The Importance and Preservation of the Thoreau Society's Audio and Video media

An Interactive Project
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by

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Abstract:

The Audio and Video collections at the Thoreau Institutes Library are in Jeopardy of being lost forever. The media is inaccessible due to obsolescence, and much of it is deteriorating to a point were it couldn't be read, even with an appropriate player. Due to much research we have found that the majority of the collections can be easily, safely, and cost effectively converted to a digital format. A digital format will make all the different media formats in the collections accessible by a computer and easy to back up, duplicate, and preserve.

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Acknowledgements:

We would like to acknowledge and thank Jeff Cramer of the Thoreau Institute Library for allowing us to help the Institute update its archived audio and video formats into digital files for future use. Jeff is always helping and gave us the insight to realize why this project is important. The best way to contact Jeff is to email him at Curator@walden.org. Next we would like to thank Jim Courmier from the Academic Technology Center. Jim helped us with the equipment we used in converting the media types into digital format, without him we would have been lost. Finally we would like to thank our advisors Wesley Mott and Rodney Obien for giving us the weekly guidance necessary to complete this project.

Introduction:

This project is set up to prevent precious collections of the Thoreau Society from being torn from the pages of history as time wears them down. The media is vast and in various formats. The full collection of media at the Thoreau Institute Library includes:

- 227 Audio Cassette Tapes
- 226 Video Cassette Tapes
- 23 Vinyl Records
- 29 Films of various sizes
- 45 Microfilm strips
- 11 Beta Max cassettes
- 5 Pneumatic tapes

The Thoreau Society does not own any devices to play these various media types, except for one VHS player. This makes the material, which is of great importance to the society and additional followers of Henry David Thoreau's work, inaccessible (Cramer). In addition to the inaccessibility, the media is getting farther from accessible as time passes. The devices needed to play them are becoming more and more obsolete as technology continues to evolve. Also, the media itself is deteriorating. The longer this project is put off, the less there will be to save. Even with this school's background of being on the cutting edge of technology, it still does not have some of the equipment necessary to convert some of these media formats into the updated digital format. For these formats, it seems as though outsourcing to a professional company will be of a greater benefit to the Thoreau Institute. This subject will be discussed later in the paper.

The problem with these collections is that they are becoming more obsolete by the day. Many of the devices needed to play the different formats of medium are very hard to find, for example projectors for large film strips are extremely rare. Also, some media, like microfilm, is very hard to convert because it is very labor intensive unless very expensive equipment is available for conversion to a digital source. These are just some of the problems facing this project, let alone the deterioration of the materials that are being dealt with.

The Legacy of Henry David Thoreau (1817-1862):

Henry David Thoreau was a Harvard University educated man who became a very influential person in the lives of so many. After graduating from college, Thoreau did not go on to fulfill a typical Harvard graduate's lifestyle that many people think of today as a "successful member of society," but in retrospect, the contributions he gave to society were much more lasting than anyone else in his graduating class. Thoreau lived, went to school, graduated, and became one of the leaders of a movement that is still seen today. Although he graduated from Harvard, this was not the Harvard we think of today. Harvard was an educational institution for an education past what was offered by the public school system. The transcendentalist movement still has remnants today, with people preserving what they can and what is most important to the world. Thoreau is most remembered for his contributions to the preservation of historical artifacts and a simpler life. His writings advocate a smaller government and a simpler life, which is more likely to be seen today than in the nineteenth century because of the many different means for people to communicate. In today's world, the relay of information is instantaneous, whereas in the nineteenth century it would have taken days or weeks for the spread of a newly published book to reach certain parts of this country, let alone the rest of the world. The government is still a large part of today's society, but there are many people vocalizing what Thoreau tried to get out to so many, living a simpler life will lead to a happier life. He created a simple vision in the minds of many people that lives on to this day, one does not need to be constantly surrounded by people to feel whole, a person can spend the majority of his time in solitude and only socialize when necessary and still be happy (Woodlief). However, Thoreau's way of life is not fitting for everyone. Some people feel the need to be surrounded by many different people in their lives, so when Thoreau speaks of his solitude and lack of need of interaction with people he is simply talking about his experience in life, and suggesting people may wish to try it.

After graduating from Harvard, Thoreau taught young children at a school in Canton, but was dismissed early on in his teaching career because of his forward thinking. After this failed conquest, he decided to join with his brother John and open a school in Concord, but after his brother's death in 1841 he failed to keep it in operation. This was the period where he met and lived with Ralph Waldo Emerson, a person who

had much to teach the then young Thoreau. Emerson was a teacher, employer, and friend of Thoreau who took kindly to the bright student from their first meeting. Emerson took him in as a tutor to his children as well as a handy-man. It was Emerson who pushed Thoreau to write and contribute to a local journal. These early works set the groundwork for his later writings as he would soon turn into a true transcendentalist as Emerson and a few other personalities shaped him to be. In 1844 Thoreau decided that as an adult he needed a farm or house of his own to be self sufficient.

After he decided to build, he used land provided to him by Emerson to construct a small house that could be left at any moment and still remain the same. This is where his famous writings of *Walden* were composed, named after the pond he lived two hundred yards from. Thoreau created other works besides *Walden,* but this was easily his most famous work. His next most famous work was "Civil Disobedience," which was almost anarchist in nature, but in stead of saying "overthrow the government" it stated that people should depend less on the government and that the government should have less influence on people's daily actions, basically meaning that small government makes more sense.

Walden is such an influential literary work that it has been a best selling literary work for a very long time. One of the reasons it is so influential today is because of the message it put across to the up and coming industrial revolution period (Cramer). This message was simple and contradicted what was going on in America during that time period, live a simpler life, not one person needs the "bells and whistles" that are everyday distractions. And this message has helped pave the way for a movement that has been around for well over a hundred years now, the transcendentalist movement. People are still trying to pursue a simpler life and there are many groups out there asking for less government interference, also know as a smaller government. Although Thoreau advocated simpler living, he realized that there was a need for improvements in technology. Thoreau understood that there were things out there to make life easier, such as new and improved tools, so that one could enjoy more time with nature.

Walden is a collection of writings that Thoreau took years to create. This collection describes his feelings as well as his actions and lifestyle while he was living on Walden Pond. His living situation while at the pond was very simple, it was a small

"cabin" that he initially described as "*...merely a defence against the rain…"* (*Walden*) Thoreau lived in this place to set an example of the way he thought life should be lived. He had limited government interference in his life, as well as very few distractions. He was a mile and a half from town and two miles from the famous battle site, of Lexington and Concord (*Walden*). His nearest neighbor was Emerson, with whom he kept a close relationship. All of these things led to a simpler life than even he could have imagined, he was almost in solitude and he chose when he wanted to expose himself to civilization.

The reason *Walden* left such an impression on humanity is because of its simplicity. Thoreau was pretty much a man living in the woods because of his thoughts on society, the farther he was from the government the better. So many people follow in Thoreau's wake that they have dedicated much time and many resources into collecting the many things that Thoreau contributed to, including audio cassette recordings of readings of *Walden* and "Civil Disobedience". Another thing to look at when remembering Thoreau is the legacy he left behind; he inspired so many people that there are organizations dedicated to educating people on his ideas. Also, there is an organization that preserves artifacts from his personal life as well as many different types of media that depict Thoreau. These are what need to be preserved, not necessarily the works of Henry David Thoreau, but the things that prove exactly how important Thoreau's thoughts, actions, and life were.

"Civil Disobedience" is yet another call out for people to recognize that government involvement can only worsen a person's ability to be free. Thoreau thought long and hard on these seemingly simple topics, but the way that he puts it across is the reason why it is still remembered today. The logic behind this essay was not that far from the way people thought in the nineteenth century, especially with the Civil War approaching. Thoreau was just one of very few people to express his thoughts on paper and one of even fewer to publish his thoughts. This essay, as with *Walden*, had disappointing sales when it was first released, but has rebounded very well since its first release in 1849.

This work is much shorter than *Walden*, but puts forward a much stronger point. When Thoreau says *"...I ask for, not at once no government, but at once a better government,"* ("Civil Disobedience") it is clear what he is trying to get across to his

readers. Thoreau was not an anarchist, he was just a man that believed the government should be involved very little in the managing of people's personal lives, and they should stick to the larger scale political issues as much as possible. However, that was not the case here in America as many of us well know. This is yet another example of an essay from Thoreau that many of the tapes that are being converted stemmed from for the rest of us to be able to use, except for the fact that most of the formats of the resources are outdated and the place that stores them, the Thoreau Institute Library, does not have the equipment for them to be seen or heard. Digital preservation of the media types that the Thoreau Institute is in possession of is a must, to show future students exactly how important works like this are. If a future student needs any proof of how important these works are, they could just see how so many different people recorded certain things about them, such as a video recording of a news segment about Thoreau.

The materials that the Thoreau Institute Library need to be preserved because they depict exactly how strong Thoreau's words were, and still are for that matter. Thoreau has impacted so many people and that is why these people have created collections of everything Thoreau. To these people, Thoreau was writing to better humanity and as long as his influence is shown through the support of his collections, people in the future will have no doubts about his influence for the past hundred and fifty years. Many people believe that if everyone lived a much simpler life as Thoreau did, the world would be a much better place than it ever was. Also, Thoreau believed in conservation of land and protecting the environment, which today is a very important concept because without the preservation of lands and conservation of our natural resources this earth would be much different than what it is today.

Thoreau's beliefs can still be seen today in many different aspects, anywhere from the preservation of a piece of land to a new building being built as an earth friendly "green building." Without the preservation of Thoreau's works this world may not think about these things and how much the earth depends on a conscious effort from everyone to protect it, as well as to preserve it.

Thoreauvian Organizations:

There are two bodies that are now involved with preserving not only the works of Henry David Thoreau, but also the land which he wrote about. These two organizations have been collaborating for the past nine years and look to continuously maintain their missions. These two separate entities serve two different roles for the same purpose, one, the Walden Woods Project, is involved in the preservation of the lands around Walden Pond, as well as the literature and artifacts of Thoreau's life, and the second, Thoreau Institute, is working to preserve many different collections of various media types of readings and news segments on Thoreau (http://www.walden.org/index.htm). The Thoreau Institute maintains a library on site that consists of many different writings and artifacts from Thoreau that have been donated by many different individuals and groups. This is where this project comes into play; it is to help preserve, in the best way possible, the audio and video collections that the library has on site so that they may be more easily shared with interested parties (Cramer).

The Walden Woods Project was founded by musician Don Henley in 1990. The mission at the time seemed simple, preserve the lands around Walden Pond as well as to collect items relevant to Henry David Thoreau and keep them from deteriorating. The land surrounding Walden Pond, at the time of the founding of the project, was up for sale to a condominium construction group that wanted to build condos in the area and therefore destroy the essence of Walden Pond as it was. The Project consisted of a single house that was converted to hold offices and was initially thought to be able to hold the library as well. After further consideration, a library was built separate from the Project's main building, but shares the same land. The library is located across a small parking lot and is home now to the Thoreau Institute. The Thoreau Institute was created in 1998 to help pass on the beliefs of Thoreau as well as to run the library and collect as many pieces concerning Thoreau as possible and to preserve artifacts from Thoreau's life and legacy (Walden Woods Project Website).

Literature Review:

The field of Analog to Digital conversion is vast and diverse. Digital media is the most modern and convenient way to store media and it is widely accepted as the best format. It is possible to convert old media from analog sources to digital for use on computers and easier backup and access. There are many ways of getting the information from the analog to the digital format. On a small scale, when quality isn't a big issue, most people can do audio analog to digital conversion themselves. Microsoft describes how to do this method on their website at "http://www.microsoft.com/windows/windowsmedia/knowledgecenter/mediaadvice/0081.mspx". This is the same method that was used on the "Canterbury Shaker Village Preservation Project".

For video it is necessary to use an analog to digital converter between the analog media player and the computer. Prices on these units reflect their capabilities. Several different manufactures were shopped for converters to pick specifications to fit the projects needs. Information was gathered from Canopus http://www.canopus.com/ and Laird telemedia "http://www.laird-support.com/laird/index.php". Canopus makes a full range of A-D converters for the occasional user to full professional equipment. Laird is the manufacturer of the converter that Worcester Polytechnic Institute allowed the use of for the project.

The method of conversion is fairly straight forward and doesn't leave much to interpretation. James Cormier, Worcester Polytechnic Institute Campus Media Coordinator was a great help by introducing the equipment and their functions. Additional information on A/D conversion of VHS tapes was gathered from Robert Hudson at Sign Video and the information proved relevant to all media formats.

Information on the deterioration of media was vast. There are many sources on the subject. Information for film and microfilm came from Kodak. Information for VHS tapes came from VidiPax. Information on VHS tapes is also applicable to audio cassettes, pneumatic tapes, and Betamax tapes. The information for CD deterioration was from Henry Walter at Sanford University and John Frame from Queerradio.org. Information on Vinyl record deterioration was not too easy to come by. Vinyl is a very stable media that can be worn out by too much play or warped from exposure to too much heat. The

majority of information available was on how to prevent these things from happening, and was written by record collectors and enthusiasts. Information on a laser record player that plays vinyl records without touching them was found at "http://www.elpj.com/index.html".

Information on digital formats was vast. Facts about formats were easy to find, and picking the correct formats for the project was mandated by compatibility and space requirements. A chart outlining the strengths and weaknesses of different media's was found at http://www.cyberlink.com/english/dv-entertainment/articles/video_format.jsp. The formats were then checked for compatability with the latest version of Windows Media Player to ensure it would work with the majority of systems.

Technology:

Media Deterioration:

The media formats at the Thoreau Society are in danger. The physical media is deteriorating with time; eventually it will become completely useless. Different formats are more stable than others, but they all have flaws. The media is stored in a climate controlled vault at the Thoreau society, which is the best environment it could be in. The media is being converted to a digital format but the material is not completely safe in the media world. There still has to be a physical place to store the digital copy which can fail. The advantage to digital is that it can be copied and backed up easily, quickly, and without losing quality. The reasons different formats can fail can be seen in the appendices.

Appendix A: VHS and Audio Cassette Deterioration
Appendix B: Film and Microfilm Deterioration
Appendix C: Vinyl Record Deterioration
Appendix D: Compact Disk and Digital Video Disc Deterioration
Appendix E: Digital Deterioration

Method of Conversion:

The goal is to convert Analog media to a Digital format. This is called analog to digital conversion or AD conversion. Analog media is media that is stored in a physical way. Records have a textured surface that is read by the needle, Film have pictures that light passes through to make it visible. Cassettes and Tapes have magnetic particles that send electric charges to speakers. Most of the formats at the Thoreau society are able to be played by a device with speakers, and or a screen. Speakers and screens work on electrical signals. The electrical signals make the sound and picture by varying in Amps or Volts. Through Analog to Digital conversion the electrical signals are interpreted into a series of zeros and ones known as the digital language.

This requires a machine that can convert to analog signal to a digital signal. These machines range anywhere from one hundred to three thousand dollars. It is possible to do AD conversion using a personal computer as the converter. This is accomplished by hooking a line out of any source to the microphone port that almost all computers have. For the purposes of the project, this is not recommended. Most sound cards can do the conversion, but they will only do it at 8 bits. Any actual AD converter will do at least 12 bits and usually 16 bits. The higher the bits, the higher the quality. The downfall is that higher quality files take up much more memory space. Memory space is a concern at the Thoreau Society. An example of the conversion set-up without an AD converter, found in Joseph E. Carr and Elisabeth A. Drenzek's Canterbury Shaker Village IQP, which can be seen if Figure 1.

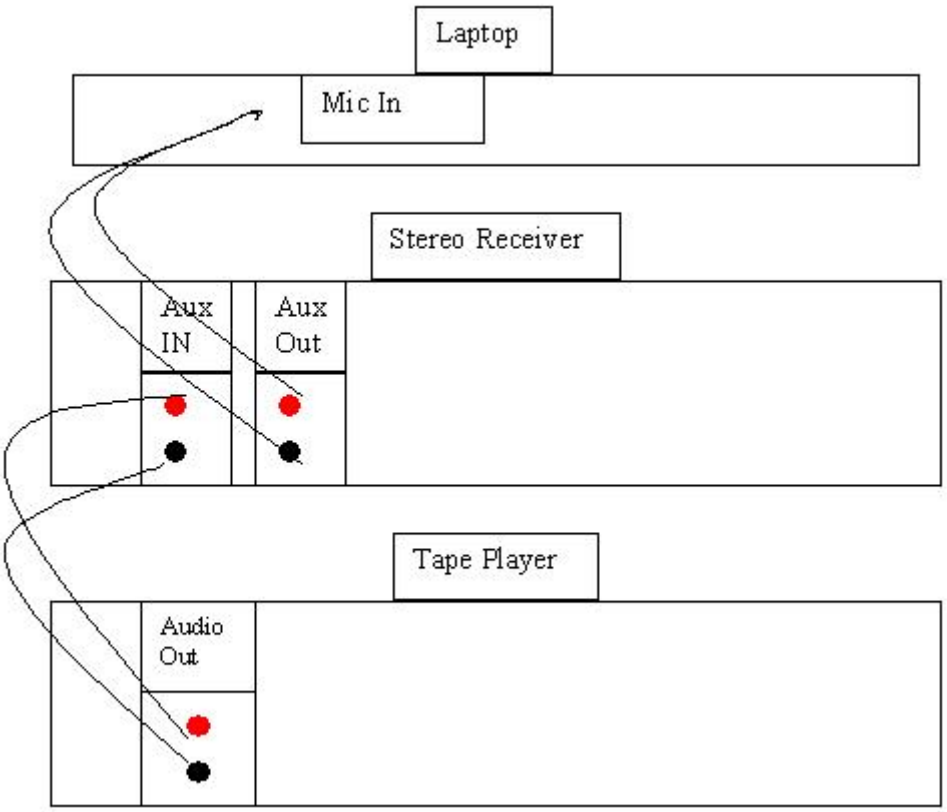

Figure 1.

Conversion With out A-D Converter

The tape player is already putting out an electrical analog signal. There wouldn't be a need to run it through the stereo receiver unless the signal needed to be significantly modified which is doubtful due to the sensitivity of the microphone jack. It can be as simple as a Personal Computer and a Device to play the media as shown in figure 2.

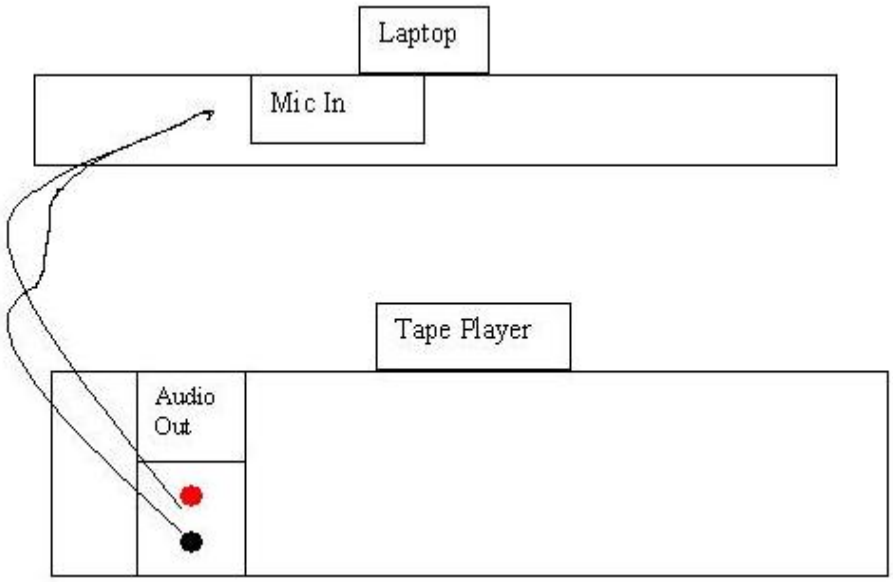

Figure 2.
Simplified Conversion

Due to the limited quality possible using a computer alone as an analog to digital conversion, a stand alone DA converter should be used in conjunction with a personal computer to record the signal from the DA. Also the method will only work for audio. The microphone jack on personal computers is mono (only accepts one signal). In order to do video we need to record at least two (audio and video) and perhaps three (two audios and one video). The best way to do it is to run the analog output of the source to the DA converter. The output from the converter is the input to the computer which will encode the digital signal to the desired format (How to Convert VHS to DVD). The schematic can be seen if figure 3.

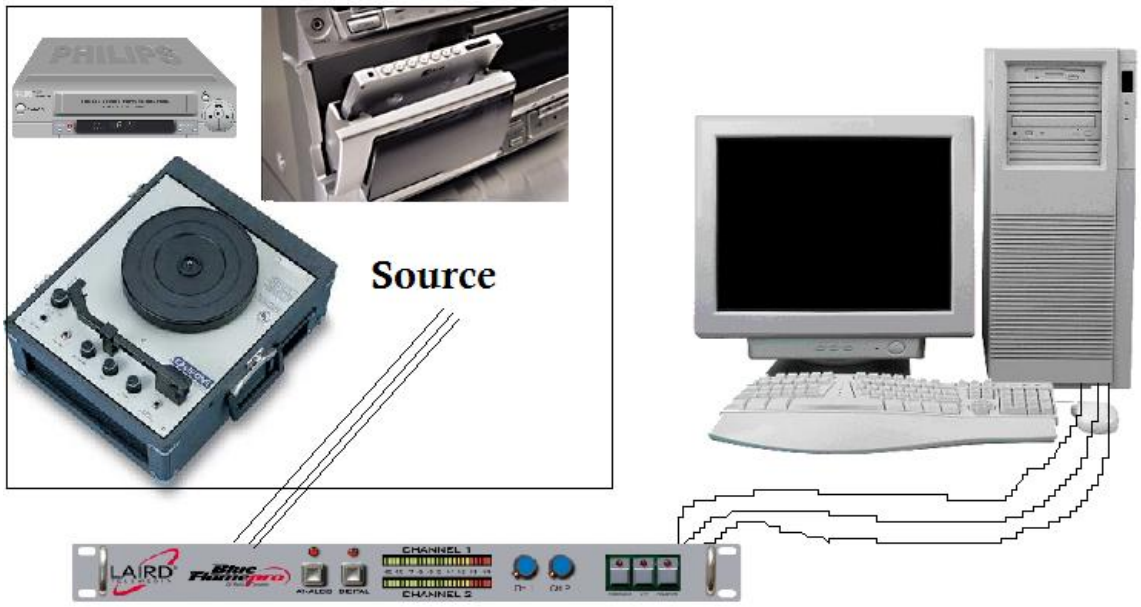

Figure 3.

The method in figure 3 will be used to convert the VHS, BetaMax, pneumatic tapes, cassettes and records. They all have an electric output and make this feasible. Media that works off light is not so easily converted. Microfilm and film work by passing light through them. An analog to digital converter can't pick up light signals. Fortunately there are scanners that can scan the film frame by frame. Professional models of the scanner can go through the film very fast. Access to one is hard to come by and the machines themselves are very expensive. For the purposes of this project, I think it will be more feasible to outsource this format to a professional company with the correct equipment.

Desired Digital Format:

The first thing to know about the format is that the information is always the same; there are just many different ways to compress and store the information. The different ways to store and compress the information are the different formats. Due to the fact that most computer systems today are either Windows or Mac, the formats possible will be limited to those compatible with these systems. For audio the most common formats are .mp3 .wma .wav. WAV is a lossless format. That means that it is not compressed at all when it is in this format, so no sound quality is lost (Digital Audio Formats). Another example of a lossless format is .flac. The downfall of a lossless format is that it takes up much more space than a compressed format. WAV is the default format for Microsoft Windows. WMA (Windows Media Audio) and mp3 are compressions (Digital Audio Formats). They have the potential to maintain the same quality as a lossless compression, but often some of the quality is lost. The amount of loss is often not noticeable by human ears. That's why mp3s are more commonly used than WAV, they offer about the same sound quality while taking up much less memory.

A Windows compatible format seems to be the best choice due to system compatibility on the WPI campus as well as the Thoreau Society. WAV, WMA, and mp3 are all commonly used with windows. When an audio conversion is executed, it will be encoded into a WAV file. The reason for this is to have the highest initial quality possible. It is very easy to convert a WAV to a WMA or an mp3 through many software programs. It is possible to convert an mp3 or a WMA to a WAV file, but no quality will be gained in the process (Digital Audio Formats). The quality of the format used will be determined by the quality of the physical media. If the initial quality is medium / low, then an mp3 will be the choice, which is expected.

A video format will also have to be chosen for the video media. A windows compatible format would once again be the choice. There are many choices with many different qualities. From lowest to highest the plausible choices are:

- AVI
- MPEG-2
- DivX
- MPEG-1

- RealVideo
- MWV
- QuickTime

Real Video and QuickTime are streaming formats which require special players, although they are very common. As with the Audio, when a conversion is executed, it will be encoded into an AVI or a MPEG-2 format to have the highest initial quality. It will then be converted to a quality appropriate format to save on space. All of the Digital Video Formats and their attributes can be seen in Appendix F (Quick Guide to Choosing the Right Video Output Format).

After digitalization, the media can also be converted into multiple streaming formats. A streaming format is a format that is designed to be placed on a website so others can view it without downloading it. If the materials were placed in a streaming format on the internet, it would make the now inaccessible media highly accessible to anyone and would help spread knowledge of Thoreau. The problem of placing the media on the internet is that of copyright laws. The media and materials belong to different collections with different protections. Making the files ready for streaming is one thing, but it's the Thoreau Society's call on if and how to use them.

Equipment:

All of the conversions require a certain amount of equipment. For all media formats a computer with a program to record the input, an Analog to Digital converter to convert the analog signal to something the computer can understand, and a reader/player for which ever type of media is needed.

Software:

After the physical signal is input to the computer, it is the job of the software to encode the digital signal to a file in a format that can later be played back. WPI's computers are set up with Windows Media encoder 9 series to do this job.

"Windows Media Encoder 9 Series is a powerful tool for content producers who want to take advantage of the many innovations in Windows Media 9 Series, including high-quality multichannel sound, high-definition video quality, new support for mixed-mode voice and music content, and more" (Windows Media Encoder 9 Series). Windows media encoder uses MPEG and WAV files which are lossless formats for premium initial quality.

There are many other encoders, they all do the same thing, and Windows Media Encoder 9 Series is the most plausible option because it is already installed on the computers that will be used for the operation.

Analog to Digital Converter:

Analog to digital (A/D, ADC) converters are electrical circuit devices that convert continuous signals, such as voltages or currents, from the analog domain to the digital domain where the signals are represented by numbers.

The AD converters are expensive pieces of equipment. Their prices range from one hundred dollars, to three thousand. The AD converter that WPI is in possession of is a LTM-5500 Blue Flame Plus Broadcast Bi-directional IEEE1394 Dv Media Converter. It converts the signal to IEEE 1394 digital signal which is completely compatible with Windows Media Encoder 9 series. IEEE 1394 is the standard signal output for AD converters. It is capable of 100 Mbps (Mega bytes per second) and can do 12-bit, 32 KHz

or 16-bit, 48KHz. 16-bit is high quality. It can balance the audio, and has line level adjustments to adjust the volume of audio. The cost of this piece of equipment is two thousand six hundred dollars. This is the most plausible choice due to it already being accessible and free of charge, however there are many other converters out there. Examples of other converters, their capabilities, and their prices can be seen in appendix G.

Media Player / Reader:

A device will be needed to play each of the different media formats. A VHS player, a BetaMax player, a pneumatic tape player, and a cassette tape player, are already in the possession of WPI and are accessible to the project. A micro-film scanner is allo accessible, but to convert microfilm in this way is very time consuming. A way to do reel-reel tapes, the film, and records still needs to be dealt with. Vinyl records are still current due to Disc Jockey use, so a device to play then should not be hard to come by. If a device to play the film and the microfilm were accessible, it would still me much less time consuming to have a third party company handle them, the film will have no electrical output, so an AD converter can not be used, It must be scanned frame by frame, or projected and recorded using a digital video camcorder.

Results and Conclusion:

Results:

The digitalization of the files went exactly as expected. Due to time constraints in the lab and the fact that the digitalization had to be done in real time, time was the major limiting factor in how much can be done in a day. The quality of the digital copies seems to be every bit as good as the original. The files were originally in the WMA \ WMV formats. The audio files were chosen to remain in the WMA format. Mp3 formatting is a possibility but the difference is very slight. The audio files were left in the WMA format is due to the size of the files; the mp3 format would not have saved enough memory space to warrant the conversion time / effort or the loss of quality. The conversion of WAV files to mpeg is also a possibility. WAV is a compressed format but it is still much larger than mpeg. Samples were converted from the WAV format to mpeg and although the file size was 25% the original, the quality was significantly decreased. Samples were also converted to the mpeg2 format which is an updated format for mpeg that maintains a higher quality. The mpeg2 samples were of not of sufficient quality although they were much better than the original mpegs. Memory space could have been saved using this format, but maintaining quality was out goal. The video files were left in the WMV format.

We were able to convert numerous examples of VHS, and audio cassettes. Although the means of converting, Betamax, vinyl records, Pneumatic video tapes, and floppy disks were present, no samples were supplied due to time constraints. Some formats were beyond the resources of the project and were not able to be converted. The formats not converted are Microfilm, reel to reel audio, 35mm and 16mm film strips. It is this projects recommendation that the formats be outsourced to professional agencies. Recommendations on agencies and their services can be found in appendix H.

Conclusion:

There were many problems facing this project, ranging from something as simple as copying a file from a floppy disk to something as complex as converting a media type that hasn't been seen in over twenty years to a digital format. Many of the formats that were the subject of this project are in jeopardy of being lost forever and that is why converting them to a digital format was so essential. Once in a digital format the files can be more easily accessed by anyone interested and the files are also much safer because the risk of them being compromised is much less than with an open format such as and audio or video cassette.

The materials that were digitized were passed on from Jeff Cramer, curator of the library at the Thoreau Institute. The files that are now in digital format weren't selected in any particular order, however they are files that have no funding behind them and were therefore less likely to be converted unless they were given more immediate attention. Overall, the project was able to convert over thirty files that take up more than four gigabytes of memory.

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Appendices:

Appendix A: VHS and Audio Cassette Deterioration:

Any tape that is older than 10 years old is in serious jeopardy. The largest threat is the breakdown of the binder / glue that holds the magnetic particles to the polyester base of the tape. After time the glue will let go and the magnetic particles will just fall off (Magnetic Tape Deterioration: Tidal Wave At Our Shores). What is left after that is clear, unplayable tape, which likes to stick to the device playing it. Tapes are also prone to accidental erasure. Most tapes, unless professionally made, can easily be recorded over with the touch of a button. “I know people who have recorded over parts of their daughters weddings on accident, just to catch a T.V. show they weren’t going to be home for” (Jeffery Cramer). A lot of the Cassettes at the Thoreau society are recording of something Thoreau related from the Television or recordings from the annual conference. Converting the Tapes to a digital format will make them easy to back up and make copies. It will also allow it to be placed on a more current media such as DVD as well as remain digitally on a computer storage device.

Appendix B: Film and Microfilm Deterioration:

Film degradation will usually occur from the outside to the inside of the film. The film will degrade faster if it is loosely wrapped because it allows the environment to get in between the layers. It increases the surface area and exposes more of the tape (Kodak Reliable Image Tip #73). Film is often damaged by people that handle them, not just by time and the environment. The film in the Thoreau Society are not handled at all which will add to their life span.

Most film tape is made of Cellulose Acetate. When the Cellulose Acetate deteriorates it will leave the film very brittle, the edges of the film may fade, and the film might shrink (Kodak Reliable Image Tip #73).

They also have Antihalation dies that absorb light to stop light from bouncing through the film a second time when it is being projected. When the Cellulose Acetate decomposes it produces an acid. The antihalation dies are clear when the film is developed, but the acid causes them to turn back to their original colors, which is pink or blue. The entire film would still be useable, but it would have a hue of pink or blue (Kodak Reliable Image Tip #73). The colors should be able to be fixed after digitalization.

Vesicular film is the majority of what was produced in the 1960's. When this film decomposes it gives off Hydrogen Chloride gas, which is the same as hydrochloric acid. It's not good for the films to have this around. It is easy to spot because it will make the box that it is in very brittle.

Film can also be acetate based. When acetate based film deteriorates it produces acetic acid. This has harmful effects on the film, film, container, and fades the colors in the film. When the acetate base degrades the film becomes sticky and soft to the touch. Most film also has plasticizers in it. The plasticizers make the film as non-flammable as possible. The problem with them is that they will ooze out of the film after time (Kodak Reliable Image Tip #73). The plasticizers will granulate of the surface or cause liquid bubbles in the film. Film also has silver in it. If the silver oxidizes it will ruin the picture.

Due to the fact that film is generally an obsolete technology, it is safe to say that the film at the Thoreau Society is old enough to exhibit any of these problems. Being kept in a climate controlled vault is the best thing for them, and that is where they are.

Appendix C: Vinyl Record Deterioration:

Vinyl Records age rather well. Not much will happen to them as long as nothing is rubbing them. They work by rubbing the needle different ways to produce different sounds; there is not a lot to go wrong. The needle wears the record out a little bit every time it is played, so the quality gets a little bit worse. Digital formats don't degrade with continuous plays, making it a safer option. The material Vinyl is the most stable analog media. As long as the records are handled with care they should be fine. The records should also be converted for reasons of accessibility as most people have a computer It is an obsolete format and devices to play them are becoming rare.

There is a Japanese company that recently came out with an electronic laser turntable. It works like a record player but without the needle. A laser reads the disk so it doesn't wear anything out and allows users to play the disk as many times as desired. It also has the capability of reading vinyl records that are warped. More information can be seen at http://www.elpj.com/index.html

Appendix D: Compact Disk and Digital Video Disc Deterioration:

The deterioration of CDs and DVDs isn't talked about as much as other media formats because they are relatively new. CDs first came out on the market in 1982 which make them 25 years old (CD-Rom Longevity). Theses discs and the media on them do deteriorate. The actual disk is made of polycarbonate with pits in it. A layer of aluminum is then sprayed onto the pitted side to reflect the laser. On top of the aluminum there is a layer of lacquer to seal it all up. The lacquer is where the label is printed (CD-Rom Longevity). If the lacquer gets scratched or wears away over time, the aluminum can corrode. When the aluminum corrodes there will be places where there is no aluminum to reflect the laser. A breach in the lacquer layer can also be caused by caustic dyes used to make the labels (Testimonial Essay on CD Deterioration). The dies would burn through the lacquer leaving holes for air to get to the metal reflective surface. This has been reported in CD aging more than 10 years and the caustic dye was in use in the mid to late eighties.

The disks are also vulnerable to a strand of fungi that actually eats the disk. If the disk is stored in a hot and humid place it is much more likely to get rooted. They fungi enter through poorly sealed edges or through small holes in the lacquer. This should not be an issue for the disks at the Thoreau Society because they are stored in a cool dry place.

Appendix E: Digital Deterioration:

Digital media is the end result of the project. Digital media is the media that is the most current media platform so it will be the most accessible, but digital media does have its own flaws. If a small bit of a file is damaged, the entire thing could be useless (Selecting a Proper Storage Device). If you half a tape, or a few tracks on a CD, you can still listen to the rest, a damaged digital file won't do anything. Depending on the storage device they are also prone to be deleted. If the memory they are stored on fails, or someone deletes it, the files will be gone forever. They are also prone to erasure through magnetism if the magnetic fields are too strong (Selecting a Proper Storage Device). The problem of compatibility is also an issue. To play a CD only a CD player is needed, and a tape, a tape player. To play something in a digital format, you need a physical computer capable of storing the file, a compatible operating system to store the file, compatible software to read the file, and a fully intact file (Selecting a Proper Storage Device).

The advantage is that digital media is easy to back up. It can be copied to many different hard drives, solid state memory, CDs, DVDs very easily so that it can be preserved. The format must be chosen wisely as well so that there will be software to play them in the future, although, as formats evolve there will be programs to convert the old formats to new.

Appendix F: Digital Video Format:

Advantages	Disadvantages	Note
DV-AVI		
* Superb video quality * Can record back to DV tape	* Large file size * 25GB for 60 min of video	Need to consider computer processing power due to file size constraints
MPEG-2		
* Good Quality * Can burn onto DVD disc	* Large file size * 4.7GB for 2 hours of video (the file size will differ based on the bitrate used, higher the bitrate, the bigger the file size)	Can easily produce high quality videos on DVD, using a DVD burner
DivX		
* Good Quality with reasonably small file size	* Not a standard video format * Cannot produce video onto DVD or CD	It is an editable video file format
MPEG-1		
* Standard video format for making Video CDs	* Video quality is not as crisp as MPEG-2. * Some DVD players do not support VCD playback	Best choice for making Video CDs
RealVideo		
* Small file size * Good picture quality * Ideal for web transmission	* Compressed format * Require special playback program * Cannot Edit	Was a commonly used video streaming format, but not in such high use today
WMV		
* Small file size * Good picture quality * Ideal for web transmission	* Compressed format * Cannot Edit	Microsoft supported streamable video format. Files can be viewed with Windows Media Player.
QuickTime		
* Good picture quality * Ideal for web transmission	* Larger file size (compare to other streamable formats) * Cannot Edit	Is known to have the best video quality of all three streaming formats listed here. In widespread use on the Web.

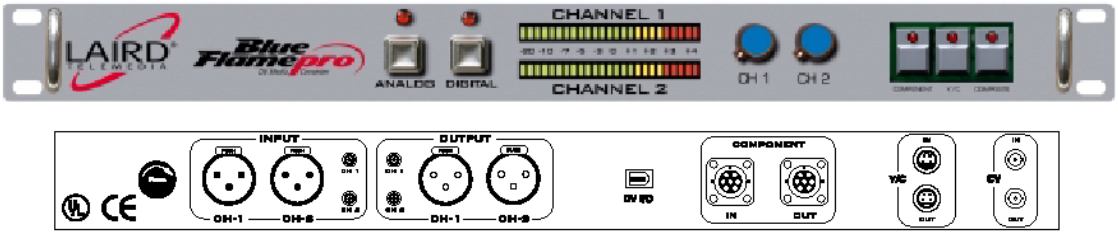
Figure 4.

(Quick Guide to Choosing the Right Video Output Format).

Appendix G: Equipment

LTM-5500 BI-DIRECTIONAL IEEE1394 DV MEDIA CONVERTER

$21550



LTM-5500 BI-DIRECTIONAL IEEE1394 DV MEDIA CONVERTER

The LTM-5500 provides a broadcast quality means of bidirectional conversion of analog video & audio signals to IEEE1394, also known as FIREWIRE or ILINK.

The unit accepts COMPONENT (R-Y, B-Y, Y), Y/C, or COMPOSITE VIDEO and 2-CHANNEL BALANCED AUDIO and converts it into IEEE1394 DV signals (100Mbps). The LTM-5500 is BIDIRECTIONAL and will therefore convert DV signals to analog.

Front panel controls allow audio level control and VU metering of audio signals. Each Balanced section (input & output) is equipped with an unbalanced audio signal for standard amplifier monitoring.

The LTM-5500 delivers broadcast analog signals to the world of DV, and can add new life to older technology that is not DV compatible. The LTM-5500 is housed in a 1RU cabinet.

Features

The LTM-5500 will accept Component, Composite RS170A NTSC signals or Y/C (SVHS) signals. NTSC & PAL Compatible.

Dual channel Balanced (XLR) audio signals can be fed to the LTM-5500.

An unbalanced high impedance line level pair of outputs is provided for

both input and output audio signals. These signals can be fed to standard power amplifier or powered speakers for monitoring purposes.
A front panel LED VU display is provided for monitoring of audio levels in either direction. The LED VU METER automatically tracks the audio signals in either mode of operation of the unit.
Front panel controls allow the adjustment of audio levels entering the unit. This allows the LTM-5500 to be interfaced with various equipment signal levels.
The LTM-5500 has two audio sampling rates:
12-Bit, 32KHz & 16-Bit, 48KHz
A front panel switch allows the user to select either Component Video, Composite Video or Y/C Video. In the DV to Analog mode, the LTM-5500 outputs both Component, Composite and Y/C video simultaneously.
The LTM-5500 is housed in a 1RU(1.75") standard EIA rackmount metal cabinet.
The LTM-5500 uses an automatic 110/220, 50/60 Hz power supply. The unit will automatically work in either 110VAC or 220VAC

800-898-0759 • 914-339-9555 • 2000 Sterling Road • Mount Marion, NY 12456 • www.lairdtelemedia.com

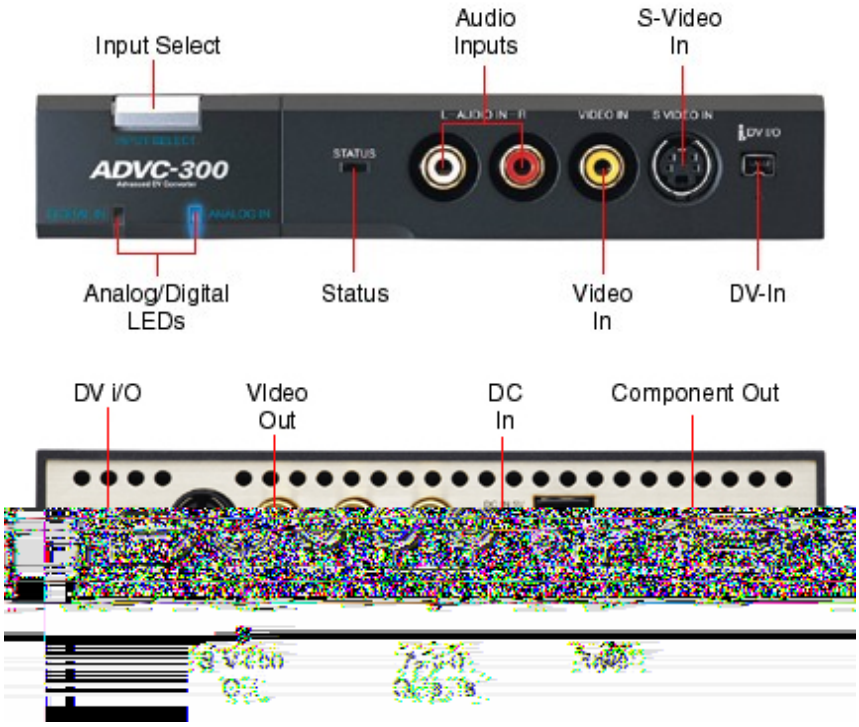
Canopus Grass Valley 602159 Advc 3000 Analog/digital Converter

$2206.99

- Connects to all standard definition (SD) video cameras, decks and editing systems
- Bidirectional conversion between analog and DV, analog and SD-SDI, and DV and SD-SDI
- Uncompressed 4:2:2 video processing between component and SDI
- Signal generator feature (black burst signal)
- Converts DV device control signals to RS422 for professional VTR control
- Canopus PerfectSync technology eliminates signal disturbances, frame skips and duplications for perfect conversion of every frame
- Compatible with leading editing and DVD authoring applications including Grass Valley EDIUS, Final Cut Pro, Avid Xpress, Vegas, Adobe Premiere Pro and more
- Industry-standard digital I/O including SDI, DV and digital audio (AES/EBU)
- YUV component, S-Video and composite video I/O
- XLR balanced and RCA unbalanced audio I/O
- Reference input and LTC time code I/O
- Two RS-422 control channels
- Color bar/1kHz test signal output
- EIA 19 inch rack mount size (2U)

Canopus ADVC300 Bi-directional Analog / Digital Video Converter

$479.99



- Video Formats
  - NTSC: 720x480 @ 29.97fps
  - PAL: 720x576 @ 25fps
- Audio Formats
  - 2-channel 48kHz 16-bit
  - 4-channel 32kHz 12-bit (input for two channels only)
- Digital Video Input/Output
  - 1 x 4-pin FireWire
  - 1 x 6-pin FireWire
- Analog Video Input
  - 1 x S-Video (4-pin miniDIN)

    - 1 x composite (RCA)
- Analog Video Output
    - 1 x component (D1)
    - 1 x S-Video (4-ping miniDIN)
    - 1 x composite (RCA)
- Analog Audio Input (unbalanced)
    - 1 x stereo (RCA)
- Analog Audio Output (unbalanced)
    - 1 x stereo (RCA)

Canopus 776-10138-100 ANALOG TO DIGITAL CONVERTER

$199.00

- VIDEO FORMATS- NTSC: 720 x 480 @ 29.97fps
- PAL : 720 x 576 @ 25 fps
- ADVC110 also accepts SECAM video (input only)

- AUDIO FORMATS- 2-channel 48kHz 16-bit
- 2-channel 32kHz 12-bit
- DIGITAL VIDEO INPUT/OUTPUT-
    - (1) 4-pin S100 FireWire port (100Mbps)
    - (1) 6-pin S100 FireWire port (100Mbps)

- ANALOG VIDEO INPUT-
    - (1) S-Video port (4-pin miniDIN)
    - (1) Composite port (RCA)
- ANALOG VIDEO OUTPUT-
    - (1) S-Video port (4-pin miniDIN)
    - (1) Composite port (RCA)
- ANALOG AUDIO INPUT- (unbalanced)
    - (1) Stereo port (RCA)
- ANALOG AUDIO OUTPUT- (unbalanced)
    - (1) Stereo port (RCA)
- POWER SOURCE - IEEE 1394 bus powered or DC5V from EIAJ#2 DC jack
- REQUIRES - Note: A video capture card or IEEE 1394 FireWire connection is required to capture DV.
  Wins PC: Windows 2000 (requires Service Pack 3 or higher),
  Windows XP Home or Windows XP Professional
  (requires Service Pack 1 or higher).
  Mac : Mac OS X 10.1 or later

Appendix H: Outsourcing:

Digital Scanning Inc. is a company dedicated to Microfilm. They make microfilm, reproduce microfilm, and digitalize microfilm. They are located in Scituate Massachusetts. Digital Scanning Inc. (DSI) offered to do a representative sample to show how well they can convert the microfilm. The cost of the process depends on which type of microfilm, condition of it, and the media that is on it due to the fact that hand written is harder than text. A quote was obtained from DSI stating that the microfilm would range between two hundred and twenty five to two hundred and fifty dollars per roll. With fourty five rolls of microfilm in the collection that is a hefty price of ten to eleven thousand dollars.

Video Transfer is a company based in Boston Massachusetts with a branch in Southborough. They specialize in transferring video between different formats. A 35 / 16 mm film projector proved hard to find, and even if one was available, recording the projection was the best that could be done on this project with the available resources. Professionals scan each frame of the film and put them into a digital video format. Video Transfer charges $12.50 per 50 feet of 16mm or 35mm film. Video transfer also has the capability of doing reel to reel audio.