

LITERATURE OF SCIENCE FICTION IN SCIENCE EDUCATION: AS CRITICAL DISCOURSES FOR SCIENTIFICALLY AND POLITICALLY LITERATE CITIZENS

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Abstract

This work pertains to the contribution of science fiction texts to Science Education. We argue that science fiction, as cultural form, but above all as a way of thinking might help us to generate new ways of imagining global transitions in social environments and civil society in our present times and circumstances, and therefore could invite a more social and critical approach in the context of Science Education. We also argue that the conjunction of disciplines / cultures figured by the term “science fiction” bears re-examination as a resource for science studies and a potential mediator in science-humanities encounters. Moreover, science fiction, as product and part of the social consciousness of the contemporary world, could be an important participant in critical negotiations with techno scientific discourses. We conclude that these creative and critical conversations around sciences, such as science fiction, function as an enormously fertile environment of socio-cultural understanding of Science and Technology, and situate science fiction as a resourceful agent to respond to the political and ethical consequences that Science has in the world (human and non-human). Such approaches go a long way to develop culturally sensitive and sociocultural perspectives in Science Education, and contribute to educate a new generation of scientifically and politically literate citizens who actively take part in social processes.

Key words: *science fiction, science education, literate citizens*

1. INTRODUCTION

The fact that we live in an age of rapid, ongoing scientific and technological changes in the one hand, and poverty, wars, social injustice and environmental degradation on the other, calls for a need of a sober approach towards these challenges through Science Education. This ambiguous development needs approaches that will help us think through not only the impact of scientific and technological developments on our lives, but also the deeper social and ethical implications of science and technology in facing the above controversies. As these problems require sound scientific understanding, critical analysis, and responsible solutions, there is a need for a more socio-cultural and ethical approach towards the society and the environment through Science Education (Noblit *et al.* 2007).

In this world transformed by technological, economic, and ecological changes, the role of literary culture seems more important than ever. This is a fact that is recognised as an imperative in the field of Science Education, as recent decades have seen an increase in sociocultural perspectives within Science and Environmental Education that are reflective of the cultural turn in intellectual theory more generally. These critical, historical, political, and socioecological views, interested in access to scientific knowledge, education, and power, have become part of enlightened Science and Environmental Education discourses (Carter, 2008). In this perspective, the gap between the sciences and the humanities and the urgent need to confront it, do not exist on the theoretical level alone. Indeed, we face an increasing number of situations that Bruno Latour, variously describes as ‘borderline’ questions or ‘sociotechnical’ and ‘ethicoscience’ imbroglis (Latour, 2003). These are intricately woven mixes that pertain simultaneously to the domains of the natural sciences and the humanities. Therefore, a sort of composite sciences-humanities literacy is required to help a democratic citizenry not only to scrutinize but also to contribute to science-and technology-based decisions about such imbroglis.

One way of investigating into these issues is through the literature of science fiction. With the genre’s license to create new societies and worlds, it seems an ideal tool with which to explore socio-scientific alternatives. Moreover, as science fiction is so often taken to be the expression of political opinion or ideology of the scientific and technological society aimed at presenting alternatives to social condition, it functions as thought experiment and critical discourse which can also bring more skepticism about politics, ideologies and epistemological certainties in the context of Science Education (Gough, 2006, Weinstein, 2006).

Science fiction is an incubator for imaginative minds to create visions that help us to glimpse not only the scientific present and future, but also something about ourselves, and functions as the integrator of socio-cultural space that supports the dialogue between science and humanities. Yet more, science fiction is a genre well-suited to express the concerns about environment and explore humanity’s place in ecological systems since it

encompasses a broad range of issues that derive from the interaction of humans with the natural world, and this literary genre's articulations contribute significantly to the broad rethinking of the relations between human and nature that is currently taking place specially in western societies (Merrick, 2005, Miller, 2005).

Fuelled by the extrapolation of "what is" into "what can be", science fiction transports us beyond the horizon of our current technologies enabling us to observe the possible incarnations of scientific progress and to experience and appreciate the many ways this may impact upon society and environment, as well as to serve as a focal point for discussion about our attitudes, perceptions, hopes and fears about science, technology, society and how they interweave. As Deery argues science fiction performs "a vital social function, which is to offer a testing ground, a thought experiment, where the social consequences of science and technology can be extrapolated in an intuitive, holistic and empathetic manner", thus offering "humanistic-cultural" as well as political dimensions to Science Education (Dritsas, 2007).

2. WHY SCIENCE FICTION IS "GOOD TO THINK WITH" - SCIENCE FICTION AS 'THOUGHT EXPERIMENT'

Creative forms such as science fiction can offer a wider field, when we are concerned with critiquing and unpacking techno scientific practices, cultures and knowledge. Furthermore, as "cross-cultural" narrative in encounters between the humanities and sciences - this conjunction of disciplines figured by the term science fiction - bears re-examination as a resource for Science Studies, and a potential mediator in science-humanities dialogues which could illuminate the social and cultural meanings and consequences of scientific research (Merrick, 2005, Gough, 2006).

A basic element of science fiction is the challenges and the questioning articulated in its reading process whose necessary and sufficient conditions are the presence and interaction of *estrangement* and *cognition* or *cognition effect* (Freedman, 2000:16-23). As theoretical models – abstract constructions of subject, of representation – become fleshed out in the particularized worlds of the science fiction imagination, science fiction articulates and explores those models through its narrative experiments and, in the ongoing dialectical relationship between abstraction and concretization science fiction continues to influence the development of the new worlds and the new futures. The mixing of science fictions with science 'facts' and theories serves the immediate function of undermining universal claims to 'truth', and in emphasizing narrativity, it potentially opens up scientific discourses to challenge and interpretation. In this essence, science fiction is called upon as useful space, "reading practice" or "dream laboratory" in which to reflect upon and engage with scientific cultures, practices and knowledges and configures a more productive interaction relation between fictional and theoretical writings on science, especially in the field that opposes the authority of the natural sciences as "crafts for distinguishing between fact and fiction" (Haraway, 1989: 3-4). Placing the narratives of scientific fact within the heterogeneous space of science fiction produces a transformed field. This transformed field sets up resonances among all of its regions and components. No region or component is 'reduced' to any other, but reading and writing practices respond to each other across a structured space (Haraway, 1989:5). The resulting stories are not simply programmatic 'mirrors' of particular theoretical arguments, but rather they incorporate those arguments into the lives and actions of imagined human subjects in imaginary worlds, subjecting them to detailed fictional examination. In Le Guin's terms "such stories are 'thought experiments' whose purpose is not to predict the future...but to describe reality, the present world," (LeGuin, 1976) the more defensible representations of present realities. The particular reading practices and protocols of science fiction make overt the way that "stories" may construct worlds, indeed in science fiction it could be said what we know of the world cannot be assumed from prior experience or context but must be constructed anew from the observations, actions and actors of the story. Obviously, then, science fiction reading strategies offer fertile ground for reconstructions and revisions of world-shaping stories.

As creative form, science fiction offers different ways of situating or positioning the observer / reader, whether through the deliberate use of metaphor, cognitive dissonance, or the inherent undermining of the notion of the objective reader and works to create critical distance between observer and observed, to defamiliarize certain, taken for-granted, aspects of ordinary human reality, 'denaturalizing' situations of historical inequity and oppression that otherwise may appear inevitable to us. In these texts, confrontations between 'human' and 'other' are ripe with possibilities for denaturalizing the boundaries and allegiances which infuse traditional depictions of human / non-human dichotomy, a process that arouses questions about the artificiality of dualism between humans and animals, cultures and nature, science and technology and highlights the ways in which these stubborn dichotomies intersect to produce alienated and estranged subjects (Merrick, 2005).

Consequently, these texts provide the possibility "to remap the borderlands between culture and nature" and force the individual to sense the limitations of his or her rationality of a different, not-alienated relationship with nature, or in other words, a reconciliation between human beings and nature that would not be based on domination and control. Such questions about "nature-culture" are intimately connected to the ways we approach and understand the notions of 'human', 'other', 'life' and the difference in the discourses of Science and contemporary techno scientific cultures (Merrick, 2005). They are also educationally relevant because they represent important ways of articulating our understanding of the human situation, whereas, the present environmental predicament provides an exciting opportunity to re-focus education on them (Bonett, 2008) and productively promote socio-ecological sustainability while accepting and embracing socio-ecological change (Buell, 2005:56).

Science fiction, also, offers a point of negotiation between a critique of the future and the present mapping of the world. As a critical function, science fiction performatively demonstrates what Jameson simply calls “future history”, that moment in which the project of imagining the future is seen to be conditioned by the social, scientific, and technological dynamics of the present and it provides a critique of the very ideological underpinnings of the task of imagining the future. In this sense, imagining the future is not an issue of imagination versus actualization, and neither is it an issue of affirming the future, or ‘keeping the future alive’. Rather, science fiction can configure the future as the conditions of possibility and constraint for social change in the present. What the imagined space and time of science fiction thus offer the reader is not a vision of a possible future, but an interrogation of the present. In such an instance, science fiction becomes not merely a genre that refers to Science and Technology but it actually begins to embody the very technologies it critiques (Jameson, 1982). As in science fiction texts the representation of science and technology goes beyond mere depiction, these texts spotlight the ownership and control of the means of production and consumption of the products of science. In contemporary science fiction the assumptions and effects of science and technology are always scrutinized. Likewise, they have a lot to say about the ideological dynamics of science or of the ruthless exploitation of science and the ‘dual use’ of technology, as the latter far from being neutral, carries encoded politics (Burling, 2006, McLeish, 2006). This quality lends a sense of urgency to the work, an appeal to social ethics. So, science fiction represents mandates to act on the concerns expressed, and to act now.

In this regard, science fiction is read not only for alternative representations but because it digs into scientific concepts with imagination, creativity, and a thorough appreciation of consequences and functions as valuable sources of knowledge when evaluating new scientific and technological developments (Martijntje Smits, 2006).

3. SCIENCE FICTION AS LITERARY RESPONSE TO SOCIAL AND ENVIRONMENTAL CHALLENGES.

Science fiction texts, having references to ethical, social, or political implications of technologies, can be used as a medium for speculation on the philosophical basis and ethical implications of science and can offer a criticism of science regarding these implications as part of the processes of discovery and development in a cross-disciplinary critique.

The intriguing and multifaced interrelationships between science and culture are explored and the context is created in which important questions without easy answers are raised, engaging the student in critical thinking about novels, stories and essays. Such approach acknowledges social, emotional, and political aspects of science and seeks to develop a new kind of scientific literacy, an awareness of the complex ways in which science gets across, and emphasizes the common grounds where science, literature, and politics are integrated (Gough, 2006). This is a fact that leads towards both cognitive awareness and critical awareness of scientific activity taken as cultural activity which can effectively contribute to the solution of contemporary social and environmental problems. Such critical approach shifts focus towards the possibilities for meaning making and social action of the literate person and allows us to think which sorts of contexts are set out in society for participation and what the individual and collective expectations are for social action in science related situations. Being literate involves, therefore, the possibility to become aware of one’s own socio-conceptual horizons as well as tolerate individual and societal levels.

This awareness of scientific knowledge enables a different kind of participation in society, namely, one in which subjects not simply reproduce, reinforce or consolidate relationships already established but actively engage in questioning and transforming society. By expanding their consciousness of scientific knowledge as the product of social practices which are not neutral and marked by power struggles, subjects can situate themselves – as well as their knowledge systems and beliefs – with respect to such practices, expand their awareness about questions which matter to them and take part in dialogues which might lead to a more democratic basis for social consensus. Therefore, the development of such scientific literacy necessarily entails a less factual, fragmented science education where the science can be discussed critically in terms of its deferent procedural aspects and of the political, economic, social, environmental, and ethical issues it arouses (Gough, 2003, 2006).

These literacy practices add to traditional notions of scientific literacy possibilities of criticism to the traditional perceptions of scientific and environmental literacy regarding the ambivalence towards science, forming, according to Weinstein, a network of “counter scientific literacies” which potentially open up the curriculum in a variety of ways that are crucial for teaching science. This network of *multiliteracies* or *multidimensional scientific literacy* offers the possibility of a more nuanced, more appropriately ambivalent, and more politically and ethically engaged subject of science than the one offered by the current version of literacy dominating science educational discourse (Weinsten, 2006). This perspective of scientific literacy incorporates an understanding of science that extends beyond the concepts of scientific disciplines and procedures of scientific investigation. It includes philosophical, historical, and social dimensions of science and technology. In this context, students develop some understanding and appreciation of science and technology regarding its relationship to a multitude of socio-scientific and socio-technical issues. More specifically, they begin to make connections within scientific disciplines, and between science, technology, and the larger issues challenging society. Science fiction offers multiliteracy in science education with the faithful engagement through writing and reading in science from multiple perspectives rather than merely from one. A process that enables students to understand and to challenge inequalities, and to be critically aware of the ideological functions of all cultural forms, as these cultural forms have different interests in the natural and social worlds and tend to ask different questions about their

realities. These resources direct different kinds of inquiry projects that produce different systematic patterns of knowledge and ignorance (Harding, 2003). Thus, it may be necessary to integrate scientific knowledge with other systems of knowledge in order to understand how understanding of science is formed. Given the fact that the emphasis on the interconnections between science and society has entailed a focus on science-related social issues, which have a basis in science, frequently that at the frontiers of scientific knowledge (Ratcliffe & Grace:2) and the fact that most people gain information about these socio-scientific issues through both media and science fiction (but they do not process the messages through the linear) it is important to explore how these cultural works shape the knowledge about these socio-scientific issues and attitudes to them. It has also been argued that to empower the students as citizens, there is a need to emphasize science as an institution and the processes by which scientific knowledge is produced. One argument has been that knowledge of the human character of science, values in science, limits of science and its tactics for decision making are prerequisite knowledge for thoughtful decision making (Ratcliffe & Grace:21-38).

Getting to know cultural works, such as science fiction is a part of a collective process of knowing the world, both the natural and the human, in the context of Science Education. The path of knowledge and action that goes through such approaches is for the most part a roundabout one, a route that turns away from knowing or acting in the most direct or immediate way possible. The reception and use of cultural works, such as science fiction, is thus a complex, indirect, and often subtle way of sending a feedback signal to the ongoing processes. It is a way of adding to the richness of human life and activity, of noticing things that would otherwise not be noticed, and perhaps thereby of provoking kinds of action or decision-making that would not otherwise be envisioned or investigated (Paulson, 2001:120). Such treatments produce different meanings if we encourage their connections with a multiplicity of other cultural materials and provide opportunities to engage students in analyses of the social meanings of scientific research (Gough, 2006).

Science fiction highlights the ethical and policy issues raised by science and technology. The narrative elements from science fiction literary genre are used in the discourse of Science and Technology to bridge the gap not only between what is technically possible today and its inflated promises for the future but also the ethics about science and technology and thus, science fiction could be used as a tool with which students might navigate the ethical and societal dimensions of unfamiliar technological terrain (Berne & Schummer, 2005)

In this regard, science fiction could function as an important cultural arena, where scientific knowledge is mediated, and as an important space where the critical analysis of issues and perspectives is negotiated promoting a (multi) cultural practice of science communication (van Dijk, 2003) thus leading to cross-disciplinary discussions which can illuminate our understanding of science (Saunders *et al*, 2004, Dritsas, 2007)

In addition, science fiction is a genre well-suited to express the concerns about the environment and explore humanity's place in ecological systems since it encompasses a broad range of issues that derive from the interaction of humans with the natural world (Miller, 2005), as many of the texts spell the agonizing struggles of the future between near-term utilization and long-term preservation of a planet's natural resources and ecosystems, as well as examine a range of moral problems, requiring ethical reflection, that are associated with the environment (Stavrou *et al*, 2007).

Indeed these texts are good shorthand expressions for capturing a prevalent contemporary sensibility regarding our place in nature and our responsibility for discovering ecologically sustainable futures and can be read as 'sociotechnical thought experiments' that produce alternative representations of present circumstances and uncertainties, and anticipate and critique possible futures (Gough, 2003).

As a result, critical readings of such stories can help us to anticipate critique and respond to social and cultural changes. Consequently, thought experiments, like science fiction texts, invite a socially critical approach to curriculum and curriculum inquiry because they foreground socio-political structures and agency as well as techno scientific responses to social and environmental crisis. Therefore, the inclusion of literature, especially literature of science fiction in the procedures of science education could liberate thinking about sedentary points of view and judgmental positions that function as the nodal points of science education discourse and generate questions, provocations and challenges to some of the dominant discourses and assumptions of contemporary science education (Gough, 2003, 2006, Roth & Desautels, 2002: 65-91)

4. CONCLUSION

Although any literary genre can lend itself to teaching critical thinking skills, science fiction could be an excellent curriculum source in that it encourages discussion topics, such as problem-solving, issues of moral responsibility and issues of race and milieu. Therefore, an integrated unit on science fiction which encompasses not only the Language Arts, but also, Science and Social Studies is possible.

Good science fiction is story, science, and speculation all wrapped up in a package custom-made for improving literacy and critical-thinking skills. Through science fiction, students are given opportunities to move beyond ideas of present reality into the domains of the imagined future, where they can work with moral questions of the future with science and technology in creative and active ways. From their engagement with science fiction they can ask where we may possibly move with these technologies, and how they may affect social, moral, and environmental conditions of human life (Czerneda, 2006).

Cultural works provide multiple, varied, and indirect paths of feedback; they add diversity and subtlety to the process of knowing and acting on the world. Their contribution is crucial, because the effective working of feedback control systems depends on the quantity and quality of the feedback signals they can process.

What literary culture may best be able to contribute to today's transformed world are not theories but stories, not accounts of worlds revealed to be words but offerings of words to touch the world (Paulson, 2001:76). Similarly, cultural works in science education can contribute significantly to our understanding of the barriers to effective science education. Science fiction can force students to think about our present society, including its strengths and weaknesses. It encourages students to consider what might make a better society, or just as important, what would make a worse society.

Such approaches aspire to shape a new kind of scientific, technological and environmental literacy, where the emphasis falls on the realization of the complex routes and common ground where science, literature and political ideologies meet (Gough, 2006, Merrick, 2005, Weinstein, 2006). A fact that leads to critical awareness as well as cognitive awareness of scientific activity as cultural activity, able to contribute to effective solutions to contemporary social and environmental problems.

We need literary culture, which is offered by science fiction because we live in a human world that is social, open, competitive and conflicting, that is inherently concerned with far more getting at the truth about the objective condition of things, and because we live in a historically and culturally complex world that we must seek to know with some degree of thoroughness and subtlety if we are to act effectively within it.

However, by means of science fiction critical discourses, we can make a beginning, committed to the view that it is important to develop, as a matter of civic responsibility, an understanding of the interactions between science and humanities and their functions as complex enterprises that take place in specific contexts shaped by, and in turn shaping, the cultural, moral, and political values. This can be accomplished in the context of educating a new generation of scientifically and politically literate citizens who actively take part in social processes.

5. REFERENCES

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