

Anyone who has ever tried to work out with a portable music device can speak to the disadvantages of portable cassette players and portable CD players. Cassette players cannot access specific tracks instantly like a CD player can. A runner can't replay her favorite song at the most difficult point in her run. The quality of the music on a cassette player is also not as good as on a CD player. CD players, even the newest, most shock absorbing models, are always prone to skipping. Neither device is capable of easily adding new tracks. Cassettes can be re-recorded but the recording process is error prone and often results in the taping over of part of a song. Once audio CDs are created new tracks can not be added to the CD. Many of these "flaws" may seem trivial but to anyone who listens to music on the go, these imperfections represent an impetus to seek a better mouse trap.

The portable digital music player, first marketed in the U.S. in 1998, solves all of the problems associated with the portable music players that came before it. The device has no moving parts so it never skips and produces CD quality music. Since its songs are actually mp3 files written onto the device's memory, songs can be removed or added at any time. Each song can be accessed at any time and the order in which songs are played can be randomized.

From reading the above description of inferior portable music technology, it is clear why inventors of the portable digital audio player sought to develop such a device. What is not clear, is why it took inventors so long after the invention of the CD player, by Sony in 1991¹, to produce and market the portable digital audio player. One can imagine two reasons for the timing of the entrance into the market of the portable digital music player; one is supply side, the other is demand side. On the supply side, it is possible that the portable digital audio player was invented when it was because of the invention of any one of its component parts. On the demand side, it is possible that the device was brought to the market in 1998 because of the existence of free, easily attainable, high quality, yet relatively small music files, specifically, files in the mp3 format. This paper argues that the demand side explanation is the one which was the driving force behind the arrival in the marketplace of the portable digital audio player.

¹ <http://www.uspto.gov>

The portable mp3 player would never have been viable for use with previous audio file formats. The first audio format, the wav, encoded a 2 minute piece of CD quality audio in about 20 MB. In 1992 the Moving Picture Experts Group, a consortium which meets under the International Organization for Standardization defined MPEG, a standard for compressing audio files. The MPEG format was never patented because it was meant to be an international standard for audio encoding. However, many companies hold patents in the US for specific algorithms that perform the encoding and decoding of MPEG files. Since 1992 the Moving Picture Experts Group has been improving on the quality of compression of MPEGs and has introduced layers 1, 2, and 3. MPEG layer 3 has the most complex and effective encoding and is the popular format of audio files on the internet today. The file format is abbreviated mp3.²

Not only are mp3 files small and of good quality; almost any popular song in mp3 format can be found and downloaded for free from the internet. In the old days, that is, before 1999, technically inclined music aficionados could use various search engines to locate computers that acted as file servers from which they could download mp3 files. This process, however, was error prone. Computers that were not online were still included in the search engines. Additionally, many people who maintained music servers made their sites “ratio sites” which means that they required people to upload music files, sometimes specific songs, before they could download from the server. Still other sites contracted with third party companies and required potential music downloaders to pay the third party company for some service (for example, a magazine subscription). In return, the person would get unlimited or “leech” access to the music site. Finding a fast, free, low ratio site that had the music that one wanted was a time consuming task.

Then in 1999 nineteen year old Shawn Fanning wrote a program called Napster in his college dorm room. Napster is an application that can be downloaded from the internet for free. The program allows users to log in and provides a search engine to locate songs from the entire body of files on the hard drives of everyone who is logged in. Once a song is located on some other person’s machine, the user may download it onto her machine. Napster replaces the error prone task of locating a suitable source from which to download. It provides a way for people who are not technically inclined to get

² <http://www.cselt.it/mpeg/>

mp3 files. Moreover, it provides an easy means for people to acquire the files to put on a portable mp3 player.³ The demand side explanation for the immergence of portable mp3 players is a powerful one because the timing is right. The portable mp3 player was launched in 1998, when the internet music industry was just picking up, and just months before Napster came online.

The conception of an mp3 player has been around well before the portable models were first produced in 1998. Mp3 player applications for personal computers were developed almost as soon as the MPEG standard was published. One of the most popular of such programs is Winamp, a free application for Windows machines developed in 1997 by Nullsoft and pictured in figure 1.1. Winamp's main panel displays the song that is playing, the number of minutes that it has been playing, and contains buttons like a CD player for previous track, play, pause, stop, next track, randomize, and repeat. It also has an equalizer panel and a playlist panel.⁴

The first portable version of Winamp was developed by Diamond Multimedia and came onto the market in 1998. The product was called the Rio and the first model is referred to as the Rio 300. (see figure 1.2) The Rio 300 came with 32 MB on board memory which yielded up to 60 minutes of audio files, depending on the quality of the files (higher quality files take up more room). Its dimensions were $3\frac{1}{2} \times 2\frac{1}{2} \times \frac{5}{8}$ inches, it weighed 70 grams, it was powered by a



Figure 1.1

Winamp can be downloaded from <http://www.winamp.com>. Songs procured from Napster <http://www.napster.com>. Screenshot taken by Lisa Basile.

³ <http://www.napster.com>

⁴ <http://www.winamp.com>

single AA battery for 12 hours of continuous play, it had one slot for an additional flash memory card, and it shipped with headphones and a parallel port adapter to connect to a personal computer. It also included software for a Windows 98 machine that enables users to transfer mp3 files from the PC onto the Rio when the two are connected via the parallel port. The product initially went for \$199.95.⁵



Figure 1.2

<http://www.riohome.com>

Figuring out how the Rio works might give us some hints as to what component parts might have been responsible for the Rio's entrance into the marketplace. Winamp is implemented by a multi-purpose personal computer, which means that it is purely a piece of software. It was written in a high level language, probably C++ or Java, by a team of software developers. The computer hardware executes the program only after the program has been translated into the 1s and 0s that the computer can understand. The Rio is a specialized piece of hardware whose only requirement is to perform one task: that is, to play music. Therefore, the logic that performs the task can be implemented completely in hardware. That is, no software program runs on top of the Rio's hardware. Instead, there are physical previous track, play, stop, next track, hold, randomize, and repeat buttons on the machine. When they are pressed, the electronic gates inside of the Rio implement the logic that is necessary to perform the task being asked of it. Electrical engineers have been designing systems of electrical gates that perform specialized tasks for years. The calculator is a much older example of a specialized machine whose functions are implemented in its hardware.

The memory technology that the Rio uses is much newer than the technology used to drive the machine. It might be argued that it is this technology that was responsible for the device's entry into the market in 1998. The Rio uses flash memory cards that are literally cards about the size of a stamp. The card is non-volatile memory whose contents can be altered. This type of memory card is referred to as Electrically Erasable Programmable Read-Only Memory (EEPROM). The card was initially

⁵ <http://www.riohome.com/>

developed for use in a digital camera. US patent number 5,517,241 is entitled “EEPROM memory card for an electronic still camera.” Its assignee is Fuji Photo Film Co., Ltd. in Kanagawa, Japan and the patent was granted on May 14, 1996.⁶ Today there are many companies that manufacture the same type of cards. For example, Diamond Multimedia sells EEPROM cards for use with the Rio.

The launch of the Rio 300 in 1998 was a success. In November of 1998 Popular Science Magazine awarded the Rio 300 the “Best of What’s New Award.” Additionally, in the December 1998 issue of Computer Gaming World, the Rio 300 was named the “Number One Hardware Stocking Stuffer.” The article in Computer Gaming World stated, “Now Diamond has developed the Rio PMP300 portable music player, which lets you take MP3 files on the road in a player about the size of a pager...Because the files are stored in solid-state memory, the device is completely shock-resistant.”⁷

Since the Rio 300 was released, Diamond has shipped the Rio 500 and also the Rio 600. The Rio 500 had 64MB of onboard memory as opposed to the 300’s 32. It also connected to the PC via the USB port as opposed to the 300’s parallel connection. This is an improvement because the USB port facilitates a connection that is 5 times faster than the parallel port and because it is often free while the parallel port is often used to connect a computer to a printer or to another drive. The Rio 500 was also compatible with a Mac computer while the Rio 300 was only supported by a PC. The advantage of the Rio 600 over the Rio 500 is that it will work with Windows 2000 machines while the Rio 300 and 500 are exclusively for Windows 98 machines.

In addition to shipping new improved models of the Rio, Diamond Multimedia ships a car cassette adapter that can be plugged into the Rio so that one can listen to the mp3s on her Rio via the speakers in her car. Diamond has also teamed up with Nike to produce the Nike Psa120 which has a sporty design, a belt clip, and a handheld remote. The device is marketed specifically to athletes. Coming soon from Diamond is the Rio 800 and the Rio Receiver, which you can plug into any phone jack in your home and use to stream audio from your PC’s hard drive without interfering with your phone calls.⁸

⁶ <http://www.uspto.gov/>

⁷ http://www.s3.com/default.asp?menu=company&sub_menu=Press_Center&ID=224

⁸ <http://www.riohome.com/>

Diamond Multimedia was the first company to produce and market a portable mp3 player. However, the player was never patented. Today, there are over a dozen companies that manufacture popular portable mp3 players. Each player has its own design and specifications. Figure 1.3 is a table of the major players in the U.S. portable mp3 market.

Product Name	Company
RaveMP	Sensory Science Corporation
IMC Kanguru CD MP3 Player	IMC Kanguru
NOMAD	Creative Labs
IPaq Personal Audio Player	Compaq
DUO-MP3 Player	Digiset
Sony Clip	Sony
Finepix	Fuji
Yepp	Samsung
SoulMate	DigMedia, Inc.
Lyra	RCA
MPDj	Audiovox
COOLTrax	ClearLink
Mpress3	Philex
Pontis	Pontis Electronic
PJB	Remote Solution

Figure 1.3 – Popular portable digital audio players marketed in the U.S.⁹

Of the products in Figure 1.3, a few warrant discussion because of their differences from the Rio. For example, the RaveMP includes a built-in microphone that can be used to record voice audio. The RaveMP also does not use EEPROM memory cards to store files. Instead, it uses Iomega click! disks which are much more inexpensive than EEPROM

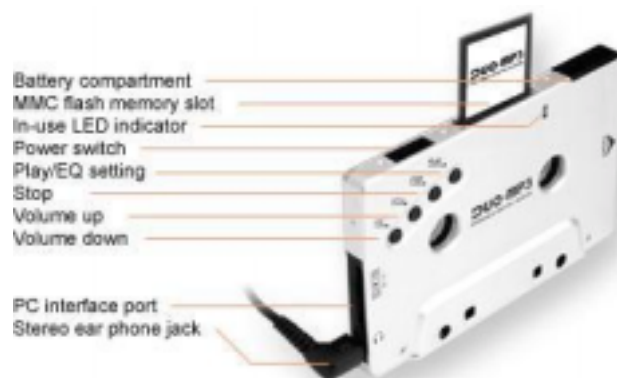


Figure 1.4 – the Digiset DUO-MP3 Player

<http://www.digiset.com/>

⁹ <http://www.mp3shopping.com/english/mp3players.htm>

memory cards. The Digisette, pictured in figure 1.4, is an mp3 player but also a cassette that can be put into virtually any standard cassette player and played. The EEPROM memory card fits into the cassette. Headphones are attached to the player when it is used as a stand-alone mp3 player. The IMC Kanguru is actually a CD player that will read standard audio CDs but also CDs that have mp3 files stored in them. A standard CD holds 650 MB of data which translates into about 11 hours worth of mp3 files. Although this device allows one to carry around a lot of music, it does not solve the skipping problem that regular CD players pose. Fuji's FinePix is both a digital camera and a portable mp3 player.

It is the existence of very compressed, high quality music files, aided by the explosion of music file trading on the internet, that is probably most responsible for the portable digital audio player's entrance into the market in 1998. First, the timing is right. If EEPROM memory cards were solely responsible for the product's emergence, the portable digital audio player would have come on the market in 1996. Secondly, one can certainly imagine portable mp3 players that do not use EEPROM cards for memory. If the EEPROM memory technology had not been invented, the existence of the internet mp3 file trading industry would have forced inventors to use a different memory medium to get a portable mp3 player into the marketplace. Such substitute memory technologies are available as shown by Iomega, a company that, as discussed above, is already producing mp3 players that use click! disks to store mp3 files.

It should now be clear that a demand side explanation for the portable mp3 player's entrance into the marketplace is the most convincing. What has not yet been explored is why Diamond Multimedia does not hold a patent for its Rio player, since it was the first company to introduce the portable mp3 player. The next section of this paper will explore this puzzling question.

Part II – Technology Diffusion

Figure 1.3, which displays all of the popular mp3 players marketed in the United States, is evidence that a patent for a portable digital audio player was never issued in the US. If a patent had been issued, one firm would hold the rights to produce such a player and these rights would be exclusive for the length of the patent. For a utility patent filed after June 8, 1995, patent protection lasts for 20 years after the filing date of the patent.¹⁰ In the event that Diamond holds a patent for the Rio, all the firms in figure 1.3 would be paying Diamond Multimedia licensing fees in order to produce a portable mp3 player. However, after my own unsuccessful search of the United States Patent and Trademark Office database and after email communication with Kelley McGrath, a public relations representative for Diamond Multimedia, I learned conclusively that a patent for the Rio was never issued.

There are several viable explanations as to why the first developer of the portable mp3 player in the United States, namely Diamond Multimedia, does not currently have a patent for its product. This paper will consider the explanations and determine which is the most likely.

It is possible that Diamond did not patent the Rio because when the Rio first came onto the market, Diamond was a small startup company that did not have the resources available to finance patent lawyers and patent fees. Another possibility is that in the spirit of free mp3s distributed on the internet and free mp3 player software for personal computers, Diamond tried to cater to its prospective internet-age customers by not using the government to prohibit other companies from developing similar products. A third explanation is that Diamond deliberately did not patent so that competitors would enter the market and help Diamond improve on its technology. Still another explanation is that a patent application for the Diamond Rio actually exists but is being deliberately submerged in paperwork so that the patent has not been issued and therefore has not been published. Lastly, the existence of a foreign firm which has patented a portable mp3 player in every developed country except the US, may explain why Diamond didn't patent the Rio in the US.

¹⁰ Mahoney, 363.

The theory that Diamond did not patent the Rio when it was developed because of limited financial resources is not likely. When the Rio first came onto the market it received a lot of interest and attention. Its November 1998 win of the “Best of What’s New Award” from *Popular Science Magazine* and its December 1998 naming of “Number One Hardware Stocking Stuffer” by *Computer Gaming World*¹¹ would have both been signals to company management that the Rio could be an extremely lucrative product. Moreover, the Rio attracted a lot of attention in October 1998 from the Recording Industry Association of America (RIAA) who filed a suit against Diamond Multimedia in an attempt to prevent the company from distributing the Rio.¹² (Diamond won the suit on October 26, 1998) The early attention that the Rio received would have indicated that the product could be extremely lucrative. Such attention would have attracted firms wishing to finance the project, most of whom likely would have insisted on filing for patent protection.

In addition, it is likely that Diamond’s early relationship with the law firm that defended it in the RIAA suit, Wilson Sonsini, Goodrich, and Rosati, would have encouraged Diamond to file for a patent. Wilson Sonsini, Goodrich, and Rosati is perhaps the preeminent law firm in the world for work with clients in high tech industries. The firm is headquartered in the heart of Silicon Valley and its clients include, to name a few, Apple Computer, Inc., Hewlett-Packard Company, and Sun Microsystems, Inc. The firm has six patent attorneys and it very likely would have encouraged Diamond Multimedia to patent its Rio, even if it had to allow Diamond to delay payment on patent related work.¹³

Even if Diamond did not have the resources to file for a patent when it first started shipping the product, it would have had the resources to file for a patent after it started collecting sales. US patent law allows a “grace period” under which a company can file within one year of its first public use, sale, or disclosure of an invention.¹⁴ Because of the early signs that the Rio could be profitable and because of the grace period US patent law

¹¹ http://www.sonicblue.com/default.asp?menu=Press_Room&sub_menu=&ID=224

¹² http://www.sonicblue.com/default.asp?menu=Press_Room&sub_menu=&ID=215

¹³ <http://www.wsgr.com>

¹⁴ Mahoney, p. 363.

allows to file, it is unlikely that Diamond failed to file for a patent because of lack of resources.

Another potential argument for the reason Diamond neglected to file is that the company tried to emulate the behavior of internet music industry firms such as Napster and Winamp, who offer their products free on the internet and also have not filed for patents. In choosing not to file for a patent, Diamond may have intentionally encouraged other firms to start producing similar devices so as not to alienate potential customers, who might be put off by the monopoly stature that a patent temporarily provides. This argument is weak because unlike software programs like Napster and Winamp, which are distributed free, Rio is a piece of hardware, sold on e-commerce sites and in stores, for a profit. It is doubtful that Diamond would have risked forfeiting potential profit by instead making the gamble that customers would have a greater propensity to buy a product whose inventors failed to protect its product with a patent.

Perhaps Diamond deliberately did not file a patent in order to encourage other firms to get into the market in order to improve on the product. The overall strategy in this case is twofold. Firstly, the strategy was to be first in the marketplace, gain brand name recognition, and become the industry standard. Secondly, if firm X comes up with a better design, Diamond could steal company X's design quickly, and, because Diamond already has brand name recognition, it would reap the benefits of company X's innovation.

This description of a business plan, which does not employ the use of a patent, is possibly Diamond's business plan because Diamond has already accomplished phase one of the strategy (that is, first in the marketplace, brand name recognition, and industry standard). For most American consumers, a portable mp3 player has become synonymous with a Rio. Mainstream articles describing the new portable mp3 players typically only mention the Rio or endorse it as "the best" or "the most popular" or "the first" portable mp3 player.

Additionally, it is possible that this type of business plan is Diamond's strategy because the Rio 300, while an extremely innovative product, left much room for improvement. Perhaps a small firm like Diamond Multimedia did not have the resources to explore all the possibilities for aspects of the Rio 300 that could be improved. The

most serious flaw of mp3 players sold today lies in the solid state memory EEPROM cards that are used to store music files. An article entitled, “Hey, Walkman: Time to Face the Music on a Chip” printed by the *New York Times*, observes, asserts, “Much of the cost of a player, which is passed to consumers, is consumed by the cost of memory”¹⁵ The article laments, “A digital player with memory that costs less than \$100 has eluded the marketplace.”¹⁶ Some firms have tried to overcome this problem by using a different medium for storing the music files. For example, Sensory Science Corporation, who produces the RaveMP, has begun to use Iomega click! disks instead of EEPROM cards to store files. Each 40MB disk costs about \$10. However, use of the click! disk introduces moving parts and therefore the possibility of skipping into RaveMP players.¹⁷

Another serious problem with EEPROM cards, perhaps more important than their high cost, is that their decreasing supply. In 1999, the *EE Times* reported, “A shortage of supply and rising prices for flash memory, a core component of MP3 digital music players, are slowing manufacturers' introduction of the products.”¹⁸ The problem of expensive and a diminishing supply of EEPROM cards has not yet been solved by producers of portable digital audio players. However, it is possible that Diamond, seeing no clear solution to the problem, deliberately did not patent its product so that other firms would work concurrently to find a solution.

If a firm other than Diamond is the first to find a solution, it will not necessarily mean a loss in market share for Diamond. Because of the brand name recognition and industry standard position Diamond is in, if another firm makes an improvement, Diamond can quickly introduce the improvement into its Rio and hardly lose any business. In this way, by not patenting, Diamond can use other firms to conduct R&D and then reap the benefits of competitor's R&D because of its position in the market.

The argument that Diamond Multimedia could steal R&D from other companies also rests on the assumption that Diamond would have access to improvements made by Company X at a reasonable price. Conceivably, Company X could patent its improvement to the portable mp3 player. In order for the above business strategy to

¹⁵ Marriott, “Hey, Walkman: Time to Face the Music on a Chip.”

¹⁶ Id.

¹⁷ Id.

¹⁸ <http://ebnonline.com/story/chipwire/OEG19991020S0064>

work, Diamond would have to assume that if Company X patented its improvement, it would allow Diamond to license or buy the improvement at a reasonable price.

Additionally, making the decision to intentionally not patent requires a bit of a gamble, which is another reason this explanation for the lack of a patent is not entirely convincing. Diamond Multimedia had to make a decision about whether or not to patent within a year of the first shipment of the Rio. Although the company knew it was first in the marketplace, how did it know it was going to become the industry standard? What if the first model of the Rio was a disaster? What if thousands were shipped with serious defects? What if it got bad reviews? These events would have made the above business strategy unavailable to Diamond. Decision makers within the company may have thought it wiser to simply file for a patent in order to guarantee monopoly position in the marketplace. It is not clear that intentionally not filing, and instead going with a riskier business plan, would have been at all appealing to anyone who had equity in Diamond Multimedia in 1998.

A fourth explanation for why Diamond never patented the Rio might be that Diamond actually filed for a patent, but is deliberately keeping the application submerged in paperwork so that it has not yet been issued. After the patent is issued, other firms marketing a portable digital music player would have to pay royalties to Diamond. The reason for not allowing the application to go through in a reasonable amount of time might be that not as many firms would get into the industry if they knew from the beginning that they would have to pay royalties. This scenario is not without precedent. A famous example of such a “submarine” patent is that filed by Jerome H. Lemelson for robotic equipment for assembly lines. Lemelson first filed his patents in the 1950’s, but filed continuances and altered his designs with such regularity that it delayed his patent from being issued until the 1980s. Thereafter, Lemelson was able to collect royalties from people who used his technology but had no idea that he had filed a patent for them.¹⁹

The American Inventors Protection Act, enacted on November 29, 1999, requires that every patent filed be published within 18 months of filing, regardless of whether or not it has been issued. This new procedure does not apply to patents filed before

¹⁹ Blount, p. 11 – 32.

November 29, 1999.²⁰ Therefore, the strategy of keeping a patent from being issued and published would still have been available to Diamond Multimedia. This strategy is not favored as a possible explanation for the lack of a patent because Diamond executives would have had to make business decisions that could be considered to be unethical. Moreover, the strategy would not guarantee Diamond royalties after its “coming out” because companies might object to the devious way in which the patent was kept from being published.

More insight into why the product was not patented in the U.S. can be found by examining what patents exist for portable digital audio players outside the U.S.. It turns out that a Korean company named Saehan Information Systems which produces the MPMan holds a patent for the product in virtually every developed country except the U.S. Saehan holds European patent EP00982732A1 for the MPMan which was filed on August 24, 1999 and issued on March 9, 2000. It holds Japanese and Chinese patents also both filed on August 24, 1999.²¹

It is clear why Saehan does not market its MPMan in the United States. Because Diamond has name brand recognition and an industry standard position since 1998, it does not make sense for Saehan to enter the U.S. market in 1999. However, although the MPMan appeared in the marketplace after Diamond’s Rio, it might not be clear as to which firm actually *invented* its product first. It is possible that both Saehan and Diamond have filed a patent in the U.S. and that patent officials are currently trying to determine who invented first. In this case, neither patent would be published and the public would have the impression that no patent application exists in the U.S. for the product.

This paper favors the possibility of a patent dispute in the U.S. between Diamond Multimedia and Saehan Information Systems as an explanation for the lack of U.S. patent for the portable digital audio player. There are three main reasons for this conclusion. First, other plausible explanations for a lack of a U.S. patent for the product have been examined in great detail and deemed unlikely. Secondly, the fact that Saehan held patents for the product in every developed country except the U.S. leads one to

²⁰ <http://www.uspto.gov>

²¹ <http://www.delphion.com>

believe that Saehan would have filed a patent in the U.S. Thirdly, correspondence with Andrew Bridges, the attorney at Wilson Sonsini Goodrich & Rosati that defended Diamond Multimedia in its suit with the RIAA, hints that a patent application for Diamond Multimedia actually exists. Bridges writes, “It’s not clear that Diamond Multimedia has **not** indeed filed an application to patent technology in its MP3 player. Patent applications in the U.S. are confidential. I don’t handle patents personally and am unaware of any patent status regarding this technology; even if I were, unfortunately, I wouldn’t be at liberty to comment.”²²

²² correspondence in email dated 11/20/00 from Andrew Bridges, Esq. of Wilson Sonsini Goodrich & Rosati.

Part III – Impact of Technology

Like most new technologies whose implementations are successful in the marketplace, the invention of the portable digital audio player has had far-reaching and powerful impacts on consumers and producers in a wide array of industries, both domestically and internationally. The most important impacts the invention has had have been the intimidation of the Recording Industry Association of American (RIAA), the decrease in sales of previous portable music technology products, and the explosion of sales of the portable mp3 player.

In October of 1998, as Diamond Multimedia was getting ready to release the Rio for the first time, the RIAA filed a legal suite with the U.S. Central District Court of California in order to prevent Diamond Multimedia from selling the Rio. On October 16, the court issued a Temporary Restraining Order (TRO) on Diamond Multimedia's Rio until a hearing on a Preliminary Injunction was to be held on October 26. As part of the TRO, the RIAA was required to issue a bond in the amount of \$500,000. In the event that Diamond Multimedia eventually prevailed in court, the \$500,000 from the RIAA would be used to compensate Diamond for lost sales due to the delay in the launch of the Rio.²³

Hilary Rosen, president and CEO of RIAA, commented after the TRO was issued, "While we are gratified by the court's action today, it is unfortunate that we had to resort to legal action to deal with this issue...Our preference has always been to work together with the many computer and consumer electronics companies to arrive at solutions to legitimize the commercial marketplace for digitally distributed music in a manner that protects the rights of artists."²⁴

On October 26, 1998 the U.S. Central District Court of California denied the RIAA's request to halt shipment of the Rio. "We are pleased with the ruling," said Andrew Bridges, attorney at Wilson Sonsini Goodrich & Rosati representing Diamond Multimedia. "This suit was brought on by the RIAA as a violation of the Audio Home Recording Act (AHRA), which imposes technology restrictions on certain types of consumer audio recording devices. Diamond Multimedia's Rio, which is incapable of

²³ http://www.sonicblue.com/default.asp?menu=Press_Room&sub_menu=&ID=214

²⁴ http://www.riaa.com/News_Story.cfm?id=162

independent recording or serial copying, simply is not a device governed by the AHRA.”²⁵

Diamond subsequently filed a counterclaim against the RIAA, and the RIAA responded with the following statement in a press release, “The claims made by Diamond can only be described as preposterous and irresponsible, and a transparent ploy to gain publicity for the Rio device in time for holiday sales. There is no factual or legal foundation for their claims whatsoever, and we are confident that the court will find accordingly. The RIAA will respond to each of Diamond’s frivolous allegations in court, in due course.”²⁶

Curiously, today the RIAA’s website contains a glowing review of the Rio 500. “This second generation player has a lot going for it...The sound quality, USB interface, 64MB of onboard memory and intuitive software are clear advantages.”²⁷ Perhaps the RIAA has chosen to disassociate itself from its attack on Diamond Multimedia in order to avoid further alienating the RIAA’s customers. In any case, the RIAA’s behavior toward Diamond Multimedia in 1998 clearly indicates that the new, portable mp3 player technology was seen as a threat to the RIAA’s business.

Since 1998, Diamond Multimedia’s sales have increased, largely because of the launch of the Rio. In 1997 Diamond’s total sales were \$443.3 million and 1998 they were \$608.6 million. Even though the Rio was only launched in November of 1998, Diamond’s financial statement, filed with the U.S Securities and Exchange Commission (SEC), states, “Net sales increased in 1998 by \$165.3 million or 37% compared to 1997, primarily due to an expanded product line-up, including two brand new product lines released in the latter half of the year, Rio and HomeFree.”²⁸

In 1999 Diamond’s net sales did not go up. Net sales for the second quarter of 1999 decreased by \$43.6 million or 25% to \$128.7 million compared to \$172.3 million in sales for the second quarter of 1998. Net sales for the first half of 1999 decreased by \$85.8 million or 24% to \$272.7 million compared to \$358.5 million in net sales for the first half of 1998. Diamond’s financial report filed with the SEC states, “The decrease in

²⁵ http://www.sonicblue.com/default.asp?menu=Press_Room&sub_menu=&ID=215

²⁶ http://www.riaa.com/News_Story.cfm?id=160

²⁷ http://www.listen.com/riaa/hp_info.jsp?sect=hw&sub=ps&pg=rio500_pp

²⁸ <http://www.sec.gov/Archives/edgar/data/936734/0000936734-99-000001.txt>

net sales was primarily attributable to reduced shipments of the Company's graphics accelerator products. This was partially offset by increased shipments of sound cards, as well as revenues from new products such as the Rio portable Internet music player and the HomeFree line of home networking products.”²⁹ Thus, in 1999 sales of the Rio actually went up, but we do not know by how much.

After S3 bought Diamond Multimedia, its sales continued to rise. S3’s net sales were 437.5 million for the nine months ended September 30, 2000; a 154.3% increase from the \$172.0 million of net sales for the nine months ended September 30, 1999. S3’s 2000 financial report, filed with the SEC, states, “our net revenue becomes increasingly based on entertainment-related products, including our Internet-related products such as our Rio digital music players.”³⁰

Other small companies that, for the most part, focus on the manufacture of portable digital audio players, have seen an increase in net sales as well. Sensory Science Corporation, which produces the RaveMP, had net sales of \$17.1 million for the three months ended September 30, 1998, and \$19.6 million for the three months ended September 30, 1999. This was a 15% or \$2.5 million increase. Sensory Science’s statement at the SEC states, “The increase in sales resulted from a \$3.1 million increase in revenues from new product lines. These new product lines include the RaveMP Portable Internet Media Players, Digital Televisions and California Audio Labs digital home theater products.”³¹

In fact, the entire market for internet audio related products is projected, by Frost and Sullivan, to increase exponentially in the years ahead. Frost & Sullivan's world internet audio market reports that the internet audio market generated revenues of \$41.7 million in 1998, an increase of 1,516.3 percent over 1997. Frost and Sullivan predicted that the industry would expand to \$1.9 billion total worldwide revenues by 2005. The market's compound annual growth rate is expected to be 72 percent.³² Refer to figure 3.1 for a graphical representation of this projection.

²⁹ <http://www.sec.gov/Archives/edgar/data/936734/0000936734-99-000013.txt>

³⁰ <http://www.sec.gov/Archives/edgar/data/850519/000089161800005112/0000891618-00-005112.txt>

³¹ <http://www.sec.gov/Archives/edgar/data/784721/0000950147-99-001281.txt>

³² <http://www.frost.com/verity/newsletter/it/99-07/art01.htm>

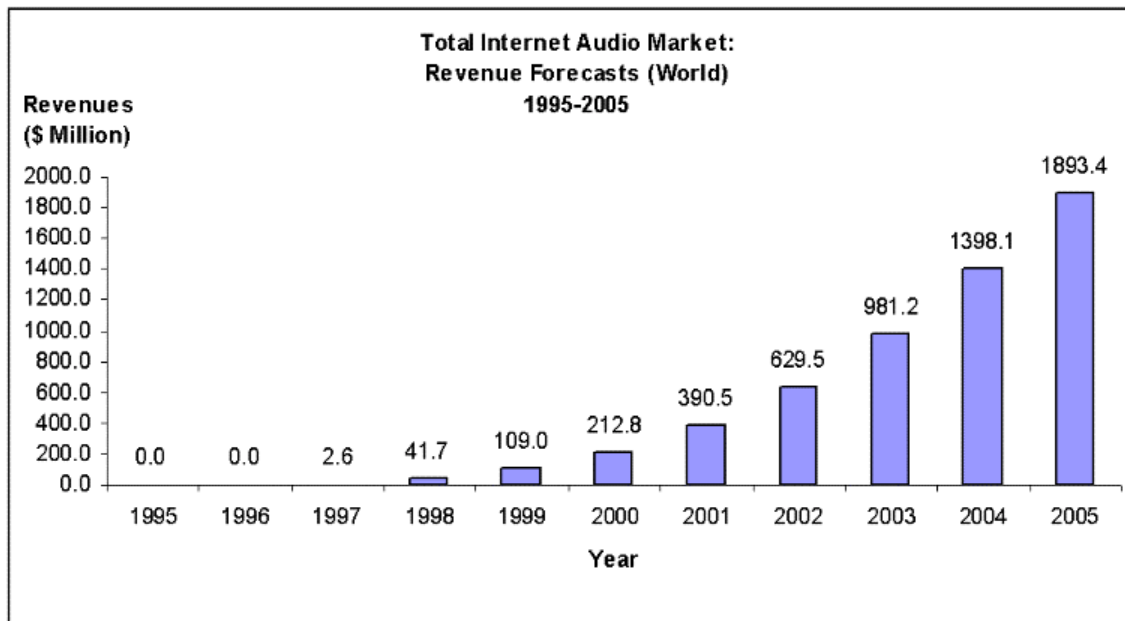


Figure 3.1

Given such a large increase in the sales of portable mp3 players, one might wonder how sales of previous portable audio products have fared. There is evidence that these sales have, in fact, decreased. Sony is a leading manufacturer of portable CD players and portable cassette players. In 1998 Sony's audio sales were 1,127,788 ¥, in 1999, 1,072,621 ¥, and in 2000, 934,865 ¥. Sony defines audio as including: MiniDisc ("MD") systems, CD players, headphone stereos, personal component stereos, hi-fi components, radio-cassette tape recorders, tape recorders, IC recorders, radios, headphones, car audio, professional-use audio equipment, audiotapes, and recordable MDs.³³

It should be noted that this "audio" category contains many devices that do not represent previous portable audio technology. In addition, causation can not necessarily be determined from this data. Just because Sony's audio sales have declined does not automatically mean that the entrance into the market of portable mp3 players has caused the decline. Still, it is reasonable to assume that many of the people who have bought portable mp3 players in the last three years would have otherwise bought other portable music solutions in these years. Since there has been such an increase in the sales of

³³ <http://www.sec.gov/Archives/edgar/data/313838/000095012300007096/0000950123-00-007096.txt>

portable mp3 players, it is reasonable to conclude that this has contributed to the decline in Sony's audio sales. Sony's audio sales data simply is consistent with our hypothesis that the invention of the portable digital audio players has decreased the sales of substitute products.

Panasonic, another leading producer of portable cassette and portable CD players, had declining sales in audio and video equipment for the fiscal year ending March 31, 2000. Sales of video and audio equipment fell 9.9%, to 1,706 billion yen.³⁴ Again, we can not claim using this data that it was the invention of portable mp3 players that caused this decline. However, we can say that our hypothesis that sales of substitute goods have gone down is supported by data that audio equipment sales are down for two major suppliers of previous portable music technology.

It is worth considering the possibility that the portable mp3 player portable is a perfect substitute for portable CD players and portable cassette players, lumped together as a single category of previous portable music technology. If this is true, we can extrapolate from the data just presented the amount of damage the Diamond portable mp3 player has imposed on sales of previous portable music technology. One must keep in mind that net sales data from Diamond Multimedia and S3 include sales from products besides the Rio. Therefore, this analysis represents an upper bound on the damage done by the invention of the portable mp3 player to the sales of previous portable music technology. In 1998, for which the Rio was only available for sale in the latter 2 months, Diamond's sales were up \$165.3 million. If Diamond's sales were evenly distributed throughout the year (we know they were not because of the Christmas season hike in sales the Rio must have caused), the Rio would have generated \$13.8 million in sales. This translates into a \$13.8 million decrease in the sales of previous portable music technology.

In 1999 the data is more confusing to interpret because Diamond actually had a decrease in sales relative to its sales for 1998. This was due to a decrease in the sales of its graphics accelerators. Therefore, I will not attempt to estimate an upper bound on damage done by the Rio in 1999. In 2000, nearly completed at the time of writing this paper, we turn to the data presented in S3's financial report, because S3 acquired

³⁴ <http://www.sec.gov/Archives/edgar/data/63271/000095012300006965/0000950123-00-006965.txt>

Diamond in September of 1999. S3 had an 154.3% or \$267.5 million increase in sales from the first nine months of 1999 to the first nine months of 2000. It is important to remember that during this time there were other portable mp3 players that came onto the market. However, because Rio has a large proportion of the market share because of its brand name recognition (this was explored in Part II of this paper), I will consider sales of other portable mp3 players during this time period negligible. Therefore, I conclude that an upper bound on damage done to previous portable music technology from 1999 to 2000 was \$267.5 million.

These estimated damages are upper bounds because Diamond and S3 sell other products, however, they are also upper bounds because clearly portable mp3 players and previous portable music technologies are not perfect substitutes. To determine a rough estimate of the degree to which the product categories are substitutes, one must consider whether two types of consumers exist. First, one must consider whether or not there are any consumers who, in the same year, would buy a portable mp3 player and a portable CD player or portable cassette player. Second, one must consider whether a person who buys a portable mp3 player would have otherwise bought a piece of previous portable music technology.

At the onset, it might seem ridiculous for any consumer to buy both a portable mp3 player and, for example, a portable CD player in the same year. However, one can imagine a scenario in which a consumer buys a portable mp3 player for the purpose of listening to it during exercise, hoping to avoid the skipping that a portable CD player introduces. However, this consumer might become dissatisfied with the limited and expensive storage space that portable mp3 players currently have. So this consumer might purchase, for example, a portable CD player to be used to listen to music on long airplane trips. Other such scenarios exist in which a consumer might purchase both a portable mp3 player and a piece of previous portable music technology in the same year. Consequently, we can determine that both products are not perfect substitutes.

Additionally, there are some consumers who might purchase a portable mp3 player and would not have otherwise purchased another portable music device. This type of consumer might be described as a “gadget girl;” a consumer who is so excited about new technology that she just has to buy it. This type of consumer bought a cell phone

when they were outrageously expensive, bulky, had a short battery life and were not at all commonplace. This person owns a laser pointer, a fergie, and a remote controlled vacuum. Although identifying these two types of consumers shows us that these products are not perfect substitutes, one many wonder how common these two types of consumers are. The answer is probably not that common. These types of consumers are probably a small subset of all the consumers that purchase portable mp3 players. Thus, the figures presented for the damages imposed by the portable mp3 player on previous portable music technology are certainly upper bounds, but the distance between the actual damage and the upper bound is probably not very far.

In the short time in which portable digital audio players have been on the market, they have had an impact on the music recording industry, on companies that have begun to produce the player, and on companies that produce substitute products. The emergence of portable mp3 players has served to threaten the RIAA and boost the sales of firms that got into the portable mp3 player market. Because the portable mp3 player is a close substitute to previous portable music technology, it has probably decreased the sales of portable CD players and portable cassette players.

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