Joe Diaz
21M.380
10/29/2009

The Fate of Auto-Tune

"This is anti-auto-tune,
death of the ringtone,
this ain't for iTunes,
this ain't for sing-alongs…
I know we facing a recession,
but the music y'all making going
to make it the Great Depression."

"D.O.A. (Death of Autotune)" - Jay-Z[1]

When strong lyrics are released in order to challenge a means of modifying music, one can

be certain that technology in question has had a prominent effect on those who use and listen to it.

With that said, auto-tune has become extensively intertwined in the present music scene of the

current youth generation. In one sense, it is used craftily behind the scenes to "perfect" performers'

voices while maintaining a semi-natural timbre. Concurrently, auto-tune has also been employed in

extremely audible contexts, especially within the pop, hip-hop, and R&B genres of popular music. In

fact, the top five songs from every weekly Billboard Hot 100 list over the past year include songs

that have implemented auto-tune as a clear, primary feature (see attached table).[2] Without much

detective work, one can assess that auto-tune technology has made its presence as an extension to

sound alteration very apparent.

Conversely, what still remains unclear is the period in which auto-tune will remain relevant

within today's popular culture. The electronic modification of music has existed for years in many

forms (effects pedals, modular synthesis, etc.) within multiple genres including country, classic rock,

blues, and others. However, very few technologies have had cultural impacts that last and continue

to be significant within the constant evolution of music development. Auto-tune appears to have

---

[1] Carter, Shawn "Jay-Z", "D.O.A. (Death of Auto-Tune)," The Blueprint 3, 2009.
[2] Top 100 Music Hits, Top 100 Music Charts, Top 100 Songs & The Hot 100 | Billboard.com, November 3, 2009, http://www.billboard.com/charts/hot-100#/charts/hot-100 (accessed November 3, 2009).

many forms of support that are pushing its usage along, ranging from its attractiveness within the hip-hop community to the millions of internet users that are steadily developing creative applications for the technology. Though, with the insurgence of artists and supporters fueling a growing "anti-auto-tune" coalition, it may seem that the magic of auto-tune may be on its way out.

Auto-Tune History and Development

The framework behind auto-tune was developed by Dr. Harold (Andy) Hildebrand during his time working as a research scientist for Exxon Production Research and Landmark Graphics.[3] Originally, Dr. Hildebrand developed a technique to map the Earth's subsurface in the search for rich oil deposits using signal processing and autocorrelation. Carefully placed dynamite charges would send sound waves into the crust, and the reflections from the waves' interceptions would be recorded and interpreted to create images of layer structure and deposits.[4]

After leaving Exxon and returning to study music in 1989, Dr. Hildebrand founded Antares Audio Technologies and applied his seismic imaging techniques to problems found in musical digital signal processing (DSP). Using a similar form of autocorrelation, Hildebrand explored the possibilities of treating desirable pitches much like the hidden oil reserves in the crust. Using the input of sound (human voice) like the charges, Hildebrand was able to develop a software that "automatically tuned" to the nearest acceptable pitch given constraints such as key or mode. Thus, Auto-tune was born and first made available in 1997. Released as both software and hardware, audio engineers could purchase and install a plug-in or get the rack mount known as the ATR-1.

The technology for auto-tuning differs from both of its similar predecessors: the talk box and the vocoder. A talk box is an effect pedal that contains a strong speaker and an airtight plastic

[3] Antares History. 2009. 29 October 2009 <http://www.antarestech.com/about/history.shtml>.
[4] Frere-Jones, Sasha. "The Gerbil's Revenge." The New Yorker 9 June 2008.

tube that runs from the pedal to the singer's mouth.[5] Though there is some dispute to the actual creator of the talk box, Bob Heil is generally accepted as being the first one to make a modern prototype.[6] Peter Frampton received one from Heil as a Christmas gift in the 1970's. After using it in performance, the talk box's modern popularity began to skyrocket.

A vocoder is a synthesis system in which speech is passed through a multiband filter. The filters then are affixed to carrier envelopes, and a decoder applies the control signals (desired pitches) to the corresponding filters during re-synthesis. Put simply, speech is modulated with instrument pitches acting as carriers, creating an effect that takes a voice and gives it a robotic sound at a given pitch or chord.[7] Originally, this technology was developed as a speech coder for telecommunication by Homer W. Dudley during the 1930's.[8] Actual musical use of the technology first took form in 1969. A man named Bruce Haack developed the FARAD, the first vocoder designed for usage in music, and it premiered on his album, *The Electric Lucifer.*[9] However, the musical vocoder became wildly popular in late 1970's. The Main Street Disneyland Electric Parade, which began in 1972, is one of the most well-known applications of vocoder technology.[10]

Auto-tune is considered to be a phase vocoder. A phase vocoder differs from a standard vocoder in its ability to modify both frequency and time domains using algorithms that employ the short-time Fourier transform (STFT).[11]

$$\mathbf{STFT}\left\{x(t)\right\} \equiv X(\tau, \omega) = \int_{-\infty}^{\infty} x(t) w(t - \tau) e^{-j\omega t}\, dt$$

[5] I. What is a Talkbox? (The Talkbox FAQ). 2009. 29 October 2009 <http://www.blamepro.com/talkboxa.htm>.
[6] Heil, Bob. Bob Heil: A Living Live-Sound Legend Musician's Friend. June 2006.
[7] Anderton, Craig. PAiA Corporation - How Vocoders Work by Craig Anderton. 2006. 29 October 2009 <http://www.paia.com/ProdArticles/vocodwrk.htm>.
[8] Dudley, Homer W. System for the Artificial Production of Vocal or Other Sounds. United States: Patent 2121142. June 1938.
[9] [H] titles at Aquarius Records. 24 October 2009. 29 October 2009 <http://www.aquariusrecords.org/cat/h.html>.
[10] Smith, David. "Disney A to Z : The Official Encyclopedia." New York City: Hyperion Books, 1997.
[11] Chen, Victor C. and Hao Ling. Time-frequency transforms for radar imaging and signal analysis. Norwood, MA: Artech House, 2002.

Differing from a standard Fourier transform, the STFT includes a window function *w(t)*. The purpose of this function is to "frame" the inner transform, shaping it into discrete granular sections that can be modified individually. Using the STFT this way, the modification of frequencies can take place independently without modifying the time, and vice versa. This prevents effects such as an increase in tempo (velocity) when the pitch is increased, like voices of the cartoon characters, "Alvin and the Chipmunks."
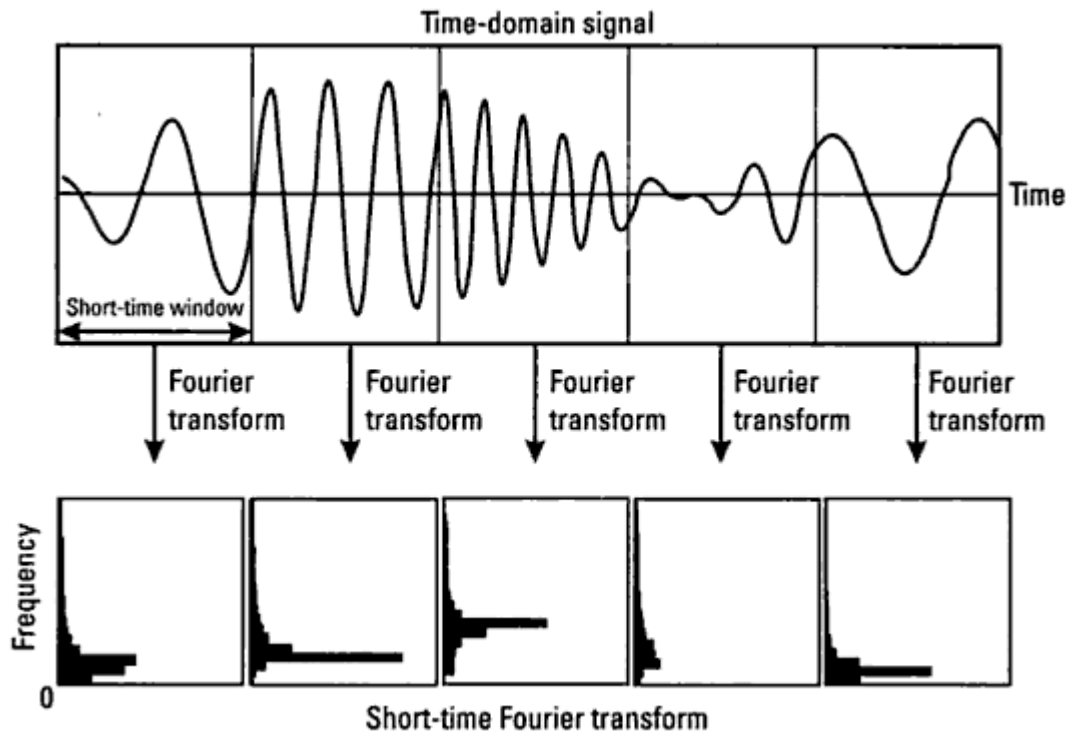
In the illustration above, the concept of small "granules," or portions of the overall transform can be visualized.

Concealed Use of Auto-Tune in Music Production

Though the technology has existed since 1997, auto-tune remained nearly unknown outside of the world of audio engineers and music production studios in its early years. Initially, its principal function was to covertly fix and alter incorrect notes in the studio without forcing the performers to come in again to re-sing, saving both time and money. However, little by little, studios would offer more and more extra help, e.g. assisting singers by sprucing up challenging passages to sound pitch

perfect. Eventually, these alterations became more and more frequent until they began to approach the ubiquity of a song itself.

As this phenomenon occurred, many artists and producers began to simultaneously question the ethics of digitally engineering their voices. Those that opposed the technology believed that in sacrificing their natural voices to the machine, the expressiveness of the music lost some form of its human element. In a Canadian Broadcasting Corporation (CBC) radio interview with Jian Ghomeshi from Q, NPR Music Reviewer, Tom Moon discusses the "takeover of Autotune."[12] When discussing the producer David Foster's decision to correct a flat performance by artist Neil Young, Moon comments,

> "[T]here's a certain quality that you get from him that no one else in the world has, and the minute that you put him on the grid and align him, as happens with auto-tune, you're in a different business. [S]uddenly, something that's essential about Neil Young, something about his 'Neil Young-ness' is taken away."

Auto-tuning also began to flourish specifically within the country genre, where performers voices tend to waver in tone more frequently. Opposing this trend, many artists took pride in their natural abilities. Artists such as, Martina McBride, Garth Brooks, Vince Gill, Trisha Yearwood are some of the artists that refused the studios' decisions to modify their songs and producing "auto-tune" free albums.[13] Despite the effort by these performers, the trend of modifying the music has forged strongly into the recording studios for many musical icons, where auto-tuning is both expected and utilized to make pop music always retain perfect pitch. A Grammy-winning recording

---

[12] Ghomeshi, Jian. "The Podcast for Thursday, June 25 2009." 25 June 2009. CBC Radio: Q. 30 October 2009 <http://www.cbc.ca/podcasting/pastpodcasts.html?42#ref42>.

[13] McCall, Michael. "Nashville News - Pro Tools - page 1." 10 June 2004. Nashville News. 30 October 2009 <http://www.nashvillescene.com/2004-06-10/news/pro-tools/1>.

engineer, who wished to remain anonymous, is credited with saying that, "It [Modifying the pitch] usually ends up just like plastic surgery. You haul out Auto-Tune to make one thing better, but then it's very hard to resist the temptation to spruce up the whole vocal, give everything a little nip-tuck."[14]

Overt Use of Auto-Tune in Music Production

Since 2006, the presence of obvious auto-tune usage appears to have exponentially grown. The emergence of this technique is generally attributed to two artists, Cher and T-Pain.

"And I can't break through. There's no talking to you." – "Believe" – Cher[15]

Within the first 37 seconds of Cher's single, "Believe," the world was exposed to the innovative use of auto-tune in an evident way. Spending seven weeks as the number one single around the globe in 1998, there were not many in the music community that had not heard it.[16] Two producers from London, Mark Taylor and Brian Rawling, are credited with discovering what is now known as the "Cher Effect." The warbled end product that Cher sings was achieved by using auto-tune and altering the pitch correction speed. By adjusting it so that the gradual slides between each note, or *portamento*, were reduced to nothing, instantaneous and rigid transitions between the tones are created, producing the synthetic effect heard in the song. However, there was some initial controversy over the technique. Taylor and Rawling originally reported that the effect was made using a vocoder setting on a Korg VC10 in order to protect the producers' trade secret.[17] When

[14] Tyrangiel, Josh. "Auto-Tune: Why Pop Music Sounds Perfect." Time 05 February 2009.
[15] Sarkisian, Cherilyn "Cher". "Believe." Believe. London, Warner Bros. Records.
[16] BBC News | Entertainment | Cher's treble success. 27 May 1999. 30 October 2009
<http://news.bbc.co.uk/2/hi/entertainment/354542.stm>.
[17] Sillitoe, Sue. Recording Cher's 'Believe'. February 1999. 30 October 2009
<http://www.soundonsound.com/sos/feb99/articles/tracks661.htm>.

asked if he had ever planned for auto-tune to be used this way, inventor Dr. Hildebrand responded, "No, I didn't. I didn't think anybody in their right mind would use it that way."[18]

Following Cher's success, other artists soon dabbled in the realm of exposed auto-tuning. Italian electronic dance group Eiffel 65 released their hypnotic "Blue (Da Ba Dee)"[19] in 1999. Reaching marginal success overall in the United States, their hit reached #6 on the Billboard charts. Southern rock soon followed with Kid Rock's "Only God Knows Why"[20] (2000). Using auto-tune, Rock was able to smooth his voices and create soothing tones that lay in stark contrast to the harshness that could normally be found in his tonal range [see "Cowboy" (1999)]. Rounding out the pop audience, Avril Lavigne's "Complicated"[21] (2002) uses auto-tune to round out the tones in the song's verses and final outtro. It is easily seen that the secret of auto-tune had been unleashed on the audience. Though, despite Cher's influence, an upcoming MC from Tallahassee would continue to push the boundaries of auto-tune usage and forge a new sub-genre.

Born Faheem Rasheed Najm, T-Pain first started experimenting with auto-tuning in 2003.[22] Heavily influenced by Roger Troutman of the group Zapp and his use of the talkbox sound modification, T-Pain simply experimented with auto-tuning not expecting for anyone to want to hear it.[23] With the release of his first single "I'm Sprung" in 2005, he quickly grabbed the ears of the music crowd, debuting at number eight on the Billboard Hot 100.[24]

Much like Cher, T-Pain's use of auto-tune had a profound effect on the music community. However, his reach would extend far greater than "Believe" had in the late 1990s. Taking his new-

---

[18] PBS. Nova Science Now: Auto-Tune. 1 July 2009. September 2009
<http://www.youtube.com/watch?v=o6bCdZmSE7M>.
[19] 65, Eiffel. "Blue (Da Ba Dee)." Europop. 1998.
[20] Ritchie, Robert "Kid Rock". "Only God Knows Why." Only God Knows Why - Single. 2000.
[21] Lavigne, Avril. "Complicated." Let Go. 2002.
[22] skeetv. T-Pain video discusses autotune, his new album, music & haters w/ DJ Skee. 17 November 2008. 31
October 2009 <http://www.youtube.com/watch?v=45bKBvPCX18>.
[23] T-Pain Biography. 2009. 31 October 2009 <http://www.t-pain.net/biography>.
[24] T-Pain Album & Song Chart History | Billboard.com. 2009. 31 October 2009
<http://www.billboard.com/charts/hot-100#/artist/t-pain/chart-history/690156>.

found style to the next level, his practice of auto-tuning was not used to simply accent certain phrases within songs but instead, entire albums. With the progression of his success, he seemed to have a greater impact through the formation of a unique sub-genre of R&B and hip-hop that featured heavy electronic manipulation with an emphasis on auto-tune. Other musicians, inspired by this success, began to experiment with a similar sound. Some of these other artists include Kayne West, 3OH!3, Rhianna, Sean Kingston, Lil Wayne, and Drake.

Auto-Tune Flourishes Within the Hip-Hop Community

Trends between artists in a similar genre happen with every style of music. Most metal bands wear black, most country musicians sing about southern themes, and most punk bands praise anarchy. However, the group that tends to create and append the most trends throughout its network of locations, crews, houses, and artists themselves is ultimately found in the overarching hip-hop genre. While the typical structure for trend-setting tends to start with those who are most successful, hip-hop artists tend to derive new movements from anyone, whether they are a rookie or a well-seasoned veteran.

For example, Jay-Z was new to the scene when his album, *Reasonable Doubt* debuted in 1996. However, on the track "Brooklyn's Finest," he made mention of a particular champagne, *Cristal*. For ten years, various artists and groups within the hip-hop community frequently mentioned *Cristal* on their albums and displayed it in videos to demonstrate wealth and power. until the community banned it. (This was subsequently lifted.)[25] Similarly, retro trends are often re-popularized numerous times. The concept of a grill (jewelry that consists of a piece of sometimes precious metal that

---

[25] Adaso, Henry. Jay-Z, Hip-Hop Community Boycott Cristal. 15 June 2006. 31 October 2009 <http://rap.about.com/b/2006/06/15/jay-z-hip-hop-community-boycotts-cristal.htm>.

covers the teeth) is a trend that became popular in New York in the 1980's. This was revived during the rise of the Dirty South rappers in the early 2000's.[26]

Given that this assessment of culture proves valid, then auto-tune appears to following a similar path to other trends characteristic to the hip-hop community. For example, much like Nate Dogg,[27] T-Pain began his career as a mostly "featured" artist.[28] Similar to clothing, alcohol, or cars, featuring a popular guest on an album is another example of a trend that is common with hip-hop, mirroring the revival of a set tradition in community. However, with the rise of his solo popularity, T-Pain's usage as a secondary commodity began to diminish. When it became apparent that his original style of sound was something that could be theoretically easily emulated given the right parameters on a simple plug-in (a simple Google search will retrieve dozens of "how to get T-Pain's sound" tutorials), a multitude of other artists soon flocked to auto-tuning, demonstrating how someone that may be new to the hip-hop scene can still be influential.

Closely related to trends is the effect of economics on the development of hip hop music. In addition to keeping up with their peers within trend-setting and –following, the members of the hip-hop community are in constant self-competition to stay on of top of what is popular and desirable to the public. In the case of auto-tune music, the artists are thriving in its support from the public, and its usage is increasing due to its perceived value. For example, Kayne West's last album, *808's and Heartbreak*, is currently selling at a Platinum level with at least a million copies sold.[29] In Florida, the Miami Dolphins football team recently hired T-Pain and artist Pitbull to refresh the team's

[26] Sims, Brian. HipHopDX | Hip Hop Editorials | History of the Grill. 17 July 2006. 1 November 2009 <http://www.hiphopdx.com/index/editorials/id.600/title.history-of-the-grill>.

[27] allmusic (((Nate Dogg > Credits))). 2009. 1 November 2009 <http://www.allmusic.com/cg/amg.dll?p=amg&sql=11:9ijxlf0ehcqr~T4>.

[28] allmusic (((T-Pain > Credits))). 2009. 1 November 2009 <http://www.allmusic.com/cg/amg.dll?p=amg&searchlink=T-PAIN&sql=11:dzfyxqrsldfe~T4>.

[29] RIAA. RIAA - Gold & Platinum - November 01, 2009. 1 November 2009. 1 November 2009 <http://www.riaa.com/goldandplatinumdata.php?resultpage=2&table=SEARCH_RESULTS&action=&title=&artist=Kanye&format=&debutLP=&category=&sex=&releaseDate=&requestNo=&type=&level=&label=&company=&certificationDate=&awardDescription=&catalogNo=&aSex=&rec_id=&ch>.

franchise by remixing the team's fight song for an undisclosed amount of money.[30] While these sales cannot prove that auto-tune alone is purely responsible for driving the success of these artists, these figures do act as a support to the principle that the artist's style (performance or otherwise) has a significant effect on the artist's marketability to the consumer audience.

Auto-Tune and the "Ringtone Generation"

Another factor in the success of auto-tune in today's society may not have anything to do with the genre at all. In considering today's generation of music performers and listeners, the environment in which they thrive must also be considered. Dubbed the "ringtone generation"[31] for their propensity to value music in the form of cell phone accessories and digital media, today's preteens, teenagers, and young adults (ages 10-25) are immersed in a world where technology has been a critical part of their daily routines throughout their entire lifespans.

With approximately 9.2 million "tweens" (ages 8-12) owning cell phones in the United States, easy accessibility to technology can be assumed for a majority of the country.[32] Compared to music electronics of the past, auto-tune is a fairly compact and easily reached tool. The iPhone app named, "I Am T-Pain," produced by Antares that allows for auto-tuning on the go[33] has reached record sales, selling approximately 10,000 copies per day as recently as early November 2009.[34]

Along with technology being everywhere, it is not only expected to work but also to work well and with little effort. Auto-tune is an interesting tool in its simplification of complex music

---

[30] Pitbull, T-Pain Record Miami Dolphins Theme Song. 10 August 2009. September 2009
<http://www.theboombox.com/2009/08/10/pitbull-t-pain-record-miami-dolphins-theme-song/>.
[31] Coldplay - Martin Slams Ringtone Generation - Contactmusic News. 14 March 2007. 1 November 2009
<http://www.contactmusic.com/news.nsf/story/martin-slams-ringtone-generation_1024923>.
[32] Reardon, Marguerite. Mobile carriers see opportunity in 'tween' market. 10 September 2008. 1 November 2009
<http://reviews.cnet.com/8301-12261_7-10038783-51.html?tag=mncol;txt>.
[33] I Am T-Pain. 2009. 1 November 2009 <http://www.antarestech.com/products/I-am-t-pain.shtml>.
[34]Resnikoff, Paul. The Vast Wasteland of 100,000 iPhone Apps... 4 November 2009. 18 November 2009
<http://www.digitalmusicnews.com/stories/110409apps>.

theory and performance. The entertainment value may be found in the instant gratification of a desirable sound without the time and exertion that comes with voice training and practice.

The internet also plays a colossal role in what music stays relevant in today's generation, not only in how people receive information but also in how it is transmitted between groups. Between the ease of social networking communication and the prevalence of viral videos, people will both create and share what entertains them on the World Wide Web.

Auto-tune's relevance is constantly being renewed on the internet through the creativity of its users. With videos like "Auto-Tune the News,"[35] a mash-up of newscasts set to music and played with auto-tune, and the usage of auto-tune in gaming media like the song "Still Alive"[36] from the popular game, *Portal,* auto-tune usage within contemporary music will most likely disappear sooner from pop culture than the auto-tune content on the web will.

Given that a new technology surfaces within the United States, it is commonly observed that most of the population will only focus on its popular intended purpose and be satisfied with the limits that are assigned to it. However, when the same equipment is reflected upon within the mindset of another region, new creative outlooks may take place, providing new uses that may have been neglected or simply never considered. Many countries outside of the United States have embraced creative uses of auto-tune because of the jilted sounds it can produce. For example, in North Africa, contemporary Raï and Berber music features *glissandos* that can be easily emulated with the synthetic sounds of the auto-tuner. This may seem problematic given the technologies steep price index. However, given that these countries see far less strict regulation and enforcement of

---

[35] schmoyoho. Auto-Tune the News #8: dragons. geese. Michael Vick. (ft. T-Pain). 2 September 2009. 1 November 2009 <http://www.youtube.com/watch?v=bDOYN-6gdRE>.
[36] Coulton, Jonathan. Portal - Credits Song 'Still Alive'. 2007. 1 November 2009 <http://www.youtube.com/watch?v=Y6ljFaKRTrI>.

digital materials, the plug-in can be obtained much more easily than would be possible in the United States, allowing for it to function as an alternative instrument in those regions.[37]

The Fate of Auto-Tune

Despite being a relatively new technology, auto-tune has had a rich history of development. Considering that it stemmed from a technology in an engineering field, its rampant popularity within the expansion of music in the 21st-century, and the controversy many people associate with its practices, there is little precedence for how the technology will fare in the coming years. However, while it has many current uses, it seems probable that auto-tune will eventually become less frequent as a noticeable technology in popular music and will be used mostly for concealed song correction and in special interest ensembles.

It is difficult to gauge how long its popularity will last and what other inventive avenues it may take. Given its current influence over the music of today, we may see the development of an entirely new genre or instrument. Though, with forces such as Jay-Z leading a pack of a growing negative force that is aimed to end the abuse of the technology, the possibility is present that innovative auto-tune development could be halted before its potential can be reached.

Nevertheless, it is important to note that regardless of whatever the outcome may be, a single constant remains true throughout all of music history: the development of new music technology and performance is always moving forward. Musical technologies tend to build on themselves, and auto-tune itself was the product of forward thinking on other idea. The musical struggle that may rise from its exclusion in popular music will surely produce an interesting debate, without, the youth of this generation will unquestionably be there, waiting to pick up what is left over and create musical "magic" with the pieces that remain.

---

[37] Clayton, Jace. "Pitch Perfect." frieze May 2009.

Works Cited

[H] titles at Aquarius Records. 24 October 2009. 29 October 2009
<http://www.aquariusrecords.org/cat/h.html>.

65, Eiffel. "Blue (Da Ba Dee)." Europop. 1998.

Adaso, Henry. Jay-Z, Hip-Hop Community Boycott Cristal. 15 June 2006. 31 October 2009
<http://rap.about.com/b/2006/06/15/jay-z-hip-hop-community-boycotts-cristal.htm>.

allmusic (((Nate Dogg > Credits))). 2009. 1 November 2009
<http://www.allmusic.com/cg/amg.dll?p=amg&sql=11:9ijxlf0ehcqr~T4>.

allmusic (((T-Pain > Credits))). 2009. 1 November 2009
<http://www.allmusic.com/cg/amg.dll?p=amg&searchlink=T-PAIN&sql=11:dzfyxqrsldfe~T4>.

Anderton, Craig. PAiA Corporation - How Vocoders Work by Craig Anderton. 2006. 29 October 2009
<http://www.paia.com/ProdArticles/vocodwrk.htm>.

Antares History. 2009. 29 October 2009 <http://www.antarestech.com/about/history.shtml>.

BBC News | Entertainment | Cher's treble success. 27 May 1999. 30 October 2009
<http://news.bbc.co.uk/2/hi/entertainment/354542.stm>.

Carter, Shawn "Jay-Z". "D.O.A. (Death of Auto-Tune)." The Blueprint 3. New York, 2009.

Chen, Victor C. and Hao Ling. Time-frequency transforms for radar imaging and signal analysis. Norwood,
MA: Artech House, 2002.

Clayton, Jace. "Pitch Perfect." frieze May 2009.

Coldplay - Martin Slams Ringtone Generation - Contactmusic News. 14 March 2007. 1 November 2009
<http://www.contactmusic.com/news.nsf/story/martin-slams-ringtone-generation_1024923>.

Coulton, Jonathan. Portal - Credits Song 'Still Alive'. 2007. 1 November 2009
<http://www.youtube.com/watch?v=Y6ljFaKRTrI>.

Dolson, Mark. ♫Jens Johansson ·The Phase Vocoder: A Tutorial:. 17 November 2000. 30 October 2009
<http://www.panix.com/~jens/pvoc-dolson.par>.

Dudley, Homer W. System for the Artificial Production of Vocal or Other Sounds. United States: Patent
2121142. June 1938.

Frere-Jones, Sasha. "The Gerbil's Revenge." The New Yorker 9 June 2008.

Ghomeshi, Jian. "The Podcast for Thursday, June 25 2009." 25 June 2009. CBC Radio: Q. 30 October 2009
<http://www.cbc.ca/podcasting/pastpodcasts.html?42#ref42>.

Heil, Bob. Bob Heil: A Living Live-Sound Legend Musician's Friend. June 2006.

I Am T-Pain. 2009. 1 November 2009 <http://www.antarestech.com/products/I-am-t-pain.shtml>.

I. What is a Talkbox? (The Talkbox FAQ). 2009. 29 October 2009
<http://www.blamepro.com/talkboxa.htm>.

Lavigne, Avril. "Complicated." Let Go. 2002.

McCall, Michael. "Nashville News - Pro Tools - page 1." 10 June 2004. Nashville News. 30 October 2009
<http://www.nashvillescene.com/2004-06-10/news/pro-tools/1>.

PBS. Nova Science Now: Auto-Tune. 1 July 2009. September 2009
<http://www.youtube.com/watch?v=o6bCdZmSE7M>.

Pitbull, T-Pain Record Miami Dolphins Theme Song. 10 August 2009. September 2009
<http://www.theboombox.com/2009/08/10/pitbull-t-pain-record-miami-dolphins-theme-song/>.

Reardon, Marguerite. Mobile carriers see opportunity in 'tween' market. 10 September 2008. 1 November
2009 <http://reviews.cnet.com/8301-12261_7-10038783-51.html?tag=mncol;txt>.

Resnikoff, Paul. The Vast Wasteland of 100,000 iPhone Apps... 4 November 2009. 18 November 2009
<http://www.digitalmusicnews.com/stories/110409apps>.

RIAA. RIAA - Gold & Platinum - November 01, 2009. 1 November 2009. 1 November 2009
<http://www.riaa.com/goldandplatinumdata.php?resultpage=2&table=SEARCH_RESULTS&action=&title
=&artist=Kanye&format=&debutLP=&category=&sex=&releaseDate=&requestNo=&type=&level=&labe
l=&company=&certificationDate=&awardDescription=&catalogNo=&aSex=&rec_id=&ch>.

Ritchie, Robert "Kid Rock". "Only God Knows Why." Only God Knows Why - Single. 2000.

Sarkisian, Cherilyn "Cher". "Believe." Believe. London, Warner Bros. Records.

schmoyoho. Auto-Tune the News #8: dragons. geese. Michael Vick. (ft. T-Pain). 2 September 2009. 1
November 2009 <http://www.youtube.com/watch?v=bDOYN-6gdRE>.

Shafer, Matthew "Uncle Kracker". "Follow Me." Double Wide. 2000.

Sillitoe, Sue. Recording Cher's 'Believe'. February 1999. 30 October 2009
<http://www.soundonsound.com/sos/feb99/articles/tracks661.htm>.

Sims, Brian. HipHopDX | Hip Hop Editorials | History of the Grill. 17 July 2006. 1 November 2009
<http://www.hiphopdx.com/index/editorials/id.600/title.history-of-the-grill>.

skeetv. T-Pain video discusses autotune, his new album, music & haters w/ DJ Skee. 17 November 2008. 31
October 2009 <http://www.youtube.com/watch?v=45bKBvPCX18>.

Smith, David. "Disney A to Z : The Official Encyclopedia." New York City: Hyperion Books, 1997.

Top 100 Music Hits, Top 100 Music Charts, Top 100 Songs & The Hot 100 | Billboard.com. 3 November
2009. 3 November 2009 <http://www.billboard.com/charts/hot-100#/charts/hot-100>.

T-Pain Album & Song Chart History | Billboard.com. 2009. 31 October 2009
<http://www.billboard.com/charts/hot-100#/artist/t-pain/chart-history/690156>.

T-Pain Biography. 2009. 31 October 2009 <http://www.t-pain.net/biography>.

Tyrangiel, Josh. "Auto-Tune: Why Pop Music Sounds Perfect." Time 05 February 2009.

21M.380 Music and Technology (Contemporary History and Aesthetics)
Fall 2009