

From Bion to Delany: Samuel R. Delany's “Modular Calculus” as an Example of Bionian Transformation*

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Abstract

Literature furnishes a particular vertex to see reality through narrative fiction. In particular, science fiction literature, which creates a fantastic situation starting from realistic data (history, science, cultures), may be considered a kind of creative process. It uses heterogeneous things and “integrates” them into a homogeneous, new and comprehensible product. Science fiction writing allows the objects of the real to be reprocessed in terms which are thinkable at the current moment. Using the terminology established in psychoanalysis by Wilfred Bion this reprocessing work is a transformation. According to Bion we can hypothesise that the writer of the science fiction literary work serves as a “container” and the science fiction novel, considered a different way to represent reality and not just a simple editorial product, serves as a alpha-function to make concepts that were not previously thinkable or understandable. Between the 70s and the 80s the writer Samuel Delany theorized and put into practice the use of a literary model called “modular calculus”. This model allows the literary work of making something unthinkable into thinkable. The purpose of this paper is to highlight how modular calculus is a particular type of Bionian transformation, and how the science fiction novel can play the role of alpha-function, transforming unthinkable concepts into thinkable ones.

Introduction

Literature and science express human thinking, and they are both manifestations of creativity. Harry Slochower wrote that “Science looks for causes and reasons, aiming to get at uniform laws. The function of art is to reveal forms which are mobile and manifold”(Slochower 1965, p. 117). They both seek to reveal an order of things established by nature. Whereas science seeks a conceptual order (a formula that describes nature’s behaviour in a standard way), the order provided by literature (which is a form of art) is sensuous (it comes from the senses), and manifests itself in tangible forms that can be seen and heard. Relating this hypothesis to literature, we can say that, just like science speaks the language of abstraction, literature speaks the language of symbolism. Science deals with signs that have a specific and fixed denotation, whilst literature uses mobile symbols.

Science fiction literature can be found where science (or popularization of it) and literature meet.² Getting back to Slochower’s definition, we can say that science

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fiction grants dynamism to the specificity and secureness of science. Tom Idema points out that “what can materialize in SF is a dynamic understanding of science in which the latter, rather than being represented as an authoritarian monolith, is taken as a highly differentiated set of fields, people, institutions, practices, ideas, attitudes, emotions, and so” (Idema, 2015, p. 45). The great heterogeneousness of the contents of science fiction literature was also underscored by Paul Graham Raven: “there are a lot of futures out there, and I think it’s important that we learn how to read them. Science fiction and futures often function as engines of techno-scientific desire, but there is also a way in which narratives of futurity perform a function akin to collective cultural dreaming” (Raven, 2016, p. 51).

Science fiction writing allows the objects of the real to be reprocessed in terms which are thinkable at the current moment. This process is more complex than the simple relocation of a current plot to a faraway planet, as it happened with the space opera of the 1930s. In those stories, entertaining yet naïve, the theme of the frontier and the fight against American Indians described in popular western novels was simply adapted in order to develop a plot to be set on faraway alien planets. In a different manner, science fiction in its most mature form does not merely change the costumes and scenarios of the western romance, but rather re-thinks reality.

Using the terminology established in psychoanalysis by Wilfred Bion, the space opera of the 1930s can be an exemplification of what is known as transformation in rigid movements. The more mature science fiction is instead an example of a more complex transformation: the task of science fiction is not to think about what has already been thought, but to be able to think of that which has yet to be thought. Samuel R. Delany, a writer who often analysed the science fiction genre as a linguistic means, stated that in science fiction the future is a convention that allows the writer to indulge in a distortion of the present “that sets up a rich and complex dialogue with the reader’s here and now. The “future” is the most common writerly convention science fiction uses to accomplish this, but it is not the only one. Another is the “parallel world” convention, wherein the SF writer supposes that some event in history had turned out differently and uses the resultant alternative present for the story setting” (Delany, 1984/2012, p. 165). This characteristic of distorting the present using the means of creativity makes science fiction not merely a type of writing, but also “a way of reading” (Delany, 1994, p. 276). A transformation of all aspects of the representation of the real. By saying this, the reference to Bionian transformations is even more fitting: the transformations operate both on the reader and on the writer, just as they operate both on the analyst and on the analysand.

One of the examples often used by Delany in several critiques, concerns the way in which science fiction solves the problem of imagining the future starting from real elements of the present. The solution consists in *transforming* that which already exists into something different, by means of a particular type of *function* (psychic

² Several science fiction authors are scientists (e.g. Gregory Benford, David Brin, Peter Watts, etc.) and their science fiction books are actually a literary embodiment of the application of a scientific theory or a technological process. Most science fiction authors, on the other hand, do not construct their books starting from the primary source (the scientific theory), but from the secondary source, namely a popular dissemination of it.

during the analytic therapy, literary in writing/reading): “when Heinlein placed the clause “the door dilated” casually in one of the sentences of his 1942 novel, *Beyond This Horizon*, it was a way to portray clearly, forcefully, and with tremendous verbal economy that the world of his story contained a society in which the technology for constructing iris-aperture doorways was available” (Delany, 1994, p. 34).

The psychoanalyst Wilfred Bion is the one who, more than anybody else, explored the mechanisms of thinkability. If one should wish to resort to Bionian terminology, and refer to the example used by Delany of the diaphragm door, we could say that when Heinlein invented it in his novel, he made the “dilating” door understandable or thinkable. In this way, the science fiction writer is the one who takes the door-element and *transforms* it through the science fiction-function, starting from a pre-existing idea (preconception) of the diaphragm opening of the iris or of a camera shutter. From that moment on, the dilating door is understandable for the reader, too.

Bionian Transformations

Wilfred Bion “was a potent and original contributor to psychoanalysis” (Mawson, 2011, p. 3).³ One of his major theoretical innovations was that of the concept of transformation. The transformations are a series of mental processes such as to transform incomprehensible information (emotional states and sensuous input) into mentalizable thoughts. The term is taken from mathematics, according to which the transformation is a change of shape.

Bion exemplifies the concept of transformation by comparing it to the series of operations intervening between the view of a field of poppies a painter sees in front of him and what the painter draws the canvas. The artist performs a transformation of what he sees in order to represent what his senses perceive in the form of a painting. Some of the elements of the painting are the result of the painter’s interpretation, whereas other elements remain unaffected. The latter are those that allow us to recognize the real scene in the painting, that is, the vision of the field (for example, poppies, if they are drawn exactly as they are). Bion calls these elements invariants. The psychoanalytic interpretation, which takes place during the analyst-analysand

³ Although the grandeur and originality of Wilfred Bion is widely acknowledged, he would have countered such popularity. Here is what he wrote about his American stay in *Cogitations*: “It took a long time to get used once again to the fact that nobody had ever heard of me, except one or two people who seemed to feel for some reason that they wanted further assistance. At the same time there were attributed to me qualities or abilities that seemed to be very wide of the mark; if I had had the qualifications or the addiction, I could have found myself thrust into the role of a sort of messiah or deity. All this ran parallel with its being made crystal clear to me that I was a mere human being, that psychoanalysis was, after all, only a form of verbal communication, and that there were limits to what could be done by it--especially as one was dependent on having somebody who would listen to what one had to say. So, what with having to say something, and also having to have somebody there who would listen to what I said, it was clear that the position that was being thrust upon me, or that I was being invited to take, was one not at all within my compass or capacity” (Bion, 1992/2005, pp. 376-377).

relationship, according to Bion, “can be seen to belong to this same group of transformations” (Bion, 1965/1977, p. 4). Following this theory, the invariants of psychoanalytic transformation are the theoretical pillars on which the theory rests (e.g. the Oedipus complex).⁴

During the psychoanalysis, the analyst transforms that which is brought (unsymbolised and sensuous things) into thinkable symbols by the patient into thinkable material. Bion distinguished transformations in rigid movements, projective transformations and transformations in hallucinosis. In therapeutic practice, the transformation in rigid movements coincides with the transfer phenomenon, with which the patient actualises his own unconscious desires within the therapy; in the projective one, the patient’s communication takes place, as he remodels his own account of reality according to his own desires; the one in hallucinosis is characterised by a complete distortion of the real through acting-out, deliriums and hallucinations.

In order to describe the mental processes of thought formation (which is a first step towards artistic creation), Bion used the term alpha-function to describe a mental process through which thoughts and feelings impossible to understand by the person being analysed (beta-elements,) become understandable and thinkable (alpha-elements) thanks to the analyst’s work. It is a simple form of transformation which provides meaning and coherence to the patient’s speech. Therefore, growth of the thought is tied to a continuous and complex transformation process; it is a shift from scattered and shapeless ideas to forms which are alive and understandable. But in order to be “taming wild thoughts”, thoughts must first be “housed”, they must find a home that welcomes them (Monti, 2014). When these elementary components become thoughts (or concepts), they are stored in the unconscious so as to not occupy needlessly the conscience and be available. Hence, thought development depends on the interaction between the non-thing (the object for which one has no experience) and its realisation. This makes it possible to solve problems in the absence of the object (Bion, 1965/1977). In *Learning from experience* Bion introduced a concise form of these processes referring to them in strictly analytical-mathematical terms. The great Bionian revolution at the textual level consists precisely in a widespread use of a terminology taken from mathematics. Bion “found a mathematical form for this in what has come to be called ‘Model Theory’, invented in the 1950’s by Alfred Tarski. Model Theory draws freely on the intuitions that we all use in representing new experiences in terms of old. A standard example of the use of a model can be found in the early attempts to explain the strange world of the atom and its

⁴ Bion points out that it would be improper to speak of invariants in psychoanalysis, since psychoanalysis, as a discipline, keeps developing over time: “Since psycho-analysis will continue to develop we cannot speak of invariants under psycho-analysis as if psycho-analysis were a static condition. In practice it is undesirable to discard established theories because they seem to be inadequate to particular contingencies; such a procedure would exacerbate a tendency to the facile elaboration of ad hoc theories at times when it were better to adhere to established discipline. It is therefore advisable to preserve a conservative attitude to widely accepted theories even when it has become clear that some adjustment needs to be made” (Bion, 1965/1977, p. 4). If, however, a certain conservative attitude is maintained, it might be correct to speak of invariants even in psychoanalysis.

complicated mathematics. Some intuitive person hit on the image of a solar system, such as our own local universe supplies, to make things clear” (Skelton, 1995, p. 392).

The most elementary Bionian transformation is the emotional experience $x-K-y$. It must not be understood as x that owns something of y , but rather as x that is trying to get to know y . K (knowledge) is the domain in which transformations take place. For Bion, thought and emotional experience coincide. This is the reason why the proposition $x-K-y$ can also express the alpha-function, stating that the beta-elements prefigure the alpha-element (Bion, 1962/1967). The beta-element must be digested (according to the classical Bionian metaphor) in order to become thought, and this occurs only if there is an apparatus for thinking. Bion defines the latter with the expression “container-content”: it is a psychic organisation that emerges during the two moments of the earliest infancy, which are the paranoid-schizoid (PS) position and the depressive (D) position. The container-content expression comes from the fact that the child (or the analysand) in D-position, uses the object as if it were a container that metabolises the projective identifications (beta-elements), transforming them into alpha-elements, in other words element of symbolic thought. The presence of the container is necessary in order to collect the psychic fragments of experience and to give them coherence. The transformation process entails a shift from beta-elements to alpha-elements, from oneiric thoughts, dreams and myths to pre-conceptions, from conceptions to concepts, and lastly to the scientific-deductive system. They are all stages of the creation, with each one being the transformation of the previous stage. By following this theory, we can say that the narrative work carries out the function of “container”, since it collects inside hypotheses and ideas that need to be reprocessed and transformed according to the writer’s skill.

Samuel R. Delany’s “Modular Calculus” as an Example of Bionian Transformation Introduction

Hanna Segal, who dedicated part of her work to creativity, was a fan of science fiction. She considered it an excellent reprocessing means, especially if the story answered the question “what if...” (Bell, 2016, p.64). To Segal, literature was a means of reflection on reality and, at the same time, it furnishes another vertex to see reality through the narrative fiction. Literary writing does not only describe situations, it also exemplifies some psychic processes underway in the writer and in the community. Melanie Klein wrote about “reparation” meaning that mental process through which the distressed person tries to “repair”, in other words to remedy, their own destructive fantasies towards the beloved object. This “reparation” action of the mental representation of reality is very similar to the action carried out by literature. By creating fictitious realities, the work of fiction has the task of forming “possible” images of the world, and therefore to contribute to forming new elements of thought, conceived for the first time in that form. The psychologist Carol Fleisher Feldman wrote that the various types of non-scientific interpretation, those that may be considered as fiction genres, constitute various ways of thinking, integral explanation models that are evoked by the stories and are attributed to the stories themselves (1994/1997). According to Bion, every time that, during the therapeutic process, the analyst provides an interpretation of beta-elements transforming them in alpha-elements, he performs a narrative transformation. The term narrative in psychoanalysis means “as the interventions in which, say, the analyst undertakes an

extension into the world of ‘myth’ [...] when he recounts something meaningful from a position on Row C of the Grid” (Ferro, 1999/2009, p. 1).

By making a parallelism between what happens during the analysis and the science fiction literary invention, we can say that by writing science fiction stories, a transformation of elementary scientific theories is carried out in order to make them “thinkable”. This thinkability is then also transposed by the reader who, through the science-fictional text, he acquires a new image of what it has become possible to think. Furthermore, we can say that science fiction is the mythological literature of the contemporary era.

Following the Bionian model, science fiction is the equivalent of a “container”, capable of elaborating theories that would otherwise be abstract and “not digestible”. The writer is the one who is able to retain knowledge and past experiences (in other words existing scientific theories) in order to use them in the literary invention. Since the work of fiction is a “container”, it allows a theoretical concept to realise itself through a speculative and literary formulation that can be enjoyed by the reader. In science fiction, the literary “container” is constructed through the use of writing techniques, or through the creation of fantastic images: actions that presuppose an additional step in the complexity of the thought.

It was Bion himself who realised that science fiction was a privileged expression of creativity. In *The Dawn of oblivion* (1979), the third volume of the Trilogy *A memoir of the future*, he makes one of the leading characters Roland, who speaks with the P.A. (psychoanalyst), say that a metaphor is science fiction.⁵ Science fiction makes it possible to increase the ability to tolerate the speculative image, given that the science approach only would be understood by people centuries later (Harris-Williams, 1983/2011). In this way, narrative fiction acquires a character of truth more than the unknowable (unthinkable) event, which in instead made up of the abstract scientific concept⁶.

⁵ The first volume of the Bionian trilogy also contains a reference to science fiction. In one scene, Rosemary, one of the leading characters, speaks to some spectral figures while she is half-fainted (hence it is the passage from the PS position, dreamless, to D position). The ghosts reveal to Rosemary: “We are Science Fiction. Who are you? / I am the Artist who made the ram caught in a thicket beautiful in gold. I am the hunter who caught the ram in a thicket. I am the thicket in which the ram was caught. Who are you?” / “I am Science Fiction. I am S. F. I am the Fiction which became Science Fact. I am the tomb robber. I am the drug that stole your sense away. I am the tomb, ugly and frightening. I am the thief that made you bury, in the golden ram and its golden, golden thicket, the work of Art. I made you bury in the death pit of Ur. I robbed the death pit of its terrors. I am the S. F. who, disguised as the holy fool, appears as the Silly Fool. I am S.F”. (Bion 1975-79, p. 36).

⁶ The American author Philip K. Dick, writing about the role of the science fiction writer, made a statement that is very close to the Bionian theorization, in other words that “the SF writer senses that story, or many stories from the clues of tangible reality around him, and does the rest; he talks for the objects, the clues. He is driven to. He knows there is more, and he knows that he will not live long enough to see all the scientific data actually brought forth. . . they may never be. *Language and Psychoanalysis*, 2020, 9 (2), 13-27. 18
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Bion introduced mathematical abstraction in psychoanalysis when he theorized the three types of transformations (in rigid movements, projective, in hallucinosis). In this way, he performed a modelling of psychic processes. This theorization has certain points in common with the metaliterary abstraction introduced by the Afro-American writer Samuel R. Delany in some of his works between the end of the 1970s and the early 1980s. He suggested a particular form of narrative, and called it “modular calculus”. “The term “modular” derives from the mathematical term “modulus”, which refers to changing numbers from one base to another, and *Triton* concerns precisely this kind of “calculus”” (Miller, 2012, p. 57). The transition (transformation) from a real narrative to a science fiction one is analogous to the change from a numerical base to another one.⁷

The considerations on this writing method are contained in the group of texts consisting of the novel *Triton* (1976) and its appendix “Ashima Slade and the Harbin-Y Lectures”, followed by the appendix to *Tales of Nevèryon* “Appendix: Some Informal Remarks Toward the Modular Calculus, Part Three by S. L. Kermit” (1979); of the novel *Neveryóna, or the tale of signs and cities* (1983), and lastly of “Appendix A: The Tale of Plagues and Carnivals” contained in *Flight from Nevèryon* (1985). Delany suggests that, by means of specifically developed models (literary, mathematical, linguistic), it is possible to translate reality. One of these is metalogic, a “mathematical superstructure” (Delany, 1990/2011, p. 318), a mental and scientific process designed by the leading characters of *Triton*. This book can be considered both a story of space science fiction (it is set on a satellite of Neptune) and an application of the modular calculus technique invented by Delany. This congruence between literary form and narrated story, between container and content, is possible because “the science in SF is mostly doubletalk anyway—like the “metalogics” and the “modular calculus” I spoke of before” (p. 332). *Triton* can be defined a meta-text: it narrates a science fiction story and, at the same time, it discusses science fiction itself.⁸ This technique increases the co-penetration between the writer’s real world

The writer, then, begins to sing about those battles and those deeds. He places them in the future only for convenience; it is the placing of the story mostly in an imaginary world, but bound by small actual clues to this world, that drives him into expression” (Dick, 1974/1995, p. 73).

⁷ The idea of associating mathematics with language might come from Delany’s youthful readings. The writer said that he was given *The black star passes* by J. W. Campbell to read as a young man, a book whose plot he could not remember, but, “[...] I do recall that someone in it had invented a Very Powerful Mathematical Tool called “the multiple calculus” (Delany, 1974-75/78b, p. 107).

⁸ In *Triton*, some of the leading characters’ dialogues are parts of essays about science fiction that Delany had previously written. Even the appendix to the novel contains parts of literary critique articles which the writer had already published (1974-75/1978) or already written (1976/1978c). Therefore, the novel can be considered an example of recursive science fiction, that is “*science fiction about science fiction*” (Resnick, p. vii). Delany pretends that the appendix to the novel *Triton* is a commentary on the lecture on modular calculus given by Ashima Slade (a character in the novel) and published under the title “Shadow” in the *Foundation* magazine by Lux University of Titano (Delany, 1976/1992, p. 346). Actually, “Shadow” was an essay by Delany that appeared on the *Foundation* magazine of the Liverpool University.

(the one of the publishing world that produces science fiction) and the fictitious world of the Triton satellite. The slightly pretentious name of “modular calculus” actually conceals the idea that a literary content may be associated with different contexts.

In the theoretical text entitled “Shadow” (1974-75) Delany had imagined the need for a representational system that operates by models: “For A to be recognized as a model of B, first a set of internal relations, as A relates to itself, must be read from A, then processed in some way probably similar to a mathematical integration, then *another* set of internal relations must be read from B (some of the relations *may* be similar to these read from A; but they not be) and then integrated (by similar process; or by a very different one) and the two results compared; if I find the *results* congruent, then I recognized A as a model of B in the context of the joint integrative process that produced the congruent results”(Delany, 1974-75/78b, p. 52). Delany conceives literary (science fiction) modelling to be similar to mathematical integration, i.e. the operation that allows one to obtain the calculation of the (surface) area starting from a curve (a line). In the simplest possible terms, it could be defined as a type of operation that “adds” or “increases” the initial data (the curve) providing a more complex result (surface) than the initial one. Just like a mathematical formula is able, in its abstractness and uniqueness, to describe phenomena that are very different one from the other;⁹ in the same way a text based on modular calculus must be able to represent realities which also are very different one from the other, such as the U.S. between the 1970s and the 1980s, and the heterotopy of the Neptune satellite or the prehistoric world of Nevèrjôn novels. Delany wrote that “the Modular Calculus is basically a set of equations that will take any description of an event, however partial, and elaborate it into a reasonable, accurate, and complete explanation of that event” (Delany, 1990/2011, p. 344).

The writer’s intention is to create a literary form the content of which is specific and accurate in its expression, but at the same time capable of being used in different contexts for the purpose of allowing knowledge. In short, this is a definition of modular calculus. It was initially exemplified in the novel *Triton*, it can be defined as an initial attempt to apply the method and for this reason, it being a meta science-fictional reflection, can prove to be obscure to non-scholars of science fiction. Conversely, “Appendix A: The Tale of Plagues and Carnivals”, inserted in *Flight from Nevèrjôn*, is more fitting and immediate: “The modular calculus is an algorithm or set of algorithms (a set of fixed operations) that can be applied to any fitting grammar to adjust it into a guiding grammar” (Delany, 1985, p. 376).¹⁰ In an

⁹ “Mathematical formulation is not yet available to the psycho-analyst though there are suggestive possibilities” (Bion, 1962/1967, p. 51).

¹⁰ Fitting and guiding grammar are definitions that Delany takes from the work of Willard Van Orman Quine: “In more informal terms, there can be perfectly accurate descriptions of systems, of situations, or even of machines, which, while they tell us what these systems, situations, and machines look like, how they move, how they function (that is, tell us how they *might* work) nevertheless do not indicate how they *do* work. Similarly, there are explanations that tell us, accurately and precisely, how something actually does work, so that we can both recognize and (potentially) construct an object that works in the same way—though often those explanations will not let us recognize the initial object from which the grammar was derived (it doesn’t necessarily tell us whether it was a

interview he kept using the same mathematical metaphor by explaining that “Modular Calculus is basically a set of equations that will take any *description* of an event, however partial, and elaborate it into a reasonable, accurate, and complete *explanation* of that event” (Delany, 1990/2011, p. 343).

These definitions are not always entirely clear: the mathematical model proposed by Delany is more of a science fiction metaphor than anything else. To make his point clearer, the author wrote “Appendix A: The tale of plagues and carnivals” as part of the *Nevèryon* fantasy series. There Delany states “Clearly the Neveryon series is a model of late twentieth-century (mostly urban) America” (p. 377). The story, written in 1984, clearly shows the two characteristic elements of modular calculus: the fantastic part is set in *Nevèryon* whereas the realistic one is set in New York. It is a clear application of what Delany had already written ten years earlier in “Shadow2, namely that “Everything in a science-fiction novel should be mentioned at least twice (in at least two different contexts)” (Delany, 1974-75/78b, p. 341) . In this case, in the prehistoric city of *Nevèryon* and in the New York of the eighties. One story stands as the model, the other is its transformation. The first fiction it is about an epidemic that starts to strike men (and, to a lesser extent, women) in *Nevèryon*. Pheron, one of the first to fall ill is thus described: “He’s so thin—he must weigh only half of what he did when we saw him! His joints and his neck are all swollen. There’re terrible sores on his leg and his side! His eyes are red and runny. And he’s... sick! He can’t even put his arms down. Underneath hurts too much” (Delany. 1985, p. 181). Those who are affected by the epidemic is hopeless. The place of origin is the Bridge of Lost Desire, the site that hosts the city’s brothels. The second story tells about the way AIDS spreads and becomes a subject of concern for the population of contemporary New York and of Delany himself. The transformative action of modular calculus is evident in two respects: a meta-narrative and a narrative one.

The meta-narrative one is represented by the appendix, where it appears that the fantastic story is but the story based on an ancient (fictitious) text found by Afro-American archaeologist K. L. Steiner, who comes as “a black woman—and your friend for a good many years too. Also I’m a thirty-six-year-old, substantially overweight black woman, with an awful overbite” (p. 328). Steiner is the pseudonym under which Delany wrote several critical pieces on modular calculus even outside the fiction of the series *Nevèryon*. Delany entrust to it the fictitious finding of writings dating back to 9000 years ago, which constitute the fantasy narration of *Nevèryon*.¹¹ The narrative part is the one that can properly be defined as a Bionian transformation. It starts from a realistic situation but difficult to understand at that time (the spread of AIDS in the United States), and transforms it into a story of epidemic which, by

green one or a red one, if its being green or red is not part of its workings) should we stumble over it in life. The first is, more or less, a Fitting grammar. The second is, more or less, a guiding grammar” (Delany, 1985, p. 376). The writer concludes: “In short, the problem of the modular calculus is: How do we know when we have a model of a situation; and how do we tell what kind of model it is?” (p. 377).

¹¹ This game of mirrors between narrative text and critique of the (fictitious) text as if it were real, can only be a reference to the literary fiction of Nabokov in *Pale Fire* (1962), where the romance consists of a critique of a poem written by a fictitious author.

resembling plague stories from the past but with the characteristics of syphilis, the reader can understand better.

The story of the spread of AIDS is sadly well known. Contagion started in 1979, when a few unexplainable deaths were reported (Gilman). However, it was not until 1981 that people started talking about a new disease, when, between October 1980 and May 1981, five young, previously healthy homosexual men were treated in Los Angeles for *Pneumocystis carinii* pneumonia. It is a type of pneumonia that usually affects people with severely weakened immune systems. In June 1981, the Center for Disease Control and Prevention (CDC) published an article in their weekly newsletter about the five men and their cases, and soon, information about the new disease spread quickly in the medical community. Owing to the predominance of homosexual patients, the term GRID (gay-related immune deficiency) was used, then, from 1982 onwards, the term AIDS started being used.

In 1984, when Delany was writing “The Tale of Plagues and Carnivals” the disease was still relatively unknown to most of the population, and therefore also to science fiction readers. Its dangerous is not yet “understandable”. Therefore, Delany takes an unthinkable topic (an epidemic of AIDS) and makes it thinkable by turning it into an epidemic that is similar to the plague or syphilis but with the characteristics of AIDS, that strikes the prehistoric land of Neveryóna. At the beginning of the 80s very little is known about AIDS; so, it is still something unthinkable. If one wants to make it thinkable, that is understandable, one needs to turn this reality into an unrealistic fantasy story. The fantasy genre is a narrative that is well known to the readers, even if it does not describe real situations. Even the main topic of “The Tale of Plagues and Carnivals” (a sexually transmitted disease standing between the plague and syphilis) is however known to the reader through other works of fiction (the Plague can be found in many classical texts, and syphilis, too). So, fantasy and plague are thoughts that have already been conceived. The fantasy narrative of AIDS in “The Tale of Plagues and Carnivals”, which in Delany’s intention is an example of modular calculus, is a Bionian transformation, since it makes it possible to make the AIDS-thought understandable by transforming the plague-thought through the fantasy/science-fiction genre.

If we use the formula of Bionian transformation, $x K y$, then we can say that Delany operates in the text according to the transformation $x - Science Fiction/Fantasy - y$. Its “boundaries between languages become permeable; a new ‘dialect’ is created in order to approach the expression of truth” (Priel, 2013, pp. 1117-1118).

In this way Delany starts from certain predefined situations (emotions related to a deadly plague and syphilis epidemic) and integrates them in the fictional narrative transforming them (the sexual plague in Neveryón), he produces a meta-fiction that is entirely similar to the interpretation made by the analyst during the session. The transformation of text is similar to a transformation in K, and if this personally implicates the writer and the reader, then it is similar to a transformation in O. The performance of this transformation in the creative-literary process itself is similar to the transformation process of the analysis inherent in psychoanalysis. Just like the analyst knows the rules of analysis (transformation in K) and during the analysis he also changes himself, in the same manner the writer knows the rules of writing science fiction, and applies them to rethink his own role. Starting from a literary

model such as science fiction, the writer changes both the literary genre and his own function within the genre itself. Delany's modular calculus is nothing but "another term for the "significant distortions" that science fiction produces—both creates and works in tandem with another effect that the genre generates, the representation of ways in which the reader's world could be different" (Tucker, 2010, p. 255).

The Modular Calculus as Bionian Transformation: A Conclusion

According to the psychoanalyst Wilfred Bion, thoughts and dreams are closely related things. Alpha-elements are the outcome of work done by alpha-function on sense impressions; alpha-function is the interior process "by which sense impressions are transformed into elements capable of storage for use in dream and other thoughts" (Bion, 1963/1989, p. 4). Thought and dream are two aspects of the same inner process, so much so that "Failure of alpha-function means the patient cannot dream and therefore cannot sleep" (Bion, 1962/1967, p. 7).

As regards the artistic product, we can say that creativity is the mirror image of the dream. The dream is the preferential way to the unconscious and some literary forms are particularly suitable to represent such way. Poetry is one of them. Science fiction is also one of these art forms. Delany maintains that science fiction is closer to poetry than mainstream literature: "By much the same process that poetry expanded beyond its beginnings in ritualistic chant and incantation to become a way to paint all that is human and etch much that is divine, so s-f became able to reflect, focus, and diffract the relations between man and his universe, as it included other men, as it included all that man could create, all he could conceive" (Delany, 1970-71/1978a, p. 127).

The ability that some particular literary forms have to reach deeper meanings (the Bionian O) than others has also been underlined by Francesca Bion. She recalls that her husband thought that poets "seem to me to say something in a way which is beyond my powers and yet to be in a way which I myself would choose if I had the capacity. The unconscious-for want of a better word seems to me to show the way 'down to descend', its realms have an awe- inspiring quality" (Bion, 1985/1991, p. 241). Delany also identifies this ability that poets and psychoanalysts have in science fiction writers. Psychoanalysis succeeds in making conscious what is unconscious; to Delany "science fiction is a way of casting a language shadow over coherent areas of imaginative space that would otherwise be largely inaccessible" (Delany, 1974-75, pp. 117-118). Science fiction, among the literary genres, is the one best suited to exemplify a Bionian transformation; Bion himself used it to write his narrative trilogy, precisely because it is capable of making transformation processes readable. The problem of the adaptation of representational forms to different types of reality is a problem that Bion had sensed with regards to the epistemology of psychoanalysis. His equation, $x-K-y$, is conceptually taken from mathematics. With this equation, he attempted to write a strict formula to describe in a concise way a process through which something becomes understandable, and therefore known, via a knowledge task starting from other elements of departure that are not thinkable in that new context. Alpha-function is a very limited functioning of the mind, restricted to intra-session experiences. In the hypothesis that has been made here, it is advised to extend the operation of this function (transformation) to a more complicated process such as the composition of a science fiction story, that is Samuel Delany's modular calculus.

In the 1970s, Delany wrote a series of texts that refer to a model of linguistic representation, invented by the writer himself, called modular calculus. The system vaguely refers to systems science and cybernetics. Through this system, Delany attempts to create stories equipped with a sense of the real world in which the writer operates, and in the fictitious world populated by his characters. Science fiction itself, with its characteristic malleability and allegoricalness, is an example of modular calculus. Delany makes the example of the dilating door described in Heinlein's novel: through that novel the dilating door, which was earlier an unknown image, has become understandable via the transformation of concepts already conceived of doors and camera shutter, into the now understandable dilating door. Delany mainly writes within models of this literary genre that can be itself considered an example of modular calculus. Science fiction, which usually describes future societies rewriting present ones, is "essentially a modelling" (McHugh, 2003, p. 20). Modular calculus, in the writer's intentions, is a general theory of modelling and representation (Freedman 2006). It coincides with science fiction when this constitutes "truly the bridge between science and literature, a notional gadget for postulating the hidden works of a black box which might hide the fundamental physical laws of the universe, or the obscure heart of a suffering human being" (Broderick, 2005, p. 130).

In psychoanalytical theory, the formulation or adherence to a model makes it possible for the analyst to give meaning to the form of the patient's story. Bion uses mathematics because it is a symbolism that makes it possible to work in the absence of the object being dealt with greater "precision and universality" (Bion, 1965/1977, p. 41). A modelling offers an interpretation of an unfamiliar state of affairs in terms of a familiar one, in order to reduce the anxiety of uncertainty. The "earliest experiences of modelling provide the functions that will process later experiences. If the earlier experiences have formed a bizarre or lopsided view of the world, later experiences will be cast in this mould. For example, a baby who had a psychotic mother (who would in the middle of the night wake up the baby to be dressed and then put it back to sleep again, only to feed it when it was not hungry) is laying down a foundation process for very bizarre models of the world, in which authority figures can act in utterly unexpected ways" (Skelton, 1995, p. 394).

When Samuel Delany offers the reader a representation of an unknown state in familiar terms, he behaves just like the analyst when the latter offers the patient, with his interpretation, a thought that would otherwise be difficult to formulate for the person being analysed. In the creative process "a symbol is inherently healing to the psychic system, restoring ties to the object and resolving unconscious relational conflict" (Waska, 2005, p. 95); analogously with science fiction writing new symbolisations, and new thoughts, are created. Here comes to mind the concept of "open work" defined by Umberto Eco. The open work "suggests", i.e. it is "performed with the full emotional and imaginative resources of the interpreter. Whenever we read poetry there is a process by which we try to adapt our personal world to the emotional world proposed by the text. This is all the more true of poetic works that are deliberately based on suggestiveness, since the text sets out to stimulate the private world of the addressee so that he can draw from inside himself some deeper response that mirrors the subtler resonances underlying the text" (Eco, 1962/1989, p. 9). Umberto Eco, a few pages later, goes on stating that open works are "works which, though organically completed, are "open" to a continuous generation of internal relations which the addresses must uncover and select in his act of perceiving the

totality of incoming stimuli” (p. 21). “Appendix A: The Tale of Plagues and Carnivals” is a sort of open work, obtained by transforming the emotional stimuli produced by the spread of AIDS into a fantasy tale. Thus, it is also an example of modular calculus¹² and, therefore, following our hypothesis, of Bionian transformation. He writes the story, set in pre-historic and mediaeval-esque Nevèryon, and there places an epidemic that looks like the plague but which is sexually transmitted like syphilis, and whose symptoms are those of a new disease about which there is growing discussion in New York. Delany’s novel about AIDS is “an allegory of feeling in the absence of history” (Bradway, 2017, p. 66). Modular calculus allows to express this absence, like a Bionian transformation allows to realize the no-thing.

What Delany calls modular calculus is similar to the process of making something unthinkable (AIDS, unknown before that time) into thinkable (AIDS as a sexually transmitted epidemic), a process that is similar to a Bionian transformation. The science-fiction writer uses the literary medium (operating in the K domain) to turn something that was not understandable to the reader into something that now is such. In the story, the Bionian transformation, which coincides with the application of modular calculus, is performed typographically and literarily by alternating the descriptive paragraphs of Nevèryon with New York, the epidemic with Aids, the Bridge of Lost Desire with Brooklyn. In the arts a transformation can be exemplified by using the Bionian example of the painter who paints a field of poppies and the picture that represents it. The transition from the sight of the real scene to the painting is a transformation. The invariants are the elements that make it possible to recognize the real scene in the picture (for example, the poppies).

When science fiction is considered a transformative function, the invariants are the elements that make it possible to label the literary work as science fiction. Generally, they are literary *topoi* such as space adventure, the presence of aliens, etc. In the specific case of Delany’s modular calculus, the invariants are Martian and Neptunian colonies. In his treatise on transformations Bion writes that “the artist is not the only person involved in looking at a picture” (Bion, 1965/1977, p. 1). That is to say, the transformation takes place in both directions. As in psychoanalysis both the analyst and the analysand undergo transformation, in modular calculus both the writer and the reader are involved. It is no coincidence that Delany often repeated that science fiction is “a way of reading” (Delany, 1994, p. 276). That is, there is no one way to read a text, there are several; and the greater the reader’s knowledge of the means of science fiction, the greater his or her ability to interpret the science fiction story will be.

Using the Bionian expression $x-K-y$, which describes the transformation in elementary and minimum terms, the following expression can be written: (thought-plague-syphilis)-(SCIENCE FICTION)-(AIDS), which means that the understandable and known picture of the disease, through the use of science fiction function, makes

¹² However, the modular calculus remains an abstract operation. Umberto Eco additionally writes: “the mathematical concept of information cannot be applied to the poetic message, or to any other message” (Eco, 1962/1989, p. 66). Indeed, literature “expands the general notion of information; but the important thing here is less the analogy between two different situations than the fact that they share the same procedural structure” (p. 66).

the concept of AIDS, at that time unknown and unthinkable, understandable. Using one last time Bion's words, we know that "the theory of transformations is intended to illuminate a chain of phenomena in which the understanding of one link, or aspect of it, helps in the understanding of others" (Bion, 1965/1977, p. 34). Similarly, modular calculus enabled Delany to make clear (illuminate) a particular moment in our recent history through the use of particular literary genres, such as science fiction and fantasy.

References

- Bell, D. (2016). The world as it is vs. the world as I would like to be: contemporary reflections on Freud's 'Formulations on the two principles of mental functioning. In G. Legorreta, L. J. Brown (Eds.), *On Freud's "formulations on the two principles in mental functioning"* (pp. 39-64). Karnac Books .
- Bion, W. R. (1967). *Learning from experience*. Jason Aronson. (Original work published 1962)
- Bion, W. R. (1977). *Transformations*. Jason Aronson. (Original work published 1965)
- Bion, W. R. (1989). *Elements of psycho-analysis*. Karnac Books. (Original work published 1963)
- Bion, W. R. (1990). *A memoir of the future*. Karnac Books. (Original work published 1975-79)
- Bion, W. R. (1991). *All my sins remembered: Another part of a life & the other side of genius: Family letters*. Karnac Books. (Original work published 1985)
- Bion, W. R. (2005). *Cogitations*. Karnac Books. (Original work published 1992)
- Bradway, T. (2017). *Queer experimental literature: The affective politics of bad reading*. Palgrave Macmillan.
- Broderick, D. (2005). *Reading by starlight: Postmodernscience fiction*. Routledge.
- Delany S. (1978a). Critical methods/speculative fiction. In *The jewel-hinged jaw: Notes on the language of science fiction* (pp. 119-131). Berkley Windhover. (Original work published 1970-71)
- Delany, S. R. (1978b). Shadow. In *The jewel-hinged jaw: Notes on the language of science fiction* (pp. 122-153). Berkley Windhover. (Original work published 1974-75)
- Delany, S. R. (1978c). To read *The dispossessed*. In *The jewel-hinged jaw: Notes on the language of science fiction* (pp. 218-283). Berkley Windhover. (Original work published 1976)
- Delany, S. R. (1985). *Flight from Nevèryon*. Bantam Books.
- Delany, S. R. (1992). *Triton*. Grafton. (Original work published 1976)
- Delany S. R. (1994). *Silent interviews on language, race, sex, science fiction, and some comics*. Wesleyan University Press.
- Delany, S. R. (2011). The second *science-fiction studies* interview. Of trouble on triton and other matters. In *Shorter views: Queer thoughts & the politics of the paraliterary* (pp. 315-350). Wesleyan University Press. (Original work published 1990)
- Delany, S. R. (2012). *Starboard wine: More notes on the language of science fiction*. Wesleyan University Press. (Original work published 1984)
- Dick, P. K. (1995). Who is an SF writer? In *The shifting realities of Philip K. Dick: Selected literary and philosophical writings* (pp. 69-78). Pantheon Books. (Original work published 1974)

- Eco U. (1989). *The open work*. Harvard University Press. (Original work published 1962)
- Ferro, A. (2009). *Mind works: Technique and creativity in psychoanalysis*. Routledge. (Original work published 1999)
- Feldman, C. F. (1997). Literary genres as mental models. In M. Ammaniti, D. Stern (Eds.), *Rappresentazioni e narrazioni* (pp. 113-131). Laterza. (Original work published 1994)
- Hagmann, G. (2005). *Aesthetic experience: Beauty, creativity, and the search for the ideal*. Rodopi.
- Harris-Williams, M. (2011). Underlying pattern in Bion's *memoir of the future*. In C. Mawson (Ed.), *Bion today* (pp. 381-405). Routledge. (Original work published 1983)
- Idema, T. (2015). Toward a minor science fiction: Literature, science, and the shock of the biophysical. *Configurations*, 23 (2), 35–59.
- Imbasciati, A. (2001). The unconscious as symbolopoiesis. *Psychoanalytic Review*, 88 (6), 837-873.
- Mawson C. (2011). Introduction: Bion today – thinking in the field. In C. Mawson (Ed.), *Bion today* (pp. 3-32). Routledge.
- McHugh, D. (2003). Give me your mirrorshades: Science fiction ‘methodology’ meets the social and organizational sciences. In M. Higgins, G. Lightfoot, M. Parker, W. Smith (Eds.), *Science fiction and organization* (pp. 15-30). Routledge.
- Miller, G. A. (2012). *Exploring the limits of the human through science fiction*. Palgrave Macmillan.
- Monti, F. (2014). *Osservare al nido. Pensieri in cerca di un Pensatore*. Persiani.
- Priel, B. (2013). Transformation and invariance in creative translations and analytic interpretations: A Bionian reading of Borges and Cervantes. *The International Journal of Psycho-Analysis*, 94(6), 1115–1127.
- Raven, P. G. (2016). The rhetorics of futurity: Scenarios, design fiction, prototypes and other evaporated modalities of science fiction. *Foundation*, 123, 50-63.
- Resnick, M. (1994). Introduction. In M. Resnick, A. R. Lewis (Eds.) *The passage of the light: The recursive science fiction of Barry N. Malzberg* (p. vii-x). Nesfa Press.
- Sandler, P. C. (2006). The origins of Bion's work. *The International Journal of Psychoanalysis*, 87 (1), 179–201.
- Skelton, R. M. (1995). Bion's use of modern logic. *The International Journal of Psycho-Analysis*, 76 (2), 389-397.
- Slochower, H. (1965). Symbolism and the creative process of art. *American Imago*, 22 (1), 112-127.
- Tucker, J. A., (2010). The necessity of models, of alternatives: Samuel R. Delany's *Stars in my Pocket like grains of sand*. *South Atlantic Quarterly*, 109 (2), 249-278.
- Waska, R. (2005). Symbolization and the good object. *Bulletin of the Menninger Clinic*, 69 (1), 81-97.