

# The Influence of Science Fiction Films on the Development of Biomedical Instrumentation

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**Abstract** – The question of whether science imitates art or if art imitates science has for long been a subject of debate in educational circles. In this project, we want to analyze the question of how science fiction movies influenced biomedical instrumentation and how has the development of biomedical instrumentation influenced science fiction movies. Our work is aimed towards production of a video to be used as an educational tool in biomedical engineering courses. We analyzed this question in detail, by dividing the history of the cinema into four sections and then drawing parallels between the development of ideas on film and the development of instrumentation in real life. We viewed and analyzed more than 50 science fiction movies covering all four historical cinema areas. From each movie, we extracted clips that contain biomedical instrumentation, analyzed the instrument from a presently existing level of knowledge and technology, and compared it with the instruments available nowadays. Our conclusion is that there is a definite non-linear correlation between the bioinstrumentation shown in science fiction films and the development of biomedical instrumentation.

## INTRODUCTION

Biomedical device development has come a quite a long way in this century, especially in the past two or three decades. A significant percentage of medical instruments available today did not even exist 10 – 20 years ago, or were so expensive that only the largest facilities could afford them. In our universities, biomedical engineering (BME) students are taught about the existing state of technology. Although most of them achieve good understanding of the present, very few acquire a feeling for the dynamics of the instrument technology development. To achieve it, students should be exposed both to the BME history and given an opportunity to glimpse at what the future might bring. This is not a simple educational task.

Motion pictures have been around since the early part of this century. Of all the movies that have been made in the history of film, many have sought to predict the future in some way. These *Science Fiction* movies portrayed what writers thought would happen in future. Since we now live in the “future” from the perspective of those films, we can look back on those movies and attempt to evaluate how well they did predict the future. In this project, we concentrated specifically on the appearance of biomedical devices in science fiction films and on how these films may have in some way predicted instruments that exist now, or might exist in the near future.

The relationship between science fiction films and biomedical device technology is a great example of an interaction between technology and the arts.

In addition to investigating this relationship, we created and edited a documentary style video. This video uses clips of actual films and clips of real life instruments along with a scripted narrative to draw the parallels in an entertaining manner.

## AIMS & METHODS

The most sensible way to approach this project was to attack each of the identified aims individually. Here we will present our aims and outline the methods for their accomplishment.

- *Develop a search & film identification strategy:*  
Use Internet, contacts from the arts and entertainment department of the local newspaper and local video rental store.
- *Explore copyright laws that relate to the use of short film clips for non-commercial educational purposes:*  
Communicate with lawyers who have knowledge of “Fair Use” laws, explore libraries, and the Internet.
- *Develop a classification scheme for evaluation of biomedical devices presented in science fiction films:*  
Several aspects about each described instrument have to be analyzed: how the instrument presented in the film works, why it works, whether it is or will be possible to make such an instrument now or in the future, etc.
- *View a significant number of films, e.g. 50, selected according to the developed search strategy:*  
Use the local video rental stores and the local libraries.
- *Extract scenes featuring biomedical devices from the films & copy them onto a computer for digital editing:*  
Create digital recordings that include all the selected clips. This allows for easy video editing. Along with a high quality VCR, use a professional quality video capture card.
- *Analyze the identified instruments according to the previously developed classification scheme:*  
Analysis of biomedical, electrical, mechanical and computer science aspects of the device’s use, function and construction. Extrapolation of those ideas that are not at first readily seen.
- *Present the research results in a form of a report:*  
After viewing a significant number of films and classifying data about the instruments presented in those films, organize and compile all information into a scientific report. Report has to serve as a reference for the video.
- *Compile selected film clips into a video and edit it with the analysis comments in such a way to produce an educational video to be used in biomedical engineering courses.*  
Present findings is in the form of a narrated video. Pick the best examples of biomedical devices and edit clips from the movies containing the devices into a short, 40 minute overview of the history of biomedical devices in the Science Fiction Film genre. The aim is to produce a film that can be used in biomedical engineering classes as an interesting introduction to the field of biomedical technology and to provide means to demonstrate the dynamics of the BME instrument development.

## RESULTS

We divided the films into 4 categories according to major events that altered the course of cinematic development. The Early Cinema spans from the invention of the motion picture (1900) to the introduction of sound as a part of production (1930). The Golden Cinema period spans up through the invention of television (1955). The Pre-Modern period lasts till the commercialization of the VCR (1977). The Modern period (1977 - Present) is characterized by enormous rise in film and special effects budgets that have lead to the most realistic realizations.

There are very few films from the first period of cinema. *The Cabinet of Dr. Caligari* features biomedical instruments in the form of a magic wand and a box that is used to wake a man from a coma-like state of sleep. *Dr. Jekyll and Mr. Hyde* features a potion of the doctor's own design, that upon introduction to the body causes a massive physical transformation. The 1925 classic, *Metropolis*, shows an entire lab full of interesting biomedical instruments, but it focuses on a device designed to remove the soul and visage of a person and transfer them into a robot. This film features effects such as animated lines of electricity flowing back and forth between the patient and the robot as well as animated electromagnetic fields around the robot itself. All of these movies relied mostly on the magical aspect of medical science and depicted devices that were at least well ahead of the scientific technology at that time.

The second period featured many more instruments that were influenced by scientific advances made around that time. The original *Frankenstein*, came out in 1930 and shocked many people with its horrific monster and maniacal theme. The device used to bring the monster to life is one of the most famous medical devices in all of film history. Dr. Frankenstein uses a huge electrical device (powered by lightning from an electrical storm) and essentially defibrillates the heart of his monster and returns it to life. The first successful animal defibrillations were performed at the very end of the 19<sup>th</sup> century, and the first successful human defibrillation didn't take place until 1947. This puts the science fiction and the science-technology in the same time domain as far as advances are concerned. In *The Bride of Frankenstein*, a crude EKG monitor is used that has indicator lights arranged in a contemporary bar display fashion. Again, the time span approximately parallels the development of the first real EKG devices that evolved after Einthoven's discovery.

The third period shows a lot of realism and correlation between the film and fact, but at the same time we can see the science fiction really starting to accelerate and pull ahead of technology. In *The Andromeda Strain*, there are several featured devices: a scanner that "looks" over the surface of a person's body and picks out areas of "fungal lesions." Another device is a computer system named Med-Com used as an expert system to diagnose and prescribe treatments for patients. Today such programs exist. In the Woody Allen's *Sleeper*, we find several biomedical devices that correspond to the devices of the late 60's. In the very beginning of the film Allen, who was cryogenically frozen, is thawed and woken up 200 years in the future. Then he undergoes medical testing including an EEG. This is approximately the period when experiments in cryogenics became popular, and it is only a short time after the EEG became a reliable diagnostic modality. The third clip is from the *Star Trek*, featuring one of the most famous devices to come into popular light: the transporter. It not only dematerializes the human body into some sort of energy ray and then reassembles it, but also performs biological filtering by removing any

unwanted contaminants before it rematerializes the body. The most famous science fiction medical device is the *Star Trek* Medical Tricorder. It originally appeared in the first TV series; however, newer models keep emerging in the new TV series and *Star Trek* movies (Modern period). We may say that it is a portable version of today's MRI scanners - an ideal non-contact omnipotent medical diagnostic and imaging instrument.

The fourth section of film history marks the time when enormous film budgets and computing advances have allowed for spectacular special effects. In *Star Wars: The Empire Strikes Back* we see Luke Skywalker getting a robotic hand prosthesis installed. The remarkable thing is that it provides Luke with both nervous control and sensation. Today experiments are just beginning with such possibilities. The 1996 film *Alien 3* features a scanning device that functions like an ultrasound. However, this device generates an image in 3-D and it does not need any form of a contact between the imaged organ and the instrument's sensor, as the actual scanning device is hovering 3 feet above the patient. In *Star-Trek: First Contact*, there is a scene which features the *Enterprise's* android Lt. Data having artificial skin grafted onto his arm. This skin apparently has some kind of nervous contact with Lt. Data's systems as he experiences feeling, and the sensation of "goose-bumps" through it when his skin is blown upon. Artificial skin is a fairly recent product on our medical market, used to help burn victims.

During the recent years, there has literally been an explosion of special effects developments that have made such movies possible. Likewise, current technology is increasing at an almost exponential rate. However, nowadays it is lagging behind the imaginations of today's science fiction writers.

## CONCLUSION

There is an interesting relationship between science fiction films and the development of biomedical instrumentation. A qualitative graphical interpretation of both the presentations of biomedical ideas in science fiction movies, and real, existing devices is presented in Figure 1. It is interesting that the ideas presented in films actually lagged behind the real technology for a while (approximately 1930-1965). However, for most of the time (before 1930, and after 1965), the imagination of movie directors, and the audience's interest and fascination with effects stimulated the movie industry so that the instrumentation in the movies surpassed the exponential growth of modern technology.

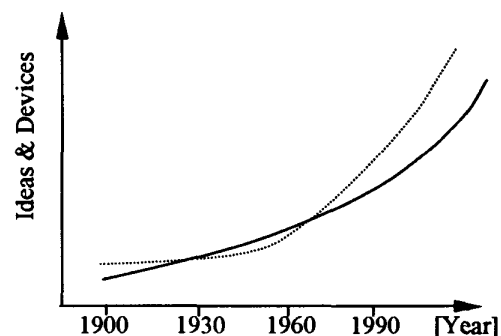


Figure 1: Exponential increase over time of both the ideas presented in science fiction films (dotted line), and realized biomedical engineering devices (solid line).