CALVINO AND THE "NATURE" OF STYLE:
AN INTERACTION BETWEEN LITERATURE AND SCIENCE

It has often been stated that the multiplicity of reality can be compared to an artichoke. This simile may be used to describe a literary work: the many interpretations that arise are like the peeling away of its numerous parts, discovering in the process new ways of reading the same text. Calvino expresses this idea in 1963 in support of Carlo Emilio Gadda, who is a great writer of "artichoke" literary works. This image of the artichoke is one of many images that Calvino uses to express his idea of the potentialities inherent in literary creation:

> Come un carciofo. Ciò che conta per noi nell'opera letteraria è la possibilità di continuare a sfogliarla come un carciofo infinito, scoprendo dimensioni di lettura sempre nuove[1].

Most of his own works are created according to multiple levels of interpretation. As the reader of Calvino struggles to discover what things are or may be they find themselves pulling an artichoke apart and creating a variety of interpretations. This describes the way Calvino reads the many classics he quotes in his critical essays, which seems more a process of creation rather than interpretation. He demonstrates how critical thinking is possible in places where many may have thought it to be exhausted. He also believes an ancient myth is recreated when it speaks to us from the point of view of our personal lives and the age we live in. *Perché leggere i classici*, for example, is Calvino's way of saying that the classics will always speak to us if we learn to listen with our feet firmly on the ground of our own time. The artichoke image is vital to our approach with the classics; by pulling away the many meanings surrounding them we will hopefully arrive at a new meaning, or a primordial meaning that may have been lost over the centuries. This is what Calvino the reader teaches us; new ways of reading old signs with the power of one's own imagination and experience. This approach, I believe, is essentially cognitive. It is the knowledge, the discovering of things within us and around us that Calvino is interested in. The complexity of reality and the human psyche naturally compelled him to be a complex

writer; a writer that attempted to look at reality from every angle, and represent it in the most succinct way possible. It is no wonder that Jorge Luis Borges is commended in Calvino's memo "Molteplicità" for being able to concentrate a number of possible worlds in only a few pages. There is no end to the possible ways of representing reality, and this point is made by Calvino when he describes Gadda's work from a philosophical and scientific standpoint:

> Gadda vive il dramma del nostro tempo anche come dramma del pensiero scientifico, dalla sicurezza razionalista e progressista ottocentesca alla coscienza della complessità d'un universo per nulla rassicurante e al di là d'ogni possibilità d'espressione[2].

Calvino's comment will lead us to Galileo's *The Assayer* and *Dialogue Concerning the Two Chief World Systems – Ptolemaic and Copernican*, and will ultimately bring to one of the main themes in *Order out of Chaos* by Ilya Progogine and Isabelle Stengers. The former will provide Calvino with an effective way to assess reason in its struggle with immediate sensorial experience, while the latter will explore the multiplicity and randomness of natural phenomena along with re-establishing a dialogue with nature that had been initiated by Galileo.

Literature and science will be our main concern as we observe the complexity of the world reflected in Calvino's tendency to change his style from one novel to another. We may recall Maria Corti's interview with Calvino, where he justifies his dynamic style by stating that what he needed to say took on its necessary form: "cambio di rotta per dire qualcosa che con l'impostazione precedente non sarei riuscito a dire"[3]. In Carla Benedetti's book *Pasolini contro Calvino*, for instance, Calvino's cosmicomic story "Un segno nello spazio" is examined from the point of view of his tendency to change style. According to Carla Benedetti, this story demonstrates Calvino's need to avoid being categorized after his first novel, since being labeled and identified through one's personal style is like turning to stone. Carla Benedetti states that after *Il sentiero dei nidi di ragno*, Calvino becomes Perseus, and in order to avoid turning to stone, his writing is never direct, but necessarily indirect. Therefore, Calvino's works may be seen as a series of mirrors where reality is reflected in many different forms. In this way, Carla Benedetti explains, Calvino avoids remaining trapped in one particular way of writing. That is, he never looks directly at the face of Medusa, "Lo scrittore ha insomma bisogno di continui stratagemmi per sfuggire all'incombente pietrificazione"[4]. Carla Benedetti continues by saying that the tendency to avoid being defined as a writer with a definite style, is a reaction to a modernism that insists on defining and placing everything in neat

categories. From this argument we could establish a link between Calvino and Galileo, making our point of departure the interaction between reason and nature related to the knowledge of truth.

Calvino's literary works and his idea of literature are closely knit with the possibility of acquiring knowledge. The powerful statement at the end of *Le città invisibili*, is a clear indication of Calvino's concern about knowing how to distinguish between what is hell and what is not in our complex post-civilized societies. He gives two approaches to the problem: a person could either be in hell knowingly or unknowingly and not question it, or question it, and strive to make room for that which is not hell:

> Il primo riesce facile a molti: accettare l'inferno e diventarne parte fino al punto di non vederlo più. Il secondo è rischioso ed esige attenzione e apprendimento continui: cercare e saper riconoscere chi e cosa, in mezzo all'inferno, non è inferno, e farlo durare, e dargli spazio[5].

Of course, the second approach is the more difficult one because it requires a continuous battle with those who prefer the first approach. Calvino's ending sums up issues that he confronted in his essays "Il mare dell'oggettività" (1960) and "La sfida al labirinto" (1962). Such words like "inferno" and "non inferno", often remain in the memory of readers, especially when they are placed at the very end of a text. Calvino's notion of "inferno" and "non inferno", may be further explained with Plato's simile of the cave. Plato's philosopher offers us a good way of looking at the activity of a writer who strives to communicate a certain truth. It is obvious that the simile is effective in demonstrating the indirect nature of literature. The necessity of an indirection stands at the very essence of artistic creation and its cognitive effect. Evidently, this is a very old notion that Aristotle observes in his *Poetics*, when he states:

> In fact, mankind's pleasure in beholding likenesses of objects is due to this: as they contemplate reproductions of objects they find themselves gaining knowledge as they try to reason out what each thing is […][6].

Once out of the cave, the enlightened one, if they should decide to go back in to share their new knowledge with those in darkness, must know how to communicate such knowledge. We know by Calvino's Perseus, discussed in his memo "Leggerezza" in *Lezioni americane*, that a refusal of reality is not part of his poetics. The question is how Plato's philosopher will speak about the light, without refusing the reality of darkness, to those who never left the cave. Many will agree, it is one thing to leave the cave through an act of freedom and see the source of things, but quite another to return to the cave and be able to effectively share one's light. Galileo's *Dialogue* is a prime

example of this; the conflict between Salviati and Simplicio is of this nature. Most of the time the direct approach gives little results and is intimidating for those who depend on darkness and find comfort in it. The most effective and long lasting results seem to come from an indirect approach. That is, by using language figuratively. Most readers find that Calvino's narratives, especially his works from *Le cosmicomiche* and on, are not easy to decipher. However, it may be precisely this difficulty that makes Calvino's moral message all the more powerful and effective. While the reader of Calvino attempts, as Aristotle says, "to reason out what each thing is", at some point the difficulty should fade when the reader realizes, that instead of trying to see what is not in the text, one should concentrate on what is in the text, and work from there. I believe the approach to Calvino's texts should be the one he suggests we use when we read an ancient myth: "coi miti non bisogna aver fretta; è meglio lasciarli depositare nella memoria, fermarsi e meditare su ogni dettaglio, ragionarci sopra senza uscire dal loro linguaggio di immagini. La lezione che possiamo trarre da un mito sta nella letteralità del racconto, non in ciò che vi aggiungiamo noi dal di fuori"[7].

Returning to the image of the artichoke, we should consider another image, which also fascinated Calvino: the onion. Calvino finds this image in his reading of Cyrano de Bergerac. In his article "Cyrano sulla luna", published on December 24, 1982 in *la Repubblica*, Calvino quotes Cyrano's vision of the universe:

> l'universo è fatto come una cipolla, che 'conserva, protetta da cento pellicine che l'avvolgono, il prezioso germoglio da cui dieci milioni d'altre cipolle dovranno attingere la loro essenza […] l'embrione, nella cipolla, è il Sole di questo piccolo mondo, che riscalda e nutre il sale vegetativo di tutta la massa' […][8].

This image is also used by Galileo in his *Dialogue*, when referring to differing opinions about sunspots, "For in the sun's eccentric sphere there is established a sort of onion composed of various folds, one within another, each being studded with certain little spots, and moving […]"[9]. The onion is another effective image that conveys the complexity of the universe and the nature of a literary work. Calvino is impressed by Cyrano's imagination and his sense of awe towards movement and transformation. In the following passage, Calvino describes Cyrano's position and outlook on reality: "Qualità intellettuale e qualità poetica convergono in Cyrano e ne fanno uno scrittore straordinario, nel Seicento francese e in assoluto"[10]. Calvino's interest in Cyrano is based on a playful awareness of facts and speculation. It is not a rigid philosophy that Calvino finds enjoyment in, it is the rapid movement of Cyrano's witty thought:

> Nel suo Altro Mondo non è la coerenza delle idee che conta, ma il divertimento e

la libertà con cui egli si vale di tutti gli stimoli intellettuali che gli vanno a genio […] racconto in cui le idee appaiono e scompaiono e si prendono in giro a vicenda, per il gusto di chi ha abbastanza confidenza con esse per saperci giocare anche quando le prende sul serio[11].

Cyrano, along with Galileo and many others mentioned in Calvino's theoretical and critical writings, belongs to the myth of Perseus, who avoids turning to stone by not falling into the trap of abstraction and conceptualization. The many figures gathered by Calvino, seem to have one main thing in common; they are thinkers of movement, who embrace the force of nature and never look directly at the face of Medusa. The question of style is related to this notion. In Cyrano's attitude towards scientific hypotheses, it is significant for Calvino that Cyrano never attempts to provide insight on certain theories. He does, however, demonstrate an interaction between two worlds that never blend, each maintaining its own identity without jeopardizing the identity of the other:

non vuole tanto illustrare una teoria o difendere una tesi quanto mettere in moto una giostra d'invenzioni che equivalgono sul piano dell'immaginazione e del linguaggio a quel che la nuova scienza stanno mettendo in moto sul piano del pensiero[12].

Cyrano takes delight in creating all sorts of things that are suggested to him by serious intellectual and scientific thought. The important lesson to be learned here is that ideology should not be taken too seriously. One should aim to gain knowledge and understanding of abstract ideas so as to be able to play with them in all seriousness. Calvino demonstrates this position in *Le cosmicomiche*, where the language of science is followed by the language of literature, implying a sort of interaction between the two methods of using language.

To see the complexity of reality, without being submersed by it, one must achieve a certain distance from it. This distance is described by Calvino in his idea of *leggerezza*. Galileo was an important influence for Calvino because, along with his use of figurative language, he expresses his awareness of the self-referential nature of language. In *The Assayer*, for example, Galileo uses a carafe to represent a comet's reflection, knowing that the carafe itself has nothing to do with the matter in question, and that other images of representation could be used:

I do not mean to imply by this that there is in the sky a huge carafe, and someone oiling it with his finger, thus forming a comet; I merely offer this as an example of Nature's bounty and variety of methods for producing her effects. I could offer many, and doubtless there are still others we cannot imagine[13].

Galileo's words may be interpreted in the following way: in the shield of Perseus, used by Calvino in his memo "Leggerezza", we should perceive human rationality that creates a model for that which the senses cannot perceive. The multiplicity of reality is such that immediate sensorial experience cannot hope to grasp it all. Therefore, a shield is fundamental for creating an abstraction with the purpose of making perceptible that which is imperceptible. In Galileo's *Dialogue*, Salviati's great task is to overcome Simplicio's insistence on relying completely on his senses. Towards the end of the fourth day Salviati states the essence of the difficulty he has attempted to overcome:

> I shall use all my resources to make myself understood, but the difficulty of the phenomena themselves and the great abstractness of mind needed to understand them intimidate me[14].

Throughout the *Dialogue*, Salviati must demonstrate with mathematical calculations, diagrams, metaphors, and similes, that which Simplicio does not perceive with his senses. In other words, Salviati is using the shield of reason before a reality that is fundamentally imperceptible to our senses because of its vastness and multiplicity. In the myth of Perseus, those who turn to stone may be regarded as those who rely soley on abstraction based on immediate sensorial experience, and therefore do not embrace the movement that is made perceptible through Perseus' shield. Galileo attempted to make the imperceptible perceptible with the shield of reason. His imagination is commended by Calvino because of his ability to invent experiments that would help our senses grasp a movement that is beyond us, although we are part of it. With Galileo in mind, *molteplicità* and *leggerezza* unite to give us a pespective of reality where the distance of reasoning provides an understanding of the complexity of reality. The most evident example is found in *The Assayer*. With a story, Galileo explains the infinite possibilities that exist in a simple thing as that of creating sound, to prove his point of how indefinite views about comets or any subject can be. The story is about a man who raises birds and one day hears a shepherd boy playing a flute. From this he begins his travels to discover other ways that sound can emerge from different instruments. After much travelling and many discoveries, the conclusion he comes to is the following:

> Thereupon his knowledge was reduced to such diffidence that when asked how sounds are generated he used to reply tolerantly that although he knew some of the ways, he was certain that many more existed which were unknown and unimaginable[15].

In Galileo's story we have the multiplicity of possibilities for producing

sound, and the distance (or *leggerezza*) that the man's knowledge of such a multiplicity creates. His reasoning now makes him tolerant before the multiplicity of a certain phenomenon.

Considering *molteplicità* in terms of the immense quantity of everything involved in reality, whether it is sound production, the mechanisms of a city, or cosmological problems; and *leggerezza* in terms of distance from the multiplicity and complexity of certain mechanisms and problems, we could examine the element of play as a fundamental aspect of culture. We have already noted this element in Calvino's comments about Cyrano de Bergerac, and we may also link it to Galileo, who inserts a playful atmosphere in his *Dialogue* with the character Sagredo. Moreover, the dialogue form itself creates a less serious tone and has a didactive element that leads to a cognitive effect. Therefore, to continue our discussion it would be appropriate to refer to Johan Huizinga's research on play in *Homo Ludens*. Huizinga examines play and attempts to demonstrate where the link with culture lies. He looks at primitive man and his rituals, and considers a time when certain answers to modern questions were still unknown. Today we know the answers to many of the questions listed by Huizinga thanks to modern science. However, along with discovering answers to many questions, we have also lost a sacred and magical dimension that existed in the daily life of primitive man. This dimension often established a relationship with nature that has weakened considerably in modern societies. Science comes to conclusions, sometimes tentative, that are often accepted as truth. While primitive man questions, modern man seems to have answers formulated in neat and clear theories. Calvino, for instance, does not begin his cosmicomic stories with a question, but with an answer. From this answer he travels back to primitive man, and further still, to demonstrate that in essence little has changed. In other words, the answers of modern science have not altered nature, but only our image of nature. In *Le cosmicomiche*, one of the reasons why Calvino uses names such as Qfwfq, N'ga, U(h), Rdix, Pber Pber etc., may have to do with the fact that natural phenomena will continue to be natural even when our language conceptualizes them and labels them with scientific equations. Calvino plays with the seriousness of objective statements that in reality are far from being unquestionably objective, and finds amusement in considering the so-called big questions dealing with existence and the origin of the world. The questions we do not really have answers for, but we settle for a temporary answer until we prove it wrong. The same questions Leopardi asks in his poem *Canto notturno di un pastore errante dell'Asia*,

Che fai tu, luna, in ciel? dimmi, che fai,
Sileziosa luna? (vv. 1-2)

[…] Dico fra me pensando:
A che tante facelle?
Che fa l'aria infinita, e quel profondo
Infinito seren? che vuol dir questa
Solitudine immensa? ed io che sono?[16] (vv. 85-89)

The nature of these questions is summed up in the unsolvable riddle Huizinga examines in primitive societies. His observations may remind us of Calvino's narrative strategies and wonder about the principle of the unsolvable riddle. Huizinga points out,

> The answer to an enigmatic question is not found by reflection or logical reasoning. It comes quite literally as a sudden solution – a loosening of the tie by which the questioner holds you bound. The corollary of this is that by giving the correct answer you strike him powerless[17].

When solving a riddle, it is important to carefully consider every detail. In his literary works, Calvino provides his readers with many details, which may suggest interesting interpretations. He constructs his narratives much like riddles that may have many solutions, without necessarily losing sight of the most fitting solution. The important thing is that Calvino's readers are often forced to ask themselves what things are in order to end up with some kind of understanding. In relation to the images already mentioned, the artichoke and the onion, consider the following: *Il visconte dimezzato*, *Il barone rampante*, *Il cavaliere inesistente*, *Il castello dei destini incrociati*, to name a few titles, all sound like solutions to riddles and have much of the same enigmatic nature. The reader may not solve the story, if there is any solution to discover at all. However, in attempting to solve the unsolvable, one may gain insight and knowledge, and therefore preceive what was previously imperceptible. In this resides part of the cognitive nature of Calvino's literary creations, which may be related to Galileo's attempt to make perceptible that which was imperceptible to immediate sensorial experience. Huizinga also notes that the Greeks loved *Aporíe*, questions for which satisfactory answers do not exist, and for which an answer could save your life. We may consider Boccaccio's "motto"; a sly and witty answer that may save your life or help you avoid a difficult situation. The sixth day of the *Decameron* is dedicated to the "motto" and Calvino quotes the ninth novella of this day in his memo "Leggerezza". Here leggerezza is shown to emerge from what is essentially a "heavy" situation. Wit and imagination combined with reasoning save the day. When Huizinga discusses the ancient philosophers, who solved enigmas in mythical forms, we realize that Calvino constructs mythical forms in *Le cosmicomiche*, regardless of the fact that science has found explanations to what the Greeks explained with a myth.

The implication would be that scientific hypotheses are not as definite as one may think, and there is no definite way of describing our universe or answering questions such as:

> Are we ourselves – living creatures capable of observing and manipulating – mere fictions produced by our imperfect senses? Is the distinction between life and death an illusion?[18]

With reference to the dialogue form, Huizinga observes that questions are asked and answers lead to other questions, leading to interesting and useful information that may ultimately lead to truth: "The game of question and answer in verse form also serves to store up a whole mass of useful knowledge"[19]. In relation to this, it is important to note that Leopardi uses the dialogue form in his *Operette morali*, and Galileo uses it in his *Dialogue*: Two works in the history of Italian literature that have deeply influenced Calvino as a writer. In both Leopardi and Galileo there is the notion of dialogue with nature. This notion is fundamental in Calvino's work. It is most obvious in the structure of *Le cosmicomiche*, where Qfwfq implies a reinsertion of the subject in the description of natural phenomena. This is tied to the conception of knowledge as both objective and participatory discussed in *Order out of Chaos*:

> Demonstrations of impossibility, whether in relativity, quantum mechanics, or thermodynamics, have shown us that nature cannot be described 'from the outside', as if by a spectator. Description is dialogue, communication, and this communication is subject to constraints that demonstrate that we are macroscopic beings embedded in the physical world[20].

In *Perché leggere i classici* Calvino discusses several aspects of Galileo's style, which are directly linked to *molteplicità* in "Il libro della natura in Galileo". The main themes here are the book of nature and the alphabet. Calvino observes that in *The Assayer* (pp. 183-84), Galileo states that philosophy is written in the grand book of nature whose language is mathematics. An element, which Calvino does not overlook, is Galileo's tendency to reflect upon combinative aspects in art. To prove this point he quotes from Galileo's *Istoria e dimostrazioni intorno alle macchie solari* (History and Demonstrations Concerning Sunspots and Their Phenomena). He then turns to Galileo's *Dialogue* to point out a distinction between the metaphoric relationship "mondo-libro"(world-book), in *The Assayer*, and the metaphor "mondo-alfabeto" (world-alphabet), in the *Dialogue*. Calvino states:

> Si può allora precisare che il vero rapporto metaforico si stabilisce, più che tra

mondo e libro, tra mondo e alfabeto. Secondo questo passo del *Dialogo sopra i due massimi sistemi del mondo* (II giornata), è l'alfabeto che è il mondo[21].

Calvino continues by stressing that Galileo's view of the alphabet is based on its combinative nature, making it the ideal system for capturing the multiplicity of the universe: "Quando parla dell'alfabeto, Galileo intende dunque un sistema combinatorio in grado di render conto di tutta la molteplicità dell'universo"[22]. Calvino will then quote the passage from the *Dialogue* where the invention of the alphabet is exalted and said to be the greatest of all inventions since it can overcome the barriers of space and time. He also examines Galileo's views on the dichotomy perfection/imperfection and eventually arrives at the passage in the *Dialogue* where we find the head of Medusa. Here, Calvino will make the connection between the alphabet and a world in constant movement:

> Se si collega il discorso sull'alfabeta del libro della natura e questo elogio delle piccole alterazioni, mutazioni, ecc., si vede che la vera opposizione si situa fra immobilità, ed è contro un'immagine d'inalterabilità della natura che Galileo prende partito, evocando lo spauracchio della Medusa[23].

Many are aware of what a great revolution it was for Galileo to base his knowledge of nature on his own direct observations, rather than on the works of Aristotle. If we think of Aristotle's works as a potential face of Medusa, then it becomes clear that any progress made by Galileo would have to come from the source: nature. Calvino, in a sense, adopts Galileo's vision of a world in constant movement and applies it to his way of understanding his task as a writer.

In *Order out of Chaos*, Prigogine and Stengers demonstrate how from a mechanistic world view, derived from Newtonian Physics, we have progressed to a mutable, unstable world of randomness with the advent of quantum mechanics. Every time science has claimed to have revealed the laws of nature and formed a determinstic worldview, it has, ideologically, turned to stone. Calvino's Perseus belongs to a worldview that is beyond determinism and any claim of predicting and manipulating the laws of natural phenomena. He is part of an open system that is aware of the question of revealed science, where absolute systems breakdown because of some revealed information that alters the system. In Galileo's time it is said that scientific method emerged as a road to truth, this is made evident in *The Assayer* and the *Dialogue*. In the twentieth century the gap between science and philosophy, that formed since Newton and the triumph of reason, has been bridged. Stillman Drake, in his introduction to *The Controversy on the Comets of 1618*, states: "Today, it is no longer easy to tell where physics ends and philosophy begins. In this regard, we stand now in much the same

position as did Galileo's contemporaries, though at a rather different altitude"[24]. In relation to literature, we should consider the position taken in *Order out of Chaos*. Here, it is explained that the revolution of quantum mechanics resulted in a break with classical physics, since it introduced the impossibility of explaining nature's laws in a complete description. With reference to the "two cultures", Prigogine and Stengers state the following: "One of the reasons for the opposition between the 'two cultures' may have been the belief that literature corresponds to a conceptualization of reality, to 'fiction', while science seems to express objective 'reality'. Quantum mechanics teaches us that the situation is not so simple. On all levels reality implies an essential element of conceptualization"[25]. In the history of science we have, therefore, moved from the belief that the laws of nature could be explained in a complete scientific description, to the realization that this was impossible. Giving up the idea of classical physics introduced a world of infinite possibilities in the representation of reality. With quantum mechanics we come to the consideration "that the reality studied by physics is also a mental construct; it is not merely given"[26]. This provides us with a common ground between literature and science. Prigogine and Stengers state that the fascinating thing about quantum mechanics is that "creative imagination and experimental observation are so successfully combined"[27].

This argument leads us to understand why in the twentieth century our vision of reality is described as being multiple, temporal, and complex. Calvino embraces this vision in his poetics and becomes a dymanic writer, with a style that changes from one novel to the next, almost implying the nature of entropy as an indicator of evolution and an arrow of time. He is fascinated by the mythical potentialities that are inherent in the images we have created of the universe. In Calvino's memo "Esattezza" in *Lezioni americane*, there is mention of Leopardi's *Operette morali* when he points out cosmological hypotheses as being the raw materials for literary creation: "Leopardi si divertiva a fare in certe sue prose 'apocrife': il *Frammento apocrifo di Stratone da Lampsaco*, sulla nascita e soprattutto sulla fine del globo terrestre, che si appiattisce e si svuota come l'anello di Saturno e si disperde fino a bruciare nel sole"[28]. In the same memo, Calvino will go on to mention Giordano Bruno "grande cosmologo visionario"[29] and eventually arrives at the dichotomy order/disorder, which he considers to be the underlying tension behind literary creation:

> L'opera letteraria è una di queste minime porzioni in cui l'esistente si cristallizza in una forma, acquista un senso, non fisso, non definitivo, non irrigidito in una immobilità minerale, ma vivente come un organismo. La poesia è la grande nemica del caso, pur essendo anch'essa figlia del caso e sapendo che il caso in ultima istanza avrà partita vinta[30].

This statement brings us to the idea that according to science our solar system is an order among the chaotic distribution of many other solar systems for which we do not have a definite order. In literary creation, we may imagine a novel to be an order among many orders that do not necessarily correspond or follow the same laws of motion and heat. Calvino therefore, inserts the literary work into the dynamics of natural phenomena. To be sure, another emblem or image that interested Calvino was the crystal compared to the flame: two elements belonging to scientific research that can further represent the nature of literary creation: "Io mi sono sempre considerato un partigiano dei cristalli, ma la pagina che ho citato m'insegna a non dimenticare il valore che ha la fiamma come modo d'essere, come forma d'esistenza"[31]. The crystal is considered in the dichotomy *order/activity* by Prigogine and Stengers as an underlying structure of life:

> The biological structure thus combines order and activity. In contrast, an equilibrium state remains inert even though it may be structured, as, for example, with the crystal. Can chemical processes provide us with a key to the difference between the behavior of a crystal and that of a cell?[32]

Referring to his *Le città invisibili*, Calvino comments on the structure of this work and provides us with a link to what is an important characteristic of quantum mechanics and its uncertainty principle. It is well known that in the 1920's Werner Heisenberg, Erwin Schrödinger, and Paul Dirac, reformulated mechanics into quantum mechanics based on the uncertainty principle. The consequences of this are clearly stated by Stephen Hawking in his book *A Brief History of Time*:

> The uncertainty principle signaled an end to Laplace's dream of a theory of science, a model of the universe that would be completely deterministic: one certainly cannot predict future events exactly if one cannot even measure the present state of the universe precisely![33]

He sums up his views on quantum mechanics by saying, "Quantum mechanics therefore introduces an unavoidable element of unpredictability or randomness into science"[34]. Hawking's comments are related to the spirit in which Calvino created the structure of *Le città invisibili*. In fact, Calvino states

> ho costruito una struttura sfaccettata in cui ogni breve testo sta vicino agli altri in una successione che non implica una consequenzialità o una gerarchia ma una rete entro la quale si possono tracciare molteplici percorsi e ricavare conclusioni plurime e ramificate[35].

Interestingly enough, Calvino's structure contains the unpredictability and

randomness that Hawking points out in his discussion about the uncertainty principle in quantum mechanics:

> In general, quantum mechanics does not predict a single definite result for an observation. Instead, it predicts a number of different possible outcomes and tells us how likely each one of these is […]. One could predict the approximate number of times that the result would be A or B, but one could not predict the specific result of an individual measurement[36].

This leads us to the chessboard sequence in *Le città invisibili*, where the unpredictability and multiplicity revealed to Kublai Kan remind us of how little we know for certain about the laws that govern the universe. Galileo, of course, in *The Assayer* will express the same idea in his story on the many ways that sound can be produced. The man in Galileo's story is marveled by the discoveries he makes, just as Kublai Kan is marveled over what Marco Polo can see in a simple piece of wood:

> La quantità di cose che si potevano leggere in un pezzetto di legno liscio e vuoto sommergeva Kublai; già Polo era venuto a parlare dei boschi che discendono i fiumi, degli approdi, delle donne alle finestre […][37].

Calvino ends this passage with dots to indicate that there is no limit to the things that Marco Polo could say. Furthermore, Calvino's Marco Polo demonstrates that we are connected to nature in ways we can hardly imagine. He shows that if we dig deep enough all the matter that we use to construct our surroundings will inevitably lead to nature, which is only apparently distant and lies silent for us to recognize the degree of its proximity. With Kublai Kan the model he creates of his empire goes one way and actual reality, pointed out by Marco Polo, goes the other. Calvino demonstrates a division between pure abstraction and the attempt to grasp with language the tangible objects that surround us:

> Da una parte la riduzione degli avvenimenti contingenti a schemi astratti con cui si possano compiere operazioni e dimostrare teoremi; e dall'altra parte lo sforzo delle parole per render conto con la maggior precisione possibile dell'aspetto sensibile delle cose[38].

 Calvino's statement describes quite accurately the predicament in which Galileo found himself in writing his *Dialogue*. As stated above, Salviati sharpens his reasoning to overcome the authority on which Simplicio the Peripatetic bases his knowledge, and to make Simplicio and Sagredo perceive with the senses the Copernican system. In *The Assayer*, for instance, Galileo points out the importance of analogy. To explain the conjectures about

comets he recurs to various scenarios: walking on a seashore and observing the reflection of the sun as it sets; sailors that by reflection can perceive an oncoming wind; mirrors that reflect sunlight depending on our postion of observation; a carafe that reflects the light of a candle, etc. All these similes require extensive observation of important details that may be able to tell us more about comets. They belong to Galileo's experiments, which were attacked by his adversaries, who valued the authority and the opinions of Aristotle, rather than the reasoning that Galileo describes in the following passage:

> If reasoning were like carrying burdens, where several horses will carry more sacks of grain than one alone, I should agree that several reasoners would avail more than a single one; but reasoning is like running and not like carrying, and one Arab steed will outrun a hundred pack horses[39].

This passage is quoted by Calvino in his memo "Rapidità", where he admires Galileo's figurative use of language. Calvino's interest in Galileo has much to do with the use of language reduced to its essentials for comunicating in a quick and effective way. The economy of words is fundamental; it is the main aspect of Galileo's deductive method of reasoning, which is represented, according to Calvino, in the three characters of the *Dialogue*. Salviati represents reasoning that aims at unveiling the truth of nature's laws, while revealing the hypocrisy of Simplicio's position, and Sagredo represents the imagination and quick wit in motion. In fact, Salviati will provide explanations demonstrating the power of reasoning, while Sagredo will make reference to myths, tell amusing stories, and conjecture about the nature of imagination and anthropomorphism. At times Sagredo will provide insights that challenge Salviati, who with his reason will respond to the witty questions Sagredo asks. In other instances it will be Salviati to clairify things for Sagredo, who will commend and admire Salviati for his knowledge on the subject. Simplicio on the other hand, will be faithful to tradition without any inclination towards innovation. In essence, the exchange between Salviati and Sagredo exemplifies an interaction between literature and science, where the former is the language of the imagination (N. Frye), and the latter is the natural tendency to make things intelligible through abstraction.

In Galileo's *Dialogue*, the cognitive function lies in conceptualizing what are believed to be the laws of nature. Simplicio seems to be the faithful nominalist, who discards the truth about natural phenomena and relies on the words of Aristotle. With Simplicio there is no interaction between reason and nature; the two-partner game Prigogine and Stengers describe does not exist, and nature is made to say what it does not say: "Nature cannot be forced to

say anything we want it to. Scientific investigation is not a monologue"[40]. Simplicio is in a state of monologue with nature, whereas Salviati and Sagredo are attempting to establish a dialogue. Towards the end of day three Salviati says to Simplicio:

> If you like, I can make it evident to you that you are creating the darkness for yourself, and feeling a horror of things which are not in themselves dreadful – like a little boy who is afraid of bugaboos without knowing anything about them except their name, since nothing else exists beyond the name[41].

Simplicio lives in a world Calvino would define as being a written world that ignores the unwritten world: a world essentially made of names and void of essences and truth. Salviati, however, is aware of the unwritten world and attempts to make it interact with the written world.

So far we have considered the artichoke, the onion, and the crystal/flame(fire) dichotomy, as part of Calvino's vision of literary creation that attempts to encompass the multiplicity of reality linked to natural phenomena. Another image to add to the above is the seashell (*la conchiglia*). This image is inspired by Ovid and is related to Calvino's idea of multiplicity. In "Ovidio e la contiguità universale" (1979), included in *Perché leggere i classici*, Calvino discusses the multiplicity in Ovid's style and later provides us with the image of the seashell (*la conchiglia*), to describe the structure of Ovid's poem: "Così continuamente si saldano nelle *Metamorfosi* nuove concreazioni di storie come di conchiglie da cui può scaturire la perla […]"[42]. The image of the sea shell is related to what Prigogine and Stengers refer to as a random element that seems to define the very essence of life:

> In the world around us, some basic simple symmetries seem to be broken. Everybody has observed that shells often have a preferential chirality. Pasteur went so far as to see in dissymmetry, in the breaking of symmetry, the very characteristic of life[43].

Calvino used the image of the shell in his cosmicomic story "La spirale", where the multiplicity of reality is represented in the image of the spiral. In this story Calvino alludes to the very nature of the images we create:

> Avendo la conchiglia una forma, anche la forma del mondo era cambiata, nel senso che adesso comprendeva la forma del mondo com'era senza la conchiglia più la forma della conchiglia[44].

This passage may be used to describe the essence of Galileo's method of reasoning and the conceptualization in literature and science that Prigogine and Stengers discuss in *Order out of Chaos*. From Calvino's words quoted

from "La spirale", we may understand the nature of the interaction implied between the image and nature. It may be said that nature is the all embracing entity that provides, through our own will to discover its laws of necessity, the blue prints that lead Calvino to images such as the artichoke, the onion, the seashell, etc. They may be placed on the same level of conceptualization common in Galileo's *The Assayer* and the *Dialogue*. The main idea behind these images is that they represent a reality that is beyond them and our immediate sensorial experience. Nevertheless, they interact with that reality in so far as they provide partial knowledge of it to our senses. Partial, because what is being described is multiple and complex, and cannot be embraced in one single image of representation. Within the interaction between the truths represented and the images that represent them, lies the essence of Calvino's notion of *leggerezza*. That is, distance from the object described is created with abstraction, which provides the position needed for knowledge and understanding to exist. From this distance Calvino believes the multiplicity of reality may be observed and acted upon. "La spriale" ends on an interesting note. The forming of a shell has given sight to all the living creatures of the world. However, the shell itself does not have sight, it is a model for providing sight: "Tutti questi occhi erano i miei. Li avevo resi possibli io; io avevo avuto la parte attiva; io gli fornivo la materia prima, l'immagine"[45]. In other words, the artichoke, the onion, the crystal, the shell, etc., do not see in themselves, but provide an image that may give sight or insight of phenomena that are beyond our immediate sensorial experience.

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NOTES

[1] Italo Calvino, *Perché leggere i classici*, Milano: Mondadori, 1995, p. 216.
[2] *Ibidem*, p. 218.
[3] Italo Calvino, *Saggi 1945-1985*, Milano: Mondadori, 1995, p. 2921.
[4] Carla Benedetti, *Pasolini contro Calvino*, Torino: Bollati Boringhieri, 1998, p. 86.
[5] Italo Calvino, *Le città invisibili*, Milano: Mondadori, 1993, p. 164.
[6] Aristotle, *The Poetics*, Chapel Hill: University of North Carolina, 1970, p. 6.
[7] Italo Calvino, *Lezioni americane*, Milano: Mondadori, 1993, p. 9.
[8] ———. *Perché leggere i classici*, *cit*., p. 98.
[9] Galileo Galilei, *Dialogue Concerning the Two Chief World Systems – Ptolemaic & Copernican*, trans. Stillman Drake, Berkeley and Los Angeles: University of California Press, 1967, p. 53.

[10] Italo Calvino, *Perché leggere i classici*, *cit*., p. 101.

[11] *Ibidem*, p. 102.

[12] *Ibidem.*

[13] Galileo Galilei, *The Assayer* in *The Controversy on The Comets of 1618*, Introduction and translation by Stillman Drake, Philadelphia: University of Pennsylvania Press, 1960, p. 261.

[14] Galileo Galilei, *Dialogue*, *cit*., p. 457.

[15] Galileo Galilei, *The Assayer*, *cit*., p. 236.

[16] Giacomo Leopardi, *Canti*, Milano: Mursia, 1987, pp. 147-50.

[17] Johan Huizinga, *Homo Ludens*, London: Routledge & Kegan Paul, 1949, p. 110.

[18] Ilya Prigogine and Isabelle Stengers, *Order out of Chaos*, New York: Bantam Books, 1984, p. 252.

[19] Johan Huizinga, *Homo Ludens*, *cit*., p. 126.

[20] Ilya Prigogine and Isabelle Stengers, *Order out of Chaos*, *cit*., pp. 299-300.

[21] Italo Calvino, *Perché leggere i classici*, *cit*., p. 92.

[22] *Ibidem*.

[23] *Ibidem*, pp. 96-97.

[24] Stillman Drake, *The Controversy of the Comets of 1618*, *cit*., pp. ix-x.

[25] Ilya Prigogine and Isabelle Stengers, *Order out of Chaos*, *cit*., pp. 225-26.

[26] *Ibidem*, p. 225.

[27] *Ibidem*, p. 222.

[28] Italo Calvino, *Lezioni americane*, *cit*., p. 76.

[29] *Ibidem*.

[30] *Ibidem*, p. 78.

[31] *Ibidem*, p. 80.

[32] Ilya Prigogine and Isabelle Stengers, *Order out of Chaos*, *cit*., pp. 131-32.

[33] Stephen Hawking, *A Brief History of Time*, New York: Bantam Books, 1996, p. 72.

[34] *Ibidem*, p. 73.

[35] Italo Calvino, *Lezioni americane*, *cit*., p. 80.

[36] Stephen Hawking, *A Brief History of Time*, *cit*., p. 73.

[37] Italo Calvino, *Le città invisibili*, *cit*., pp. 133-34.

[38] Italo Calvino, *Lezioni americane*, *cit*., p. 82.

[39] Galileo Galilei, *The Assayer*, *cit*., pp. 300-01.

[40] Ilya Prigogine and Isabelle Stengers, *Order out of Chaos*, *cit*., p. 5.

[41] Galileo Galilei, *Dialogue*, *cit*., p. 401.

[42] Italo Calvino, *Perché leggere i classici*, *cit*., p. 35.

[43] Ilya Prigogine and Isabelle Stengers, *Order out of Chaos*, *cit*., p. 163.

[44] Italo Calvino, *Cosmicomiche vecchie e nuove*, Milano: Garzanti, 1984, p. 233.

[45] *Ibidem*, p. 233.