria by which judgment across a set of particulars is made possible, is not dependent on a quiddity or an essence, but something that could be termed a *quamity*, a howness—how something is (in what condition it is in) during a given period. Following this logic, the *lógos* qua sense is an emergent property whose sense-making is contingent on the metastability of an object's system state (phasic or otherwise). This analogy between the Heraclitean *lógos* and metastable system states is at work in several key Heraclitean fragments, particularly DK.22 B125, the *kykeôn* fragment and (DK.22 B12 and DK.22 B91), the river fragments.

Sameness and Minimal and Maximal Difference: The *kykeôn* and the River Fragments:

In his early seminar on Heraclitus' *lógos*, Heidegger explains how the etymological origin of *légein*, the ancient Greek verb that *lógos* stems from, signifies both a "laying out" and a "gathering."[65] In other words, internal to the *lógos* itself are two contradictory movements, one that gathers and unifies and another that scatters and dissipates. One of the ways that Heraclitus expresses such a contradiction in movement is by claiming that the *lógos* does not rest on stable ground, that it "rests by changing" (DK.22 B84a).[66] Ontologically, being can be conditioned by becoming. Logically, sameness can be conditioned by difference.

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65   Heidegger, "Lógos", in *Early Greek Thinking*, trans. David Farrell Krell and Frank A. Capuzzi (San Francisco: Harper, 1985), 76.

66   Kahn, *Heraclitus*, 53.

This tension inherent to the *lógos* is in the well-known fragment that discusses the substantial nature of the Greek drink *kykeôn*, a Greek beverage made of a mixture of barley, cheese, and wine. Often translated as "Even the [*kykeôn*] separates unless it is stirred" (*καὶ ὁ κυκεὼν διίσταται <μὴ> κινούμενος*),[67] the fragment is concerned with how motion is the condition, in a seemingly contradictory manner, of the unity of the drink. That is, as N. van der Ben writes, translating *kykeôn* as posset: "'the posset stops when it moves': when the circular motion has taken full hold of it, the posset 'stops' changing in any further way, having arrived at its final state qua posset."[68] Negatively, without movement, the *kykeôn* could not be what it is. That is, the state in which it is said to be the compound *kykeôn* and not the separate parts barley, cheese, and wine emerges from *how* it is stirred. Thermodynamically, to metastabilise the *kykeôn,* which means to stop the drink from separating so that it remains in a phasic metastable liquid thermodynamic system state, one needs consistently to supply free energy to the system by stirring it. Without the action of agitation, the drink would no longer constitute unity. The movement or energetic work of agitation permits the unity of the drink to endure. The *kykeôn* rests by changing; its being is maintained through becoming. The *kykeôn* hence functions as an example of how objects in the world are metastable and how a logic of sense that allows for judgement can be transduced therefrom. This is to say, the capacity to judge the *kykeôn* as an object of sense—to be able to think, say or write something akin to "that is *kykeôn*" with validity—the quamity of the *kykeôn* has to be such that its system state is in a metastable state of *sameness*. Objective judgements pertaining to objects of sense are possible only when they remain the *same* as themselves.

This logic of metastable sameness is also at work in the well-known Heraclitean fragments concerning the river (DK.22 B12 and DK.22 B91). As Cleanthes, the 3rd Century Greek Stoic quotes Heraclitus as saying: "As they step into the same rivers, other and still other waters [*hetera kai hetera hydata*] flow upon them" (DK.22 B12).[69] The metastable "sameness" (*autoisin*) of the river as an object of sense remains the same by being continually replenished with different waters (*hetera hydata*). As they flow into the river, the waters push against the banks, and the banks hold the water in. This mutual modulation between the water and the bank constitutes the form of the river. Simondon would write that this modulation is the process of individuation from whence the individual emerges *a presentae*. There is, therefore, a play between "*autos*" and "*hetera*", "sameness", and "difference." The river, like the *kykeôn*, rests (it remains the same river) by changing waters. The work of the source's flow in conjunction with the banks of the river, like the stirring of the *kykeôn*, maintains the metastability of the river's sameness. Suppose the

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67   Kahn, *Heraclitus*, 65.

68   N. van der Ben, "Theophrastus, De Vertigine, Ch. 9, and Heraclitus Fr. 125," *The American Journal of Philology* 109, no. 3 (Autumn, 1988): 401.

69   Kahn, *Heraclitus*, 53.

river's source were to stop flowing or the banks were to give in under the pressure of an increase in flow; the metastability of the river would enter a state of instability and bifurcate. A different, new river might even be formed. The waters that feed the river must, therefore, remain *minimally different* from each other so that the quamity of the river, its system state, remains the same. As with the case of the formation of a new river, *maximal difference*s are, therefore, the condition of bifurcation.

The notion of sameness used here must be distinct from identity.[70] Identity refers to a metaphysical claim that contains no "degree" of difference and can only be logically "true" outside of space and time.[71] Unlike the Frege-Russell view cited above, I claim that it would be wrong to refer to a thing in the world as *identical* to itself, it is possible to refer to a thing in the world as being the *same*. Sameness is, therefore, contingent not on any logical or ontological identity but on minimal internal energetic differences such that the quamity (how it is) of the object of sense remains metastable. The morning star is not identical to the evening star, they are not *referentially* identical; but Venus's quamity has remained in a minimally different state for thousands of years. Its orbit has not maximally deviated, nor has its volume or surface temperature. The morning star and the evening star are thus the same. Sameness contains differing amounts of difference. While this may appear similar to Deleuze's claims in *Différence et répétition,* the difference between identity and sameness and the thermodynamic logic behind it complicates Deleuze's argument that "the Same" (*le Meme*) is a quality of identity.[72] Identity can have no corresponding concepts since anything that deviates from it as identical admits difference, this is an old problem, one that is discussed at length in Plato's Parmenides. As with the case of the river, it continually flows with "different" waters and thus cannot be understood as identical to itself. Yet it may still be understood as the "same". Heraclitus' choice of the dative *aûtoisin* over *homóisin* reflects the difference between identity and sameness since *homós* relates to *ousía*, containing within it no "otherness" or difference. By contrast, the *aû* in *autos,* meaning "back again" but also "other," describes the metastability of sameness through the "recursive" maintenance of minimal differences, as Yuk Hui might write.[73] However, because the quamity of a system state depends on the supply of free energy into the system and because the supply of free energy is entropically finite, no system can recursively maintain its sameness infinitely. Therefore, the inevitable collapse of any system is an

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70   This is far from being the case for all philosophers. See: Harold Noonan and Ben Curtis, 'Identity', The Stanford Encyclopedia of Philosophy (Summer 2018 Edition), URL = <https://plato.stanford.edu/archives/sum2018/entries/identity/>. '"Identity" and "sameness" mean the same; their meanings are identical.'
71   Walter Benjamin points this out in a fragment from 1916, "Theses on the Problem of Identity" in *Selected Writings Vol. 1: 1913-1926*, eds. Marcus Bullock and Michael W. Jennings (London: Harvard University Press, 2004), 76.
72   Giles Deleuze, "L'image de la pensée," in *Différence et répétition* (Paris: PUF, 2015), 174.
73   Yuk Hui, *Recursivity and Contingency* (Rowman & Littlefield Publishers, 2019).

inherent property of metastable sameness itself.

The *lógos* must not, therefore, be understood in terms of substantiality or as "the self-presence of full self-consciousness" or even the "truth of truth," as Derrida argues. The *lógos* emerges as a system state contingent on the degree of energetic difference inherent to the object of sense. Because all system states are entropically finite, *logoi* are likewise finite.

Conclusion: The Three Laws of Logomachy:

Above, the question was asked: Is it possible to formulate a logic of sense that pertains to things in the world as metastable? By investigating the logical and temporal structure of metastability in conjunction with Simondon's rejection of the three laws of thought and Heraclitus's *lógos* as it pertains to the metastability of objects and the emergence of sense as a system state, an answer to this question has been transduced in the form of the three laws of logomachy:

> (1) *The law of metastable sameness*: "However something is, is because its *sameness* (being) is metastable."

> *(2) The law of metastable contradiction*: "metastability maintains *sameness* while concomitantly conditioning the possibility of *bifurcation* (becoming) and the necessity of *collapse* (nonbeing)."

> (3) *The law of minimal and maximal difference*: "Nothing is identical to itself; there are only minimal (sameness) and maximal energetic differences (difference)."

These laws are logical in that they facilitate valid judgment and are ontological in that they express how things are in the world. For example, if one were to make the judgment (what Kant would call a determinate and empirical judgment) "that something *is* something" (propositional logic), the validity of that judgment, in so far as a proposition can be made about something in the world, is dependent on that object being in a metastable state of *sameness*. In other words, in the propositional statement, "That is a table", the table cannot be on fire, it cannot be reduced to ash, nor can it be chopped up and used to make a chair since all of these changes would constitute *maximal differences*: "That is a table" would no longer be valid. Furthermore, it is inevitable that through wear and tear, a table's *sameness* is likely to alter (it no longer has a functioning draw, for example) and that maintenance becomes necessary. However, maintenance understood here as replacing a part with another part (the draw),

gives way to *metastable contradiction.* In other words, the table is bifurcated by being maintained as the same. Therefore, one might say, "This is no longer the same table." Lastly, there will be a time when the table can no longer be maintained, or it's not chosen to be repaired, and the acceleration of collapse will take hold. Here the proposition becomes its negation: That is not a table" or "There is no table."

Written in natural language, these laws may now function as the guiding principles for further examination into other systems of sense, such as perception, memory, recognition, and signification, the other metastable systems of logomachy. These other metastable systems, systems that together allow for the emergence of sense, play their part in the practical application of logomachy, logomachics. Logomachics will offer philosophical semantics the tools necessary for analysing how, why, and through what means sense is maintained, manipulated, and falls to ruin.

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