

OF DEATH (AND BIRTH) OF UNIVERSES: GENDER AND SCIENCE IN PAMELA ZOLINE'S *THE HEAT DEATH OF THE UNIVERSE*¹

Ildney CAVALCANTI²
Joan HARAN³

RESUMO: Este artigo aborda questões recentemente debatidas no âmbito da crítica informada pelos Estudos de Gênero sobre utopias, distopias e ficção científica (FC) de autoria feminina, e responde a algumas destas questões, mais especificamente em relação “à necessidade de se produzir trabalhos na contemporaneidade ligando a ficção científica feminista e as teorias científicas; e ao potencial em termos de sinergia crítica evocada ao situarmos a ficção científica feminista como uma forma criativa de estudo da ciência” (MERRICK, 2007). Para isso, apresentamos uma leitura de “The Heat Death of the Universe”, de Pamela Zoline (1967), um conto clássico da FC de autoria feminina. Privilegiando uma “atitude etnográfica” (HARAWAY, 2003), observamos as formas pelas quais o conto incorpora criativamente práticas e discursos científicos em sua elaborada composição ao expandir os significados do conceito central que reelabora: entropia. Recorrendo a leituras anteriores do texto de Zoline, argumentamos que a justaposição entre ficção/ciência construída pela narrativa ativa, expande e relativiza formas de pensamento sobre a morte (e o nascimento) de universos por salientar a dinâmica entre forças e perspectivas físicas, biológicas, sociais, psicológicas e filosóficas. Para tal, a tensão central entre sistemas ordenados e desordenados, informada pela entropia, é mantida no decorrer da história com a utilização de estratégias narrativas que agem para tal suspensão. Finalmente, refletimos sobre esta obra de ficção em relação aos paradigmas científicos por ela imaginados, e sobre suas funções na formação de percepções de gênero, observando particularmente as políticas, tensões, efeitos e implicações em jogo.

Palavras-chave: Estudos de gênero; Ciência; Ficção Científica.

ABSTRACT: This essay approaches some issues recently raised in the arena of genre-informed criticism on women's utopias, dystopias and science fiction, and responds to some of those issues, specifically with regard to “the need for further contemporary work connecting feminist SF and science theories, and the potential for critical synergies evoked by situating feminist SF as a creative form of science studies” (MERRICK, 2007). It does so by presenting a reading of Pamela Zoline's “The Heat Death of the Universe” (1967), a story which has reached the status of a classic in feminist SF. Privileging an “ethnographic attitude” (HARAWAY, 2003), we look at the ways in which this short story creatively incorporates scientific practices and discourses in its elaborate composition by refashioning and expanding the meanings of the central

¹ The support of Capes and of the Economic and Social Research Council (ESRC) is gratefully acknowledged. This work forms part of the programme of the ESRC Genomics Network at Cesagen.

² Doutorado em English Studies pela University of Strathclyde. Professora da Universidade Federal de Alagoas.

³ Doutorado em Ciências Sociais pela Warwick University. Membro do *Centre for Economic and Social Aspects of Genomics* (Cesagen), ESRC, da Cardiff University. Atua na área dos estudos culturais feministas sobre tecnociência.

concept it deals with: entropy. Drawing on earlier readings of Zoline's text, we further argue that the juxtaposition of science/fiction as constructed by this narrative activates, expands and relativises our ways of thinking about the death (and birth of) universes by stressing the interplay of physical, biological, social, psychological and philosophical forces and perspectives. In order to accomplish this, the central entropy-informed tension between ordered and disordered systems is kept throughout the story masterfully by the deployment of narrative devices that maintain such suspension. Finally, we reflect on this fictional piece in relation to the scientific paradigms it envisions, and its functions on the formation of gender perceptions, paying particular attention to the politics, tensions, effects and stakes at play.

Keywords: Gender; Science; Science fiction.

Various feminisms recorded throughout history and, more recently, voices from the field of Gender Studies, have proposed revisions in all spheres of experience regarding hierarchically stratified gender relations, a phenomenon which is perceptible, in major or minor scale, within and across cultures. Despite their political and theoretical diversity and contested zones, their common agenda has been oriented by a utopian principle, characterised by a critique of dystopian historical realities and by the projection of alternative worlds and forms of socialization, either present or future, fictional or experimental. In such process of searching for an "elsewhere", for the "other place" or the "no-place", (outside) history, utopian/dystopian and science fiction⁴ writing by women in genres which have traversed centuries, cultures, languages, has allowed us to trace continuities in both feminist and utopian tendencies configured in such writing modes in their critical and prospective functions. In revisioning part of this writing and looking at some of those short fictions, not only do we promote the revision of the canon in order to incorporate voices which have been neglected, forgotten, or kept in the margins, but we also recontextualise these texts in relation to contemporary issues, which, in turn, gives rise to renewed readings.⁵

The importance and contested absence/presence of women-authored utopias, dystopias and SF has been widely discussed by now by feminist critics who have focused on these genres in response to academic gender-blindness. Specially regarding SF as a cultural activity, which has been repeatedly characterised as a strongly male-dominated realm, the fact that women authors have resorted to "neutralizing" pen names (using ambiguously gendered names or their initials, like C.L. Moore, for instance) or male pseudonyms⁶ in order to conceal their gender identities and thus obtain easier access to publication and circulation up until relatively recently has been usually mentioned as a barometer of the gender bias of the SF community (SARGENT, 1978a, 1978b; WILLIAMS, 1992; SARGENT, 2005; ATTEBERY, 2006). In the past three or four decades, a growing field of scholarly work has been produced in response

⁴ SF from now on, following Haran's usage of the short form "to refer to the multiple literary subgenres abbreviated 'sf', including speculative fiction and science fiction" (2001, p. 69).

⁵ In order to describe this gender informed approach to reading / writing / story-telling practices, and inspired by feminists such as Adrienne Rich (1979) and Donna Haraway (1989), Haran (2010) suggests the acts of re-visioning, reading out of context and continual re-reading.

⁶ The most famous case is undoubtedly James Tiptree Jr., with his/her emblematic and prize-winning 1973 short-story "The women men don't see" providing the perfect metaphor for critical commentaries about the problematics of the women's absence/presence in SF. See, for instance, the chapter whose title is homonymous with Tiptree's story, in Larbalestier 2002.

to this phenomenon and our reading emerges from and contributes to this wave of feminist-oriented scholarship aimed at the retrieval and visibility of speculative women-authored texts and at experimenting with new modes of reading. In the discussion that follows, we approach some issues recently raised in the arena of genre-informed criticism on women's utopias, dystopias and SF and respond to some of those issues by presenting a reading of Pamela Zoline's "The Heat Death of the Universe" (1967)⁷ which proposes to look at the ways in which this short story creatively incorporates scientific practices and discourses in its elaborate composition by refashioning and expanding the meanings of the central concept it deals with: entropy. Finally, we reflect on this fictional piece in relation to the scientific paradigms it envisions, and its functions on the formation of gender perceptions, paying particular attention to the politics, tensions, effects and stakes at play.

On our critical feminist genealogies

Recognizing our academic feminist genealogies also implies problematising some of its past practices and extending our own re-visioning practice to feminist as well as non-feminist texts. Initially, the pioneering work of critics like Joanna Russ, Sarah Lefanu, Nan B. Albinski and Frances Bartkowski⁸, whose studies circulated in the 1970's and 1980's, tended to focus on the aesthetics of the speculative genres and on the subversive possibilities they opened up in relation to women's roles. In the stories they construct about the relationship between women and genre fiction, however, more recent critical works have raised key issues that have led to – and encourage us to take forward – the reassessment and expansion of earlier genre-focused feminist scholarship, thus promoting revision in the sense of Adrienne Rich's now classic formulation. Specifically with regard to science fiction, our main focus here, these issues include: the absence or presence of women as characters, producers and readers (LARBALESTIER, 2002); the critique and positive appropriation of terms like "galactic suburbia" and "housewife heroine" (YASZEK, 2008); the need to stress the links and continuities of "older modes of women's speculative fictions [of the 40's, 50's and 60's]" and the "more overtly feminist SF that developed in the 1970's and that continues to flourish today" (YASZEK, 2008, p. 197); and finally, and most relevant for our purposes, "the need for further contemporary work connecting feminist SF and science theories, and the potential for critical synergies evoked by situating feminist SF as a creative form of science studies", in an attempt to help bridge the gap between the sciences and arts still observed in feminist scholarship taken as a whole, despite its epistemological contention regarding interdisciplinarity and dialogical modes of knowledge production (MERRICK, 2007, p. 214). Our response to these claims will become clear in the discussion that follows.

By observing feminist research paradigms, in the sense that knowledge resulting from such vision pushes the limits of disciplinary frontiers, the reading approach we observe can be defined as multi-, inter- or transdisciplinary; in more specific terms, we follow what Haraway has termed an "ethnographic attitude" for textual analysis, which relies on the complementary relationship and cross-reading in a variety of discourse fields:

An "ethnographic attitude" can be adopted within any kind of inquiry, including textual analysis. Not limited to a specific discipline, an ethnographic attitude is a mode of practical and theoretical attention, a

⁷ The edition consulted was the 1988 reprint in the collection *Busy About the Tree of Life*, listed in the references.

⁸ Joanna Russ's impacting essays on the field are reprinted in *To Write Like a Woman* (1995). See also Lefanu (1988), Albinski (1988) and Bartkowsky (1989).

way of remaining mindful and accountable. [...] Ethnography is not only a mode of attention, however. Textual analysis must articulate with many kinds of sustained scholarly interaction among living people in living situations, historical and contemporary, documentary and *in vivo*. These different studies need each other, and they are all theory building projects. (2003, p. 235)

Feminist scholars have already stressed the fact that gender perceptions have expanded the ways of thinking about literature and about science. They have also historicised literary readings and scientific thinking. In response to the claim – typically made by those practitioners of particular disciplines who are actually desirous of preserving disciplinary boundaries – that there remains a “divide” to be overcome between the cultures of the arts and of the sciences, creative and critical works à la Rose (1994) and Haraway (1989; 2003) have actually found some pleasure exactly in disrupting such boundaries. Specially regarding the interfaces between science and gender issues as they are metaphorised in literature, Helen Merrick has critically responded to this supposed “divide” by very accurately observing:

Many literary analysis of feminist SF imply that the genre is merely a convenient vehicle for certain devices and locales (aliens, alternate worlds or futures) that better enable an examination of gender from an estranged perspective. For some texts, this is indeed the case, but for many others a feminist revisioning or critique of scientific discourses and cultures is an integral function of the texts. (2007, p. 214)

In fact, our own readings of speculative short fictions written by women throughout the twentieth century has been aimed at surveying some of the paradigms of science constructed or critiqued and at examining their futuristic technoscientific imaginaries insofar as they interweave with gender constructions. Thinking in terms of the scientific practices and discourses incorporated in/by the fictions, we stress that this happens in four major, interrelated ways: critiques of “science as usual”⁹, the development of alternative conceptual frameworks, the development of feminist ethics in relation to science and its practices, and a pragmatic focus on what feminists can do about science in the present – in brief: critiques, concepts, ethics and pragmatics. We have noted further that these broad ‘trends’ are metaphorically stylised by means of recurring narrative tropes, motifs or figures relating to essentialism/anti-essentialism (biology as destiny, eugenics, genetic engineering and genetic modification); reproduction and NRBs (New Reproductive Biotechnologies); post-human subjectivities (artificial intelligence, cyborgs); the political ‘grammar’ of scientific practice and experimentation; women as subjects *versus* women as objects of science; journeys of scientific exploration; the reutilization of scientific concepts and metaphors (evolution and evolutionary theory, parallel universes and alternate worlds, entropy, chaos theory). As mentioned in the introduction, our reading of Zoline’s short story, to which we now shift, is focused on the author’s reutilization of the concept of entropy.

Of death (and birth) of universes

Pamela Zoline’s “The Heat Death of the Universe” presents a rewriting of the housewife heroine theme in SF stylised by the portrayal of a middle-class woman who feels estranged in the face of the traditional gender roles and expectations of her time. This estrangement is effected by means of the creative incorporation of scientific

⁹ Cf. Harding, 1986.

practices and discourses in its textual elaboration, suggestive of shifts (and provocative of critical takes) on the ways the sciences were inscribed in/by culture in the 1960's, since it refashions the concept of entropy and expands its signifying possibilities.

"The Heat Death of the Universe" has reached the status of a classic in feminist SF, having been reprinted in at least ten collections¹⁰ since its first publication in *New Worlds* in 1967. It was also revisited by Leanne Frahm's 1995 short story "Entropy".¹¹ It represents a dramatic turning point in a typical middle-class woman's life by means of the sharp and ironic rendition of her experience as a Californian housewife and mother, as made evident in the often quoted second 'biographical note' that reads: "30. Sarah Boyle is a vivacious and witty young wife and mother, educated at a fine Eastern college, proud of her growing family which keeps her happy and busy around the house, involved in many hobbies and community activities, and only occasionally given to obsessions concerning Time/Entropy/Chaos and Death" (excerpt 30, p. 58). The narrative thus links personal experience to scientific abstraction by means of its elaboration on the concept of entropy, stylised as excess and fragmentation in the rendition of one day in the protagonist's life.¹² In so doing, it provides a sharp feminist critique on gender roles and expectations in the 1960's, reshapes the SF genre in its formal and thematic elements and widens the possibilities of (re)interpretation of scientific discourses, as we will discuss below, following a route that starts with a very brief history of the concept and of its artistic reutilization; and then moves towards a gender-informed (re)reading of Zoline's story that draws on earlier readings of this work as well as on a 2009 performance by Tiffany Trenda entitled "Entropy", which also features a woman entrapped in a closed system thus offering an excellent contemporary artistic ground from which to further illuminate "The heat death of the universe".

Various accounts regarding the history of the concept of entropy¹³ converge in associating it to the rise of thermodynamics and to Lord Kelvin's work on the science of heat in the 1850's, which was accompanied by James Joule's observation of the relation between heat and work. This, in turn, led to the conception of heat as a form of energy (the first law of thermodynamics). In the context of the circulation of such ideas, also in the mid-nineteenth century Rudolph Clausius, who had been studying the flux of heat (its conversion and dissipation) from one body to another, introduced the concept of entropy to describe such flow. Greene's contemporary retelling of this history stresses that its mathematical formulation, however, is owed to Ludwig Boltzmann, a physicist who developed a form of statistical thinking "to provide a link between the huge number of individual ingredients that make up a physical system and the overall properties the system has" (2004, p. 151). Entropy enables the measurement of the

¹⁰ See a history of these publications in Papke (2006, p. 158, note 3). Another reprint is in Pamela Sargent ed. *Women of Wonder, The Classic Years: science fiction by women from 1940's to 1970's* (1995).

¹¹ Published in Sussex and Buckrich eds. *She's Fantastical – The first anthology of Australian women's speculative fiction, magical realism and fantasy* (1995). Cf. the intertextual clues that, going beyond the title, include other allusions such as a variation on the theme of the discontented housewife – who becomes a serial killer – and her moves "to evade the heat death of the universe" (127), despite the "dust [that] continues to settle" (FRAHM, 1995, p. 128). Dust is one of the key symbols in Zoline's story and will be addressed below.

¹² A parallel may be drawn here with Virginia Woolf's 1925 *Mrs. Dalloway*, which also deploys formal experimentation in its depiction of a day in the life of woman protagonist who, following expected role models, is getting prepared to hold a party in her home on the same day. In addition to this, and despite their evident "domestic" settings, subtle undertones in both narratives are evocative of post-war eras. The similarities between Woolf's and Zoline's innovative (modernist and post-modernist, respectively) fictional strategies, that act to undermine the stereotype of the housewife and critique the social contexts in which their protagonists are situated, enable us to think in terms of feminist literary genealogies.

¹³ Greene (2004); Arnheim (1971); Cartwright and Baker (2005) were consulted for their histories of this concept – and its impacts in the artistic and social fields – and will be mentioned as we proceed.

amount of disorder in a physical system, with high entropy meaning a highly disordered system and low entropy indicating a highly ordered one. When physical systems feature a high number of constituent elements, a tendency towards greater disorder is observed. In other words, “*physical systems tend to evolve toward states of higher entropy*” (2004, p. 155, emphasis in the original).

The artistic reconfiguration of this concept has been the object of critics’ attention. In his discussion on entropy and art, Rudolph Arnheim stresses the negative interpretation of this physical phenomenon by thinkers in the so-called human sciences, authors and artists in the late nineteenth- and early twentieth-century, when the idea achieved initial widespread popularity: “The sober formulations of Clausius, Kelvin, and Boltzmann were suited to become a cosmic memento mori, pointing to the underlying cause of the gradual decay of all things physical and mental” (1971, p. 9). He also points out a perceptible change in this rationale: “If during the last century it served to diagnose, explain, and deplore the degradation of culture, it now [1970’s] provides a positive rationale for “minimal” art and the pleasures of chaos” (1971, p. 11-12). Nevertheless, in their approach to the reinvention of the concept in post-war literature, Cartwright and Baker still align disorder and chaos with negative connotations: “On both sides of the Atlantic, writers rediscovered Thomson’s Second Law of Thermodynamics and Clausius’s entropy as metaphors for a declining, increasingly disordered world” (2005, p. 247), extending its meanings to encompass disintegration in the biological, psychological, moral, social and cultural spheres. In their brief analysis of Zoline’s short story, they argue that it “indicates the pessimism that accompanies the widespread use of entropy as a metaphor in the fiction of the 1950s and 1960s”, in this specific case “as a means of illuminating not a general sense of social decline but a moment of emotional trauma” (2005, p. 250). However, we would like to suggest that there is an alternative reading which acknowledges rupture, but in a more hopeful sense, and that such a reading depends on the point of view – or perhaps, the situated knowledge (HARAWAY, 1991) – of the reader. The activism of the civil rights, women’s and environmental movements might have been interpreted as a traumatic threat to the contemporary social order by those who were its beneficiaries, but promised new freedoms and a less oppressive order to those who contested it. In *The World Split Open*, Ruth Rosen provides a chronology of what she calls ‘the modern women’s movement’ (ROSEN, 2001). This chronology lists key moments in the US civil rights and women’s movements, including the 1964 circulation of a memo about sexual inequality within the civil rights movement (ROSEN, 2001, p. xix). It also cites key publications including Rachel Carson’s *Silent Spring* (1962) and Betty Friedan’s *The Feminine Mystique* (1963)¹⁴, both of which highlighted pressing – and potentially traumatic issues – environmental and social respectively, but which also functioned as calls to action for the environmental and women’s movements. Zoline’s story can be read as similarly mobilizing, albeit with a more oblique address.

Readings and reviews informed by an evident feminist perspective have emphasised the challenge posed by the text in relation to the social expectations for a middle-class US woman in the 1960’s (JAMES, 1988; LEFANU, 1988), its central female voice attempting resistance to entropy, which “eventually wins” (PAGE, 2005). Regarding Zoline’s use of the entropy theme from a gender-centred perspective, Lefanu notes that “While [the story] is obviously a part of the entropy-orientation of *New Worlds*, its meditation on entropy is grounded on the organization of a woman’s life” (1988, p. 97-98) an argument which is reiterated by later (feminist and non-feminist)

¹⁴ The 2010 edition was consulted. Cf. references below.

critics like Cartwright and Baker (2005) and Papke (2006). The latter cites Michael Moorcock's commentary that Zoline's story features the interweaving of entropy, one of the modern myths of science, and "that great myth figure of modern fiction, the Victimized Domestic Woman"¹⁵; and proceeds: "the story marries science to fiction, all for the purpose of detailing one day in the life of Sarah Boyle and her mental disintegration" (148). It is important to note, however, that the creativity of this interweaving invites, indeed incites, the reader to think about 'the purpose' of the narrative as being more expansive and ambitious than this particularizing gloss. Zoline's protagonist's predicament resonates with the experiences of those women coming together to discuss "the problem that has no name", which Friedan explored in *The Feminine Mystique*. Friedan quotes from a 1960 editorial in the *New York Times* on the topic of the educated housewife: "Like a two-headed schizophrenic . . . once she wrote a paper on the Graveyard poets; now she writes notes to the milkman. Once she determined the boiling point of sulphuric acid; now she determines her boiling point with the overdue repairman... The housewife often is reduced to screams and tears... No one, it seems, is appreciative, least of all herself, of the kind of person she becomes in the process of turning from poetess into shrew" (FRIEDAN, 2010, p.12).

We expand the earlier readings of Zoline's story mentioned above, which tend to stress the rising degree of disorder and the increasing entropic state in that flash of Sarah Boyle's experience as a housewife and mother that culminates in breakdown, by shedding light on some subtle narrative clues that may be interpreted as supplementary to the more evident association of high entropy and chaos with death. The incorporation of scientific discourse by Zoline's story is noteworthy from its title to its structural pattern (organised in numbered entries 1 to 54, interspersing "scientific" passages with the fragments containing a third person narration of Sarah Boyle's housewife routine, from breakfast to the cleaning up after one of the children's birthday party), which, in turn, help enforce its major theme – and vice-versa. From our reading perspective, this concerns the possibilities of critical (re)interpretation of scientific discourse and its juxtaposition with other modes of storytelling. As already noted, it is also suggestive of the kind of doubled perspective Friedan suggests is the purview of the educated housewife. It can also be read as the conditions of possibility for developing a feminist standpoint approach to science.

The entries borrowed from the science genres convey "information through a series of axioms, hypotheses, definitions, narrative fragments and summaries that instantiate the scientific principles embodied in the story" (PAPKE, 2006, p. 148). Both Papke and Lefanu agree on its innovative reshaping of the SF genre by means of its experimental dimension, "one that in both form and content questions relentlessly the truth of science and the blandishments of fiction" (PAPKE, 2006, p. 148).¹⁶ While we share these earlier opinions, we further argue that the juxtaposition of science/fiction as constructed by Zoline activates, expands and relativises our ways of thinking about the death (and birth of) universes to the extent that it stresses the interplay of physical, biological, social, psychological and philosophical forces and perspectives. In order to accomplish this, the central entropy-informed tension between ordered and disordered systems is kept throughout the story masterfully, as we will illustrate below by looking at some narrative devices at work to maintain such suspension.

¹⁵ Taken from his introduction to *Best SF Stories from New Worlds 3* (1968) and thus postdating the publication of *The Feminine Mystique* (1963), which provides an illuminating account of the status of the educated housewife in the 1960's, Moorcock's condescending commentary eclipses the social circumstances in which historical women were actually living by mystifying this vision.

¹⁶ For a discussion on the contested SF qualities of the story, see Papke 2006, p. 147-150.

While most previous readings of the story tend to stress the degree of disorder and the increasing entropic state, as well as Sarah Boyle's futile striving to keep her domestic environment orderly, as noted above, we attempt to demonstrate that the narrative offers some clues suggesting more complex relations between ordered and disordered systems than has been recognised so far. We will discuss this issue by approaching the depiction of the woman in a closed system (and reading this image *vis-à-vis* Tiffany Trendera's 2009 installation); the final climactic scene imaging Sarah Boyle's breakdown; and the reader response activated by some of the narrative strategies employed.

The image of a woman entrapped, framed in a closed setting, both in science and in fiction (as well as in other discourses and media) from Snow White onwards, is extremely familiar and has triggered a number of feminist readings.¹⁷ The novelty in Zoline's deployment of this trope lies in adding to this system a huge number of ingredients that have to be dealt with by the protagonist, ranging from household chores (her actions include: serving, cleaning up, shopping, organizing and giving a party, entertaining guests, tending children, pets and plants), products and house items to her own existential musings, as hinted by the story's first entry: "1. ONTOLOGY That branch of metaphysics which concerns itself with the problems of the nature of existence or being" (ZOLINE, 1988, p. 50). Opening the essay in this fashion, scientific attempts to impose order through categorization and abstraction are thrown into sharp relief by the mundane material practices of the housewife, potentially opening them up for scrutiny and re-vision.

Also probing issues that concern the nature of our existence in relation to life in general and the world around us, Tiffany Trendera's installation and performance entitled "Entropy", staged at the Los Angeles County Museum of Art in May 2009, provides another instigating perspective from which to look at "The heat death". The event featured the artist herself and twenty-four live butterflies¹⁸ encased in a 9 ft. plexi glass box and wearing a long dress she made out of real moss and what looks like an astronaut's glass helmet. Adding to the SF effect, three video screens were connected to three cameras (one on her chest and two on her always moving hands), which enable the viewers around her to be filmed by this surveillance device and exposed in the screens in the act of watching and responding to the performance.

Despite the different media employed, the similarities between Zoline's and Trendera's artistic accomplishments are striking in that both push the limits of artistic conventions in experimental ways; highlight a framed woman encapsulated in a closed system (which comprises a number of organic and inorganic elements), generating gender-nuanced connotations; and evoke the feeling of cognitive estrangement typical of SF, according to the genre definition by Suvin (1979), which, in turn, help crystallise technoscientific imaginaries.

The point we wish to explore relates to those closed and highly entropic systems in connection to us, that is, to our responses as readers of the story and spectators of the performance, and to the dystopian and utopian impulses deriving hence. Two assumptions are crucial for the purposes of this reading: the surrounding environment

¹⁷ See Cavalcanti 2005 for an analysis of the revision of this trope in women-authored dystopias.

¹⁸ It seems important to note that amongst all its other symbolic connotations, the butterfly – or rather the 'Butterfly Effect' has become an important signifier of the branch of physics known as chaos theory. Since the coinage of the term (some time between 1963 and 1972), it has probably been deployed as extensively in popular culture as the concept of entropy, but arguably to more confused ends. However, the more prosaic name for the butterfly effect – *sensitive dependence on initial conditions* – has resonance for our reading of Zoline's story. Both the initial conditions of her narrator protagonist, and the initial conditions of the story's reader impact on our interpretation of Zoline's meditation on entropy and abstraction.

(including us) plays a part in relation to the closed system represented in fiction and/or staged by the performance; such environment provides still another ‘outer’ system in which the first one is placed. The more explicitly interactive nature of the performance (when compared to the story), due to the real-time “incorporation” of the viewers made possible by the use of filming and projecting devices, leads to an immediate perception of such factors. In Zoline’s story, such links are constructed by the deployment of highly meta-fictional narrative strategies, among which are the symbolism of the wooden Russian doll (fragment 32) and of the dying/dead turtle in the bowl (fragments 23, 44, 51 and 53)¹⁹; and the slippage between the “scientific” and the “non-scientific” passages. While revealing the post-modernist self-reflexive writing mode characteristic of post-war fictions, and of the fictions which circulated in *New Worlds*, these instances as used by Zoline are strongly marked by gender (as made evident by the employment of the Russian doll image in the fragment that opens with Sarah’s thoughts on motherhood as cyclical but empty: “the mere reproductions, mirror reproduction of one’s kind”) and suggestive of a more neutral, or relativistic, notion of entropy than the negative connotations usually associated with it.

Sarah Lefanu has argued that “The numbered paragraphs fulfill the same function [the struggle against disorder], as do the factual or scientific inserts and the careful precision of Zoline’s language” (1988, p. 96). We observe that such precision can also function, in some passages, to undermine a binary, or sequential, attitude towards order/disorder. Surfacing here and there throughout the story and culminating in the (linguistically, metaphorically and psychologically) explosive final fragment, the slippages between the “scientific” and the “non-scientific” passages referred to above construct an alternative (sub-)textual dynamics to the more overt division suggested by the fragment ‘separation’. One instance of this is fragment “19. INSERT TWO. THE HEAT DEATH OF THE UNIVERSE”. Composed in the line of ‘scientific’ texts, and placed immediately after the one on entropy, it provides a ‘formal’ definition of the physical phenomenon. A careful reading, however, makes it possible to notice that the supposed objectivity of the scientific register employed is disrupted by commentaries such as: “if this were true” and “It is by no means certain, however, that the Universe can be considered as a closed system in this sense”. By featuring the linguistic ‘infection’ of a subjective tone, they also offer a contrast with the earlier inserts strongly marked by categorization and abstraction, like the one on ontology mentioned above. On the other hand, attempts at ordering her domestic universe by means of listing, labelling, cleaning etc. are also undermined by the protagonist’s own “rebellion”, as made evident in one of the most poetic among the fragments, “26. LIGHT AND CLEANING THE LIVING ROOM.” In it dust is considered aesthetically (via the reference to Duchamp) and acknowledged as “indeed the most beautiful stuff in the room, a manna for the eyes”. We argue that such precise and highly metafictional constructions effects key functions, the most evident one being the undermining of the ‘neutrality’ of scientific discourses to the extent that, by enabling us to perceive the operations at work achieved by the supposedly non-biased textualization of nature, they expose the quality of constructedness of this type of discourse. What appears to be at stake, with important implications from a gendered perspective, may be synthesised as a struggle staged by the story between the workings of a language aimed at controlling and encompassing nature and the fractured and situated perspective made possible by the subjective disruptions pointed out above. In this sense, this story anticipates a

¹⁹ This recurrence will be approached below.

feminist critique of science (and of scientific discourse) that was consolidated in the decades following its publication.

Shifting our attention back towards our own roles as readers/spectators of Sarah Boyle's crisis in "The heat death", we draw on Papke's commentary that "while the main character cannot alone succeed in saving the world, Zoline's writing of her plight foregrounds the absolute necessity of Zoline's readers doing so", which is very much in line with our consideration of the 'outer' circle to the story comprised by its reception. One of the key symbols employed by Zoline, that of the turtle, provides an apt image for evoking such a feminist perception. As hinted above, references to turtles appear in four fragments of the story, twice in relation to Sarah's tending the children's pets: in fragment 23, while feeding the fish, she notices that it "looks more and more unwell and is probably dying" (p. 55); and, in fragment 53, that immediately precedes the climactic final scene, she realises that it is dead, a fact that leads to the culmination of her breakdown. The other two passages also mentioning turtles are placed in between – fragments numbered 44 and 51 – in a textual elaboration that clearly suggests the protagonist's (feminist, political, philosophical, ecological, scientific) musings triggered by the housewife's everyday 'trivia' she deals with as the narrative flows. In the first of those, again very aptly situated after three holocaustic entries²⁰, Sarah ponders how she could intervene in order "to change, even in the motion of the smallest mote, the course and circulation of the world" (p. 61):

Sometimes she considers the mystical, the streaky and random, and it seems that one change, no matter how small, would be enough. Turtles are supposed to live for many years. To carve a name, date and perhaps a word of hope upon a turtle's shell, then set him free to wend the world, surely this one act might cancel out absurdity? (p. 62)

The next excerpt about turtles, after this very personalised take centered on the protagonist's message to the world – which is never realised (as we have seen, the death of the pet turtle follows) –, comes in fragment "51. INSERT SEVEN. TURTLES", providing a scientific account of habitats, eating habits, sizes and longevity of different species of these reptiles. (Ironically, the commentary that the European Pond Turtle "may live a hundred years" is disrupted by Sarah's realization two fragments later that the pet turtle in the bowl has died.)

Many inferences and connections may be made by juxtaposing and examining all those references. With regard to the idea of 'multiple universes', such textual elaboration reinforces the idea of circles or systems (bowl, household, planet, universe) which contain and relate to one another. Thus, the central idea of (a final, timely) "heat death of the universe" in its entropic curve, with 'universe' being understood as comprising the 'outer circle', is crossed by more imminent and urgent issues staged in the 'inner circles': on a planetary scale (the world is dying due to destruction caused by humans, as hinted throughout the narrative and illustrated by the choice of the turtle – an ancient animal whose species are endangered due to predatory practices²¹ – as a

²⁰ "41. She thinks of the end of the world by ice. 42. She thinks of the end of the world by water. 43. She thinks of the end of the world by nuclear war" (p. 61). Feminist SF has resorted to images of holocaust as a constitutive element in dystopian writings with clear utopian undercurrents. For analyses of post-holocaust themes in fictions by Sherri Tepper, Marge Piercy and Starhawk, as well as a distinction between apocalyptic and holocaust fictions in relation to hopeful feminist readings, see Chapter 3 in Haran (2003), *After the Holocaust: Projects of Memory and Hope for the Future*.

²¹ All seven species of sea turtles are on the edge of extinction. For detailed description, see the sea turtle fact sheet available on <http://www.seaturtles.org/>.

major symbol and by the entry on “the end of the world by nuclear war”, mentioned above); and on a domestic scale (Sarah’s own collapse in face of the pressures of her surroundings). The shifting scale from the macroscopic to the microscopic, effected in the narrative by the references to those enclosing, though not closed, systems, and the bringing of theory and politics home to a domestic(ated) realm contribute to a sense of urgency which we relate to a feminist insistence on the need for heeding the intricacies uniting physical, biological, social, psychological and philosophical forces and tendencies, as well as for radical transformation. This takes us back to our roles as the readers of this story, the focus of Papke’s remarks quoted above. If, on one hand, Sarah’s “word of hope upon a turtle’s shell” was never sent; on the other, Zoline’s SF story itself offers that “word of hope”, with the announced holocaust being represented “not as the end to hope, but as a rupture in the timeline that makes hope, as well as effective social and political agency, possible” (HARAN, 2003, p. 136).

Pursuing this line of thought, the feminist, hopeful reading of Zoline’s “The heat death” we propose will not miss a significant detail in its closing scene, whose setting is (also significantly) the house kitchen. In the middle of her breakdown, after a sequence of acts that include crying, throwing some eggs and shattering some dishes, smashing jars of jelly and jam, glasses and dishes, cups and cooking pots, making the kitchen sink overflow with detergent foam, in a chaotic and frantic state with entropy “increasing, tending towards a maximum, corresponding to complete disorder of the particles in it” (p. 64), Sarah is pictured in the closing lines in reverse speed, gradually slower and slower, and finally in a frozen scene evocative of a cinematic take with the last thrown eggs²² last ‘seen’ in the air (but not breaking):

She picks up eggs and throws them into the air. [...] The eggs arch slowly through the kitchen, like a baseball, hit high against the spring sky, seen from far away. They go higher and higher in the stillness, hesitate at the zenith, then begin to fall away slowly, slowly, through the fine, clear air. (ZOLINE, 1988, p. 65)

This congealed image appears to fulfill a crucial function in the story since it may be read in terms of a rupture in time – thus suspending the tendency towards the “maximum disorder” and high entropy cited in the same fragment –, provoking a kind of halt in the narrative flow. In formal terms, the scene is precisely located at the peak of Sarah’s emotional turmoil and deploys a lexical choice – cf. the use of ‘stillness’, ‘hesitates’, ‘begin to [but do not] fall’, ‘slowly, slowly’] – that successfully effects a stop in the time movement towards the future. And because those are the story’s final lines, readers are left with such a frozen image – one may even expect the action to start unwinding, or moving backwards. In our view, this opens up the space for an interpretation of entropy as a metaphor in a wider perspective than has been proposed so far in the sense that the same scene enables *both* the envisioning of its linear continuity and gradual progression forward in time and intensity towards disorder and higher entropy (with the broken eggs following the course of action past the ending) *and* also the movement backwards of the arrow of time, implying the ‘restoration’ of order and lower entropy. *And even* the conception of total stillness in time. By evoking such meanings *simultaneously*, this passage may be read as disruptive of the master scientific

²² It seems relevant to mention that descriptions of the dynamics of entropy in scientific books usually illustrate the concept by using the image of eggs breaking. This is so due to the obvious quality of impossible reconstitution of broken eggs. Besides resonating those theories, Zoline’s choice of eggs, which are also symbolic of birth, is highly evocative of meanings related to new beginnings, renewed perspectives, thus reinforcing our reading in relation to the death and birth of universes.

theories of the dynamics of entropy to the extent that it encapsulates all possibilities in one image (whereas the theories on entropy approach its flow onwards *or* backwards in time)²³ and, in so doing, it undermines scientific teleological reasoning. Moreover, this elaborate and very science-fictional narrative strategy parallels other instances in the story in which the relations between order and disorder are kept in tension; and the rupture effected by such interweaving of fiction and science acts like a breach from which we, readers, are invited to take a stand with regard to “the course and circulation of the world”,²⁴ or, to pursue one of our major arguments here, to choose a feminist, utopian, hopeful position in the face of dystopian history.

In response to recent gender informed criticism on women-authored SF, specifically with regard to the need, articulated by Merrick and quoted above, “for further contemporary work connecting feminist SF and science theories”, our discussion of Zoline’s story stressed the critique of “science as usual” that functions as a key factor in the narrative composition of “The Heat Death”, stylised both in its play with taxonomising forms of knowledge production and communication and in the development of an alternative conceptual framework regarding the idea of entropy. As pointed out in the analysis, the revisioning of scientific paradigms at work in the story is accomplished by excessive play with the concept of entropy, whose discourses and meanings are refashioned and expanded by Zoline. By examining some of the narrative devices employed, looking at their effects in terms of activating certain forms of reader response, and reading the story *vis-à-vis* Tiffany Trenda’s contemporary performance, we have shown that the central entropy-informed tension between ordered and disordered systems is kept throughout the story, that those systems are characterised by complexity and interaction in their constituent elements; and continuously interfere on (or contain) one another. This interplay disrupts notions of linearity, teleology, neutrality that have informed mainstream scientific discourses. Of major relevance for our reading is the situated and gendered perspective constructed in/by the story. By presenting scientific abstraction from the housewife’s perspective (in Haraway’s terms, from her “situated knowledge”), the heat death of the universe is relativised in spatial and temporal terms, crossed by and interspersed with feminist issues which are practically urgent, philosophically sound, politically weighty, inviting the reader to consider the ethics of technoscience (for example in relation to issues about food production and packaging), as well as the pragmatic question of what action can be taken if we are to resist or revision dominant paradigms of science. Thus the birth of universes is realised in fiction with the opening up of new perceptions regarding the politics, tensions, effects and stakes at play in the world stage in its complexity.

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²³ Cf. Greene, 2004.

²⁴ Cf. quote from the story mentioned above.

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RECEBIDO EM 03-08-2102
APROVADO EM 02-01-2013