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The Advent of Sound in Motion Pictures

Michael P. McHugh
Eastern Illinois University

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THE ADVENT OF SOUND IN MOTION PICTURES

(TITLE)

BY

MICHAEL P. MCHUGH

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

MASTER OF ARTS

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

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THE ADVENT OF SOUND IN MOTION PICTURES

BY

MICHAEL P. MCHUGH

B. A., Eastern Illinois University, 1974

ABSTRACT OF A THESIS

Submitted in partial fulfillment of the requirements
for the degree of Master of Arts at the Graduate School
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This study traced the developments which led to the advent of sound in motion pictures. The hypothesis that the advent of sound in motion pictures was the result of many technical developments made between 1894 and 1930 was supported by this work.

Following a historical methodology the research focused on four questions: 1) How did motion pictures evolve? 2) How did sound become involved with the presentation of motion pictures? 3) What were the technological developments that led to the advent of sound? 4) What were the events that led to the acceptance of the advent of sound?

This study found that the idea of motion pictures has roots in the past. The Chinese Shadow Ball was used as a form of entertainment from 6000-1500 B.C. Leonardo da Vinci described the camera obscura in 1500 A.D. In 1646, Anthanasius Kirchner devised the magic lantern which was developed from da Vinci's ideas. Many inventors modified the magic lantern and photography, developed in the mid 1800s, was applied toward creating the illusion of motion. The first actual motion picture machines were peep-show devices such as Thomas Edison's Kinetoscope.

Sound was a part of motion pictures from the beginning. Even ancient magic lantern shows had musical accompanient. Thomas Edison added his phonograph to the Kinetoscope to provide synchronized accompaniment for his peep-show machines. During the first three decades of the twentieth century many inventors experimented with two main methods of sound accompaniment: the sound on disc and the sound on film.

Inventors met two main technological problems, synchronization and amplication. When film projectors were improved large audiences could view the pictures, then amplication problems had to be solved. Lee DeForest solved the sound problem by applying the audion tube to his Phonofilm system in 1923.

With the right combination of showmanship and public relations the idea of sound films was sold to the public and to the film industry. By 1926 the public

was getting accustomed to the medium of sound as a form of entertainment because of the phonograph and the radio. Warner Brothers invested in Vitaphone, a sound on disc system. Their first film, Don Juan became a box office hit. The real turning point in the advent of sound in motion pictures came when Warner Brothers presented their second sound film, The Jazz Singer. The showmanship and magnetism of the star, Al Jolson, excited audiences everywhere. Now the film industry was convinced that there was an audience demand for sound films. All of the major film producers jumped on the bandwagon and ordered sound equipment. Almost overnight Hollywood changed. Many musical films soon followed and by 1930 the silent film era had passed. Sound films were here to stay.

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CHAPTER I

NATURE AND PURPOSE OF THE STUDY

The Introduction

On October 6, 1927 a new era began in the film industry. In a theatre on Broadway, a curtain opened and the first talking feature film flashed on the screen. Al Jolson appeared as the star of the new movie, The Jazz Singer. Jolson had such vitality, personality and charm that he sang and danced into the hearts of American audiences.[1]

Since the first public presentation of film projected upon the screen in 1895 by the Lumiere Brothers,[2] the silent film had become a steadfast form of entertainment for millions, not only in America but around the world. The silent film was an art form. Audiences were not quick to change their viewing habits. The Jazz Singer marked the turning point in the struggle for the acceptance of sound as a part of film. The "talkie"[3] era had begun.

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[1] Arthur Knight, The Liveliest Art, (New York: Macmillan Company, 1957), p. 17.

[2] Patrick Robertson, The Book of Firsts, (New York: Clarkson N. Potter, Inc., 1974), p. 63.

[3] The word "talkie" evolved in the 1920s when sound was trying to become an accepted part of film. It referred to any film that had either talking or singing. The term lasted until silent films were phased out around 1930.

The first actual presentation of a motion picture with sound occurred on October 6, 1889, exactly 38 years before The Jazz Singer debuted. Thomas Edison along with his talented assistant, William Kennedy Laurie Dickson, demonstrated an invention in which Dickson could be viewed on film and also could be heard. His voice was recorded on a phonograph.[4] There were severe technical problems of synchronization with his device.[5]

Inventors began trying their hands at making a successful projected sound film. "At the Paris Exposition of 1900, one could see 'talking' films of Sarah Bernhardt and Benoit Coquelin at the Phono-Cinema-Theatre of Clement Maurice."[6] Many inventors experimented with sound on disc systems but ran into technical problems in synchronization and amplification.[7]

After World War I, inventors turned to the sound on film method to try to solve the synchronization problem. Eventually, both the problems of synchronization and amplification were solved but sound films were not readily

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[4]Knight, p. 17.

[5]Synchronization refers to the visual picture and the audio track of a film working or occurring together at the same rate and at the proper time.

[6]Steven H. Scheuer, The Movie Book, (Chicago: Ridge Press and Playboy Press, 1974), p. 36.

[7]Amplification refers to the ability to increase the strength of the audio track of a film so that it can be audible.

accepted. Audiences did not demonstrate much enthusiasm for sound films in the 1920s and the film industry was still skeptical of sound films due to the numerous failures in the past of various sound systems.

In 1926, Sam Warner took a gamble and invested in a sound on disc system called Vitaphone, which was developed by Western Electric. Warner Brothers came out with a picture called Don Juan to premiere the new Vitaphone system. "The event was sensational. The industry was interested but not convinced."[8] Sound films still were not accepted. The audience and persons in the film industry still were either skeptical or had negative attitudes toward joining sound with film. They regarded the silent film as an art in itself.

In 1927 Al Jolson starred in The Jazz Singer and it became an immediate success. Sound films gained acceptability. The talkie era had begun and the film industry began to change overnight.

Purpose of the Study

The purpose of this study is to trace the developments which led to the advent of sound in motion pictures. Topics of research are: (1) the evolution of the motion picture, (2) the technical developments of sound on disc systems, (3) the technical developments of sound on film

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[8]Daniel Blum, A New Pictorial History of the Talkies, (New York: G. P. Putnam's and Sons, 1973), p. 11.

systems and (4) the events that led to the acceptance of the advent of sound.

The study will explore key advancements in the development of the motion picture. The focus of this study will be on the period between the years 1889 to 1930.

Origin of the Study

The writer of this paper became personally interested in silent films and early sound films many years ago. The interest grew upon viewing and critiquing silent films in an undergraduate film course. At that time the thesis topic, "The Advent of Sound in Motion Pictures," emerged as an assignment.

In researching the thesis topic, it was found that the technical developments for adding sound to film took many years of experimentation. Also, the advent of sound met a great deal of resistance within the film industry. Researching this area, it was discovered that there were no books explicitly covering the transition era of the 1920s, when the sound film was evolving from the silent film. Information was very fragmented and had to be pieced together from a great many books which had only small sections dealing with the topic.

After preliminary investigation, it was decided that a complete historical analysis of the movement to add sound to the silent film was needed to get a clearer historical look at a significant time in the film industry and to

point the way for further research concerning this era in the film industry.

Review of the Literature

At an early point in gathering materials for this study, at attempt was made to determine whether a similar study had been done. Certain indexes of research in the field of speech were explored. They were: J. Jeffery Auer, "Doctoral Dissertations in Speech, Work in Progress", Speech Monographs, XXXI-XXXVI (1964-1969); Baker, Marlor and Mulgrave, Bibliography of Speech and Allied Abstracts (New York, Chilton Co., 1962); Cleary and Haberman, Bibliography of Rhetoric and Public Address, 1947-1961, (University of Wisconsin Press, 1964); Clyde W. Dow and Max Nelson, "Abstracts of Theses in the Field of Speech", Speech Monographs, XIII-XXXVI (1946-1969); Fatherson and Thonssen, Bibliography of Speech Education, (New York, W. Wilson Co., 1939); Pat Kennicott (editor), Bibliographic Annual in Speech Communication 1970-1973, (S. C. A. Publication); Franklin Knower, "Graduate Theses: An Index of Graduate Work in Speech", Speech Monographs, II-XXXVI (1935-1969); "Dissertation Abstracts", The Bibliographic Annual in Speech Communication (1970-1973, S. C. A.).

There were a few dissertations done on some actors and actresses of that era who went through the transition period from silent to sound motion pictures, but there were no similar studies that researched the era of transition from silent to sound films.

There were numerous magazine articles written between 1900 and 1930 that dealt with the transition period. They dealt with such topics as technological improvements, attitudes of persons for and against the coming of sound in films and some articles which showed the changes that were made in the film industry after the advent of sound. Particularly, the Scientific American magazine was used to obtain technical information about sound on disc and sound on film systems. In addition, articles in magazines such as Etude, Century Magazine, Outlook, the Literary Digest and Illustrated World were among those researched for pertinent information.

There were many books which devoted a chapter or a part of a chapter to this period to show the changes. Some of the more valuable were The Liveliest Art, History of Motion Pictures, Archaeology of the Cinema, The Birth of the Talkies and Warner Brothers.[9] These books contain information on the developmental history of film and sound equipment, on attitudes toward the coming of sound, and on the events that led to the coming of sound.

Arthur Knight, The Liveliest Art, (New York: Macmillan Company, 1957); Maurice Bardeche and Robert Brasillach, History of Motion Pictures, (New York: W. W. Norton and Company, 1938); C. W. Ceram, Archaeology of the Cinema, (New York: Harcourt, Brace and World Inc., 1960); Harry M. Geduld, The Birth of the Talkies, (Bloomington, Indiana: Indiana University Press, 1975); Charles Higham, Warner Brothers, (New York: Charles Scribner's Sons, 1975).

In light of such investigation, it seemed that a thorough study had not been made to explore the following areas: (1) the evolution of the motion picture, (2) the technical developments of the sound on disc systems, (3) the technical developments of the sound on film systems and (4) the events that led to the acceptance of the advent of sound. In addition, the review of literature indicated that information dealing with the topic was very fragmented and should be collected in one volume.

The research methodology to be used is the historical approach. To be more explicit, Greg Phifer, the author of chapter four - "The Historical Approach" in Clyde W. Dow's book, An Introduction to Graduate Study in Speech and Theatre - breaks down historical studies into seven categories.[10] The type of historical study pertaining to this thesis is the institutional study.

Significance of the Study

This study will be of value to persons having interest in mass communication, film, and history. There has been no single source compiled exploring the complete transitional period of silent to sound in the film industry. This study will be of historical significance to the field of film communication. This study investigates an important transitional period in the history of film and

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[10]Clyde W. Dow, An Introduction to Graduate Study in Speech and Theatre, (East Lansing, Michigan: Michigan State University Press, 1961), p. 53-55.

contributes to the total knowledge in the field of film communication. Suggestions for further research, which will be in the last chapter, will provide a clearer understanding of this transition period in the history of film.

This study is of great personal value to the writer. It is an instrument through which the disciplines of research and creative writing are experienced. Wayne Thompson sums up the personal values for an author by saying that the preparation of a thesis should be a rich educational experience to provide training in research methods. It should integrate the knowledge of several fields and make the student an expert in a given area.[11] Personal values are shown beneficial as Homer Hockett discusses the importance of discipline that results from using the critical method.[12]

The author has gained great knowledge and familiarity with the silent to sound transition period as well as with the entire history of film. The writer has also gained a greater perspective and insight as to the development of film. Without this study, the same degree of perspective and knowledge would not have been achieved.

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[11]Wayne Thompson, "Contemporary Public Address", Quarterly Journal of Speech, XXXII (October, 1947), p. 277.

[12]Homer Hockett, The Critical Method in Historical Research and Writing, (New York: Macmillan Co., 1955), p. 12.

The Working Hypothesis

It is the hypothesis of this historical study that the advent of sound in motion pictures was the result of many technical developments made over a period between 1894 to 1930 and these developments can be identified through research. It is the purpose of this study, therefore, to identify the developments that led to the advent of sound in motion pictures and to suggest related areas of further research of the thesis subject.

The questions to be answered during the course of this study are:

1. How did motion pictures evolve?
2. How did sound become involved with the presentation of motion pictures?
3. What were the technological developments that led to the advent of sound?
4. What were the events that led to the acceptance of the advent of sound?

Availability of Materials

Whatever topic one is researching, there must be adequate research materials available. For the purpose of this study, there is a great abundance of materials readily available.

Materials used to gather information for the study will include books written about film and magazine articles dating back from 1890 to 1930.

Some key books that I will rely upon are: Antonia and William Kennedy Laurie Dickson, History of the Kinetograph, Kinetoscope and Kinetophonograph, (New York: Arno Press, 1970, reprint edition); C. W. Ceram, Archaeology of the Cinema, (New York: Thames and Hudson, 1965); Robert Brasillach, History of Motion Pictures, (New York: W. W. Norton and Co., 1938); G. R. Doyle, Harry M. Geduld, The Birth of the Talkies, (Bloomington, Indiana: Indiana University Press, 1975); Kevin MacDonnell, Eadweard Muybridge: The Man Who Invented the Moving Pictures, (Boston: Little, Brown and Co., 1972); Arthur Knight The Liveliest Art, (New York: Macmillan Company, 1957); Gerald Mast, A Short History of the Movies, (Indianapolis, Indiana: Bobbs-Merrill Co., 1976). These are books with an abundant amount of information concerning the film industry during the time period in which this thesis covers. Magazines to be used include: Scientific American, Education, Century Magazine, Illustrated World, Outlook, Literary Digest, Etude, and Harpers Magazine. These magazines contain articles which focus upon the film industry going through the change from silent to sound films.

There are many libraries from which to seek out the needed resource materials. Libraries used were the Gail Borden Public Library in Elgin, Illinois; the library at Northern Illinois University; Eastern Illinois University; the University of Illinois and at Northwest Missouri State

University. All of these libraries have excellent resources for film study.

Organization of the Study

The thesis will be divided into five chapters. The first chapter covers the thesis proposal. Chapter two deals with the evolution of the motion picture. Basic background information will be given on the early inventions that experimented in projecting pictures, how they developed, and how the idea of combining sound and the moving picture evolved.

The third chapter will investigate the development of sound on disc systems. The difficulties that occurred in trying to synchronize sound with film will be explored. It was during this period in which sound films met with frustration and the silent film was dominant.

Chapter four explores development of sound on film systems and researches the events that led to the acceptance of the advent of sound. Once adequate amplification was developed and the synchronization problems solved, the change slowly began taking place. It gained immense momentum in 1926 and flourished from then on.

The final chapter will summarize the key findings of the study. Possible areas of further research which may result from this thesis will be included.

Finally, the thesis will include a bibliography. A complete listing of all resource materials that are used

in this study will be presented. The bibliography should prove to be helpful for those who wish to pursue studies related to this thesis topic or to serve as a reference guide for works written about this period of film history.

Conclusion

The purpose of this first chapter was to introduce the study, to clarify the nature and purpose so the reader could have a clear perspective with which to confront the remaining chapters.

CHAPTER 2

THE EVOLUTION OF THE MOTION PICTURE

In studying "The Advent of Sound in Motion Pictures", we must first trace the major discoveries in the development of motion pictures to get the proper perspective as to how sound became involved with the projection of pictures. This relationship dates back many years prior to the invention of motion pictures.

Man has tried to recreate reality since the early days of his existance. One of the first methods of doing this was by drawing pictures on walls of caves. There is evidence of primitive man's attempt to recreate motion in the drawings on the walls of a cave found in Altamira, Spain.[1] There were pictures of a wild boar drawn with multiple legs, depicting that he was running. The drawing is estimated to be twenty-five thousand years old. Although this was crude, it does show the attempt of primitive man to record what he observed in the world around him.

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[1]C. W. Ceram, Archaeology of the Cinema, (New York: Harcourt, Brace & World Inc., 1960), p. 15.

The Chinese, from 6000-1500 B.C., had a form of entertainment in which they used a 'Shadow Ball.'[2] This was a hollow ball with figures and designs carved out of the surface. When light was directed toward it, the ball would cast a shadow on a wall or screen. If the ball had a series of figures carved on it that were of successive phases of motion, the ball could be rolled and the projected shadow would show a figure in motion. The Chinese Shadow Ball has no true connection with cinema, but it does demonstrate another attempt of man to create motion.

Through the ages, scientists played a most important role in the evolution of inventions that finally led to the projection of moving pictures. Among those scientists, Leonardo da Vinci was one who explained the first accurate description of the camera obscura (dark room) in 1500. The camera obscura was a completely dark and enclosed room that admitted light only through a small hole with a lens in it. The lens would invert and project a reproduction of a scene that entered the lens.[3] The only thing needed for the camera obscura to be considered a camera, as we know it, would be to replace the wall with a photographic plate.

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[2]Ibid., p. 26.

[3]Gerald Mast, A Short History of the Movies, (Indianapolis: Bobbs-Merrill Inc., 1976), p. 12.

The camera obscura developed into a form of entertainment as lenses were perfected. In 1646, Anthanasius Kirchner outlined the principles for the magic lantern. The magic lantern was a box that could reproduce images that were drawn on a slide. These images were projected upon a wall or a screen by means of light passing through the drawn glass slide and then through a lens.[4] Kirchner's device became the forerunner of the cinema projector, which would be developed in the late-nineteenth century.

Many scientists and inventors took Kirchner's magic lantern device and modified it to use it for entertainment. They improved such parts as the projection lens system and the source of light. The light source of the magic lantern was created by fire. Thus, they had to have smokestacks coming from the devices which were rather dangerous. There were many instances of fires being caused by magic lanterns.

In 1685, Johannes Zahn perfected Kirchner's optical lantern. He projected glass slides that were mounted on a circular disk which was revolved in front of the magic lantern lens.[5] If the pictures were drawn of successive phases of motion, it would imply the idea of motion to the viewing audience.

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[4]Ibid., p. 17.

[5]Ceram, p. 34.

The age of photography had its birth in 1727. A German professor, Johann Heinrich Schulze discovered that objects made images of themselves when placed on a mixture of silver nitrate and chalk. This discovery would touch off many experiments during the next one hundred years before any major breakthrough would occur.

Zahn's early attempt at projecting pictures with the idea of observing motion was further improved in 1736 when Pieter Van Musschenbroek introduced a multiple slide system into the magic lantern. The glass slides were changed through mechanical means.

In 1797, E. G. Robertson produced another version of the magic lantern called the Phantasmagoria. The lantern could be projected from behind the screen or in front of it and was mounted on wheels. Entertainers could move the lantern closer to the screen and the picture would then seem to move closer to the audience.[6]

Robertson used his Phantasmagoria mostly for macabre entertainment. He would give shows picturing apparitions and spectres to frighten the audience. Special lenses and concave reflectors were also used to scare the audience.[7] The Phantasmagoria also could emit a screen of smoke. Occasionally, Robertson had music accompany his shows.

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[6]Samuel McKechnie, Popular Entertainments Through the Ages, (New York: Benjamin Blom Inc., 1969-reissued), p. 176.

[7]Ceram, p. 39.

These special effects made Robertson's entertainment extremely popular.

The magic lantern was a popular form of entertainment through the mid-nineteenth century. In 1822, J. Johnson published "The Magic Lantern". In his book he suggested that music accompany the magic lantern shows.[8] Following his publication many magic lantern programs did indeed have musical accompaniment.

Theories on the illusion of motion became clearer in 1824 when Peter Mark Roget, author of the famous thesaurus, explained his theory of the persistance of vision.[9] The theory explains how the brain retains images in the eye for a fraction of a second after they have been seen. This allows one to project one frame of a movie at a time, with black between each frame, and the viewer perceives a continuity of motion due to the persistance of the previous image upon the retina of the eye.

Persistance of vision was known by the ancients, but Roget was the first to clearly explain this phenomenon. Once his theory was published, "...the advance toward motion pictures and motion-picture projection was rapid and direct. Almost immediately, scientists throughout Europe began putting his theory to the test."[10]

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[8]Ceram, p. 39.

[9]Mast, p. 10.

[10]Arthur Knight, The Liveliest Art, (New York: Macmillan Company, 1957), p. 14.

One such person was Dr. John Ayrton. In 1825 he devised a toy called the Thaumatrope.[11] The Thaumatrope was based on the persistance of vision theory. It consisted of a circular paper disc which had strings attached at opposite ends. There was a picture drawn on each side of the disc. The two pictures have to be related such as a bird and a cage. If the disc was twirled, motion of the bird into the cage appeared. This type of toy is still seen today, mostly in the form of a trick novelty or an optical illusion.

Another scientist who worked with the persistance of vision theory was Joseph Plateau. In 1829, he suggested in his doctoral thesis that sixteen pictures of intermittent movement shown in one second would be sufficient for an illusion of motion. The sensations on the retina of the eye gradually dim. Before the first sensation (picture) dims completely out, the next sensation appears.

Plateau constructed the first significant device based on the persistance of vision theory in 1832. He called it the Phenakistiscope. Individual designs in different positions were painted on a flat, circular board. The board could be held by a handle attached to it and up in front of a mirror and spun. The viewer looked into the mirror through little slits cut into the circular board. The viewer saw the individual designs become a continuous, animated sequence. If the slits were not used,

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[11]Ceram, p. 64

the results would be to view only a blur.

> Plateau's machine required moments of darkness, of nonimage, in order to make the images appear to move. The eye needed momentary resting time to soak in the images. A successful projector would not be invented until Plateau's principle of slits was reapplied.[12]

The Phenakistiscope was the progenitor of all later and more complicated forms of motion pictures.

Simon Ritter von Stampher, a German inventor, developed the same machine as Plateau's Phenakistiscope in the same year. He called his the Stroboscope. There were many refined versions of these 'toys' based on the same principle as the Phenakistiscope and Stroboscope. William George Horner created, in 1834, a stroboscopic machine that used a circular drum rather than a flat disc. Circular strips of paper could be wrapped inside the drum. When a viewer looked through the slits in the rotating drum, which allowed moments of darkness, continuity of motion was observed.[13]

Baron Franz von Uchatius experimented with stroboscopic toys and magic lanterns. He arranged magic lanterns in a semi-circle and had phase pictures in each. They were focused on a wall screen and he moved a torch rapidly behind the lanterns. The result was a project of an apparent sequence of movement.

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[12]Mast, p. 11.

[13]Ceram, p. 19.

He continued his experiments, and in 1853 he developed a Projection Phenakistiscope which combined the Phenakistiscope disc with a single magic lantern. It projected a series of twelve phase pictures when the operator spun the disc. Instead of viewing images singularly, now many persons could view projected images.[14]

Still another more elaborate invention was Emil Reynaud's Praxinoscope. In 1877, Professor Reynaud improved earlier inventions. He abolished slots and replaced them with rectangular mirrors set in the center of a drum. The arrangement of mirrors produced an optical compensation which did away with phases of darkness between individual pictures. A band of images was placed on the inside shell of the drum. As the drum was revolved movement flowed from one mirror to the next.[15]

He constantly was improving his invention. By combining it with the magic lantern he achieved projection and by 1889 he was able to enlarge his projected pictures so as to be able to present them theatrically.

Reynaud increased the number of pictures in his bands by mounting them on reels containing several hundred separate hand drawn images. More remarkable than this, he was the first to project genuine color pictures of continuous motion.

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[14]Ibid., p. 20.

[15]Knight, p. 15.

With those great accomplishments to his credit, Reynaud came up with an even more extraordinary device. He wanted to incorporate sound with his invention and devised a way to do it. He attached cams to his film strips. When these were tripped, they would trigger a series of electrical relays thus producing noises suitable to the picture.[16] With technological developments being made in motion picture photography, Reynaud suggested having sound to accompany film. His Praxinoscope Theatre prospered until he was driven out of business in the early 1900s by rival motion pictures.

The ideas for creating projection and the illusion of motion were evolving as well as the idea for having sound or music accompany such shows. The next step was the development of photography.

First, still photography had to be perfected. As early as 1816, Nicephore Niepce obtained fuzzy and temporary images on metal plates. In 1839, Louis Jacques Mande Daguerre was able to make clear and permanent images on silvered copperplate.[17]

Photography continued to develop as cameras and photo-developing processes improved. In 1860, Thomas Hooman Dumont drew up plans for a motion picture camera, but the appropriate technological advances had not yet been made and his

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[16]Ceram, p. 194.

[17]Mast, p. 12.

attempt was a failure, as were others who attempted to develop the same type of device.[18]

The early attempts at motion picture photography were stills that simulated continuous action when projected with a Projecting Phenakistiscope. The phases of motion of these stills were not close enough to reproduce a smooth appearance of motion. The first man to break a single process into discrete photographic units was Eadweard Muybridge.

In 1872, the governor of California, Leland Stanford was seeking to settle an argument that he had with a friend, Fred McCrellish. Stanford and McCrellish both had read an article written by Etienne Jules Marey, a Professor of Medicine at the University of Paris. Marey described his experiments of tracing horse's movements by attaching four pens to the hooves of horses. Marey had found that sometimes all four hooves of the horse were off the ground.[19] McCrellish said this was impossible. They decided to hire the famous photographer, Eadweard Muybridge, in the hopes that he could settle the argument through photographs.

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[18]Martin Quigley, Jr., Magic Shadows, (New York: Quigley Publishing Co., 1960), p. 171.

[19]Kevin MacDonnell, Eadweard Muybridge: The Man Who Invented the Moving Picture, (Boston: Little, Brown and Co., 1972), p. 15.

Eadweard Muybridge tried to photograph a trotting horse in 1873. A picture was obtained that he claimed showed all four hooves off the ground. The quality of the picture was very poor due to a crude shutter system. This left the argument still open to debate.[20]

Stanford continued to finance Muybridge and in 1877, Muybridge set up a battery of twelve cameras in a row along a racing track. The horse would trip the shutters as he moved each string. The results were good this time. A series of photographs did show the horse to have all four hooves off the ground at one moment. Muybridge proved through his photographs, that at some point in a horse's stride all four hooves left the ground. Stanford won his argument and had spent nearly $100,000 doing it.

Muybridge improved the devices he used and in the summer of 1879 he increased his battery of cameras to twenty-four. This, along with a more sensitive film gave a better analysis of motion. On May 4, 1880, Muybridge projected for the first time moving images of animals reproduced from still photographs. The display lasted only a few seconds since the number of phase photographs were limited (as each photograph had to be taken from a separate camera). He called his device the Zoopraxiscope. The

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[20]MacDonnell, p. 16.

Zoopraxiscope was a variation of Uchatius' Projecting Phenakistiscope using phase photographs instead of drawings. According to Kevin MacDonnell, "To Muybridge belongs the honour of inventing the movie."[21]

Etienne Jules Marey became as interested in analyzing animal motion as Muybridge was. He requested Muybridge to take pictures of birds in flight. Muybridge's results were not good as he found it difficult to get the birds to trip the shutter wires! Continuous motion had been divided into distinct photographic frames but had not yet been photographed by a single camera.

In 1882, Marey developed a 'photographic gun,' which was a rifle shaped camera that shot a series of pictures upon a single glass photographic plate set into its chamber. Marey became the first to shoot motion pictures with a single camera.[22]

Still, Marey could only photograph motion for a few seconds on glass plates. In 1887 Hannibal Goodwin invented the celluloid strip and George Eastman perfected and promoted the celluloid roll film in 1888.[23] These discoveries were what Marey needed to improve his photographic gun.

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[21]Ibid., p. 26.

[22]Mast, p. 14.

[23]Thomas W. Bohn and Richard L. Stromgren, Light and Shadows, (New York: Alfred Publishing Co., 1975), p. 10.

By 1888 he succeeded in taking one hundred pictures a second with his portable camera.[24] It was now possible to shoot movies of one minute or more in length instead of three or five seconds long.

While Marey in France developed his photographic gun, in America, Thomas Edison was making significant advances toward making the motion picture dream a reality. Edison invented the Talking Phonograph in 1877.[25] Sound could now be recorded on tin cylinders and later reproduced.

Edison met Muybridge on February 25, 1888 when Muybridge was lecturing in Orange, New Jersey. Edison was impressed by the moving pictures he had seen and purchased a set of Muybridge's horse pictures. Muybridge suggested to Edison that he should combine the phonograph with his (Muybridge's) Zoopraxiscope.[26] Later Edison offered to record the voices of Edwin Booth and Lillian Russell while Muybridge made moving pictures of their gestures and expression. No synchronization of the two was mentioned and the Zoopraxiscope could only take short sequences. Muybridge thought over the matter but felt that

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[24]Ceram, p. 82.

[25]Quigley, p. 173.

[26]MacDonnell, p. 31.

the phonograph lacked the necessary volume for a large audience and he did not pursue the idea.[27] Nevertheless, Edison did conceive of the possibility of combining sound and film.

Thomas Edison set out to devise an instrument, "...which should do for the eye what the phonograph does for the ear, and that by a combination of the two all motion and sound could be recorded and reproduced simultaneously."[28] One of his first attempts at moving pictures consisted of a strip of small photographs wrapped spirally about a phonograph cylinder. He believed that everything should come from one hole. The important factor here is that Edison had the idea of making sound films from the start.

When the attempt failed using photographs wrapped around a cylinder, Edison turned the project over to his assistant, William Kennedy Laurie Dickson. With a new film base developed by George Eastman, Dickson solved the mechanical problem of moving film through the camera by means of a sprocket system. He also linked the moving pictures with the phonograph.

On October 6, 1889, upon returning from the Paris Exposition, Edison found that Dickson had completed his

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[27]MacDonnell, p. 32.

[28]W. K. L. Dickson & Antonia Dickson, History of the Kinetograph, Kinetoscope & Kinetophonograph, (New York: Albert Bunn, 1895; reprint ed., New York: Arno Press & The New York Times, 1970), p. 4.

project. Edison turned on the apparatus and observed, "...Mr. Dickson himself stepped out on the screen, raised his hat and smiled, while uttering the words of greeting, 'Good morning, Mr. Edison, glad to see you back. I hope you are satisfied with the kinetophonograph.'"[27] "What was in all probability the first actual presentation of a motion-picture film also marked the debut of the talkies!"[28]

The idea of using the illusion of motion for entertainment progressed from Kirchner's magic lantern to Edison's Kinetophonograph. The development of photography, the persistance of vision theory and the magic lantern all led to the development of the moving picture. Many showmen had music accompaniment with their magic lantern shows and the idea was applied to the moving picture. Edison added the dimension of sound to his moving picture peep shows with his device, the Kinetophonograph, which recorded the sound on a disc. Thomas Edison had begun an era of experimentation which would attempt to combine sound with motion pictures by using the sound on disc method.

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[27]Dickson, p. 19.

[28]Knight, p. 17.

CHAPTER 3

SOUND ON DISC SYSTEMS

The first public display of Edison's films was at his West Orange laboratory on May 22, 1891. One-hundred and forty-seven members of the National Federation of Women's Clubs had lunch with Mrs. Edison and were shown the Kinetoscope.[1] This was a viewing device that had a peephole that only one person could see the film at a time. It was able to show a film about fifty feet long which lasted less than one minute and had no sound accompaniment. The device which took these short silent films was the Kinetograph. The sound and film recording machine that Edison later marketed was called the Kinetophonograph. This was actually a Kinetograph and phonograph connected by mechanical means. The device to view and hear the sound films was called the Kinetophone. Ear tubes were used to hear the music (or dialogue) that was nothing more than roughly in synchronization with the film.[2]

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[1] Patrick Robertson, The Book of Firsts, (New York: Clarkson N. Potter Inc., 1974), p. 62.

[2] W. K. L. Dickson & Antonia Dickson, History of the Kinetograph, Kinetoscope & Kinetophonograph, (New York: Albert Bunn, 1895; Reprint ed., New York: Arno Press & The New York Times, 1970), p. 8.

On August 24, 1891, Edison applied for an American patent for his Kinetoscope. He neglected to pay the extra $150.00 to make foreign application. Edison had found that in the past, a patent application served only to advertise his inventions and invited imitators to copy his devices.[3] The result was that others did indeed imitate his Kinetophone in foreign countries and Edison was deprived of a small fortune. Thomas Edison, the genius that he was, made some shortsighted errors in judgement. When he applied for patents covering the phonograph for both disc and cylinder talking machines, the patent office only held up the disc patent. He was advised to modify the disc application to conform to certain patent office requirements. Edison did not make the changes as he felt that "'...the disc phonograph will never amount to anything anyway'."[4]

Edison did not regard the Kinetophone seriously. He thought it was a toy or a novelty that would be forgotten.[5] This may account somewhat for his rather lackadaisical attitude toward acquiring complete control on his Kinetoscope patents. Not everyone regarded the Kinetoscope as a

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[3] Martin Quigley, Jr., Magic Shadows, (Washington, D.C.: Georgetown University Press, 1948), p. 135.

[4] Terry Ramsaye, A Million and One Nights, (New York: Simon & Shuster, 1926; Reprint ed., 1964), p. 55.

[5] Richard Griffith & Arthur Mayer, The Movies, (New York: Simon & Shuster, 1970), p. 1.

toy. An article in Harpers Weekly of June 13, 1891 carried a two page story about Edison's invention and regarded it with at least some concern: "'To say that the Kinetograph can be nothing more than a marvelous toy would be nasty'."[6]

Between 1889 and 1894 Edison conducted projection experiments, but he did not think screen projection would be commercially successful. He felt that a few machines would exhaust the world demand.[7] He gave up his projection experiments for a few years. Later, Edison re-initiated them but it was too late. The Lumiere brothers in France had beaten him to the goal as they perfected their camera and projector which they called the Cinematographe. They were the first to exhibit projected films before a paying public in Paris on December 28, 1895.[8] The pictures were accompanied by commentary and a piano for background music.[9] Thus, the first public presentation of projected pictures included a background of music.

In 1899, Kinetoscope Arcades opened up around the country. They continued to grow in number as people were

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[6]Quigley, p. 135.

[7]Ibid., p. 134.

[8]Thomas Bohn & Richard L. Stromgren, Light and Shadows, (Port Washington, New York: Alfred Publishing Co., Inc., 1975), p. 10.

[9]Harry M. Geduld, The Birth of the Talkies, (Bloomington, Indiana: Indiana University Press, 1975), p. 28.

exposed to this new form of entertainment. In 1894 and 1895 there was a great boom in Kinetoscope parlors and there was at least one in every large city in the country.[10]

But what about the Kinetophone? Edison had been releasing press reports since 1888 forcasting the completion of a machine that would successfully combine a synchronized phonograph with the motion picture.[11] The Kinetophone's synchronization was not accurate and there was no public demand for it. Yet Edison still kept on trying to improve the synchronization of it. Agents who leased Kinetoscopes from Edison were led to expect that the Kinetophone would soon replace them. Many agents decided to sit tight and wait to see if the Kinetophone would develop significant improvements before investing more in the silent Kinetoscopes. Edison's continued experiments proved to be unsuccessful. By December of 1894, efforts to achieve synchronization were given up. Edison settled for nonsynchronized accompaniment to the moving pictures.[12] At this time, Edison had made over 1,000 Kinetoscopes, but only 45 Kinetophones.[13]

William Kennedy Laurie Dickson, Edison's assistant and a key figure in the development of all of Edison's

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[10]Gordon Hendricks, The Kinetoscope, (New York: Theodore Daus' Sons, Inc., 1966), p. 64-69.

[11]Geduld, p. 21.

[12]Ibid., p. 21-22.

[13]Hendricks, p. 125.

motion picture devices, was very optimistic about the Kinetophone. He had written an article in 1894 concerning the Kinetophonograph and described it as nothing less than a success.

> Nothing more vivid or more natural could be imagined than these breathing, audible forms, with their tricks of familiar gesture and speech. The inconceivable swiftness of the photographic successions, and the exquisite synchronism of the phonographic attachment, have removed the last trace of automatic action, and the illusion is complete.[14]

Dickson later claimed that synchronized pictures, with the phonograph, were projected screen size in the fall of 1889. Thomas Edison denied this.[15]

As we shall examine, historically, reports of the success and failures in combining the phonograph with motion pictures differed. Many claims were overstated or prematurely optimistic and had no concrete evidence upon which to be substantiated.

Edison reconsidered projection of motion pictures. In March of 1896, he viewed a projecting machine developed by C. Francis Jenkins. Edison was impressed and the two signed a contract for the manufacture of the machine under the name of the Edison Vitascope. He was abandoning the Edison Kinetoscope.[16]

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[14]W. K. L. Dickson & Antonia Dickson, "Edison's Invention of the Kinetophonograph," Century Magazine 48 (n.s. 26) (June 1894): p. 210-212.

[15]Quigley, p. 134.

[16]Homer Croy, "The Infant Prodigy of Our Industries," Harpers Magazine 135 (August 1917): p. 356-357.

Again Edison geared his efforts toward synchronizing sound with the motion pictures. Only this time the pictures were projected. In the past Edison's pictures were viewed only through his peep-hole machines.

The New York Herald, on May 3, 1896, reported that:

> Mr. Edison is not quite satisfied yet. He wants now to improve the phonograph so that it will record double the amount of sound it does at present, and he hopes then to combine this improved phonograph with the Vitascope so as to make it possible for an audience to witness a photographic reproduction of an opera or a play--to see the movements of the actors and hear their voices as plainly as though they were witnessing the original production itself.[17]

It was quite a while before his dream became reality, but again, the idea of combining sound with motion pictures was being attempted. But this time Edison had a second problem to cope with besides synchronization. He also needed adequate amplification so that the entire audience could hear. The comment in the New York Herald referring to Edison's desire to "record double the amount of sound is believed to have meant that Edison wanted to improve amplification of his phonograph."[18]

By the end of the nineteenth century, there were numerous Kinetoscope Arcades (some featured Kinetophones), Edison was distributing his Vitascope projection machines, the problem of synchronizing sound with motion pictures was still trying to be solved and a new problem of ampli-

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[17]Geduld, p. 28.

[18]Ibid., p. 29.

fication had arisen with the advent of projected pictures. Thomas Edison would re-experiment with combining his phonograph with motion pictures a little over a decade later, but in the end he would not be able to solve these perplexing problems.

Thomas Edison was not alone in his quest to synchronize sound with motion pictures. Many inventors ventured out and developed similar devices only to encounter much of the same difficulties Edison had met. George Demeny did some work in trying to combine the phonograph with pictures. He was a pupil of Etienne Jules Marey and later became Marey's assistant in analyzing animal movement. Demeny became more interested in the profits to be gained from motion pictures in comparison to Marey's purely scientific interests. Therefore, Demeny left Marey in 1893 to try to exploit what he had learned.

Earlier, in 1891, Demeny worked on a project with Professor H. Manchelle, a speech pathologist, of the French National Institute for Deaf Mutes. Demeny created a version of Marey's photographic gun camera to take close-up pictures of people talking so that deaf mutes could use pictures to learn how to speak. He also constructed a device called the Phonoscope to view these pictures. The Phonoscope consisted of a large oblong box on a tripod. The user peered into the eyepiece, turned the handle which revolved a disc on which the pictures showing someone speaking a certain word were attached.

The action could be watched frame by frame or sped up for a continuous motion effect by turning the handle faster.[19]

Demeny thought it would be profitable to join the Phonoscope and phonograph. The invention was not a commercial success. "Either the deaf and their doctors were not impressed by the machine or else it was not as perfect as Demeny claimed."[20]

William Friese-Greene, a British pioneer in cinematography, attempted to combine a phonograph recording with pictures in 1887. He bought a phonograph and filmed a man mouthing the words of a song with a device that he had patented (it also projected pictures). When he played the recordings back, he found the results were very poor. Synchronization was not achieved and the projection method was imperfect. However, from this experiment, Greene realized the possibilities of such an invention.[21]

Friese-Greene then wrote to Thomas Edison in June of 1889. He provided a careful description of his experiment including details of his camera and projector. He suggested that he and Edison combine to perfect synchronized sound movies. The letter was formally acknowledged by one of Edison's assistants or secretaries and Friese-Greene was asked to forward drawings of his apparatus. He did this

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[19]Ibid., p. 23-24.

[20]Ibid., p. 24.

[21]Ibid., p. 24.

and this was the last he was to hear of the matter. He was not acknowledged that Edison received the drawings. Later, in 1910, Edison was to state that he had never seen Friese-Greene's drawings.[22]

Edison may have not received Friesse-Greene's letter. Possibly one of Edison's employees may have kept them. Regardless, William Friese-Greene may have given Thomas Edison some ideas. Earlier it was mentioned that Edison had neglected to get his Kinetoscope a foreign patent. Friese-Greene's biographer wondered why Thomas Edison did not take out a patent in England:

> Was that just an oversight, or did he, knowing of Friese-Greene's patent, realize it would not be possible to get a British patent? The mechanism of the Kinetoscope in 1891 would not have stood the test of novelty in the British Patent Office. It would have infringed part of Friese-Greene's patent.[23]

Alexander Black also used the idea of combining sound with projection in 1894. He prepared a long series of photographic slides showing the adventures of a girl reporter. Although there were no motion pictures, he hoped to convey the impression of dramatic action as he narrated the slides that were projected at the rate of four per minute. Music was specially created for the show.[24]

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[22]Ibid., p. 25.

[23]Ray Allister, Friese-Greene: Close-Up of an Inventor, (London: Marsland Publications, 1948), p. 53.

[24]Geduld, p. 26.

Black's picture plays did not last long. He restricted his showings to sophisticated upper or middle class patrons who attended educational lectures. This coupled with his waning interest in the picture play made its demise inevitable. One important fact remains, he did attempt to combine sound and pictures with the idea of motion. The Paris Exposition of 1900 displayed various sound on disc motion picture systems. Recitations by famous actors, songs and selections from operas were shown. They had only relative success.[25] One such exposition was by Clement-Maurice Gratioulet who showed talking films of Sarah Bernhardt and Benoit Coquelin at his Phono-Cinema-Theatre. The display also showed a severe difficulty in synchronizing the film and record.[26]

Thus far all attempts to combine the phonograph and the motion picture had failed. The efforts made to link the phonograph with film fall into three categories.[27] The first category is when the film is made first and then a phonograph record is provided to accompany it.

Films that were made to illustrate previously recorded phonograph records make up the second category. An actor

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[25]Maurice Bardeche & Robert Brasillach, History of the Motion Pictures, (New York: W. W. Norton & Co., 1938), p. 27.

[26]Steven Scheuer, The Movie Book, (Chicago: Ridge Press and Playboy Press, 1974), p. 36.

[27]Geduld, p. 43.

or singer usually mimed to the sound of the record. Before 1910, recordings had to be made with the performer as close to the microphone as possible. This meant that, in order to get a good sound recording, the microphone had to be in the film.

The third category is films that were made simultaneously with the recording of the sound. Here again, before 1910 there were severe problems with the microphones having to be in the picture since they were insensitive more than a few feet away. In all of these categories, problems of synchronization, amplification and brevity of recording discs in relation to standard movie lengths hindered success.

The problem of synchronization was felt at two stages: in the recording stage and in the reproducing stage. Three various methods were used to try to synchronize the projected pictures with the phonograph recordings.

The unitary method of combining the phonograph and projector used synchronous electric motors for both apparatus that were driven by the same power source. A main shaft connected the two machines. In the film studio the shaft could be rather short, but in a theatre it was often very long. It had to connect the projector, which was placed in a booth behind the audience, with the phonograph, which was either behind or alongside the screen so the sound would seem to be natural and come from the screen.

The picture and sound would have to start off at exactly the same time in order for them to be in synchronization.

If the timing was thrown off at any time, there needed to be a means to slow down or speed up one of the machines. Sometimes a clutch mechanism was used to disengage the projector from the main shaft and the projector could be hand-cranked to adjust the speed correctly. This method proved to work, but not with much regularity. Also, problems arose when there was a defect in the record or the film had to be spliced.

Secondly, the dependent method was one where one machine was controlled by the other. The phonograph motor usually controlled the speed of the projector. If the reverse was used, then any change of projector speed would change the pitch of the recording. A clutch adjustment that could be disengaged was used to allow an operator to restore synchronization by hand-cranking the projector.

The dial-regulated method or operator-regulated method had no connections between the machines. Dials gave readings of the speed of each machine in the dial-regulated method. The operator could watch the dials to check the speed of each machine. If one was off speed, the operator could make hand-cranked adjustments. The operator-adjusted method did not rely on dials. Instead the operator listened to the sound and adjusted the speed of the projector accordingly.

None of these methods was perfect. Occasionally synchronization was achieved, but not with any consistancy.

Yet the inventors still made exaggerated boasts of having achieved perfection.[28]

George W. Brown synchronized pictures and the phonograph with a device he patented on February 9, 1897. The pictures were not projected as the device was similar to Edison's Kinetoscope viewing machine. The phonograph speed was automatically adjusted to that of the pictures. The future of the device was doomed, though, as the peep show machine was being replaced by projecting devices.[29]

Another inventor, Auguste Baron took out a patent on April 16, 1896 for a device that would record and reproduce pictures and sound. On April 4, 1898 he took out another patent to perfect his machine. This combination of a phonograph and "chronophotographic apparatus" (projector) had an electrical device to control the projector's motor which was linked to the motor of the phonograph.[30]

Baron was not able to find an inexpensive way to duplicate the wax cylinders he used to record the sound on. This made it impossible to duplicate the same sound films. His financial condition deteriorated and he eventually went blind thus putting his efforts to a sudden end.

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[28]Geduld, p. 44-45.

[29]Ibid., p. 47.

[30]Ibid., p. 49.

An obscure attempt to combine sound and film occurred in 1900, when a French inventor, Gariel, patented a system for combining the phonograph and a cinematographic device that would record and reproduce sound films. Although Gariel patented his device, there is no evidence that it was ever built.[31] Evidently it was just another idea that was not practical.

A rather elaborate attempt at combining sound and film was created through the combined efforts of C. F. Dussaud, L. A. Berthon, and G. F. Jaubert. Dussaud found a means of clearly capturing various sounds that might be heard in a single location (such as orchestra music, background noises and people talking). He combined simultaneous recordings that were made by at least twelve phonographs. The apparatus was called the Macrophonograph.

Dussaud then worked with Berthon and Jaubert to combine the Macrophonograph with the cinematograph. On January 1, 1898 they patented a device called the Cinemacrophonograph. It was later renamed the Phonorama and shown in exhibit at the Paris Exposition of 1900.

Felix Mesquisch was employed to shoot the films for the exhibit. He made three films: one of maritime life in Le Havre and Marseilles, another of Paris street scenes and the last of a singer with an orchestra accompaniment. In making the films, a certain degree of synchronization was achieved by having the same electrically powered shaft

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[31]Geduld, p. 51.

drive the movie apparatus and the twelve phonographs. The films were then colored by hand at the Gaumont studios.[32]

The Phonorama exhibit at the Paris Exposition was actually a presentation of sound films in color. Members of the audience watched the films while listening through earphones to the synchronized sound coming from twelve phonographs. The Phonorama was a remarkable accomplishment for that era.

An even more impressive device was the Phono-Cinema-Theatre of Clement-Maurice Gratioulet and Henri Lioret. Gratioulet was a photographer who became interested in making sound films of stage personalities while photographing them. Lioret was Gratioulet's associate who patented in the 1890 s a cylinder talking machine called the Lioretographe. The amplification and recording qualities of this device were said to be superior to Thomas Edison's phonograph.

The Phono-Cinema-Theatre used the Lioretographe sound system and was one of the first known systems which used the operator adjusted method of synchronization. There was no mechanical connection between the cinematograph and the Lioretographe. The projectionist would listen to the Lioretographe, which was located in the orchestra pit, by means of a telephone. He regulated the speed of the hand cranked projector (film) to the sounds coming from the Lioretographe.

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[32]Ibid., p. 52.

This device, along with many others that have been discussed, was presented at the Paris Exposition of 1900. The program included such personalities as Sarah Bernhardt in the duel scene from Hamlet, Coquelin the Elder in scenes from Cyrano de Bergerac and Moliere's Les Precieuses Ridicules, Victor Maurel in Falstaff and Don Juan, and a host of many other actors, opera stars, singers and vaudeville celebrities. The only other bill that would approach this list of celebrities in sound films would be the one that Warner Brothers offered twenty-six years later as they introduced their Vitaphone sound system to the public.

The Phono-Cinema-Theatre received excellent reviews. People were impressed with its synchronization and with the vast number of stars that were featured. The show went on tour during the winter of 1900-1901 to Sweden, Germany, Austria, Switzerland and Spain. It proved successful and even met attempts of sabotage when the program moved back to Paris.

The Phono-Cinema-Theatre lasted no more than three years. The audience marveled at the array of stars the show presented, but when the novelty of seeing the various stars wore off, the audience went back to see them in person rather than on film. Also, contrary to the claims of promotors and reviewers, the sound was harsh, strident and only approximately synchronized.[33]

French filmmaker Leon Gaumont displayed a movie

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[33]Geduld, p. 52-55.

projector mechanically connected to a phonograph at the Paris Exposition of 1900. Gaumont's device would prove to be relatively successful as he would make many improvements with it during the next decade.

In 1901, Gaumont received a French patent for his method of electrically driving a projector from a phonograph. The device did not prove to be perfect, but it did serve to demonstrate that synchronization of sound and film might be achieved with various improvements in the mechanisms.[34]

Gaumont was granted another patent on November 18, 1902 when he developed a clutch device for correcting faulty synchronization.[35] In 1902, Gaumont put the Chronophone on the market. This was the name for his sound and film system. His sound films were known as Phono-Scenes.[36]

A microphone and telephone connections from the phonograph was introduced in 1903. The phonograph was located beside the projector and the telephone lines connected it to loudspeakers, which were placed behind the screen. To add realism, Gaumont's system required the loudspeakers to be moved by hand to follow the action on the screen. This proved to be quite a lot of work in the long run and, considering the sound quality of the system, was unnecessary.

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[34]Ibid., p. 56.

[35]Geduld, p. 57.

[36]Bardeche, p. 26.

An alternative system was created by Gaumont using a patent granted on February 16, 1904. A projector controlled the speed of the phonograph to achieve synchronization.[37] This was a questionable system because if you changed the speed of the disc, the sound would be off its normal speed and appear distorted.

Early in 1905 Gaumont exhibited the Chronophone in various music halls. Spectators would be able to see and hear various sound films including one in which they saw a blacksmith working while hearing him sing 'The Village Blacksmith.' A writer had said that the two senses of sight and hearing were stimulated in a very agreeable manner.[38]

Gaumont had realized that in order for his sound films to be a commercial success, they needed to have a sound accompaniment equal in length to the films. One disc would not provide sufficient length for this. He also realized that to successfully record simultaneously sound films and to reproduce these pictures in synchronization, other factors must be met besides the length of the disc being adequate. The synchronization between the projector and the phonograph must be absolute and without deviation. Small differences in synchronization would eventually lead into larger and more noticeable differences between

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[37]"Moving and Talking Pictures," Scientific American, 108 (January 18, 1913): p. 79.

[38]Samuel McKenchnie, Popular Entertainments Through the Ages, (New York: Benjamin Blom, Inc. 1969), p. 193.

the picture and the sound. Improvement also needed to be made so sounds could be picked up at a distance so the pictures and sound could be recorded at the same time without the phonograph being in the picture. Gaumont also knew that sufficient amplification of the sound would be necessary for a large audience to hear and understand the sound film.[39]

In 1907 Gaumont made yet another improvement for both of his systems. He patented a gearing device that connected the phonograph and projector which operated a dial that clearly indicated when the machines were running in synchronization. He also provided a way to rapidly switch from one record to the next by having an electrical circuit that closed when the needle of the phonograph reached the end of a record and a second phonograph would then start. A long sound accompaniment could now be used for the average one-reel film.[40]

Gaumont was not satisfied with his amplification system and he was able to increase the volume of sound from his phonograph by using several loudspeakers and intensified the sound waves by means of compressed air. The method was adopted from the Auxetophone of C. A. Parsons.[41] He never did solve the problems of amplification.

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[39]"The Gaumont Speaking Kinematograph Films," Scientific American, 73 (June 22, 1912): p. 395.

[40]Geduld, p. 57.

[41]"The Gaumont Speaking Cinematograph," Scientific American Supplement, 72 (July 29, 1911): p. 80.

Before 1910, Gaumont had to first record the pictures and then have the performer mouth the sound and record on the phonograph. Otherwise the microphones would be in the pictures. They were not sensitive enough to pick up sound at any distance. Many times synchronization was a matter of sheer luck using this method. But in 1910, Gaumont improved the Chronophone so the recording horn could be placed out of the camera's view. The pictures and its sound accompaniment could then be recorded at the same time.[42]

Leon Gaumont toured Europe with his program and even added color to his films. His sound on disc film experiments were interrupted by World War I. He would later enter his final phase of his sound on disc work in the early 1920s. In 1922 he ended his work by shooting two short sound films. Gaumont would later promote a sound on film sound system for some colleagues of his.

Overall, Gaumont's Chronophone did not have perfect synchronization. Even when it was synchronized, the sound quality was crude and it did not have sufficient amplification. And just as important:

> ...compared with the increasing sophistication of the story material in silent cinema, the subject matter of even the most elaborate of Gaumont's sound films seemed ludicrously primitive to European and American audiences in 1913.[43]

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[42]Geduld, p. 58.

[43]Ibid., p. 59.

During the first decade opening the twentieth century there were many other inventors who tried to perfect synchronizing pictures with sound. In Germany, Oskar Messter, a producer of silent films, began to make sound films using a disc system. In 1905 he patented an operator adjusted disc system. These patents were improved in 1906 and 1909.

Messter went into partnership with Alfred Duskes. Duskes constructed a unitary disc system using synchronized motors. Their hope was that the new system would avoid the need for operator adjustments. There were problems with the amplification as in all other sound systems that were developed. This coupled with a waning public interest in sound films led Messter to give up his experiments after 1911. Messter and Duskes later became a subsidiary of the famous UFA film production company.[44]

The Cameraphone, developed by E. E. Norton, was the first American disc system to become a commercial success in the twentieth century. In 1908 he leased the Cameraphone to exhibitors. The demand was so great that the factory that made the units was producing them at full capacity.

An article in Moving Picture World on April 25, 1908 (pages 369-70) described the Cameraphone as a combination of projector and graphophone. Both were electrically controlled by an operator. The devices were perfectly synchronized, according to the article, and if the pictures

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[44]Ibid., p. 60-61.

were out of synchronization, the operator could control both so as to bring the pictures and sound to coincide with one another.[45]

The Cameraphone's synchronization and sound quality ranged from nonexistent to impressive.[46] The phonograph had a deep metallic quality which sometimes proved distracting. Later, articles in Moving Picture World had reservations about the Cameraphone's "perfect" synchronization about which it had earlier raved.

L. P. Valiquet of Newark, New Jersey combined the mutoscope projector with a phonograph to produce sound pictures in 1908.[47] This device, called the Photophone, never really amounted to anything. It had difficulties of amplification and its sound quality must have left something to be desired. The pictures were projected through the horn of the instrument. The horn of the phonograph is what the sound was emitted from. Therefore, to put a large hole at the central point of the emission of sound would certainly change the quality.

In 1909, Capt. Couade created a motion picture mechanism that used the dependent method. The phonograph electrically controlled the projector's speed so they

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[45]Geduld, p. 63-64.

[46]Ibid., p. 64.

[47]"Combined Mutoscope and Talking Machine," Scientific American 98 (April 25, 1908): p. 292.

were exactly the same. The device did not become well known. Again we find that early reports of the device were optimistic: "Capt. Couade seems to have solved the problem of working the two machines in harmony."[48]

Thomas Edison began to resume his experiments with sound films in 1911. His new system, the Cinephonograph met mixed feelings. Edison announced that the problems of synchronization were either solved or near solution. Film columnist, Robert Grau, who had viewed an Edison Cinephonograph presentation, commented, "Although perfection has not yet been achieved, no great wrench of the imagination is necessary, in order to predict that another year or two at most will witness the attainment of absolute synchronism."[49]

The Cinephonograph could only play one five-minute record. The average film story ran twenty to thirty minutes, so this limited the device as to the type of subjects and stories that could be filmed.

Edison had problems with recording sound for films because of insensitive microphones. He, like others, could record in synchronization if he let the microphone

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[48] "Moving Pictures that Sing and Talk," Scientific American, 100 (January 2, 1909): p. 5.

[49] Robert Grau, "The 'Talking' Picture and the Drama," Scientific American, 105 (August 12, 1911): p. 155-156.

be in the picture. Otherwise, as mentioned earlier, film-makers shot the picture first then added the sound by having actors or singers say the words while viewing the pictures. In 1913, Edison used improved microphones so that the phonograph could record a voice with the microphone out of range.[50]

Since the Cinephonograph had discrepancies, Edison began experimenting again. He developed a modified system he called the Kinetophone, named after his earlier invention. On February 17, 1913 Edison gave his first public exhibition of his new Kinetophone.[51] Edison's talking pictures were "perfectly life-like, and the speaker's voice reached the remotest parts of the theatre."[52]

The Kinetophone was well received by some. They foresaw many uses of such a device besides entertainment. Edison himself also foresaw many possibilities of its use such as, to record historical figures and events, for training people in various fields, for use in schools and in churches. An article from Outlook magazine commented on the worth of such a device, "The value of the kinetophone is too obvious to be emphasized or discussed. What would we not give for such a record of the Gettysburg Address!"[53]

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[50]"Talking Movies," Outlook, 103 (March 8, 1913): p. 517.

[51]Ibid., p. 517.

[52]L. Clapp, "Moving Picture Shows," Education 33 (June 1913): p. 624.

[53]"Talking Movies," Outlook, 103 (March 8, 1913): p. 517.

The sound of the Kinetophone was recorded on soft wax cylinders. From the master, other copies were made. The system itself was designed so that the phonograph controlled the speed of the projector.[54]

Thomas Edison expected his dream of perfectly synchronized sound films to become a reality within a short period of time. His hopes were quickly smashed when his system failed in many commercial showings. His system worked well in his laboratories and in closely controlled studio showings, but when the system was moved into theatres, unexpected imperfections developed. In several theatres the Kinetophone lost synchronization or broke down completely. Audiences hissed Edison's movies off the screen. Persons who had booked Kinetophone programs terminated their contracts.[55]

Thomas Edison became frustrated. He no longer considered his device to be worthy of further improvement. He dropped all future experimentation with sound films. Edison even ridiculed efforts of others who continued experimentation as his attitude became harsh and bitter. This was one of the rare times that Thomas Edison had failed.

Overall, we have seen that these early inventors had met a great many obstacles in trying to perfect the sound on disc systems to accompany films. The first devices

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[54]Geduld, p. 66.

[55]Geduld, p. 69.

were the peep-show apparatus which used a phonograph that had either ear tubes or a horn speaker so the viewer could hear. These machines had severe synchronization problems.

Once the projected picture phased out the peep show, inventors had the problem of amplification along with synchronization. Now large audiences viewed the films and the sound needed to be amplified loud enough for all to hear.

In the early 1900s, various devices were equipped with ways to try to keep the sound and pictures in synchronization. Clutch mechanisms were developed to disengage the projector which would then be hand cranked to adjust the speed to that of the phonograph. The two machines were often connected mechanically by a long shaft. This sometimes was very long and at times became disconnected and generally it was hard to keep the phonograph, located in the front of the theatre, in synchronization with the projector in the rear.

Later, electrical means of synchronization was developed. This method, which usually had the phonograph controlling the speed of the projector, was a bit better than the mechanical shaft connectors. Dial-regulated methods were also devised which improved the synchronization, but it was still far from perfect. Many times the projector and phonograph would become hopelessly out of synchronization during a showing at a theatre.

It must be kept in mind that the synchronization problem had to be dealt with at two stages; first in the recording stage and then in the reproduction stage. Reproduction could only have a chance of being in synchronization if the recording of the pictures and sound were made synchronized. Much of the time it was a game of chance as the pictures had to be made first, then projected back and the performers would then record the sound portion. This was the only way to record sound films without getting the microphone into the picture.

Then when more sensitive microphones were developed around 1910, films were able to be shot in close synchronization as the sound could be recorded at the same time the film was being shot. Now reproduction of sound films were improved, but they still encountered many difficulties when shown before audiences in theatres. Synchronization was still far from perfect.

The amplification problem was never solved satisfactorially. The quality of the phonograph's reproduction was another thing that left something to be desired. The tones were not reproduced truely and this tarnished the reality of the presentation.

Many of the storylines used for sound pictures were rather poor compared to that of the silent films, which were becoming more sophisticated. The audience could tell the difference. The time limitations of the disc records affected this, as the lengths of stories were limited.

Interest in sound films dwindled after 1913. The promises of perfectly synchronized sound films had been around a long time. Many gave up faith in the ability to get perfect synchronization. There were many people who viewed sound films as a novelty and this novelty at this time was beginning to wear off. World War I helped to divert efforts in sound films to complete the waning interest in them.

The silent film was still dominant. One must keep in mind that even though interest in synchronizing sound films faded, there was still the demand for sound accompaniment for the silent films. Actually, silent films were never really silent. As early as 1895, filmmakers began to think about the uses of music as accompaniment to movies.[56] 'Silent' films were customarily accompanied by one or more of the following: sound effects; music played by live performers; live singers, speakers or actors; and phonographs. In other words, sound accompaniment has been an integral part of film from its conception. Sound has been used to provide mood for the story, transitions within the story, to verbally tell a story as well as to add reality to the cinema.

There would be a brief resurgence of experimentation with sound disc systems, but the breakthrough for perfect synchronization would occur via the sound on film process. Amplification problems would be solved also in the 1920s.

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[56] Mark Evans, Soundtrack: The Music of the Movies, (New York: Hopkins & Blake Publishers, 1975): p. 2.

Even though the sound on film system would prove to be the most stable method of synchronization, it would take Warner Brother's Vitaphone sound on disc system to revitalize audience interest in sound films in 1926.

CHAPTER 4

SOUND ON FILM SYSTEMS AND THE ADVENT OF SOUND

The story of photographing sound on film dates back to the late nineteenth century. In 1880, Charles Fritts became the first to devise a method to recreate sounds that were photographically recorded.[1] Fritts' system recreated sound that was photographed by using a selenium cell. The selenium cell was an electrical resistor whose conductivity varied with a variation of light intensity. Therefore, by having a light shining through a strip of film, which had sound photographically recorded on it, the selenium cell would pick up a variation of light in correspondence to the recorded light and dark areas on the film. The selenium cell would allow more current to flow with increased light intensity. The reverse would also be true.

Fritts' method of recording sound onto the film consisted of a tiny mirror attached to the diaphragm of the microphone. A steady beam of light from an electric lamp was focused upon the mirror. The diaphragm vibrated in response to sound waves which the microphone picked up.

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[1]Harry M. Geduld, The Birth of the Talkies, (Bloomington, Indiana: Indiana University Press, 1975): p. 75.

The mirror would vibrate as the diaphragm did and reflect the light beam through tiny slits and onto the film to produce a photographic record of the sound.

The photographing of sound waves had been done before, but Fritts was the first to find a means of reproducing these recorded sounds. On October 22, 1880 Charles Fritts applied for a United States patent for his invention. The patent was not granted until 1916, a number of years after his death.[2] Fritts did not market his device. His ideas did, however, spur other inventors to experiment with the sound on film process.

Around 1900, a German inventor, Ernest Walter Ruhmer made the first speaking film with his invention called the Photographophone. He was successful in photographically recording and reproducing sound on film, although he did not have accompanying visual images.[3]

Ruhmer used the currents from a microphone to produce variations in the intensity of a light ray issued by an arc lamp. The light ray was concentrated onto the under-developed film which moved at a constant speed. The film was developed and thus the sound became recorded on the film.

To reproduce the photographed sounds a beam of light was passed through the recorded film strip onto a selenium cell which was sensitive to the light variations. The

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[2] Ibid., p. 75.

[3] "Films that Talk," Literary Digest, 71 (December 3, 1921): p. 20.

varied current operated a telephone earpiece to hear the sounds.[4]

The Photographophone was not able to produce talking pictures as it had some serious limitations. Its carbon microphone was extremely insensitive and would not adequately pick up sound. Also, the arc lamp produced fluctuations that created unwanted noises. Finally, the selenium cell generated very faint sound currents. These could hardly be heard through the telephone earpiece.[5]

Ruhmer's device was similar to Fritts' method of recording and reproducing sound. Although Ruhmer's experiments had not met overall success, his research was heading in the right direction.

There were others who also believed in the possibility that the sound on film system might prove superior to the sound on disc system. A British physicist, William Du Bois Duddell, conducted experiments in recording sounds by means of light. He was, however, unable to improve upon Fritts' ideas.[6]

In 1906 a Frenchman, Eugene Lauste, took out an English patent for his sound on film invention called the Photocinematophone. The device was another version of earlier attempts at photographing sound on film although it

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[4] Geduld, p. 76.

[5] Ibid., p. 75.

[6] Ibid., p. 75.

utilized a split system in which sound was recorded on one film and pictures on another.[7] The Photocinematophone received little notoriety as, at this time, the sound on disc system was viewed as the answer to the dream of producing sound films.

The Photocinematophone was not the first venture of Lauste's in cinematography. Actually, at the time of this invention Lauste was already a pioneer inventor in motion pictures. He demonstrated his ability for invention and his interest in pictures at the very early age of ten. At that time, in 1867, he made a variation of the Zoetrope and projected pictures which were on a strip.[8]

Twenty years later Lauste became a mechanical assistant to William Kennedy Laurie Dickson at Thomas Edison's laboratory in Orange, New Jersey. He assisted Dickson in many areas of research, including that which led to the invention of the Kinetoscope. In 1894 Lauste aided Major Woodville Lantham in the construction of the Eidoloscope, which was the first projector to use wide gauge film. Lauste returned to France in 1896 to direct the laboratory of the American Biograph Company near Paris.[9]

In 1910, Lauste improved his system significantly with the use of a string galvanometer. His invention used

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[7] A. R. Fulton, Motion Pictures, (Norman, Oklahoma: University of Oklahoma Press, 1968); p. 154.

[8] Geduld, p. 76.

[9] Ibid., p. 77.

sensitive microphones which modulated the current.

> This modulated current is brought to the fine wires of a string galvanometer--a device consisting of five wires placed in a powerful magnetic field, so that the slightest current flowing through the wires causes the latter to warp. A powerful beam of light is projected through the galvanometer strings and on to the sensitized motion picture film. Then, according to how much or how little the wires are warped by the current flowing through them, more or less shadow falls on the film...[10]

The variations of light are then photographically recorded.

The modern day sound-on-film process can be traced back to Eugene Lauste's first successful optical soundtrack in 1910.[11] Lauste's name stands out among the sound-on-film inventors for these improvements. His modified invention now employed more sensitive microphones and a more sensitive method of recording the sound. Also, Lauste was the first to make a motion picture with the photographed sound track and the visual images all on the same strip of film.[12]

Unfortunately, Lauste's invention lacked sufficient amplification. He never was able to solve this problem with the Photocinematophone. Lauste was unsuccessful in his attempt to interest the film industry because of the amplification problem and because the Gaumont and Edison sound on disc systems were thought to be near perfection.

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[10]"Pictures That Talk," Scientific American, 128 (January, 1923): p. 19.

[11]Steven Scheuer, The Movie Book, (Chicago, Illinois: Ridge Press and Playboy Press, 1974): p. 36.

[12]Geduld, p. 76.

Lauste continued to try to solve the amplification problem until his attempts were interrupted by World War I and a lack of money to carry on his research.

There were others who attempted experiments with sound on film systems. Many developed what appeared to be promising systems, but in time their ideas and inventions drifted into oblivion. Webb's Electrical Pictures was a venture which proved to be a short-lived enterprise. In 1914 Mr. Webb developed a sound on film system similar to Lauste's Phonocinematophone. Little else is known about Webb's system.[13]

In 1916, W. F. Alder found means of photographically recording sound. He utilized the audion amplifier so as to be heard throughout an auditorium.[14] The device received little attention and never was commercialized. A British inventor, H. Grindell-Matthews, developed a single film system (a system of recording the sound and pictures on a single film strip) in 1921.[15] Matthews' system was demonstrated but his also was never commercially exploited.

Among the rather unknown inventors who contributed to the development of sound on film was Joseph Tykocinski-Tykociner. Tykociner visited the United States in 1896 as a student. He attempted to improve phonograph

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[13]Ibid., p. 78.

[14]David Williams, "Motion Pictures that Really Talk," Illustrated World, 26 (December, 1916): p. 551.

[15]"Films that Talk," Literacy Digest, 71 (December 3, 1921): p. 21.

recordings by using photographic film in place of wax cylinders.[16] He did not get very far but he had other ideas.

When viewing silent pictures, he realized how unnatural the absence of sound was. Tykociner set out to devise a way of combining pictures with photographically recorded sound. Again, he did not meet immediate success and could not continue his experiments due to a lack of finances.

Twenty years later Tykociner would get the backing he needed for his research. In 1921, he received an appointment at the University of Illinois as a research professor of electrical engineering.

Tykociner worked under department chairman, Ellery Paine. When asked by Paine what area of research he would pursue, Tykociner indicated that he wanted to experiment with recording sound on film. Paine was a bit surprised.

> Most of the Department's research was in power engineering so Tykociner's idea was in an area unfamiliar to Paine. 'Can you prove it will work?' he asked. The question annoyed Tykociner. 'Prove it? That's why you do research.'[17]

A demonstration was given to a committee of engineering faculty and they responded favorably to Tykociner's proposed research. Tykociner proceeded with his research and had to improvise with equipment. Tykociner borrowed vacuum tubes from the student radio station and a motion

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[16]Geduld, p. 80.

[17]Ibid., p. 82.

picture projector from the College of Agriculture. These tubes had to be returned quite often when the station went on the air and when the projector was in use.

Besides a few inconveniences such as these, Tykociner had met with some good luck. Jacob Kuntz, a physicist, had a laboratory down the hall from Tykociner's laboratory. The two became acquainted with each other. Tykociner soon realized that one of Kuntz's inventions could help his work. Kuntz had developed the photoelectric cell in 1913. Tykociner used a photoelectric cell instead of a selenium cell since the photoelectric cell proved to be superior.[18]

His first talking picture was completed in October of 1921.[19] The sound track ran down the center of the film and there were no pictures. Later he combined pictures and sound and shifted the sound track to the side of the film.

The first public demonstration of Tykociner's system was at the University of Illinois. The first film featured Mrs. Tykociner and the second featured Ellery Paine delivering Lincoln's Gettysburg Address. Everyone viewing was impressed but many of the professors in the audience looked at his device as a mere toy and not necessarily a scientific achievement.[20]

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[18]Ibid., p. 82-83.

[19]Tom Shales and others, The American Film Heritage, (Washington, D. C.: Acropolis Books Ltd., 1972): p. 75.

[20]Geduld, p. 84.

The University of Illinois refused to further fund Tykociner's research unless he assign the university all patent rights. Tykociner rejected that proposal and turned to the film industry to find parties interested in his invention. He was turned down by everyone he approached, including General Electric. Dejected, Tykociner went back to Urbana, Illinois and gave up his efforts to sell his system. His system, if adapted and marketed properly using popular talent, may have won the acceptance of audiences close to five years before The Jazz Singer revolutionized the film industry. Fate did not work in Joseph Tykocinski-Tykociner's favor and his name remained among the important unknowns in the advent of sound.

General Electric may have lacked interest in Tykociner's work for a good reason. Charles Hoxie and C. W. Hewlett were researching General Electric's own sound on film system. This system, called the Pallophotophone, used a minute mirror which vibrated by the fluctuating current from a microphone. The vibrating beam of light was directed toward the unexposed film. It employed a pattern of recorded sound only one tenth of an inch wide and recorded pictures alongside of the sound.[21] A photoelectric cell, radio amplifiers and a radio loudspeaker were used in reproducing the sound.

The initial interest of the Pallophotophone was in

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[21] "Pictures that Talk," Scientific American, 128 (January, 1923): p. 19.

its use in radio broadcasting. Its first public use was on General Electric's radio station, W G Y in Schenectady, New York. An experimental broadcast in the fall of 1922 featured the well known announcer, K. Hagar. The radio audience heard Hagar's voice which had been recorded on the Pallophotophone one week earlier. Listeners were asked to respond to the broadcast to see if it came over as clearly as the regular broadcasts. The listeners who wrote comments on the experimental broadcast indicated they believed Hagar's voice was more distinct than ever before.[22]

The Phallophotophone was renamed the Kinegraphone after it was improved. Then Paramount film studios became interested in it to provide synchronized music and sound effects for the movie, Wings. The film premiered on April 12, 1927 and was commercially successful. Paramount, however, did not use the system again after its experiment with the movie.

In Europe, the Tri-Ergon system became a successful development of three inventors: Josef Engl, Joseph Massolle and Hans Vogt. They began their work in 1918 and completed their single sound on film system in 1922.[23] A single sound on film system is one that records both the sound

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[22]"Mr. Hoxie's Talking Film," Literary Digest, 75 (December 9, 1922): p. 26.

[23]Thomas Bohn and Richard L. Stromgreen, Light and Shadows, (Port Washington, New York: Alfred Publishing Co., 1975): p. 206.

and picture on the same film as opposed to other systems which recorded them on separate films.

A photocell was used in the Tri-Ergon process. The inventors found, as did others who experimented with the sound on film process, that the photocell proved to be superior to the selenium cell. Another feature of Tri-Ergon was that it used a flywheel apparatus to avoid any variations in the speed of the film.[24] The flywheel patent was one of the most important patents of the film industry in the late twenties and early thirties as every company that manufactured sound film equipment between 1928 and 1934 had to make arrangements with Tri-Ergon. Otherwise they would be infringing on Tri-Ergon's flywheel patent.

William Fox bought the patent rights for the Western Hemisphere in 1925.[25] The Fox Film Corporation now had the legal rights to proceed with patent infringement suits against many film companies who used the flywheel device. During the next ten years Fox had the infringement cases in court. At first the court held the various film organizations liable for large sums of money for infringing on the Tri-Ergon patents. Then in 1935 under pressure from politicians, lawyers and businessmen; the Supreme Court reconsidered its verdict. The Court overturned

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[24]Geduld, p. 89.

[25]Eric Rhode, A History of the Cinema, (New York: Hill and Wang Publishing Co., 1976): p. 260.

their previous decision in the best interest of the public.[26]

During the ten years of legal battles sound became a fixture in the film industry. I have mentioned the names of many inventors who had developed various types of sound on film or sound on disc systems. Before the events which led to sound finally becoming an accepted part of films are explored, there is one inventor who needs to be discussed as he contributed more to the perfection of the sound on film process than any of the other pioneer inventors. I am referring to the American inventor, Lee DeForest.

In 1906, DeForest invented the Audion Three Electrode Amplifier Tube. The 'Audion', as it was called, enabled weak sounds to be greatly amplified. His work with the Audion initially was in improving wireless telegraphy.[27] Then in 1912 he realized the Audion could provide an important application to sound movies. According to DeForest, "...the one consideration which, more than any other, prompted me to enter this field (of talking pictures) was my desire personally to develop a new and useful application of the audion amplifier..."[28] DeForest had, however, envisioned talking pictures as early as 1900.[29] It is interesting to note that Lee DeForest clearly had the idea of using dialogue with pictures while

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[26]Geduld, p. 90.

[27]Shales, p. 76.

[28]Lee DeForest, "When Light Speaks," Scientific American, 129 (August, 1923): p. 94.

[29]Shales, p. 76.

many other inventors strove only to add music or sound effects to films. Either they had no desire to add dialogue or they felt strongly to keep the art of the silent film. Many felt that sound effects and music would enhance a silent films' realism and mood, but dialogue would destroy the art of the silent film.

DeForest began working on sound pictures in 1913, but was forced to delay his work for five years as his work with radio became too involved. In 1918 he returned to work on his ideas of developing a sound on film system. He worked on a sound on film system instead of a disc system since the disc method had a greater number of shortcomings (such as the short length of the record, the frequent need to change needles and the scratchy noise found in reproduction).

By 1923 DeForest had developed his Phonofilm system. The sound was recorded alongside of the pictures in a strip about three-thirty-seconds of an inch wide. In the movie camera, a Photion light was inserted. When recording, this gas-filled lamp emitted light upon the film in varying degrees which corresponded to the strength of the signal sent from the pick-up microphone. The light from the Photion tube passed through an extremely narrow slit to fall upon the film which ran at a constant speed while the pictures were recorded with the usual intermittent motion.[30] The negative film was developed in the usual

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[30]DeForest, p. 94.

manner, but the details of the sound strip needed a special developer.

In reproduction for the Phonofilm system, a standard projector was used for the pictures. For sound reproduction an incandescent lamp and photoelectric cell were attached. As in other systems, the lamp emitted light which passed through a tiny slit and then passed through the film onto the photoelectric cell. The amount of light reaching the photoelectric cell was determined by the sound variations photographically recorded on the film previously. A battery was connected to the photoelectric cell so a current could be supplied. The current was controlled by the amount of light falling upon the photoelectric cell. This current was very minute. Therefore, DeForest provided a series of audion amplifiers so the power could be increased hundreds of thousands of times.[31]

DeForest placed specially designed loudspeakers either behind or alongside of the movie screen so the reproduced sound appeared to come from the projected pictures. Lee DeForest stated that "By the phonofilm process the problem of synchronism is obviously completely solved."[32]

This, indeed, was a system that finally successfully combined synchronization of sound and film with an amplification process that could be heard throughout an auditorium.

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[31]Ibid., p. 94.

[32]Ibid., p. 94.

DeForest began to produce sound on film pictures in 1922. In April of 1923, Lee DeForest presented his first public demonstrations of his Phonofilm system before paying audiences at the Rialto Theatre in New York City. DeForest featured a variety of singing and musical shorts. During the next twelve months, thirty-four cinemas were wired for sound in the eastern portion of the United States.[33]

In 1924, Calvin Coolidge gave a campaign speech which was presented on the Phonofilm. In that same year Lee DeForest recorded the musical score for the popular movie, The Covered Wagon, and initiated sound newsreels.

Between 1923 and 1927, DeForest's studio made more than a thousand short sound films of stage musicals, minstrel shows, vaudeville acts, singers and orchestras. Personalities such as Eddie Cantor, George Jessel, Gloria Swanson, Frank McHugh, Joan Bennett and Ben Bernie were just a few among the many performers featured in DeForest's Phonofilms.[34]

DeForest was actually the first to notably exploit optical sound films (films with the sound recorded directly on the same film) commercially. Overall, his films did not meet with much success. DeForest never received the big offers from the Hollywood studios that he had anticipated. Speeches did not interest audiences. The various

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[33]Patrick Robertson, The Book of Firsts, (New York: Clarkson N. Potter, Inc., 1974): p. 70.

[34]Shales, p. 76.

shorts that DeForest produced did feature many prominent entertainers, but the audiences were not excited over them. It seems that another factor was needed. It was showmanship.[35] This is what was eventually provided by Warner Brothers using their Vitaphone disc system.

The turning point in the advent of sound in film came in 1926 when Warner Brothers released the movie, Don Juan. The film starred the popular John Barrymore and was basically a silent film with musical accompaniment and some sound effects. This was the premier of Warner Brothers' Vitaphone system.[36]

The Vitaphone system was developed by Bell Telephone's laboratories. They had been working on a sound system since the days when Thomas Edison was conducting early experiments with sound films.[37] Bell offered the system to the film industry's major companies, but they all shunned the device just as they had done to Lee DeForest's Phonofilm. "In the mid-twenties the big motion picture companies were making money with silent pictures and did not wish to risk their profits by experimenting with sound."[38]

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[35]Scheuer, p. 36.

[36]Ibid., p. 36.

[37]Richard Griffith and Arthur Mayer, The Movies, (New York: Simon and Schuster Co., 1970): p. 240.

[38]Fulton, p. 155.

In 1925 Sam Warner attended a demonstration of the Vitaphone system at Bell Labs. He was impressed and convinced his brothers that that was the direction the Warner Brothers Studio should go toward. The Warners contracted for exclusive use of the Vitaphone System.[39] To invest in this unproven sound on disc system was a gamble. The Warners took the gamble because their studio was showing little profit. Their only profitable films were ones starring John Barrymore or Rin Tin Tin.[40] The rest of the movie industry was amazed that such a minor studio would risk so much to invest in a sound system that the major producers rejected.

The Vitaphone recording system consisted of a high quality microphone which transferred the audio signal to an electrical amplifier. The signal was then sent to a record cutting device which made a recording on a seventeen-inch wax disc. In recording on the disc, the stylus traveled in the groove from the center of the record to the outer edge (exactly reverse from the manner a phonograph travels). The disc traveled at thirty-three and one third revolutions per minute. Accordingly, this reverse tracking provided a more accurate recording. The cameras taking pictures on a set were run by synchronized motors operated on the same circuit as was the motor that turned

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[39] Griffith, p. 240.

[40] Scheuer, p. 36.

the disc of the disc recording device. This electrical linkage of the various components provided a recording that was always in step.[41]

In reproduction, the Vitaphone system had the turntable playing the disc connected on the same motor shaft that drove the projector mechanism. A mark was placed on the film and on the disc to insure proper starting. Thus the playback of sound was synchronized with the picture. The audio was reproduced by amplifying the signal with vacuum tubes so sufficient volume could be obtained in an auditorium. Loudspeakers were placed alongside or behind the screen in the last stage of reproducing the audio.[42]

When previous new sound on film or sound on disc systems were first shown, the inventors usually demonstrated their experimental systems at exhibits. Instead, to premier Vitaphone, Warner Brothers decided that "...they would use the system to create a spectacular show that everyone would want to see...Thus, from the outset the public would associate Vitaphone with entertainment of the highest order."[43]

The Warners then chose the star, John Barrymore to play the lead in the film, Don Juan, their first venture in using the Vitaphone sound system. Since the musical score could decide the future of the Vitaphone system, the

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[41]A. P. Peck, "Giving a Voice to Motion Pictures," Scientific American, 136 (June 1927): p. 379.

[42]Ibid., p. 379.

[43]Geduld, p. 113.

Warners carefully selected the musical accompaniment. David Mendoza, William Axt and Major Edward Bowes were chosen to write the musical score while the New York Philharmonic Orchestra was selected to perform it.

The Warner Brothers did not stop there. They wanted to offer more than just one film. So they proceeded to line up a variety of short features before the main attraction.

Will Hays, the head of the Motion Picture Producers and Distributors Association of America, introduced the program with a timid prediction that sound would bring a new era of pictures and music into films.[44] The other features included: Giovanni Martinelli, Marion Talley and Anna Case singing with the Metropolitan Opera Chorus and Efrem Zimbalist playing the violin along with Micha Elman.[45]

Warner Brothers debuted their spectacular program on August 6, 1926 at the Warner Theatre in New York City. The initial public response was mixed, but overall it was encouraging. On one end of the scale, critics raved about the Vitaphone system.

> Many reviewers were ecstatic about Vitaphone. A reporter for London's Kinematograph Weekly described the show as a 'sensation', and went on to say that 'It was universally admitted that no earlier experiments had achieved

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[44]Griffith, p. 240.

[45]Daniel C. Blum, A New Pictorial History of the Talkies, (New York: G. P. Putnam and Sons, 1968): p. 11.

> anything like the same degree of success in regard either to exact synchronization, volume or tone. The 'Vitaphone' is amazing in all three particulars...There is general agreement here that if the test was typical and if the apparatus is portable and 'commercial it opens up amazing possibilities of the reproduction of the finest music in the meanest theatres.' Charles Divine (New York Evening Telegram) described it as a 'miracle of sound.' 'Marvelous invention,' wrote Rose Pelswick in the New York Evening Journal, 'It is almost uncanny in its excellence. Vitaphone is revolutionizing. Go see it for yourself and be convinced.' 'It is impossible to imagine,' said Regina Cannon (New York Graphic), 'Vitaphone is the eighth wonder of the world.'[46]

Other critics were not quite as complimentary. A few condemned the use of sound in films saying that 'canned' music was inferior to the live orchestra while many feared that the sacred art of silent cinema was endangered, as the next step would be the talking picture. An article in Outlook advocated keeping cinema a silent art and went on to comment, "It is gratifying to find that the Vitaphone has contented itself with such a step (adding only musical scores) instead of attempting 'speaking movies.'"[47]

Generally, the critics agreed that the musical score enhanced the film and heightened the moods and dramatic intensity of the film. What was feared was the prospect of adding the spoken word.

The synchronization of the picture and the sound

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[46]Geduld, p. 141.

[47]"The Marriage of Music and Light," Outlook, August 18, 1926, p. 526.

accompaniment was favorable, to say the least, The Etude magazine reported that:

> ...The first thing to astonish was the volume of the sound completely filling a theatre of ordinary size...the synchronization was so perfect and the effects so astonishing that one had to pinch oneself now and then to realize that this was a mechanical reproduction rather than the original.[48]

The Scientific American Digest raved that the music and sound effects of the Vitaphone film "...was perfectly synchronized with the picture..."[49] and that the system "...should bring the large picture houses of Broadway, with the splendid incidental music of their large orchestras, to much smaller communities."[50] This is what the Warners' original intention was. They only planned to use the Vitaphone system to add musical scores to their pictures so that the small independent theater owners, who could not afford to pay a large orchestra, would have musical accompaniment for their silent films.

Vitaphone had passed its first test. A few theatres installed sound equipment to show the Warner Brothers' features, but Vitaphone remained unproven after only one program. The film industry was interested but not yet convinced. There were many in the film industry who

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[48]"New Musical Marvels in the Movies," Etude, October, 1926, p. 781.

[49]Albert G. Ingalls, "Talking Motion Pictures," Scientific American Digest, 135 (September, 1926): p. 209.

[50]Ibid., p. 209.

believed that the success of the first Vitaphone show was a mere stroke of luck, a novelty that would soon pass. With all of the condemnation as well as praise, the Warners stuck with Vitaphone and began to make plans for the future. They realized that the public was getting used to sound as being a part of entertainment with the development of radio and the phonograph.

> By 1926-27 the phonograph and radio had become established household medias, 45 percent of American homes had a phonograph and 40 percent a radio set. Sound as entertainment was an accepted reality for a majority of American homes and the extension of sound to motion pictures was quite natural.[51]

The climate for acceptance of sound seemed to be right.

Warner Brothers needed more than John Barrymore, the New York Philharmonic and Will Hays to lure audiences away from silent films featuring such stars as Charlie Chaplin, Buster Keaton, John Gilbert and Mary Pickford. Again, they sought someone with extraordinary showmanship to try to convince the audience and the film industry to accept sound. For if their second major sound production turned out to be a box office failure, Vitaphone could face an early death along with bringing ruin to the Warner Studios since they had virtually all of their finances invested in Vitaphone. Warner Brothers next sound film was to be The Jazz Singer and Al Jolson would provide the magic needed for Warner Brothers to finally break the 'sound barrier.' The Warners opened The Jazz Singer in

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[51]Bohn, p. 182.

New York on October 6, 1927. Motion pictures were never again the same!

The Jazz Singer was a mediocre picture with a rather common theme. Jolson played the role of a jazz singer whose father, an orthodox Jewish cantor, orders an end to his son's (Jolson's) profane jazz singing in his sacred home. Jolson's mother enjoys listening to her son's jazzy singing. Actually, the movie was a silent film. It told the story mainly through the use of titles. Only portions of the picture had synchronous sound. Jolson spoke only a few lines and sang three songs.[52]

Al Jolson was the perfect personality for the film. He was a practical joker and excellent in ad libbing. While recording the talking scenes, many of the persons working on the set were dismayed at Jolson because of his extra ad libbing that he spoke along with his few lines of dialogue. Nothing could be repeated, so they had to use what he had said. The result surprised everyone. Jolson's ad libbed lines became famous, "'Hey, ma, listen to this!' and 'Wait a minute, wait a minute, you ain't heard nothing yet!'"[53]

Al Jolson's personality, singing and catchy ad libbing went over extraordinarily well with the audience. Jolson

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[52] Griffith, p. 241.

[53] Charles Higham, Warner Brothers, (New York: Charles Scribner's Sons, 1975), p. 69.

aroused and excited the audiences to a point where they applauded his songs.[54]

In January of 1928, Warner Brothers announced that all of the pictures they would produce that year would have Vitaphone sequences. It was clear that the Warner Brothers had made a full commitment to production of Vitaphone sound pictures. The Warners released their first 'all-talking' feature, The Lights of New York in July of 1928. The Warner studios; which had shown losses in 1925, 1926 and 1927; recorded profits of over two million dollars in 1928 and over seventeen million dollars in 1929.[55] This was an increase of approximately 750 percent!

The box office success of the Warner Brothers' sound pictures convinced the rest of the film industry that there was a great audience demand for talking pictures. Other Hollywood film companies jumped on the bandwagon. They all put orders in for sound equipment. By the summer of 1928, sound equipment manufacturers became swamped with orders. In addition to buying equipment, the industry was in a fury to build sound stages and to employ carpenters, speech teachers, sound engineers, voice coaches, English instructors (for foreign speaking actors), dialogue writers, musicians, singers and anyone else who had any skill related to sound.[56]

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[54]Frances Marion, Off With Their Heads, (New York: Macmillan Co., 1972), p. 169.

[55]D. J. Wenden, The Birth of the Movies, (New York: E. P. Dutton, 1975), p. 173-174.

[56]Bohn, p. 181.

The entire process of film-making was revolutionized practically overnight.

Musical stories instantly became the dominant trend as a result of The Jazz Singer. Dozens of musicals were produced, some of which had huge and elaborate sets, costumes and casts. Between 1927 and 1931, all of the talking pictures which grossed more than two million dollars were musicals.[57]

Sound was exploited in virtually every way possible. After Warner Brothers first all-talking picture, The Lights of New York, they produced their first all-talking picture, The Terror (1928). This was a 'first' because instead of having printed credit titles, Conrad Nagel spoke them. Fox studios featured the first 100 percent all-talking drama filmed outdoors (In Old Arizona, 1929). Other billings for pictures claimed them as being the first all-Negro all-talking picture; the first 100 percent talking, singing college picture; 100 percent singing, 100 percent talking, 100 percent dancing musicals; and Warners On With the Show (1929), which was all-talking, all-singing, all-dancing and 100 percent all-color.[58]

At the end of 1928, there were more than one thousand theatres equipped to show sound films. The number rose to over four thousand by the end of 1929 and to thirteen

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Ibid., p. 182.

Arthur Knight, The Liveliest Art, (New York: Macmillan Company, 1957), p. 148.

thousand by the end of 1930. There were still about eight thousand theatres around the country which were not wired for sound, but these were mostly small rural theatres that could not afford to convert to sound.[59] The theatres that were equipped for sound were capable of handling both sound on film and sound on disc movies. Vitaphone was the only disc system used. The rest of the industry used sound on film systems. The Warner Brothers did switch to a sound on film system in 1930 when its sound quality equalled that of the Vitaphone sound on disc system. The entire film industry thus became standardized in its sound systems.

There certainly is no doubt that the advent of sound was just what the box offices needed to boost profits as audiences were waning in the mid 1920s. Profits increased not only for Warner Brothers but for all major studios. In less than three years over ninety-five percent of the films produced were sound pictures. The sound phenomenon helped pull the film industry through the beginning years of the Great Depression. The advent of sound had arrived. "By 1930, with few exceptions, silent films were a thing of the past."[60]

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[59]Blum, p. 11.

[60]Gilbert Seldes, The Movies Came From America, (New York: Charles Scribner's Sons, 1937), p. 92.

CHAPTER 5

SUMMARY AND SUGGESTIONS FOR FURTHER STUDY

The purpose of this study was to trace the developments which led to the advent of sound in motion pictures. The research questions examined in this thesis were:

1. How did motion pictures evolve?
2. How did sound become involved with the presentation of motion pictures?
3. What were the technological developments that led to the advent of sound?
4. What were the events that led to the acceptance of the advent of sound?

In order to objectively answer the questions, historical methodology was employed.

Summary

In answer to the question, How did motion pictures evolve?, this study found that the idea of motion pictures evolved out of ancient ideas for entertainment. In summary, it began with the Chinese Shadow Ball which was used as a form of entertainment from 6000-1500 B.C. Leonardo da Vinci described the camera obscura in 1500 A.D. In 1646, Anthanasius Kirchner devised the magic lantern which was developed from da Vinci's ideas. The magic lantern projected images upon a wall and was the forerunner of

the motion picture projector.

Many inventors modified the magic lantern. The idea of adding the illusion of motion was attempted by Johannes Zahn in 1685 by projecting various phases of motion. Others produced various types of magic lanterns for entertainment purposes. E. G. Robertson added music to his Phantasmagoria in 1797. Thus the medium of sound was added.

The illusion of motion was explained in 1824 when Peter Mark Roget developed his theory on the persistance of vision. This stimulated the development of many inventions designed to create the illusion of motion. Many of these inventions, such as the Thaumatrope, were merely toys. Others were serious attempts aimed at entertaining audiences and had sound effects or music accompany the shows.

Photography developed in the mid 1800s and it was soon applied toward recreating the illusion of motion. Eadweard Muybridge successfully photographed successive phases of the motion of a trotting horse using a battery of cameras. In 1880 Muybridge then projected for the first time these phase photographs. Etienne Jules Marey, who was interested in studying the motion of animals, devised a photographic gun in 1882. This enabled Marey to shoot the motion of animals with a single camera.

The next step needed for the development of the motion picture was provided by Hannibal Goodwin with his development of celluloid film. George Eastman heavily promoted the celluloid roll film which now was used in shooting pictures of motion with Marey's photographic gun. The first

actual motion picture machines were peep-show devices such as Thomas Edison's Kinetoscope.

In answering the second research question, How did sound become involved with the presentation of motion pictures?, this study has found that sound was a part of motion pictures since their inception. Ancient magic lantern shows had musical accompaniment. Throughout the ages, sound has been an accompaniment for various projected entertainment.

The addition of sound is an attempt to recreate reality. Thomas Edison added his phonograph to the Kinetoscope to attempt to have synchronized sound accompaniment to his peep-show machines. These devices (Kinetophonographs) produced poor synchronization. Throughout the opening three decades of the twentieth century, inventors have attempted to add a dimension of reality to films by having sound accompaniment. Two main methods of sound accompaniment were used: the sound on disc method and the sound on film method.

The advent of sound took years of various technical developments. What were the technical developments that led to the advent of sound? In answer to the third research question, this study has found that inventors met two main technological problems: that of synchronization and that of amplification.

When film projectors were improved, the projected picture eventually phased out the peep show by the early 1900s.

Large audiences could now view pictures instead of one person viewing them at a time. Projecting pictures posed another problem. Inventors who were trying to combine sound with film, in addition to synchronization problems, now had to also deal with the problem of amplifying the sound loud enough for everyone in the theatre to hear properly.

Various methods were used in trying to synchronize the sound which was recorded on phonographic discs. Methods used to improve synchronization were the unitary method, the dependent method and the regulated method. None of these improved the synchronization between the sound discs and the film satisfactorily.

In addition to the problems faced in attempting to synchronize the reproduction of the sound with the film, there were also problems in trying to record the sound films in synchronization. At first, films were shot and the sound was recorded later on. This had to be done because filmmakers were working with very insensitive microphones and they did not want them in the pictures. However, this difficulty was solved as microphones were improved. By 1910 they could pick up sound while being out of the picture.

During the second decade of the twentieth century, the silent film became a major form of entertainment. Interest in trying to perfect sound films waned after 1913. Experimenters were not able to perfect synchronized sound on disc

films or to overcome the insufficient amplification of sound in theatres.

The idea for having sound to accompany motion pictures did not die. The silent films of that era were not totally silent. Many films were shown with accompanying live singers, orchestras, speakers, sound effects or with a phonograph playing recorded music. Sound was traditionally an accompaniment to motion pictures to provide mood for stories, to use as transitions, to verbally tell stories as well as to add a dimension of reality to motion pictures.

Inventors eventually turned to the sound on film process after World War I when the earlier sound on disc experiments failed to solve its inherent problems. The process to photographically record sound directly on film was not new as Charles Fritts had devised a method as far back as 1880. The sound on film experiments in the early 1900s of Ernest Ruhmer and Eugene Lauste never achieved perfect synchronization or adequate amplification, but they helped to pave the way for more sophisticated experiments in the early 1920s.

Joseph Tykocinski-Tykociner began sound on film experiments in the early 1900s. After halting experiments for a time, he continued his experiments in 1921. Tykociner recorded both the sound and pictures on the same film and used a photoelectric cell instead of a selenium cell to improve the sound on film process.

Tykociner could not interest any of the large filmmakers

in his device. Many were skeptical of experimental systems which added sound to film and considered them dangerous to invest in due to their poor performances in the past. Other film companies were not interested in these devices as they were trying to develop their own.

Lee DeForest solved the amplification problem by applying the audion tube to his Phonofilm system in 1923. The Phonofilm system also provided good synchronization. DeForest was unsuccessful in trying to convince the film industry to invest in sound films even after he had made over a thousand short sound films which featured some name performers.

All of the technology necessary for the advent of sound was present by 1925. The next step needed was for the audiences and the film industry to be convinced to accept sound films. This study answered the fourth research question, What were the events that led to the acceptance of the advent of sound?

The study found it took the right combination of showmanship and public relations to sell the idea of sound films to the public and to the film industry. Also, the timing had to be right. In 1926 the public was getting used to the medium of sound as a form of entertainment because of the phonograph and the radio. The setting was perfect.

Warner Brothers invested in Vitaphone, a sound on disc system which provided good synchronization and a better

sound quality than the current sound on film systems. In 1926, Warner Brothers presented an elaborate program featuring their first Vitaphone film, Don Juan. It became a box office hit, but the rest of the film industry still was not convinced to invest in sound equipment.

The turning point in the advent of sound in motion pictures came when Warner Brothers presented their second sound film, The Jazz Singer. The showmanship and magnetism of the star, Al Jolson, excited audiences everywhere. With the extraordinary success of The Jazz Singer, Warner Brothers proved to the rest of the film industry that their success with their Vitaphone features was not a fluke. The audiences were truely ready to accept sound films for the development of the radio and the phonograph got people into the habit of associating sound with entertainment.

The film industry was finally convinced that there was an audience demand for sound films. During the 1920s the film industry was experiencing a decline in attendance at movie theatres. They could clearly see that audiences were infatuated by the sound films. Theatres all over the country were equipped to handle sound films. All of the major film producers jumped on the bandwagon and ordered sound equipment. Sound was immediately exploited by way of the musical film. Almost overnight Hollywood began to change.

Personnel who could work with the new sound motion pictures were brought to Hollywood to build soundproof studios, train actors, write sound scripts and work with

the new sound equipment. Hollywood, without a doubt, was committing itself to the production of sound films.

Eventually the film industry standardized sound films. In 1930, when the sound quality of the sound on film systems was equal to that of the Vitaphone system, Warner Brothers switched to a sound on film system. By 1930 the silent film era had passed and sound films were here to stay.

Suggestions for Further Research

This study may serve as a guide to further research in the field of the history of motion pictures. There are many related studies that could be undertaken. The following questions may serve as a guide to further research:

1. What were the roles of music in both silent and sound films?
2. What were the roles of sound effects in both silent and sound films?
3. What changes in acting occurred in both silent and sound films?
4. What changes in labor and management took place as a result of sound films?
5. What changes in film content occurred as a result of sound films?

There are a number of further studies that could be done as a result of this research. It is hoped that this study, The Advent of Sound in Motion Pictures, will stimulate the faculties of those interested in doing historical studies to continue further scholarly research in the field

of motion pictures. It is also the author's wish that the study has served to provide the reader with knowledge and insight into an extremely pertinent era in the history of motion pictures: the advent of sound in motion pictures.

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