

## POTENTIALITY OF THE CINEMATOGRAPHIC WORK *CONTACT* BY CARL SAGAN AS A MEANS FOR POPULARIZING ASTROBIOLOGY CONCEPTS

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### RESUMEN

Los trabajos de Ciencia Ficción pueden verse como una de las formas que la escuela podría utilizar para reducir las injusticias sociales y las desigualdades de oportunidades que ofrece el sistema educativo, especialmente en el campo de la educación científica. No tiene un carácter de investigación educativo-acción, en el que necesita desarrollar estrategias para los docentes, con aplicación en el aula. El objetivo principal de este trabajo fue presentar los aportes que la ciencia ficción puede brindar para un enfoque interdisciplinario en la enseñanza de las ciencias, a través de la contextualización a partir de la tríada Ciencia, Tecnología y Sociedad de la Base Curricular Nacional Común. La metodología se llevó a cabo a través de una encuesta documental basada en los aportes teóricos comparativos intersemióticos de la literatura y el cine, a partir de libros y artículos científicos. Los resultados se obtuvieron a través de la recolección de datos, llevando a cabo la transcripción de discursos y diálogos relevantes para esta investigación.

### ABSTRACT

Science Fiction (SF) works can be seen as one of the ways schools could take in order to reduce social injustices and inequalities in opportunities presented by the educational system, especially in the field of scientific education. This research has a qualitative approach to understand and explain the dynamics of science content through science fiction. It does not have an educational-action research character, in which it needs to develop strategies for teachers, with application in the classroom. The main purpose of this work was to present the contributions that science fiction can provide for an interdisciplinary approach in science teaching, through contextualization based on the Science, Technology and Society triad of the Common National Curriculum Base. The methodology was carried out through documentary survey research based on the intersemiotic comparative theoretical contributions of Literature and Cinema, from books and scientific articles. The results were obtained through data collection performing the transcription of relevant speeches for the research during the movie screening.

*Key Words:* astronomy education — interdisciplinary astronomy

### 1. INTRODUCTION

Several authors have proposed the use of SF films in science teaching as a tool with great potential for developing interdisciplinary debates related to Science, Technology and Society (Piassi & Pietrocola 2008). The task of educators, teachers, and even parents is not just to instruct more scientists, but also to deepen the public understanding of science, stimulating the curiosity and imagination of children and young people. A point raised by Sagan (1990) is that around the world, there are daily columns of Astrology (considered a pseudoscience) in practically all newspapers, but there are almost no science columns in the respective media. However, the author continues, although printed newspapers play a significant role in shaping opinions, by far the most

effective means of arousing interest in science is television and film.

Although science and science fiction works do not have harmonious links, films and books can collaborate to reinforce or deconstruct the image of the scientific universe, in addition to contributing to broadening the view of the world (Barca 2005).

#### 1.1. *Contact*, by Carl Sagan, and the cinematographic work

This work is based on the 1997 science fiction cinematographic work, *Contact*, which was produced and directed by Robert Zemeckis based on the eponymous work by Carl Sagan and Ann Druyan from 1985 (Judensnaider et al. 2019). The work's language and plot aim at a wide audience, being of great appeal to the lay public, addressing scientific issues of general interest. The story revolves around

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Dr. Eleanor Arroway (Ellie), an astronomer who has been interested in science since childhood, being encouraged by her father, who died when she was only nine years old (Piassi & Pietrocola 2008). Arroway, as an adult, will be interested in researching extraterrestrial intelligent life through radio telescopes, thus becoming a scientist specialized in radio astronomy.

## 2. METHODOLOGY

The present work is not focused on developing a teaching methodology in the classroom through the film *Contact*, that is, it is not an educational-action research (Tripp 2005). The developed content hopes to be able to contribute in order to show the different parts that can be contextualized and used for the teaching of science. For Minayo (2011), qualitative research works with the universe of meanings, motives, values and attitudes, corresponding to a deeper space of relationships, processes and phenomena that cannot be reduced to the operationalization of variables. The objective, therefore, is to gather information or prior knowledge about the problem in this respect (Da Fonseca 2002). For data collection, relevant speeches for the research were transcribed during the film screening. The distinction regarding the relevance of the statements was made through the concepts presented in the conceptual-phenomenological theoretical foundation (science), specifically segmented in Astrobiology.

## 3. RESULTS

Parts of the movie will be presented in which concepts, laws and phenomena associated with science appear, as well as applications, technologies, technical standards and other knowledge that can be considered products of scientific and technological activity (Piassi & Pietrocola 2008). These are the elements seen as the school “content”, since they are the proper objects of science study. This part of results has been divided into 2 subtopics: Astrobiology and Physics.

### 3.1. *Astrobiology*

From remote antiquity to today, the scientific community has been asking questions and wanting to find out: “How did life originated and evolved on Earth?”, “Is there life on other planets?” and “How has life adapted to an ever-changing planet and how will it do so in the future?” (Des Marais 1999). At the beginning of the movie, questions about Astrobiology are raised by Ellie, the main character. As a child, Ellie questions her father:

Ellie: Hey, Dad? Do you think there’s people on other planets? Ted: I don’t know, Sparks. But I guess I’d say...if it is just us...it seems like an awful waste of space (*Contact*, 1997, 06min17s).

It is worth drawing attention to the last sentence of this dialogue, which is authored by Carl Sagan himself and said in interviews with Boston University and *Veja Magazine* in 1972 and 1982, respectively. In this dialogue, little Ellie presents the idea and curiosity about the possibility of life outside Earth. Later, as an adult, Dr. Arroway, in a conversation with theologian Joss about the possibility of the existence of life outside the Earth:

Ellie: There are four hundred billion stars out there...just in our galaxy alone. If only one out of a million of those had planets...if just one out of a million of those had life...and if just one out of a million of those had intelligent life...there would be literally millions of civilizations out there. If there wasn’t... Joss...it’d be an awful waste of space (*Contact*, 1997, 16min34s).

Discussions of extraterrestrial life are further stimulated in viewers’ minds when, in a following scene, Ian Broderick, in the CSIRO, the Control Room in Australia, reports:

Ian Broderick: Position confirmed. We’ve got 4.4623 gigahertz, confirmed. We’ve got 112 janskys. Ellie: Do you have a source location yet? Ian Broderick: We put it right smack in the middle. Vega (*Contact*, 1997, 43min).

In addition to issues related to the origin and existence of life outside the Earth, the cinematographic scientific work also addresses issues of Astrobiology related to communication. The detected signal is unnatural:

Ellie: No! Come on! It’s restarting. Wait a minute. Those are numbers. That was 3, before it was 2. Base 10 numbers. Count and see how far we get. One. Ellie e Fisher: Seven. Ellie: Those are primes. 2, 3, 5, 7 are all prime numbers. No way that’s a natural phenomenon! Let’s just calm down and pull up the star file on Vega (*Contact*, 1997, 41min).

Similarly, as in the film, in 1979 an article was published entitled “Does the  $\phi$ X174 bacteriophage

carry in its DNA an extraterrestrial intelligence message?" (Yokoo & Oshima 1979), in which they mentioned the possibility of extraterrestrial communication. So, it would be from this article that Carl Sagan's inspiration would have emerged, that extraterrestrial beings could pass encoded messages through sequences of prime numbers. Shortly after the message is presented to the government, Dr. Arroway receives a call informing her that the message has been deciphered and that she might have an answer on how to translate. Thus, with the semiotic information in hand, the protagonist goes the next day to the White House to show, in a meeting, how to translate the content of the message and what she had described in it:

Ellie: Within the layering of the matrix, we have these basic equations: So with this very elementary foundation, they have given us a kind of general scientific vocabulary. We now have the symbols for true and false... Drumlin: This was the key...that allowed us to decipher their language for physics, geometry, chemistry. Next frame, Ellie. Ellie: Yes, and when we apply this to the rest of the message... we find this. Michael: Those look like engineering schematics, almost like blueprints. Drumlin: Yes. Ellie: It is our belief that the message contains instructions for building something, some kind of machine. Rachel: That does what, Doctor? We don't know. It might be some type...of advanced communication device, or a teaching machine of some kind. Or it might be some kind of a transport (Contact, 1997, 01h07min).

Near the end of the film, one of the parts that impress for its special effects and cinematic beauty is present not only in the scene, but also in the description that the main character tries to make.

Ellie: I'm going through some kind of a tunnel! There's a light source ahead! Brilliant...blue-white. Residual radiation? It's a star. I must have...gone through a wormhole. It's Vega! I'm in another wormhole now! I had no idea! A series of them!

They're alive. It's like...some kind of a transit system. A subway! Oh, God! I have to keep talking. It's a triple, No, a quadruple system. Beautiful! They're alive! (Contact, 1997, 01h56min).

#### 4. CONCLUSION

It is possible to see that science fiction is a rich source of discussions, promoting literary, as well as scientific literacy, forming individuals who are more critical and autonomous in their decisions through issues contextualized in an interdisciplinary way. Unfortunately, there is still no satisfactory incentive in schools, which generally use literary or cinematographic works as part of their teaching obligations or just to facilitate some assessment, which removes students' curiosity in relation to scientific subjects. The implementation of SF in classes, either in elementary or high school, correctly develops the critical view of students through the interdisciplinary link between science issues and their impacts on society, fostering debates for the world of today and tomorrow, as required in Common National Curriculum Base (BNCC) from its CTS triad. In a globalized world of great technological development, there is an immeasurable need to teach everyday life in school institutions, as society depends on countless knowledge that only science can provide.

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