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Examination session (May or November)	May	Year	2015

Diploma Programme subject in which this extended essay is registered: MUSIC

(For an extended essay in the area of languages, state the language and whether it is group 1 or group 2.)

Title of the extended essay: How musicians have Utilized the innovations of Multi-track Recording from the early 1900's to the late 1960's

Candidate's declaration

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The extended essay I am submitting is my own work (apart from guidance allowed by the International Baccalaureate).

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Please comment, as appropriate, on the candidate's performance, the context in which the candidate undertook the research for the extended essay, any difficulties encountered and how these were overcome (see page 13 of the extended essay guide). The concluding interview (viva voce) may provide useful information. These comments can help the examiner award a level for criterion K (holistic judgment). Do not comment on any adverse personal circumstances that may have affected the candidate. If the amount of time spent with the candidate was zero, you must explain this, in particular how it was then possible to authenticate the essay as the candidate's own work. You may attach an additional sheet if there is insufficient space here.

_____ has been very keen on carrying out research on music technology as he would like to go to University to study sound engineering. He had earlier struggled to narrow down his research question, but he was able to do so by focussing on the development of track recording system suitable to his intentions in the essay. He also faced difficulty to find resources for Miles Davis' work, which he had initially hoped to analyse. He then decided to choose other musicians, though he realised that he could have achieved a better balance to his results if he had collected on several musicians early on. He reflected that he relied almost entirely on one group, the Beatles, in his research where he could have chosen two different musicians for each tracking system. He now understands how important it is to collect enough appropriate information before finalising a research question for writing an extended essay. He also realised that working on the essay at regular intervals, and not leaving it to the last minute is key to a timely and successful completion of the extended essay.

This declaration must be signed by the supervisor; otherwise a mark of zero will be issued. essay.   see

I have read the final version of the extended essay that will be submitted to the examiner. to have gained more knowledge, in terms

To the best of my knowledge, the extended essay is the authentic work of the candidate. of the history of th

As per the section entitled "Responsibilities of the Supervisor" in the EE guide, the recommended number of hours spent with candidates is between 3 and 5 hours. Schools will be contacted when the number of hours is left blank, or where O hours are stated and there lacks an explanation. Schools will also be contacted in the event that number of hours spent is significantly excessive compared to the recommendation. recording system

the 1900s to the 196

I spent | 4.5 | hours with the candidate discussing the progress of the extended essay. and this has gre enabled him to be

Supervisor's signature: _____ Date: _____ ready for his uni

19/12/2014 studies in th futur

Assessment form (for examiner use only)

Candidate session number				

Achievement level

Criteria	Examiner 1	maximum	Examiner 2	maximum	Examiner 3
A research question	2	2		2	
B introduction	1	2		2	
C investigation	2	4		4	
D knowledge and understanding	3	4		4	
E reasoned argument	3	4		4	
F analysis and evaluation	2	4		4	
G use of subject language	3	4		4	
H conclusion	1	2		2	
I formal presentation	3	4		4	
J abstract	2	2		2	
K holistic judgment	3	4		4	
Total out of 36	26				

Name of examiner 1: _____ Examiner number: _____
(CAPITAL letters)

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Name of examiner 3: _____ Examiner number: _____
(CAPITAL letters)

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How Musicians Have Utilized the Innovations of Multi-Track Recording From the Early 1900's to the Late 1960's.

Word Count: 3439

Abstract

I studied How Musicians Have Utilized the Innovations of Multi-Track Recording From the Early 1900's to the Late 1960's. This essay aims to study the progression of recording techniques, from single track recording to four track recording, and how musicians took advantage of different forms of recording. The choice of researching into the late 60's was made because most innovation in terms of different amounts of track recording was made in that time frame.

The research was collected through many online sources and listening to different pieces ranging from short recordings of a Siamese (Thai) theater group to Motown hits from the late 1960's.The pieces were analyzed by looking at effects used, for example echo or distortion, amount of tracks it was recorded on, and how a larger number of tracks give the musicians more freedom of creativity. Also, a wide variety of music was used, and this was an advantage, as it was able to show that despite different music genres, there were still tendencies to prefer more tracks, as it gave the musicians more creative space to work with.

This was shown by the early Motown piece 'Shop Around' used 2 track recording, and only 3 years later, a newer more full sound of the 'Wall of Sound' recording technique was popularized, musicians preferred it to the 2 track recording process. What was found was that with the more tracks that were available, the more the musicians were able to do. What the research found was significant because it showed that the progression of recording technology was followed by musicians of all genres. The more number of tracks available, the more dynamic the song can become, as more instruments can be played, which would create a fuller sound.

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Introduction

Since the late 1800's people have been fascinated with the idea of recording noises or pictures, and playing them back at a later time. In fact, the first person to create such an invention was Thomas Edison in 1877. The need for high quality recording was in such desperate demand that the technology had to quickly develop to meet musician's demands. An instrument had to be played at the same time, if other instruments were desired, they had to be played at the moment of recording, or otherwise the whole band would have to re-record. Looking back at it from my 21st century point of view, it must have been an extremely frustrating, unpleasant experience, with hardly any creative freedom. We have the ability to lay down one track, and then add as many more separate tracks on top of the original as we please. The freedom and room for creativity is immense. The immense innovations are what intrigue me most about this topic, and is why I chose to research about how musicians have utilized the innovations of multi-track recording since the early 1900's to the late 1960's. I have looked at monaural recording, analyzing a piece by The Beatles, and comparing it to an analysis of a Beatles piece which used 4 track recording. I used the same method for 2-track and 3-track recordings, however chose to use Motown Recordings from the Motown era of the 1950's-60's. Specifically 'Shop Around' by The Miracles and 'Be my Baby' by The Ronettes as my examples. Each piece was analyzed in terms of sound quality and diversity, referring to the options and limitations each type of recording will face. This was a good approach, because it helped narrow my field of view for research, allowing for more precise analysis.

Monaural Recording

'Mono (Monaural or monophonic sound reproduction) is done mostly with one microphone and only one speaker is required to listen to the sound. Mono packs the audio in a single channel, often centered in the "sound field." In other words, when you hear music recorded in mono, it comes at you in a single stream of sound — the vocals, drums, bass, guitars, horns, strings, well, everything comes at you mixed into one channel. Everyone hears the very same signal and at the same sound level. If you listen to a mono recording through a headset, everything seems to be happening on the top of your head and there are no extraneous sounds distinctly on the right or left ear.'[1]

The very simplistic monaural recording can defined quite simply as a recording done with one microphone, and to listen to it, only one speaker is needed. This is because no matter how many speakers are present, the same sounds will come out of each speaker, unlike the more advance stereo recordings. There will be no special effects or panning, because this would pan the whole band, or add effects on to every instrument.

I first looked at a comparison of two monaural recordings, from very different eras of recording. The first piece of music was from September 24th, 1900[2], titled "Sweet Words" performed by Siamese Thai Theatre group. This is a very good example of how far recording has come. The recording is obviously of very low quality, however it was the best which was available at the time of recording, as in 1900 recording was still in its infancy. Many qualities typical of early monaural recording are present in this extract.

To begin with, the unbalanced volumes of instruments; the xylophone at times is much louder than the other instruments. For example, from 0:56 to 0:59, the xylophone is noticeably louder than the rest of the instruments. This imbalance could be caused by one of two reasons, one obvious reason being that the xylophone is what the musicians want the audience to hear as the loudest instrument. However, without all of the high-tech microphones we have today, it was the inability to place the recorder in an ideal place to catch all sounds at an equal volume. I found this to be the reason because the xylophone typical is not the focus of most pieces of music, especially when whistling is present, which usually plays the main melody. Many early

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[1] Onabbeyroad.com, (2014). The Beatles In Mono. [online] Available at: http://onabbeyroad.com/mono.html [Accessed 16 Oct. 2014].

[2] http://commons.wikimedia.org/wiki/File:Kham_Hom_-_Sweet_Words.ogg

recordings faced this problem because it requires, to a large extent, trial and error. Constantly placing the paleophone, which was used to record in this extract, in different spots, recording a piece of music and then listening back for sound quality would be a very time consuming task.

Another blatant issue with the early recordings of music is the distracting background noise. The constant popping noises heard throughout the track are caused by scratches on the vinyl disk. This was a common issue all the way up to present day vinyl recordings. It was one of the down sides to this form of audio reproduction. Although it still occurs in present day, it is obvious that it is not nearly as extreme as it was in the early days of recording, e.g. this 1900's recording which has very loud pops for the whole duration of the piece. Another obvious issue is the high and low frequency humming, which also lasts throughout the extract. This is caused by high gain, and low quality recording equipment. Though no fault of any person of the time, it was the best which was available in 1900. The result of all of these unideal circumstances is a recording which is difficult to listen to at times; nevertheless not much could be done about it.

The solution to the crackling sounds, the pops, the background noise and unbalanced volumes for the instruments was discovered somewhere between 1900, and 1965, when Rubber Soul by The Beatles was released. Of course, it was not a miraculous jump in quality that has taken place, for the quality of sound had seen improvements in between 1900 and 1965, but for the sake of argument, I used 'If I Needed Someone' by The Beatles, off of the Rubber Soul album to compare monaural sounds, as they are opposites of the quality spectrum.

'If I Needed Someone' by The Beatles was recorded in a studio with all the members of The Beatles sat down in a circle on their instruments, as all monaural recordings are done. However because of the advances in technology between 1900 and the 1960's it was possible to use more than one mic to capture the sounds of each instrument. Following the same structure as the first analysis of 'Sweet Word' I looked for differences in sound quality, instrumentation, and balance.

Listening to a recording of 'If I Needed Someone'[3] alongside 'Sweet Words' reveals very clear differences in quality. In this recording the cracking and popping is non-existant, any number of instruments could be there and the balance which is clear would still be maintained. 'Sweet

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[3] If I Needed Someone. (1965). (mono version) [online] EMI Stuidos: Parlophone. Available at: http://onabbeyroad.com/mono.html [Accessed 28 Aug. 2014].

Words' was a live recording by the theatre group while visiting Berlin., whereas The Beatles recording of 'If I Needed Someone' was in a very controlled studio. It is likely that a lot of sound-proofing was used to eliminate any background noise or white noise. It would be very simple to ignore these factors and conclude that 1965 recordings are superior in every way to their 1900's predecessors. This is only possible because of the advances which were made in between the time of the first and second recordings, because at the time of 'If I Needed Someone', multi-track recording was already fully developed. *Although that is not the variable considered here.*

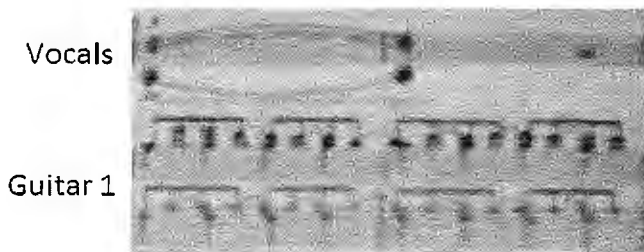**"If I Needed Someone"**

Figure 3: Bars 29 - 32

Unclear picture

Score Source?

Figure one shows bars 29 – 32, where the striking balance this recording is quite apparent. The drone notes in the vocals, singing "Ah" while the guitar plays a small solo, the lack of panning means that the listener must hear all instruments in both ears.

4 Track versus Monaural

'Stereo (or Stereophonic sound) is the reproduction of sound using two or more independent audio channels in a way that creates the impression of sound heard from various directions, as in natural hearing. Stereo recording is done with two or more special microphones. The stereo effect is achieved by careful placement of microphone receiving different sound pressure levels accordingly' [4]

This quotation from Onabbeyroad.com summarizes how multitrack recording is done very briefly and explains how the sound, which is different to that of monaural sound, is achieved. The use of stereophonic sounds creates a surround sound like feeling, which is shown in the example below. ('If I Needed Someone' by The Beatles)
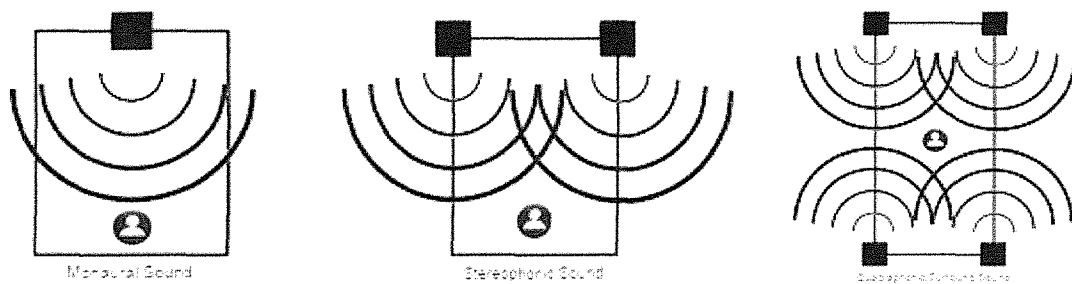
Figure 1 Depiction of Monaural to Quadraphonic sound

Figure 2 [5] shows the difference in sounds between Monaural to Stereophonic and finally Quadraphonic sounds. These pictures represent what is heard, and how each are different from the other. What I have analyzed is a stereophonic (4 track) and a monaural (one track) song, to represent the differences in sound and quality.

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[4] Onabbeyroad.com, (2014). The Beatles In Mono. [online] Available at: http://onabbeyroad.com/mono.html [Accessed 16 Oct. 2014].

[5] Onabbeyroad.com, (2014). The Beatles In Mono. [online] Available at: http://onabbeyroad.com/mono.html [Accessed 16 Oct. 2014].

This leads to the next stage of my research; how the artists made use of the multi-track recording, how it differs from varying amount of tracks, e.g. two or three tracks. Multitrack recording is defined as "Multitrack recording is a process where the tape is divided into multiple tracks parallel with each other. Because they are carried on the same medium, the tracks stay in perfect synchronization."[6] A simple example of this would be if an electric guitar, drum kit, and bass guitar are all playing at the same time, they would be playing into a different microphone or track, so that sounds from the other instruments are not heard on that track. What this allows the musicians to do is later on edit individual tracks, while leaving the other instruments the same. The introduction of the multitrack recorder was extremely important as allowed tremendous progress in recording, as two-track recording, the earliest form of multitrack recording, was quickly the preferred method of recording in the 1950's.[i]

I used the same song, 'If I Needed Someone' by The Beatles but a different version with 4 tracks+[7] and compared it to the same song, recorded in mono, which was analyzed previously. I found this as quite an advantage because it removed any sort of external factors which could change a recordings quality; perhaps a musician prefers the popping and background noise to add an "authentic" sound to the piece of music. This however can be completely counted out of this analysis because of the clean sound which can be heard from both pieces.

The listener of this piece can hear the difference in sound immediately. The use of panning different tracks to different sides of the speaker allows the song to fully surround the listener. The rhythm section playing through the left channel separates it from the lead and harmony vocals from the right channel. This technique is what gives it the surround sound like feeling.

Yet again, we can look at Bars 29 – 32. In the stereo version of this song, the same bars have been greatly enhanced. The "Ah's" and the solo guitar can be heard clearly on the right side, while the left side is filled with the accompaniment of drums, bass, and rhythm guitar.

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[6] Wikipedia, (2014). History of multitrack recording. [online] Available at:
http://en.wikipedia.org/wiki/History_of_multitrack_recording [Accessed 11 Oct. 2014].
[7] If I Needed Someone. (1965). (stereo version) [online] EMI Stuidos: Parlophone. Available at:
http://onabbeyroad.com/mono.html [Accessed 28 Aug. 2014].
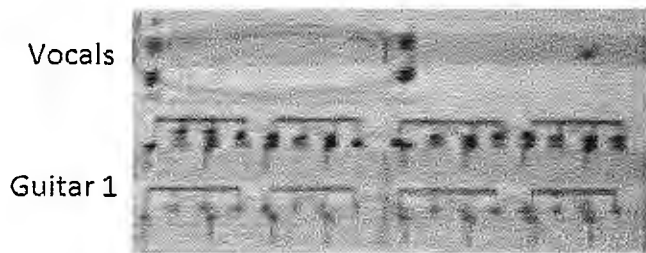
"If I Needed Someone"

Figure 3: Bars 29 - 32

Figure one shows bars 29 – 32, where the striking balance this recording is quite apparent. The drone notes in the vocals, singing "Ah" while the guitar plays a small solo come through clearly, despite it being the accompaniment.

Why repeat the illustration already given?

The idea of separating the rhythm section from the lead guitar, vocals, and back-up vocals is to create a feeling of different layers. It is an interesting dynamic and differs from the monaural recording sound. This is the main point to 4 track recording: the freedom to create sounds and feelings which were not possible with monaural recording, or even two or three track recording.

To conclude multi track versus monophonic recording, the listener can hear obvious disparities in the mono track. The use of panning, sound effects, and changing volumes in each instrument also contribute to the more clean and surround sound feeling the listener gets from the multi-track version of 'If I Needed Someone' by The Beatles. Though the obvious strengths of stereo or multitrack recording were readily seen, people still mixed down to monaural tapes because of the wide spread use of mono players and radio stations still could not broadcast in stereo. *true, perhaps?*

2-Track versus 3 Track Recording

Two track recording was the first development in multitrack recording, which is also known as stereo sound. This new discovery was developed by German audio engineers around the year of 1943. 2 Track recording quickly became the main medium of recording, and was most popular in the 1950's. This is because it allowed audio engineers to set up and record two or more microphones at once.For my investigation, I decided to analyze a typical Motown Blues song, 'Shop Around' by The Miracles, which was recorded in 1960, featuring Robinson, Claudette Rogers, Bobby Rogers, Ronnie White, and Pete Moore. The two track recording technique was most popular at this time, and so it will be assumed that this is the technique used. I compared this to the very popular 'Wall of Sound' music production template which used the three-track Ampex 350 tape recorder. The Ampex 350 tape recorder proved extremely useful for popular music, since they enabled backing music to be recorded on two tracks (either to allow the overdubbing of separate parts, or to create a full stereo backing track) while the third track was reserved for the lead vocalist. This is what created the 'Wall of Sound' effect, which the creator, Phil Spector, described the sound as:

"I was looking for a sound, a sound so strong that if the material was not the greatest, the sound would carry the record. It was a case of augmenting, augmenting. It all fitted together like a jigsaw."[8]

The piece I analyzed for this effect was 'Be my Baby' by The Ronettes and produced Phil Spector. This very famous Motown song is said to epitomize the Phil Spector 'Wall of Sound' effect. It is interesting that both the very unique 'Wall of Sound' recording technique and the quite straight forward 2 track recording method were both being used at around the same time frame. It is also noteworthy that both tracks are Motown tracks, yet use vastly different recording techniques, which just goes to show how quickly recording techniques were progressing in just a 3 year time frame.

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[8] Soundonsound.com, (2014). CLASSIC TRACKS: The Ronettes 'Be My Baby'. [online] Available at: http://www.soundonsound.com/sos/apr07/articles/classictracks_0407.htm [Accessed 12 Oct. 2014].

'Shop Around' by The Miracles is quite typical of Motown pieces in many ways. One quite apparent similarity is the choice of instrumentation, the solo voice, accompanied by a group of backup singers, then the typical, drum kit, bass guitar, electric guitar, saxophone, piano, etc. The use of two tracks is quite obvious in this piece because the sound difference between the lead singers voice and the rest of the tracks, the lead voice as quite an apparent echo effect on his voice, which was achieved by recording in an "Echo chamber", whereas now computer effects can be added to a voice after a regular recording.

A song review by Ritchie Unterberger describes the beginning of the piece:

'A great song, starting with the slow dramatic introduction, in which Smokey Robinson recalls his mother offering him some childhood advice. A low "and then she said" leads the Miracles into the verse, with Robinson's confident, almost cocky vocal about the need to shop around before settling on a wife backed with cooing, fluttering backup vocals by the rest of the group. [9]

The analysis of the music is important because this is where the first hear both the accompaniment and voice together, which contrast because of the effect on the voice. Because the ability to listen to and record two tracks at the same time, it is very possible that the band and lead vocal recorded the whole song together at the same time, just separating the vocal into another booth to add the effect to his voice. The other option would be that different sections were recorded at different times, and then played together to make one cohesive piece. For example, the musical instruments record their parts together, and then the lead vocal adds their part, then the backup singers, and so on.

[9] AllMusic, (2014). Shop Around - Smokey Robinson,Smokey Robinson & the Miracles | Listen, Appearances, Song Review | AllMusic. [online] Available at: http://www.allmusic.com/song/shop-around-mt0014040218 [Accessed 12 Oct. 2014].

"Shop Around"	The picture to the left highlights the important section which shows the nature of two track reording. The piano and guitar must have been recorded separately because of the echo effect on the voice.
Guitar / Vocal / Piano (musical notation)	
Figure 4: Bars 4 - 8	

After looking at the 2 track Motown piece, I began to find comparisons and differences to the 3 track 'Wall of Sound' Motown piece, 'Be my Baby' by The Ronettes and produced Phil Spector.

'Spector applied massive amounts of echo to multiple instruments and fused the individual components into his unified 'Wall of Sound': a brilliant, seamless amalgamation of guitars, bass, keyboards, drums and percussion with woodwind, brass and string orchestrations that reached its apotheosis on such classic tracks as the Crystals' 'Da Doo Ron Ron', the Ronettes' 'Be My Baby'' [10]

The mentioning of 'Be My Baby' is what started me on the analysis of this piece. It was obvious that Spector used the 'Wall of Sound' technique on this song, but I was interested in why and what exactly Spector used to enhance the piece. In this piece especially, the drums and percussion are used quite heavily, as the opening is a very simple drum beat. An interesting note would be how the bass drum is heard very clearly from 0:01 till 0:03 seconds, however, at 4 seconds into the piece, the wall of sound hits, and the bass drum gets buried underneath many layers of different instruments. The key point to the wall of sound is that each instrument is overdubbed or added more than once, for example the same guitar part playing twice at the same time to achieve a richer, fuller sound.

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[10] Soundonsound.com, (2014). CLASSIC TRACKS: The Ronettes 'Be My Baby'. [online] Available at: http://www.soundonsound.com/sos/apr07/articles/classictracks_0407.htm [Accessed 10 Oct. 2014].

From the same source[11]:

'from its unmistakable boom-ba-boom-pah drum intro through two minutes, 40 seconds of yearning vocals, tension-building pauses, and strings and horns that meld with claps, castanets, Hal Blaine's machine-gun breaks and Phil Spector's Wall of Sound.'

The bass drum is mentioned in this quote, and I think it is important, because it is what introduces the listener to the wall of sound, as if it is an introduction with the simple reason of showing a contrast to how full the sound will become when the rest of the instruments come in.

To conclude the analysis of the two and three track recordings, I compared the two pieces, which it was interesting because both are Motown songs, however sound very different. Due to the fact that both pieces come from the same era, the first point is to ask why the two pieces are using very different recording techniques. Although the Wall of Sound technique was around when 'Shop Around' was recorded, it was still very new, Phil Spector's Wall of Sound was just starting in the 1960's. Also the advanced sound engineering Phil Spector was using at the time may have taken away from an authentic Motown feeling, and created a more perfected sound, which some purists may not enjoy.

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[11] Soundonsound.com, (2014). CLASSIC TRACKS: The Ronettes 'Be My Baby'. [online] Available at: http://www.soundonsound.com/sos/apr07/articles/classictracks_0407.htm [Accessed 10 Oct. 2014].

Conclusion

I set out to study why musicians used a certain amount of tracks while recording, and what advantages or disadvantages this gave them. What I found was very interesting, in that it showed mostly, the only reason they used a certain amount of tracks, was because it was the best which was available at the time. This was shown in the 1960 song 'Shop around', which used two tracks, then the 1963 song 'Be my Baby' which used 3 tracks, and finally the 1965 song 'If I Needed Someone', which utilized 4 tracks to create a stereophonic sound. However, it is arguable that the 3 track "wall of sound" recording method may not fit a group like The Beatles, or The Miracles, so as well as the technological availability, the musicians preference also comes into play.

Somewhat
Superficial
More probing
would have been
appropriate

The way in which the musicians utilized these developments is also quite interesting. For instance, the use of the Echo Chamber in 'Shop Around'. It allowed the voice to have a special effect, while leaving the rest of the band sounding normal. Also the using of panning in 'If I Needed Someone' allows the listener to be fully surrounded by music – the rhythm section of the left side, while the vocals and lead guitar come from the right side. The way in which musicians took advantage of what was available at the time is what marks true imagination and musicianship – the recording techniques are merely tools to the musicians who are the creators.

The research collected and studied was suitable for this study, however if I were to do a similar study, I would use a larger number of musicians, because I relied heavily on The Beatles pieces, which may have led to skewed results. Also, I would analyze a higher amount of pieces, to obtain a more in depth view of how the amount of tracks used effects the music.

An interesting project. generally well articulated.

Some of the music choices were not so convincing and their use/could have been more balanced.

The argument, at times, loses focus on the research question, or lack sufficient contextual or musical detail.

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2) http://www.allmusic.com/song/shop-around-mt0014040218 accessed: 8/10/2014
3) http://www.historyofrecording.com/AMPEX_AG-440.html accessed: 8/10/2014
4) http://en.wikipedia.org/wiki/Phil_Spector accessed: 10/10/2014
5) http://en.wikipedia.org/wiki/Wall_of_Sound#cite_note-FOOTNOTEZak200177-10 accessed: 10/10/2014
6) http://en.wikipedia.org/wiki/The_Ronettes accessed: 10/10/2014
7) http://en.wikipedia.org/wiki/History_of_multitrack_recording accessed: 11/10/2014
8) http://en.wikipedia.org/wiki/Wall_of_Sound accessed:14/10/2014
9) http://onabbeyroad.com/mono.html accessed: 16/10/2014
10) http://en.wikipedia.org/wiki/Shop_Around accessed: 16/10/2014

Discography:

The Ronettes, "Be my baby": https://www.youtube.com/watch?v=QzhbGaCwBzs accessed: 10/10/2014

The Miracles, "Shop Around": http://www.youtube.com/watch?v=AQGXa3FiXKM accessed: 10/10/2014

The Beatles, "If I Needed Someone" (Mono): https://www.youtube.com/watch?v=Me4vCKIUt5o accessed 10/10/2014

The Beatls, "If I Needed Someone" (Stereo): https://www.youtube.com/watch?v=v9B4UD0Rp2c accessed 10/10/2014

Siamese (Thai) Theatre Group, "Kham Hom": http://commons.wikimedia.org/wiki/File:Kham_Hom_-_Sweet_Words.ogg accessed 10/10/2014

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[i] Wikipedia, (2014). History of multitrack recording. [online] Available at:
http://en.wikipedia.org/wiki/History_of_multitrack_recording [Accessed 10 Oct. 2014].