Psychoanalysis, thermodynamics and the matter of scarcity: A genealogy of Freud's death drive hypothesis

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Abstract

In his 1920 essay *Beyond the Pleasure Principle*, Freud introduced the death drive hypothesis, according to which “the aim of all life is death”. I shall not discuss the truth value of this hypothesis here; instead, I trace its genealogy in order to understand it as a moment in the history of modern Western societies. First, I present Freud's metapsychology, and in particular its “economic” dimension, the death drive being central to this dimension. Secondly, I retrace the history of the concept of energy and of the formulation of the laws of thermodynamics in the nineteenth century. Energetics and thermodynamics are shown to have been important to the Freudian economic dimension. Further, I show that for nineteenth-century scientists, the concern for energy reflected a socio-economic preoccupation with the matter of scarcity. Lastly, I argue that Freud's relationship to energy, as expressed in the death drive hypothesis, also reflected a certain relationship of Western countries to scarcity in the era of the second industrial revolution.

Keywords

Freud, metapsychology, energetics, scarcity, history of psychoanalysis.

In his 1920 essay *Beyond the Pleasure Principle*, Freud (1920/1955) capped a sinuous argument with the following statement:

If we are to take it as a truth [...] that every living dies for *internal* reasons – becomes inorganic once again – then we shall be compelled to say that “*the aim of all life is death*” and, looking backwards, that “*inanimate things existed before living ones*”. (p. 38)

This statement is the prototypical formulation of the concept of “death drive”, a concept that would spark many debates and attract criticisms for its pessimism by many psychoanalysts after Freud. The objective of this paper is not to discuss the veracity of this hypothesis, but rather to trace its genealogy, in order to understand it as a particular moment in the history of Modern western societies. Beyond the concept of death drive itself, I will probe the epistemological roots of the “economic dimension” of Freudian metapsychology. This will entail highlighting the debts of this metapsychology to 1) the energetic theories formulated within the framework of nineteenth-century thermodynamics, and less directly, 2) the industrial-capitalist ideology of modern Western societies.

The method adopted here is that of historical epistemology, which consists in seeking for the historical prerequisites that serve as conditions of possibility for a new scientific theory to emerge (Daston, 1994, pp. 282-283; Foucault, 1966/2002, pp. XXIII-XXIV, 1969/2002, pp. 142-148). This means putting aside the question of metapsychology’s truth value to focus on the scientific, social and economic context that made its existence possible at that precise moment. I will also rely on a widely accepted postulate in the field of Science and Technology Studies, according to which, in modern capitalist societies, the economic sphere (including, in a broad sense, the relations of production, the productive forces and the economic doctrines) may impact the scientific realm.

The argument will proceed in three parts. 1) I start by presenting what Freud called “metapsychology”, and in particular its “economic” dimension. The death drive hypothesis is a

central part of this dimension. 2) Then, I retrace the energetic conceptions developed in the nineteenth-century natural sciences, in direct relation to thermodynamics. The importance of those theories in Freud's conceptions of the death drive and the economic dimension has been amply documented (Assoun, 1981; Tran The et al. 2018). I highlight the stakes related to the industrial revolution and the economic matter of scarcity that determined the formulation of the thermodynamic principles, and in particular that of entropy. The significance of this industrial context for the genesis of the concept of energy has also already been underlined (Blay, 2017; Kuhn, 1959/1977; Rabinbach, 1992). 3) If the links between metapsychology and thermodynamics on one hand, and between thermodynamics and the industrial context on the other hand, are both well-documented, less has been written on the indirect relationship between Freud's metapsychology and the industrial ideology, although Raitt (2002) provided valuable insights on this issue. In a third step, I therefore explore the consequences of Freud's borrowing of the concept of energy. While there are parallels between the two laws of thermodynamics and the two principles of Freudian economics, the death drive hypothesis reflects a relationship to energy that is different from that found in the work of mid-nineteenth century scientists. I argue that this difference is rooted in the mutation of industrial societies between the mid-nineteenth century (when the two principles of thermodynamics were formulated) and 1920 (when *Beyond the Pleasure Principle* was published).

I. The economic dimension of metapsychology

The Freudian metapsychology

Energetic theories were introduced into psychoanalysis via Freud's metapsychology, and especially its "economic dimension". Metapsychology can be understood as an attempt to formalize the theoretical axioms of psychoanalysis (Assoun, 1981, p. 73, 2013, p. 13, p. 24).

For Freud (1915/1957, p. 181), this approach consists in appreciating psychical processes according to three dimensions: the “topographical”, the “dynamic” and the “economic”.

- 1) The topographical dimension understands the mental apparatus as being composed of different interconnected “locations”, each with its own mode of functioning (Freud, 1926/1959, p. 266). On this point, Freud's formulation owes much to neuroanatomy, and more precisely to the theories of specialized brain areas developed in the second half of the nineteenth century (Assoun, 1981, pp. 124-130).
- 2) The dynamic dimension perceives psychic processes as the interplay of mutually opposed or reinforcing forces (Freud, 1926/1959, p. 265). This formulation borrows from the vocabulary of Newton's classical mechanics.
- 3) The economic dimension understands psychic processes to be invested with variable quantities of energy that flow within the mental apparatus (Freud, 1926/1959, pp. 265-266). This latter dimension was particularly instrumental to the importation of energetic theories into psychoanalysis.

The second section of this paper will retrace the genealogy of these theories. For now, let us focus on what Freud says about the economic dimension of his metapsychology in particular.

The pleasure principle and the principle of constancy

The influence of the energetic doctrine on Freud can be first spotted in the *Project for a Scientific Psychology*, a manuscript he wrote in 1895 but never published during his lifetime. The explicit project of this essay was “to furnish a psychology that shall be a natural science: that is, to represent psychical processes as quantitatively determinate states” (Freud, 1895/1966, p. 295). This idea of quantifiable psychical processes is the first presentation of what Freud (1915/1957, p. 181) would later call the “economic” dimension of his metapsychology. The concept of quantity stems, he writes in the *Project*, from “pathological clinical observation”,

and can be understood through the “principle of neuronal inertia” according to which “neurons tend to divest themselves of Q [quantity of energy]” (Freud, 1895/1966, p. 295-296). This tendency allows for avoiding “unpleasure”, which “would have to be regarded as coinciding with a raising of the level of $Q\dot{\eta}$ [endogenous quantity of energy] or an increasing quantitative pressure”, as opposed to pleasure, which “would be the sensation of discharge” (Freud, 1895/1966, p. 312).

This “pleasure principle” is central to the economic dimension. Freud did not actually invent this concept, but borrowed it from Fechner, nowadays known as the founder of psychophysics (Assoun, 1981, pp. 150-153; Laplanche & Pontalis, 1988, p. 342; Sulloway, 1979/1992, pp. 66-67). In 1848, Fechner described a supposedly universal *Lustprinzip*, according to which the quantity of energy in the mental apparatus remained overall constant. However, Fechner himself did not create this concept out of thin air: he extrapolated it from the principle of energy conservation formulated by Helmholtz in the 1840s (Raitt, 2002, p. 64; Wegener, 2005, pp. 272-273). This principle, also known as the first law of thermodynamics, states that the overall quantity of energy contained in the universe stays overall constant. What Fechner did is to apply this principle to the mind (Raitt, 2002):

Building on Hermann von Helmholtz’s 1847 formulation of the first law of thermodynamics, [...] Fechner argued that the overall level of energy in the mind also remained constant: “As far as its course is bound to the course of psychophysical processes and these in turn are bound by the law of the conservation of energy, the mind will itself be bound by that law.” (p. 64)

We can therefore draw a genealogical line from Helmholtz’s principle of energy conservation to Freud’s pleasure principle via Fechner. I will later come back to the significance of this genealogy; let us return for the moment to the Freudian principle of pleasure.

Twenty-five years after the unpublished *Project*, Freud came back to this principle in *Beyond the Pleasure Principle*. He defines it as follows (Freud, 1920/1955):

[...] the course taken by mental events is automatically regulated by the pleasure principle. [...] the course of those events is invariably set in motion by an unpleasurable tension, and [...] its final outcome coincides with a lowering of that tension – that is, with an avoidance of unpleasurable or a production of pleasure. (p. 7)

The pleasure principle is still defined as a tendency of the mental apparatus to discharge its psychic energy. On other occasions, Freud (1920/1955) instead uses the phrase “principle of constancy”, but indicates that he holds the two concepts as equivalent: “the mental apparatus endeavours to keep the quantity of excitation present in it as low as possible or at least to keep it constant. This latter hypothesis is only another way of stating the pleasure principle” (p. 9). This explication is actually far from obvious: the idea of “constancy” (or “stability”) rather suggests that of an average homeostatic equilibrium, while the pleasure principle is defined by Freud as a continuous (ideally total) tendency to spend energy (Assoun, 1981, p. 153; David-Ménard, 2017, pp. 247-249; Laplanche & Pontalis, 1988, pp. 342-344). To resolve this tension, one must allow a gap between 1) the “original tendency to total discharge” and 2) “constancy” as “a state stabilized at zero plus” that would be opposed, in a second step, to the first tendency (Assoun, 1981, p. 153). This is the solution adopted by Freud (1920/1955) when he writes that “there exists in the mind a strong *tendency* towards the pleasure principle, but [...] that tendency is opposed by certain other forces or circumstances, so that the final outcome cannot always be in harmony with the tendency towards pleasure” (pp. 9-10). In the first place, it is the “reality principle” which, “under the influence of the ego’s instincts of self-preservation” (Freud, 1920/1955, p. 10), tends to divert pleasure from its tendency to direct and total discharge.¹ Therefore, if pleasure and stability are first supposed to be identical (and *de facto* non-contradictory), there is an actual difference between a “theoretical” (or “ideal”) principle and an “applied” (or “concrete”) one (the various terms used by Freud and their respective functions are summarized in Table 1). To recap (Laplanche & Pontalis, 1988):

Considerations of conceptual clarity [...] urge that a distinction be preserved between a tendency to reduce the quantity of excitation to zero on the one hand, and a tendency to keep this quantity at a constant level on the other; to meet this demand, the pleasure principle must be seen as correlative with the former trend, and the maintenance of constancy treated as a corollary of the action of the reality principle. (p. 345)

As shown above, Freud gives primacy to the pleasure principle (i.e., the tendency to discharge) over the principle of constancy (and consequently over the reality principle too). He supports this idea with a biological and philosophical discussion about the non-organic origin of living organisms. Freud (1920/1955) assumes that one can deduce, from this origin, “a universal attribute of instincts and perhaps of organic life”: “*an instinct is an urge inherent in organic life to restore an earlier state of things which the living entity has been obliged to abandon under the pressure of external disturbing forces*” (p. 36). From there, only one step was left to formulate the concept of death drive, according to which “*the aim of all life is death*” (Freud, 1920/1955, p. 38).

Principle type:	Pleasure principle	Reality principle = principle of constancy
Provoked by:	The death drive	The ego's instincts of self-preservation
Function (purpose):	To reduce the quantity to zero	To keep the quantity at a constant level

Table 1: Overview of the economic model presented in *Beyond the Pleasure Principle*

To summarize, there is, according to Freud, a tension between a tendency of the organism to totally discharge its energy and a tendency to keep it constant. He gives primacy to the tendency to discharge (pleasure principle), and therefore to death over life. Freud's energetic conceptions presented above raise two questions. Firstly, how did the concept of energy come to travel from thermodynamics into a field like psychoanalysis? Secondly, what brought Freud to conclude that life is an accident while death is an essence?

2. The economic-energetic ideology

The “physicalist oath”

Between 1830 and 1847, often independently, more than a dozen scholars² developed a series of theories that led to the formulation of the principle of energy conservation (or first law of thermodynamics) at the end of this period (Kuhn, 1959/1977). Correlative to the principle of conservation, the idea that all “forces” (whether physical, electrical, magnetic, chemical, physiological, etc.), being of the same nature, are interconvertible, became established.³ The principle of conservation of energy was thus at the center of a new physicalist current from the 1840s onwards (Assoun, 1981, pp. 59-65). Physicalist physiology was represented by a generation of scientists that included Virchow, Du Bois-Reymond, Helmholtz, Brücke and Ludwig; the latter four founded the *Physikalische Gesellschaft zu Berlin* in 1845. In 1842, Du Bois-Reymond pronounced the now famous “physicalist oath”, which was to clarify the epistemological foundations of this Society: “Brücke and I pledged a solemn oath to put into effect this truth: “No other forces than the common physical-chemical ones are active within the organism” (cited by Jones, 1953-57/1964, pp. 62-63).

After Mayer, Helmholtz explicitly sought to bridge the gap between physiology and physics, precisely by putting forth the idea that the “forces” described by these two disciplines are substantially identical (Assoun, 1981, p. 158; Tran The et al., 2018, pp. 3-5). While discussing the two conceptions of Mayer and Helmholtz, Ostwald asserted the existence of psychical phenomena that can be conceived like every other phenomenon – energetic phenomena (Assoun, 1981, p. 172; Tran The et al., 2018, p. 8). Therefore, physicalism first brought physics closer to chemistry (Duhem applied the laws of thermodynamics to chemical phenomena), then to biology, physiology and medicine (as evidenced by Fechner, Helmholtz or Lotze), and eventually to psychology and psychoanalysis at the end of the century (with Wundt in Germany, Ribot in France and Freud in Austria). Freud’s incorporation of the principle of energy

conservation within his metapsychology must be understood in regard to this epistemological context of physicalism. During his medical studies, having spent several years in Brücke's laboratory, Freud was constantly exposed to energetic conceptions such as Helmholtz's or Fechner's (Assoun, 1981, pp. 145-187; Rabinbach, 1992, p. 170; Tran The et al., 2018, p. 5).

The energetic ontology

At that time, many scientists sought to close the scientific field by marking their distance from philosophy. In the German-speaking countries, Du Bois-Reymond, Helmholtz, Liebig and Mayer thus explicitly rejected *Naturphilosophie* by faulting its mystical, speculative and non-quantitative dimensions. It is no less clear that these scholars conveyed a cosmological vision whose origins can be traced back to nineteenth century Romanticism and *Naturphilosophie*. The notion of energy conservation appears indeed as a metaphysical principle of harmonic unification of Nature as a Whole (Blay, 2017, pp. 266-267; Ellenberger, 1970, p. 540; Kuhn, 1959/1977, pp. 94-100; Prigogine & Stengers, 1984, p. 109; Rabinbach, 1992, pp. 54-56). Helmholtz (1856) for instance described his principle of energy conservation (here still named "force"⁴) as follows:

[...] Nature as a whole possesses a store of force which cannot in any way be either increased or diminished, and [...] therefore the quantity of force in nature is just as eternal and unalterable as the quantity of matter. Expressed in this form, I have named the general law "The Principle of the Conservation of Force." (p. 501)

However, as shown by Rabinbach (1992, pp. 45-68) or Blay (2017), this principle of energy conservation is not only ontology-laden, it is also ideology-laden. We are now going to see how economic concerns permeated the energetic conception of nineteenth century scholars, in the context of the industrial revolution in Western countries.

The industrial revolution and the division of labor

The eighteenth century witnessed the correlative development of science as technique (with, for example, the creation of the first engineering schools in France) and the empowerment of the economic and productivity spheres (with an accumulation of capital due to the considerable increase in trade). By the end of that century, the economic theories of the classical liberal school were born. In England, the first industrial revolution played a major role in the birth of this school, marked by the publication of Adam Smith's *The Wealth of Nations* in 1776. Smith (1776/1981) defended the thesis that "The greatest improvement in the productive powers of labour [...] seem to have been the effects of the division of labour" (p. 13). After an initial accumulation of capital in the late seventeenth century, the second half of the eighteenth century saw the development of industrial machinery and the generalization of the division of labor.

Although Smith was not the first economist to theorize the notion of labor, he nevertheless gave it a new role: it was no longer the value of the marketable object itself that determined its price, but the labor necessary to produce it (Blay, 2017, pp. 233-234; Foucault, 1966/2002, pp. 241-242). The worker was no longer paid directly because he produced an object, but because he "spent" his "energy" in the process of providing work (Blay, 2017, p. 235). Man's ontological vision of himself therefore changed dramatically. "[W]ith Adam Smith", Foucault (1966/2002) wrote, "reflection upon wealth begins to overflow the space assigned to it in the Classical age", particularly because:

[...] it is already pointing in the direction of an anthropology that will call into question man's very essence (his finitude, his relation with time, the imminence of death) and the object in which he invests his days of time and toil without being able to recognize in it the object of his immediate need [...]. (p. 244)

With the rationalization of production methods, the development of industrial machines went hand in hand with a reification of the worker himself. As a result, in the nineteenth century, a

vision of Nature conceived as a machine and the new figure of the human machine flourished⁵ (Blay, 2017, pp. 235-260; Rabinbach, 1992, pp. 45-68).

Nature and Man as machines

The formulation of the principle of energy conservation was the direct result of the development of industrial machines (in particular the steam engine) from the very early nineteenth century (Kuhn, 1959/1977, pp. 83-94; Mirowski, 1989/1995, p. 24; Rabinbach, 1992, pp. 45-46). The engineering arts played an important role in the diffusion of the ideological vision of Nature and Man as machines in the scientific field⁶ (Blay, 2017, pp. 215-225; Kuhn, 1959/1977, pp. 90-94).

In 1824, Carnot compared nature to an enormous machine with a huge reservoir of driving forces (Blay, 2017, pp. 236-237). A few years later, Coriolis (1829, pp. 2-3, p. 17) proposed for the first time to replace the term “force” by “work” in dynamics, so that the former would be used only to refer to static phenomena. He then committed to “an approach [...] that enabled him to transpose the notion of work from the economic domain, or even from the common language, into the field of physics”⁷ (Blay, 2017, p. 242). Coriolis’s writings (e.g., 1829, p. 27) were explicitly geared towards the industrial and economic applications of his concept of work. They likened not only animals and Man, but also the whole Nature, to machines and sources of driving forces (Blay, 2017, pp. 245-260; Kuhn, 1959/1977, p. 91). This theme of Nature as a gigantic machine and a reservoir of resources also comes up in the work of scholars such as Helmholtz, Du Bois-Reymond, Haeckel and Ostwald (Rabinbach, 1992, p. 49). Helmholtz (1856), for example, stated: “We cannot create mechanical force, but we may help ourselves from the general storehouse of Nature”⁸ (p. 501). Thus, from the point of view of these scientists, to consider Man as a machine was to recognize that he can produce work as long as he is given some energy, which comes from the reservoir of Nature.

The entropy principle

In 1852, Thomson formulated, after Carnot, the principle of entropy,⁹ the second “law” of thermodynamics. To do so, he started from a context that was no longer ideal, instead taking concrete mechanical energy losses into account. By emphasizing the irreversibility of these energy losses, this principle dismissed the possibility of perpetual motion (Merleau-Ponty, 1983, p. 9). Accordingly, perpetual motion was only defined negatively, as the radical impossibility for an engine to indefinitely provide “work” without an external source capable of supplying it with energy (Blay, 2017, pp. 263-265; Merleau-Ponty, 1983, pp. 8-9).

One might wonder how the two laws of thermodynamics could be compatible, i.e., how can energy be “lost” if everything in nature is conserved (Guedj, 2010, p. 116; Mirowski, 1989/1995, p. 60; Rabinbach, 1992, pp. 47-49, p. 63)? Thomson (1852) answers this:

[...] there is an absolute waste of mechanical energy available to man when heat is allowed to pass from one body to another at a lower temperature, by any means not fulfilling his criterion of a "perfect thermo-dynamic engine," established, on a new foundation, in the dynamical theory of heat. As it is most certain that Creative Power alone can either call into existence or annihilate mechanical energy, the "waste" referred to cannot be annihilation, but must be some transformation of energy.

(p. 304)

Here we are led to understand that energy is “wasted” to Man even though it is preserved in Nature – which makes it apparently possible for the two principles of thermodynamics to remain compatible (Guedj, 2010, pp. 116-123; Harman, 1982, p. 52; Merleau-Ponty, 1983, p. 14; Raitt, 2002, p. 67). The research on a perpetual motion machine (which kept many a scientist busy in the eighteenth and early nineteenth centuries) actually reflected a concern for the importance of the resources available to Man, as well as the fantasy of a world with inexhaustible resources (Blay, 2017, pp. 262-264; Rabinbach, 1992, p. 58; Raitt, 2002, p. 64, p. 67). As we are about to see, the tension that exists between the two laws of thermodynamics (conservation and

entropy) can be understood in consideration of the industrial-capitalist ideology of the nineteenth century.

The nineteenth century matter of scarcity

After the industrial revolution, and with the naturalization of the capitalist system of production, the idea of scarcity appeared to be more problematic than it was at the beginning of the nineteenth century (Foucault, 1966/2002):

In Classical thought, scarcity comes about because men represent to themselves objects that they do not have; but there is wealth because the land produces, in some abundance, objects that are not immediately consumed [...]. Ricardo inverts the terms of this analysis: the apparent generosity of the land is due, in fact, to its growing avarice; what is primary is not need and the representation of need in men's minds, it is merely a fundamental insufficiency. (p. 279)

The naturalization of the problem of scarcity was justified by classical liberals according to a scenario that combined the classical theme of natural right with the newer political-economic problem of population¹⁰ to make work a necessity for Man: contrary to the “state of nature”, and because of the growing demography, he *must* work to ensure his subsistence. Malthus inherited from Linnaeus the theme of the regulation of plant and animal populations through the “balance of nature” and applied it to human society, insisting on the natural character of the phenomenon of population growth (Canguilhem, 1977/2009, pp. 117-118). Ricardo pointed out that the more the human population grows, the more Man must work: this growth forces him to cultivate less and less fertile land, as work becomes more and more difficult and less and less profitable.

Those economic considerations have played an important role in the problematization of the concept of entropy by scientists. In the vision of the machinist ideology, the worker is a machine that produces goods, but it is an imperfect machine, which constantly requires resources

(wages) to “function” and is exhausted by its task (Rabinbach, 1992, p. 68). Nature’s reservoir of raw materials poses, on another scale, a comparable problem:¹¹ its resources, which are necessary for production, are seen as subject to an increasing scarcity (Prigogine & Stengers, 1984, pp. 114-116). Having renounced the possibility of perpetual motion, the new objective of nineteenth century scientists was to find technical solutions to the problem of the scarcity of the resources required for Man and machines to work¹². Thus, the thermodynamic cycle modelled by Carnot can be conceived as “a set of *tricks* to avoid irreversible conduction. Thermodynamics was thus built up *about* irreversibility but also *against* it, seeking not to know it but to save it”¹³ (Prigogine & Stengers, 1979, p. 270). The tension between the two laws of thermodynamics and the nearly paradoxical description of a world in which energy is never destroyed and yet dissipates reflect the concerns of “pessimistic” economists, who feared an incompatibility between a virtually infinite desire for consumption and the finiteness of the Earth’s exploitable resources¹⁴. Returning now to Freud, we will now see that this quasi-paradox is also to be found in his economic theory.

3. The second industrial revolution and the death drive

From thermodynamics to metapsychology

We have seen previously that Freudian metapsychology exhibits a tension between the pleasure principle (i.e., the tendency towards discharge) and the reality principle (or constancy, i.e., the tendency towards stability). This tension in metapsychology is reminiscent of the tension in thermodynamics between the principle of conservation (as an ideal of inexhaustible cosmic energy) and that of entropy (as the concrete impossibility of perpetual motion) (Rabinbach, 1992, pp. 63-64). In Thomson’s case, the consideration of energy losses implied the “passage” from the first to the second law of thermodynamics. In the same way, the acknowledgement of a discharge involved, for Freud, the “passage” from constancy to pleasure (Raitt, 2002):

[...] as far as the psyche was concerned, the first law of thermodynamics as it was expressed in the principle of constancy implied the apocalyptic pessimism of the second. If, in order to keep the level of psychic excitation constant, the mind was continually discharging energy, like the universe it would surely eventually run out of steam. (p. 67)

This analogy should not be surprising when considering that Freud's economics is rooted in energetic ontology and its figure of the human machine (Lacan, 1954-55/1991, pp. 60-62). Machines, according to the engineers of his day, functioned thanks to the energy they tend to disperse (entropy); if we replace machines by Man, his death is conceivable as the outcome of an entropic process (total loss of energy).

However, there is a slight yet significant difference between thermodynamic theories and Freudian metapsychology. In the former, the principle of conservation is akin to an "ideal" to strive for, by opposing the tendency of mechanical systems to disperse their energy. Thus, having given up the possibility of a *perpetuum mobile*, nineteenth century engineers designed technical devices that optimize efficiency by limiting energy losses. In contrast, in Freud's *Beyond the Pleasure Principle*, death (i.e., the result of "organism entropy") is conceived as a purpose, whereas the tendency to maintain tension at a non-zero level (i.e., alive) is perceived as an accident. In other words, Freud's model implied that expending energy is an aim, an idea that contrasts with the fear of scarcity that haunted the nineteenth century (see Table 2 below).

Principles of thermodynamics		Principles of metapsychology	
"Purpose" ←	Conservation (1 st law)	Reality (constancy)	→ "Actuality"
"Actuality" ←	Entropy (2 nd law)	Pleasure (discharge)	→ "Purpose"

Table 2: Overview of the differences between the principles of thermodynamics and metapsychology

While previous developments on the genesis of the energetic ideology and the human machine metaphor have helped us to understand how Freudian economic principles (reality-

constancy and pleasure-discharge) can be understood as transpositions of the two thermodynamic principles (conservation and entropy) in psychoanalysis, we must now try to figure out why, despite this borrowing, Freudian and thermodynamics theories differ. I will argue that the divergence between the “ideals” of thermodynamic engineering and of Freudian metapsychology is to be found in the evolution of Western societies between the mid-nineteenth century (when the law of entropy was formulated) and 1920 (when *Beyond the Pleasure Principle* was published).

Scarcity after the second industrial revolution

In the late nineteenth century, European countries experienced a series of economic and political crises. The spread of discourses (such as Nietzsche’s) on the “end of history” at the time was a manifestation of the fear of waste as well as of the social mutations that characterized the period (Foucault, 1966/2002, pp. 282-286; Prigogine & Stengers, 1984, p. 116). Likewise, the Great War, both an expression and an outcome of the disintegration of the old empires, would be perceived by many as the ultimate symptom of the decline of the West (Ellenberger, 1970, p. 548). At the dawn of the twentieth century, Vienna was the setting for a cultural and political crisis of liberalism, a crisis that constituted the premise of a second modernity (Schorske, 1980, pp. XXVI-XXVII, pp. 184-185). After the war, the fall of the Austro-Hungarian Empire created a situation of social anomie, which was anxiety-inducing for the dominant classes and influenced Freud in the writing of *Group Psychology and the Analysis of the Ego* (Ellenberger, 1970, p. 528). The influence of conflict and of the post-war period on Freud’s elaboration of the concept of death drive, particularly on the pessimism of this concept, has already been widely noted (e.g., Koteska, 2019). About this concept and its context of formulation, Clair (2018) wrote: “What stronger image could be proposed of the Viennese

sensibility and the rift it went through, a modernity both desired and rejected – "Secession" but not Revolution?"¹⁵ (p. 23).

Indeed, the post-war period also marked the advent of the second modernity on the old continent. At that time, mass consumer society, a by-product of the second industrial revolution that had begun in the late nineteenth century, experienced a boom. This industrial boom and the massification of production sparked a wave of "economic optimism" in Western countries (Zaretsky, 2004, p. 134). In the United States and then in Europe, Fordism increased the control of workers (via a rationalized production chain), but also enabled them (thanks to higher wages) to achieve consumer "status" (Rabinbach, 1992, p. 282; Zaretsky, 2004, pp. 138-139). At the turn of the twentieth century, electric and combustion engines, which were much more energy-efficient, replaced steam engines. With the expansion of domestic electrical networks, the democratization of the automobile, the development of the chemical industry and the rationalization of the work chain, scarcity now seemed to be much less of a looming prospect. In a sense, the new methods for producing and harnessing energy appeared to have actually made the dream of nineteenth century engineers, that of a society with inexhaustible resources, come true¹⁶ (Zaretsky, 2004, p. 140). As noted by Zaretsky (2004), "Fordism thus gave rise to a paradox: beginning as an attempt to regiment both work and family, it generated the utopian idea that human life need no longer be subordinated to the imperatives of production" (p. 140).

Ultimately, however, while mass production addressed (through technical innovation) the problem of access to and exploitation of raw materials, it could not conclusively solve the problem of their progressive exhaustion. The utopia of second modernity precisely consisted in highlighting the desire to consume and an apparent abundance to conceal the insoluble problem of the finiteness of the earth's resources.¹⁷ Although latent, the death drive hypothesis can be understood as the result of this tension between the desire to consume and the fear of scarcity.

Death drive and the contradiction of the second modernity

Jameson (1981/2002) proposes to analyze the text “as the imaginary resolution of a real contradiction” (p. 62). More specifically, he argued that the subtext of the narrative expressed a social collision resulting from the encounter of two antagonistic modes of production coexisting in the writer’s society¹⁸ (Jameson, 1981/2002, pp. 66-68, pp. 81-84). In light of this, we can assume that the thesis of *Beyond the Pleasure Principle* reflects not simply its “epoch”, but a socio-economic contradiction provoked by the rise of the second modernity. In this case, the antagonism in question is not between the bourgeoisie and the proletariat, which was particularly important to the history of nineteenth century Europe. It is, however, between the nineteenth-century large-scale industry mode of production, spurred by consumption ideology yet restrained by the fear of resource exhaustion, and the twentieth-century Fordist mode of production, characterized by the “democratization” of consumerism and the repression of the scarcity problem. How is this opposition expressed into Freud’s metapsychology?

Freud could consider energy expenditure (“human entropy”) as an “aim” because the early twentieth-century massification of production truly turned consumption into an end in itself. Indeed, as soon as resources ceased to appear as a “problem” (of scarcity) and demand preceded supply within industrialized societies, consumption was presented (particularly to the hitherto deprived working classes) as a genuine new way of life. On the other hand, the pessimistic aspect of Freud’s assertion (which basically draws a parallel between the expenditure of energy and death) is reminiscent not only of the nineteenth century matter of scarcity, but also of the latent persistence of the problem of resource depletion. Thus, the death drive hypothesis condenses two themes, symbolizing the encounter of two modes of production from two distinct eras: the large-scale industry model of the nineteenth century, in which the production of resources could not match consumerist dreams, and twentieth century Fordism, which found in new techniques and technologies the means to realize those dreams (see Table

3 for a schematic presentation of these equivalencies). The uncanny conclusion of *Beyond the Pleasure Principle* (although a total discharge of energy is equivalent to death, death is in fact sought by the organism) is the involuntary expression of the meeting and superimposition of these two modes of production, a phenomenon that characterized the advent of the second modernity in the postwar period.

Mode of production:	Nineteenth century large-scale industry	Twentieth century Fordism (mass production)
Expression in the death drive hypothesis:	A total expenditure of energy is equivalent to death	Energy expenditure is an end in itself

Table 3: Expression in metapsychology of the two modes of production coexisting in the second modernity

Conclusion

This paper has demonstrated the economic dimension of Freudian metapsychology is rooted in mid-nineteenth-century thermodynamic theories. The thermodynamic principle of energy conservation finds its counterpart in Freud's principle of constancy (or reality), while the idea of entropy finds an equivalent in the pleasure principle (discharge). Freud's way of dealing with death (i.e., the "organism entropy") nonetheless expresses an approach to energy that differs from that of nineteenth-century scientists, who were concerned with the problem of scarcity. This difference in perspective results from the advent of the second modernity in the early twentieth century, and in particular of the new relationship to energy triggered by the second industrial revolution: energy consumption was now thought as an end in itself.

In focusing on the genealogy of energetics, my objective was not to highlight all the historical determinants that contributed to Freud's formulation of the death drive in 1920.¹⁹ While I used the methodology of historical epistemology, my aim was also not to propose an extensive commentary on Freudian concepts or texts, but rather to frame them within the long term. As noted by Davidson (1987, pp. 256-257), this kind of method may be of particular

interest in the case of the history of psychoanalysis, where two historiographical approaches tend to conflict: one focusing on the person of Freud as a creator (Freud as a “genius”), the other denying any originality to his theories by showing how much they owe to the science of its time (Freud as an “usurper”). Here, the method of historical epistemology suggests going beyond the individual-centered level of analysis. It is indeed the history of the scientific field and of its concepts that determines the possibility, for a scientist embedded with this field and its history, of becoming the author of a given theory.

Notes

¹ The evolution of Freud’s vision and vocabulary on the drive doctrine surely complicates the attempts to ascertain the terms he used. Freud took the opportunity of *Beyond the Pleasure Principle* to redefine some of his concepts, and later reconsidered the terms used in that essay as of 1924. On the developments of *Beyond the Pleasure Principle*, see for example Laplanche and Pontalis (1988, pp. 220-222). On the evolution of the terminology, see *The Economic Problem of Masochism* (Freud, 1924/1961, pp. 159-160). In this paper, Freud situates the pleasure principle next to the “demands of libido” and the “life instincts”, while opposing them to a “Nirvana principle” expressing the “trend of the death instinct”.

² Kuhn (1959/1977, pp. 66-68) cites the following authors, noting that the list is not exhaustive: Sadi Carnot, Marc Séguin, Karl Holtzmann, G. A. Hirn, C. F. Mohr, William Grove, Faraday, Liebig, Mayer, Joule, Colding and Helmholtz.

³ It is possible to trace the concept of energy conservation back to Leibniz’s 1686 concept of “living force”, or even to the idea of conservation of movement formulated by Descartes in 1644 (Mayrargue, 2010, pp. 21-24; Mirowski, 1989/1995, pp. 16-19). For his part, Newton formulated his “first law” of inertia, which was central to the classical physics of forces. However, it was not until the mid-nineteenth century that the terms “energy” and “thermodynamics” became established in English science (particularly by Thomson), and then exported into the continent (particularly via Helmholtz) (Cahan, 2012, pp. 57-58; Gohau, 2010, p. 7; Tran The et al., 2018, pp. 6-7; Wegener, 2009, pp. 267-270). The new term of energy also reflected conceptual changes: the “key differentiation here was the slow transmutation of the concept of *Kraft*, or force, from a general and quite vague synonym for “activity” into a Kantian substance; a process that was only completed [...] with the meiosis

of the concept into a more substance like "energy" and a more characteristically active "force" (Mirowski, 1989/1995, p. 45). However, scientists disagreed as to whether the new concepts of thermodynamics could merge with or replace those of classical physics, especially matter; by the late nineteenth century, Newtonian dynamic mechanics – the science of moving masses – seemed hardly compatible with thermodynamic physics – the science of energy exchanges (Prigogine & Stengers, 1984, pp. 121-122, pp. 247-253).

⁴ On the shift from “force” to “energy”, see note 3 above. On the prominent role of the relationship between Helmholtz and the British scientists in this shift from the 1850s onwards, see Wegener (2009) or Cahan (2012).

⁵ Descartes, in particular, had already disseminated the idea that animals could also be conceived in terms of a play of forces. In his view, the human machine differs from other animal machines in that it alone is endowed with reason. The new figure of the human machine that emerged in the nineteenth century made this distinction void: “The human body and the industrial machine were both motors that converted energy into mechanical work” (Rabinbach, 1992, p. 2).

⁶ As noted by Kuhn (1959/1977), it is in part because “engines could and occasionally did look like conversion devices” that “engineering concepts proved so readily transferable to the more abstract problems of energy conservation” (p. 91).

⁷ Author’s translation.

⁸ Helmholtz then saw science as the key to industrial progress and hoped that Germany (his country) could catch up economically with Great Britain, the cradle of the industrial revolution (Wegener, 2009, pp. 265-270).

⁹ Though the idea of entropy was already formulated by Carnot and Thompson, the term itself was introduced by Claudius.

¹⁰ In the eighteenth century, the concept of “population” emerged as an economic and political *problem* justifying the establishment of “biopolitical” measures and controls on births, sexuality, marriage, health, etc. (Foucault, 1976/1978, pp. 35-36).

¹¹ If not superior: for most late nineteenth-century energetic physiologists, the “human motor” was more sophisticated than (actual) machines (Rabinbach, 1992, p. 127).

¹² In the second half of that century, as engineers tried to increase the efficiency of machines, physicians, physiologists and psychologists, having applied the thermodynamics model to the body, looked for more energy-efficient movements or ways of thinking (Rabinbach, 1992). Such endeavors can be found, for example, in the work of Gaspard-Gustave Coriolis (Blay, 2017, pp. 250-260), Charles Féré (Dupouy, 2010) and Louis Querton (Rabinbach, 1992, p. 8).

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- ¹³ Prigogine and Stengers's book *Order out of Chaos* (1984) is not a simple translation, but an adaptation, of *La nouvelle alliance* (1979). This quoted passage is only to be found in the French book version and translated by the author.
- ¹⁴ In the 1850s, Marx (1856/1969) expressed the contradiction of industrial-capitalism in these terms: "In our days everything seems pregnant with its contrary. Machinery, gifted with the wonderful power of shortening and fructifying human labour, we behold starving and overworking it. The new-fangled sources of wealth, by some strange weird spell, are turned into sources of want" (p. 500).
- ¹⁵ Author's translation.
- ¹⁶ In the scientific literature, those mutations resulted in a new way of looking at the concept of energy. In the area of physics, Boltzmann exposed his kinetic theory, an attempt to statistically capture the evolution of gaseous molecules, in 1872. While Boltzmann's aim was to reconcile classical dynamics with entropy, his model actually implied the existence of reversible phenomena, like "spontaneous" changes of temperature (Prigogine & Stengers, 1979, pp. 206-207). In the early twentieth century, the possibility of reversible processes was recognized by the theory of relativity: "a model of field interactions was proposed where the field itself could be considered to be self-generating, since it acts upon its own source. [...] Something *could* come from nothing" (Mirowski, 1989/1995, p. 81). In the field of economics, Walras and Jevons independently developed, from the 1870s onwards, the theories at the origin of neoclassical thought. Their works are explicitly inspired by physics, and in particular by energetics; their economic notion of equilibrium is thus the counterpart of the thermodynamic principle of energy conservation (Mirowski, 1989/1995, pp. 238-241, pp. 254-261). However, entropy has no equivalent in Jevons' or Walras' theories (Mirowski, 1989/1995, p. 254).
- ¹⁷ Although bracketed in the first half of the twentieth century, this problem of resources scarcity would resurface during its second half. In the 1970s, the oil shocks dramatically illustrated the dependence of Western countries on a limited resource. In economics, the matter of scarcity was extensively debated from the 1970s to the 1990s. Against the models of the neoclassical economists Solow and Stiglitz, who assumed that the productivity of resources could be increased indefinitely (thanks to technical progress in particular), the heterodox economist Georgescu-Roegen and his student Daly used the concept of entropy to restate the problem of increasing scarcity (for an overview of these debates, see Couix, 2019).
- ¹⁸ Jameson, who is a literary critic, focused his analysis on romance literature. I mean to show here that the extension of this method to scientific literature is heuristically profitable.

¹⁹ To fully understand the developments of *Beyond the Pleasure Principle*, one should also take a detour through the history of biology, which is unfortunately beyond the scope of the present analysis. I shall simply note here that with the birth of modern biology at the turn of the nineteenth century, reflections on the relationship between the living and the non-living, between life and death, took a new turn. In 1780, John Brown's (1780/1803) *Elements of Medicine* already included a statement that could be compared to Freud's future proposition: "it is certain that life is not a natural, but a forced state; that the tendency of animals every moment is to dissolution; that they are kept from it, not by any power in themselves, but by foreign powers [...]; and then, from the necessity of their fate, they yield to death" (p. 116). On the place of Brown's theory in the history of medicine, see for example Canguilhem (1977/2009, pp. 57-67).

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