

How Recording Studios Used Technology to Invoke the
Psychedelic Experience:

The difference in staging techniques in British and American
recordings in the late 1960s.

By

Anthony Meynell, MA

London College of Music

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Abstract

This thesis focuses on a time in the mid-1960s where practice in the studio changed from a formal arena where previously rehearsed songs were recorded, to a playground where sonic possibilities were explored and sound manipulation became normal practice. This abuse of technology and manipulation of reality became part of the creative process in the studio, providing soundscapes that resonated with the counter-cultural ethos of upsetting the established order, and were adopted by the mainstream during the 1967 ‘Summer of Love’.

Following a discussion of current literature, practice as research is applied to demonstrate how interaction with historical technology reveals the performative nature of the tacit knowledge that created many of the aural effects under consideration. The research then focuses through the prism of two case studies, “Eight Miles High” recorded by The Byrds in Los Angeles in January 1966, and “Rain”, recorded by The Beatles in London in April 1966. Through re-enactment of these historical recording sessions, I recreate the closed environment of the 1960’s recording studio.

By interacting with historical technology and following a similar structure to the original sessions, I investigate how the methodology was influenced by collaborative actions, situational awareness and the demarcation of roles. Post session video analysis reveals the flow of decision making as the sessions unfold, and how interaction with the technological constraints

recreates 'forgotten' techniques that were deemed everyday practice at the time and were vital to the outcome of the soundscapes.

The thesis combines theory and practice to develop an understanding of how the engineers interacted with technology (Polanyi, 1966), often abusing the equipment to create manipulated soundscapes (Akrich and Latour, 1992), and how the sessions responded to musicians demanding innovation and experimentation, circumventing the constraints of established networks of practice (Law and Callon, 1986) during the flow of the recording session. (Ingold, 2013)

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Introduction

By the mid 1960s sound manipulation, once the domain of novelty, sound effects and avant-garde soundscapes, had entered mainstream pop record production, adding colour to arrangements that were previously relying on instrumental performance. The unorthodox demands of the artists not only resulted in engineers circumventing prescribed studio equipment working practices to discover new techniques, but also ushered in a new method of performance practice that included the subsequent manipulation of individual sound sources. As a result, the final recorded piece became a construct of performances and overdubs, as opposed to a single ensemble live performance, and the separation of instruments on individual tracks encouraged new ideas of musical expression to take place, where composition and construction of the soundscape continued in the studio as a generative act through improvisation and experimentation to create “an ideal event pieced together from pieces of actual events.” (Eisenberg, 2005)

The innovative development of recording techniques during this period, led to the creation of experimental soundscapes. The subsequent adaptation of these techniques by other bands created the psychedelic genre, and allowed the sounds to become signifiers of the counter-culture of the era. My thesis is an investigation into how studio engineers used technology to evoke the aural representation of the psychedelic experience, and focuses on the differences in staging techniques between British and American studios. Zagorski-Thomas describes staging as a way of considering collaborative creativity, and considers that:

The concept of staging stems from a culturally constructed, ideological definition of the work of art that characterises collaborative forms of creativity such as music and theatre in terms of the output of a single composer or author and its performance by musicians or actors. With this in mind, the word 'staging' becomes an umbrella term for the forms of collaborative creative activity undertaken by any contributor other than the composer, author, musicians or actors. (Zagorski-Thomas, 2014, p.76)

It is this definition of staging, rather than the considerations of spacial representation of recorded music (Moylan 1992; Lacasse 2000), or sound box symbolising a 'virtual textural space' (Moore, 2001), that supports by investigations.

My interest lies in how musical ideas were presented to the studio engineers and how they went about interpreting and finding an acceptable sound or solution, and my investigation starts with finding good examples to illustrate how tacit knowledge and craft were used, rather than scientific knowledge, and how rules were often broken, and protocol circumvented in the pursuit of that end. My focus is on Top 10 singles that had a cultural impact on how the public was introduced to these sounds, that by 1967 had become part of popular culture, that created an avant-garde for the masses, disseminated not only by radio and TV, but also through selling millions of records. For examples, 1967 singles such as "See Emily Play" by The Pink Floyd, "Itchycoo Park" by The Small Faces and "I Am The Walrus" by The Beatles

produced in British studios, and “White Rabbit” by Jefferson Airplane, “San Francisco (Be Sure To Wear Some Flowers In Your Hair)” by Scott McKenzie and “Incense and Peppermints” by Strawberry Alarm Clock produced in American studios were all successful single releases and represented psychedelia, but there is a marked contrast between British and American production process. (Now watch Video Example 1, which introduces the example recordings).

In order to describe the techniques used and contrast the differences in approach between British and American studios, I have undertaken this investigation by combining theoretical study of creativity, using practice as research to understand the processes, and provide practical demonstrations of the theoretical points.

Supporting videos show the tacit nature of the techniques that cannot be described by words alone. I have focused the research through the prism of two practical case studies, re-creating the closed environment of the 1960s recording studio, providing analysis, systematic and critical evaluation and explaining the working, research, and artistic processes of these historical recordings. Through re-enactment of The Byrds “Eight Miles High” recording session (January 1966 Columbia Studios, Los Angeles California), and The Beatles “Rain” (April 1966 EMI Studios, London UK) I can better demonstrate how the social construction of the everyday working practices shaped the sounds we hear on those records (Bijker 1994).

The two recordings represent the genesis of the period of popular music record production under investigation, and heralded an era where innovation and experimentalism in the studio became the authentic vehicle for creative expression. Tracing the songs from composition to final record reveals the continuum of composition, experimentation, and compromise that happens in the studio, provides an understanding of the various constraints that afford the creation of the soundscape, and contrasts the difference in working methods between British and American studios.

It is this inventive approach by the engineers and musicians of the time, that changed popular music record production from capturing a live performance as accurately as possible, to a studio led medium, separated the roll of the record producer from artist & repertoire officer, and heralded the rise of the technician as creative agent.

Despite all the endless theorising about pop music from 1960s, the contribution of a small handful of engineers is still not fully appreciated. Inspired by particular musicians, these innovations brought about a change in the very nature of the recording studio, from a place where musical performances were simply captured in the best available fidelity to an experimental workshop in which the transformations and even the distortion of the very sound of the instrument or voice became an element in the composition. (Emerick and Massey, 2007, p.ix)

The aim of my research is not simply to find out about old technology, but to seek to understand the detail of the human interaction with the technology of the period. By creating videos of re-enactments of these particular techniques, I am able to demonstrate the performative nature of the tacit knowledge. My study follows Zagorski–Thomas hypothesis that:

Centripetal forces stemming from the training, technical, economic, social and even architectural infrastructure of the time are sufficiently powerful in relation to the centrifugal forces of personalities to constitute a recognisable and definable British Sound that stands in opposition to that of the United States of America. (Frith and Zagorski-Thomas, 2012, chap.5)

Putting this hypothetical boundary around the research focuses the investigation on the creative stimuli of practical constraints, considering what may be seen as arbitrary in the process, as vital to the outcome. This method is developed from an ontological perspective in which the relationships that develop between the various constraints are as important as the individual constraints themselves.² Actor Network Theory helps us to understand that rather than passive intermediaries, the flow of associations between the centripetal and centrifugal forces act to shape the field of connections into a collective that influences the outcome of a course of action.

² For instance, Motown Records recording engineer Bob Olhsson suggests, “Sgt. Pepper's is not a recording, Sgt. Pepper's was the solution to the various problems they came up with in the process of producing the record. (Tape Op, Issue 30, 2001)

It is important to focus on these practice led aspects to get under the skin of the creative process, and be able to truly understand how the restrictions of time, personnel and technology, in contrast to today's abundance of options, affected the methodology, and the ways audio engineers bent the rules or abused the equipment to try and create the soundscapes the musicians were demanding for their compositions, and where in the chain of events these decisions were made to create these sounds, as you could not "leave it to the mix", as in current record production.

Method of research

The re-enactment was split into two recording sessions. Recording in Nashville to recreate the American working practice that produced The Byrds track, and also perform The Beatles track under the same constraints to see whether the overall approach provided clues to whether there was an inherent studio or cultural sound. Secondly, the London recording which mimicked the template of recording The Beatles at EMI studios, where the effects of manipulation could be considered in light of affordances provided by technology of the time, followed by a recreation of The Byrds track using the same constraints to investigate whether the autonomy the band attempted with an earlier recording of the song at RCA studios, also a four track process, created a recognisable sound. Finally the recordings of both songs were analysed and particular methods and practices were simulated in order to illustrate the tacit knowledge, forgotten methodology and sonic impact of the technology and how it affected the final soundscape. This analysis also

helped to understand the blending of parts, and provides examples of whether technology alone can now recreate the sound.

The recordings were performed as an ensemble. The sessions were filmed on video and various conversations recorded by audio. The filming captured rehearsals and performances, and did not interfere with the creative flow of the process. Later analysis and interviews with contributors helped to analyse crucial moments in the construction of the record. It was generally found that placing musicians and technicians into the recording environment produced a familiar work ethic, spatial organisation, hierarchy, and associated banter that naturally mimicked the roles played out in recording sessions.

My role as part of the performing ensemble allowed not only close ethnographic observation, but also sharing of the emotional, physical and participatory experiences which provided deeper insight into the routine decision making, compromise and technical considerations of the recordings.

Preliminary findings

Preliminary consideration of the final recordings indicated that the expected technological influence had less impact on the soundscape than the established working methods. The engineer's willingness to experiment moderated the amount of manipulation on the recorded sounds. The musicians had limited understanding of the technology of recording equipment and techniques, and tended to bring performance lead ideas into the studio and worked out the songs in ensemble providing their own parts to create an

improvised arrangement, that Zak refers to as a 'head arrangement' (2001, p.36), with neither notation nor fixed arrangement. What appears is The Beatles were suddenly set free to play in the studio with unlimited time, a new engineer and emboldened producer, who embraced the spirit of experimentalism, and introduced technological novelties that were incorporated into the soundscape, while contractual negotiations went on in the background. In contrast The Byrds, had sacked the producer who had overseen their career success, determined to pursue their own production ideas. Forced to record at Columbia Studios because of union protocol, they relied on their familiar relationship with the engineer to capture whatever they came up with in the live room. A newly appointed producer who provided no creative input from the control room oversaw the session.

The Byrds desire for autonomy lead them to foreground authenticity in performance, virtuosity and jazz / raga influences to suggest a seriousness in their music, each musician focusing on their own individual performance. The Beatles, lead by McCartney's emergence as the driving force, and recent introduction to the London counter-culture, similarly wanted to step away from the 'mop top' musical stylings towards an experimental approach. However, while The Byrds maintained their specific instrumental roles and hierarchy, The Beatles delegated their musical roles towards the greater idea of creating a new sound, and so deliberately swapped instruments, adjusted tunings, and embraced the idea of constructing a soundscape that incorporated electronic and temporal manipulation so it could not be reproduced live.

Differences in working practice

The findings also expose the differences between working practices in Los Angeles and London. Although in both cases the original live ensemble was recorded to tape, in America, the experimental sound was created in the studio, whereas in Britain, a co-incident manipulation of the studio sound emerged in the control room. The difference in working methods reflected an amalgam of influence by relationships, economics and social union. What emerges from the study is that the equipment didn't change but the way it was employed did. As the British engineers bent the rules to satisfy the musicians' demands, in America, the musicians rejected the established pop industry for live autonomy, or produced themselves where allowed. Within two years, the method of recording had changed as original practitioners struggled to cope with the new demands of overdubbing, and a generation of tacit live recording skill was lost. Unterberger concurs:

“What is significant is up till then it was live recordings or novelty, afterwards the creation of signifiers allowed a third layer of meaning onto records and this coincided with rock, LP's, and the counter-culture, which changed the business forever.” (Unterberger 2012)

Although these changes also coincided with the growth of stereo, it is important to appreciate how the legacy of stereo recordings skews our understanding of the original intentions, and also how overuse of certain signifiers have transformed the original meanings i.e. phasing now signifies

1960s novelty sound effects rather than its original connection to psychedelia. Whereas monophonic reproduction with limited bandwidth, depth and missing detail is often ignored over the realism of stereo, in fact it was the mono pop medium that was the chief carrier of these recordings and played a large part in influencing the construction and production of the musical soundscapes.

Re-enactment allows research to directly engage with these processes and ask questions, understanding the true roles and forgotten techniques that connect the musical and technological contributions that texts do not uncover. Whereas expert opinion, text and interviews uncover some aspects of the period, there is a confusion and lack of memory of the detail of the tacit knowledge that by definition cannot be explained. Further inaccuracies and contradictions from sources directed more towards entertainment than academic research prove that practical reconstruction can add a valuable layer of information about an era that is fast fading from living memory.

Cultural Considerations

Unterberger states that:

The term psychedelic rock is guaranteed to generate much heated discussion... when it comes to defining what it really means. To some, it's rock with long distortion ridden guitar solos and improvisation. To others its whimsical arty pop littered with special effects. There are those that see its unpredictable collision of disparate elements as a mirror of the drug experience, specifically the LSD one. Others point to the integration of Indian and Middle Eastern influences and the spontaneous

verve of free jazz in a rock setting. ... Many would say psychedelic music is a mix of all of the above. (Unterberger, 2003, p.11)

This description encompasses not only the various styles that defined the genre, it also describes the growing autonomy of the pop musician who demanded freedom to experiment in the studio and access to the possibilities of technological manipulation as part of the creative process. Whilst a history of popular music in the 1960s is outside the scope of this thesis, consideration of the emerging counter-culture permeating popular music, coming to a height in 1967 during the 'Summer Of Love', reveals how it influenced the use of the studio as a creative tool, and the sounds became part of popular culture, recognisable as psychedelic.

The emerging counter-culture

Whiteley, in *The Space Between The Notes* makes the point that:

The counter-culture was largely concerned with alternative modes of living which involved, to a great extent, the use of drugs as a means to exploring the imagination and self expression. (Whiteley, 1992, p.3)

Observing that the different styles of American and British psychedelic rock had common codes that conveyed the musical equivalent of hallucinogenic experience. By 1967, LSD had been embraced wholeheartedly by the counter-culture in San Francisco, where it was distributed freely as a legal

drug, and in London where, though harder to obtain, it created an atmosphere of creative inventiveness.³ MacDonald notes that in November 1965:

The counter-culture lifestyle was still the preserve of an LSD using elite in California and London's Notting Hill. Even the word 'hippie' had to be coined while the 'Summer of Love' was still 18 months away."
(MacDonald, 2005, p.143)

San Francisco bands, emerged from dance or 'jam' bands (Morrison 2000; Hill 2016) and provided a musical backdrop of extended improvisations to a multimedia experience of lights, fashion and lifestyle,⁴ for the counter-culture that combined art and social political gathering of bohemians focused on the Bay Area, far removed from the record business of Los Angeles. Hill affirms:

The idea of heightened sensory perception and the 'vivid experience' of music were central to the Acid Tests, and became a fundamental element in the new expressive culture emerging in San Francisco. (Hill, 2016, p.38)

Whereas the San Francisco counter-culture reflected a dissatisfaction with the status quo, with the music displaying a consciousness of cultural politics and expressing a desire for personal freedom, the British counter-culture was

³ "LSD-25", released by The Gamblers in May 1960 (World Pacific), a fictitious band of West coast session musicians, was the earliest use of the phrase LSD on record.(Savage, 2015, p.113) . "The Psychedelic Sounds of The 13h Floor Elevators" by The 13h Floor Elevators (International Artists), released December 1966, is credited with coining the term "psychedelic rock", whilst The Holy Modal Rounders "Hesitation Blues" includes the first use of the term psychedelic in a lyric. (Hicks, 2000, p.59)

⁴ Such as Kesey's Acid Test parties

characterised by an optimistic escapism, a distraction from the demand of reality, and a voice that the old ways were out. (Whiteley, 1992, p.60)

Barry Miles,⁵ founder of International Times, states that “The British ‘Summer of Love’ provided a background of lighthearted festivity that was anarchic, innocent and didn’t really take itself seriously.” (Whiteley, 1992, p.29), describing the first poetry reading at Albert Hall in 1965, Stockhausen at Festival Hall in 1966, their own 24 Hour Technicolor events to raise funds, and eventually opening the UFO club, where bands such as The Pink Floyd and Soft Machine first performed, as key events in the establishment and mainstream recognition of the counter-culture in Britain. Eventual crackdowns, jailing on drug charges and the commercialisation of the hippy ethos during 1967 diluted the original impetus, as Britain bathed in the best summer for years. Nevertheless, the impact on popular culture was far reaching.

In synchronicity with the experimentalism resonating with the counter-cultural ethos of upsetting the established order, bands like The Beatles, with producer George Martin, and The Beach Boys lead by producer/auteur Brian Wilson began a parallel exploration of the possibilities that lay inside the studio control room, and in tandem with the innovations in performance practice, some engineers also began developing novel methods to manipulate sounds that pushed equipment beyond specification parameters, to satisfy the imaginations⁵ of the emerging bands, creating worlds that could only exist on record, songs which could not be reproduced onstage. While an artistic elite

⁵ Barry Miles was connected to Paul McCartney through Jane Asher’s brother, and explains how the emerging bohemian culture in San Francisco was the catalyst to him wanting to open

translated the effects of LSD into sonic representations, the results were interpreted as indicative of a psychedelic experience, and were adopted as signifiers by the mainstream during the 1967 'Summer of Love'.

Savage refers to this surge of new sounds in popular music as the 'Great Race' (Savage, 2015, p.115) citing Bob Dylan's July 1965 single "Like a Rolling Stone" (1965), that lasted over six minutes, as the starting gun on "a new age of pop ambition" culminating with *Sgt. Pepper's Lonely Hearts Club Band* in 1967. Studying the timing of releases from the beginning of 1966, when the two case study recordings "Eight Miles High" by The Byrds, and "Rain" by The Beatles were released, to mid 1967, when the psychedelic genre became a mainstream cultural phenomenon, provides a clear path of innovation as records were conceived to out-do each other in experimentation, creativity and importance, pushing the boundaries of the domain.⁶ Savage states that "1966 began in pop and ended in rock" (ibid., p.iv)

DeRogatis makes the point that while the psychedelic influence seemed omnipresent:

Many of the bands that recorded psychedelic rock songs in the wake of the groundbreaking efforts of 1966 had never taken psychedelic drugs

⁶ For instance, "Eight Miles High" – The Byrds, February 1966, "Paperback Writer"/ "Rain" – The Beatles, May 1966, *Pet Sounds* LP– The Beach Boys, May 1966, *Revolver* LP – The Beatles - August 1966, "Good Vibrations" – The Beach Boys, November 1966, "Penny Lane"/ "Strawberry Fields Forever" – The Beatles, February 1967, *Sgt. Peppers Lonely Hearts Club Band* LP– The Beatles, June 1967.

but the subculture told them everything they needed to know to sound authentic. (DeRogatis, 1996, p.9)

Chapman contrasts the legacy between San Francisco model of performance based psychedelia with bands such as Grateful Dead and Quicksilver Messenger Service, with studio manipulated artefacts that appeared in the singles charts, becoming the soundtrack to the era, and makes the point that:

The truth is that some immersed themselves entirely in the full lysergic experience, while others just put on a paisley shirt and looked the part ... Such multilayered simulations make a mockery of the notion of “real psychedelia”. More often than not, it’s the unreal psychedelia that has endured. Or to put it more simply, what would you rather listen to? Status Quo’s “Pictures of Matchstick Men? or some Fillmore jam band meandering their way through a Bo Diddley cast-off? I thought as much. (Chapman, 2015b)

Case studies

The research addresses centripetal influences that affected recording in Los Angeles and London in 1966, and concentrates on two case studies. The literature review considers texts from academic musicologists, eyewitness accounts from producers, engineers, band members, studies by researchers and biographers, and other sources to uncover exactly how the recordings were made. The aim to discover how the engineers used the technology, how the technology of the day affected the way the musicians performed, how the

engineers captured that performance and the influence that differences in working practice had on the outcome. If there was a difference in approach, was it simply a cultural difference or technological difference, or were other factors in play?

The Byrds “Eight Miles High”, recorded on 24 & 25th January 1966 at Columbia Studios, Hollywood,⁷ and The Beatles “Rain”, recorded on 13th and 15th April 1966 at EMI Studios, London, exemplify the move from capturing a live performance, towards using the recording studio as an instrument to manipulate the song, creating an artefact that is not dependent on subsequent live performance in exact form.

These songs, that appeared ‘out of nowhere’ compared with the ensembles’ previous repertoire of folk rock and rhythm and blues based pop, are early examples of recordings that through experimentation created soundscapes that evoke the psychedelic experience.

The Byrds “Eight Miles High” was, according to Unterberger:

Psychedelia’s signpost. At its root, it was a folk song, changed into something else entirely by the free-flight 12-string guitar solos that welded the spirit of John Coltrane and Ravi Shankar to rock music. These explorations into raga, improvisation and electronic distortion would be amplified and diversified...and while The Byrds remained

⁷ The Byrds originally recorded “Eight Miles High” and “Why” on 22nd December 1965 at RCA Studios, Hollywood, with manager Dickson producing, and Dave Hassinger engineering.

based in Los Angeles, it would be the San Francisco bands that would amplify that blueprint to the nth degree. (Unterberger, 2003, p.12)

MacDonald describes The Beatles "Rain" as:

Expressing the benign lucidity of an LSD experience... the track's sheer sonic presence – an attempt to convey the lustrous weight of the world as it can appear to those under the drug's influence. (MacDonald, 2005, p.157)

MacDonald styles "Rain" as a cross between the "clipped discipline of pop and the heavily amplified improvisatory sound of rock", and notes that the sounds predict the emerging counter-culture acid rock sound, and with weight and depth provided by the slowed down basic track, effects such as backward voices added to the resulting soundscape that became The Beatles new signature style as they absorbed the sounds of the avant-garde and embarked on their psychedelic phase.

By introducing disparate influences such as Indian raga and free form jazz to their otherwise folk stylings, The Byrds were seen as innovators who helped introduce a new genre to the mainstream pop market. In the case of Lennon and McCartney, they were immersed not only in their own careers as professional pop musicians, but also aware of changing cultural opinions and personal experiences introduced by the counter-culture, which stimulated their interest to introduce these influences within their established reputation as artists. Combined with a wish not be overtaken by an emerging rock

underground, it also fueled a need to be seen as innovators and this informed their desire to take risks with their successful formula of The Beatles and Beatlemania. By taking counter-cultural influences from the margins, combining them with avant-garde techniques and presenting them to the mainstream, both bands instigated a shift in the way popular music was considered.

The Byrds “Eight Miles High” and The Beatles “Rain” can be heard as Audio Examples A and B in the Appendix.

Chapter 1: The study of record production

This chapter discusses available literature that sheds light on detail of the case study recording sessions. Although The Byrds were primarily a recording band, academic analysis focuses more on the group's importance to folk-rock, concentrating on cultural impact, authorship of compositions, and how the fractious relationships resulted in various line up changes.

Rogan's work on The Byrds, *Requiem For The Timeless Volume 1* reveals The Beatles (Harrison & McCartney) visited Columbia Studios in August 1965, to watch a Byrds recording session. After being introduced to producer Terry Melcher, McCartney "seemed particularly interested in the technical aspects of Melcher's production, carefully noting the recording levels." (Rogan, 2011, p.179) Unfortunately, little is discussed about the actual recording techniques in the studio, although he provides tracking details for the RCA session, quoting manager Dickson who produced the recording "the whole band on one track, McGuinn on another and two tracks of vocals." (ibid. p.243) This confirms the RCA session as a 4-track recording. The backing was mixed with scratch vocals, with the intention of replacing them at Columbia.⁸

Unterberger's book *Eight Miles High* focuses on the interconnectedness and influence of the folk-rock boom in the mid 1960s. The book's title suggests a generous reading of the song, but moves quickly into a chronological narrative

⁸ The mono RCA recording of "Eight Miles High" was released on Sundazed / Columbia (S238) in 2011. (Sundazed, 2011)

of the genre. However, it makes clear there were two recording sessions, RCA studios 22nd December 1965, produced by manager Dickson, and Columbia Square studios in early 1966, the later due to “Dickson not being the band’s Columbia assigned producer...and it had not been recorded at Columbia’s own studio which ran counter to company policy.” (Unterberger, 2003, p.2) This reveals how contractual constraints impacted recording intentions. He cites Crosby as suggesting the RCA version was more in line with the sound the Byrds wanted, while McGuinn suggests the guitar solo may have been more spontaneous on that version. Unterberger claims the triumph of the Columbia recording was “Not so much the process as the end achievement”, stating the band were “so far ahead of the curve they were playing music that had yet to be named” (ibid. p2). However, how they made the sound is not discussed, and the role and identity of the engineer remains a mystery.

Teehan’s insightful analysis into why “Eight Miles High” was not a hit record in America, also cited in Rogan and Unterberger, reveals that “most writers have confused the musical brilliance of “Eight Miles High” with its commercial appeal; the former has never been a guarantee of the latter.” (Teehan, 2010) He points out that although it mirrored the new sense of social-musical experimentation - including LSD usage- that had been occurring in San Francisco, where the emerging youth counter-culture movement was being shaped, “the unorthodox arrangements and extended length of “Eight Miles High” marginalised its programming promise on Top 40 radio, while the

record's musical complexity and innovation curtailed its sales potential." (ibid. 2010) Again, the descriptive interpretation discloses nothing of the recording.

Zak in *Poetics of Rock* notes that the "central instrumental character of The Byrds first hit single "Mr. Tambourine Man" (1965) is the chiming twelve-string guitar ...described as having a sonic distinctiveness that places it in a thematic role within the track." (Zak, 2001, p.60-62) He recognises the sound and timbral qualities also associated with the tuning as important features in The Byrds sonic history, "becoming associated with the musical style that they exemplified...folk rock." It is this Byrds sound that extends to "Eight Miles High". What is not discussed is how they created this chiming signature sound.⁹ However, since the guitar sound existed before "Eight Miles High" there are other themes and effects on the recording that combine to evoke the psychedelic sound.

Morrison identifies these signifiers in *Psychedelic Music in San Francisco: Style, Context, and Evolution*, describing "Eight Miles High" as having animated bass lines, drones, Indian/jazz solos, modal chords, and trip lyrics. He places the song within the top 10 of a matrix of 315 recordings whose sonic characteristics exemplify the psychedelic sound; chosen from various published psychedelic top 100 lists. (Morrison, 2008, p.78)

Rodriguez discusses "Eight Miles High" in his analysis of *Revolver – How The Beatles reimagined Rock and Roll*, noting the impressionistic lyric, twelve-

⁹ The sound is produced by sending the amplified sound to the Columbia echo chamber and compressing the combined signals with a particular valve limiter in the control room as the performance is recorded to tape. (Cianci, 2008)

string guitar improvisation citing “Shankar’s otherworldly timbre and Coltrane’s modal explosions” as the experimental elements, but makes no mention of recording techniques. (Rodriguez, 2012, p.42)

The above statements have concentrated on the song’s cultural meaning, foregrounding musical performance in the studio above input from studio personnel or the use of technology, apart from noting the track required re-recording at Columbia studios.

Warner points out that “the changes these technological processes bring about are considerable and can directly impact on every aspect of the listeners musical experience.” (Scott (ed.), 2009, p.134) He suggests this ‘creative team approach’ undermines the romantic notion of the single artistic genius, and argues that since commentators lack expert technical knowledge and recording studio practice experience, they fail to appreciate the level of mediation required, and this lack of appreciation of how important recording is, accounts for why “it is often neglected at least from an analytical perspective in popular music studies.” (ibid. p136)

Compared to the scant amount of published academic literature concerning The Byrds recording career, the availability of published analysis for The Beatles is overwhelming. Since William Mann’s musicological essay in *The Times* detailing “pandiatonic clusters and Aeolian cadences” (Mann, 1963) in their songwriting, academics have published alongside biographies, diaries,

and cultural histories to create a growing library of information relating to every aspect of The Beatles career.

In his book *The Beatles as Musicians: Revolver through the Anthology*, Everett describes the recording session for “Paperback Writer” and “Rain”, supplying basic tracking details and musicological analysis. For “Rain” he explains:

Drums and Lennon’s distorted Gretsch Nashville guitar, both recorded much faster than heard, introducing a rich tone of queasy hesitation that could be likened to the nausea of an acid trip, in the centre, the composer’s lead vocal recorded about a major second lower than heard... McCartney likely recorded a bass line at the same time, but this would have been replaced by a new high-ranging take on April 16th...perhaps re-recorded to better harmonise with Lennon’s guitar in the chorus, maintaining static tonal harmony. (Everett, 1999, pp.43–45)

Everett’s comments seem based on a reading of Lewisohn’s *The Beatles Recording Sessions* (Lewisohn, 1988), and his own assessment of stereo out-takes of the session. He also remarks on a discrepancy between Lennon and Martin as to who came up with the idea of backwards vocals on the coda, declaring that “actually, Harrison had already recorded his guitar backward on April 6th, so all published recollections of these events seem a little inexact.” (ibid. 1999, p.44)

Whilst this account recognises temporal manipulation of the soundscape, his claim that “recollections are inexact” also suggests insider knowledge into the process and he knows the actual facts. But this is a misreading of source material, and belies various misjudgments about the recording, since Harrison did not record backward guitar on 6th April, and McCartney did not play bass on the backing track of “Rain”, before replacing it later. Similarly, the premise that the backing was recorded faster than heard, and the vocal was recorded a major second lower than heard inverts what actually happened, since the backing was recorded faster and a major second higher than heard and the vocal was recorded slightly lower than finally heard. Whilst “the vocal is altered by ADT”,¹⁰ suggests manipulation, he does not elaborate or describe how the effect was created. “Paperback Writer”, is similarly affected by ADT and ‘heavy tape echo’ and Everett suggests, “the song persuades by electronic gimmickry” rather than describing any semiotic interpretation of the manipulation. While these ambiguities are perhaps minor points of contention while reading a musicological analysis, they would produce major errors if followed as part of a script to recreate the song.¹¹

Riley’s song by song analysis in his book *Tell Me Why* notes “*Revolver* made Beatlemania irrelevant”, calling “Rain” “the first stirring of pop psychedelia” (Riley, 2002, p.178), and provides a textural analysis of instrumental

¹⁰ ADT is an abbreviation of Automatic Double Tracking, a vocal effect to electronically create the sound of physically singing twice

¹¹ The events are cleared up in the later published works of Ryan and Kehew “The group recorded a backing track of drums and guitars on Track One of the tape, (studio documentation notes that the guitars were played by Paul and John)” and “It was the first use of backward audio on a Beatles song, excluding the slightly more abstract loops on “Tomorrow Never Knows”. Following this reversal of John’s vocal, Paul would add a backwards guitar solo to ‘Tomorrow Never Knows’ and George would do the same for ‘I’m Only Sleeping’”. (Ryan and Kehew, 2006, p.419)

performances based on a reading of the final stereo mix. Commentary on the use of technology is left to a description of the backward vocal on the coda that suggests:

Lennon demonstrates his philosophical message with a musical metaphor. The dreamy effect of running tape backwards enhances the aural illusion with contrary motion – two directions at once. (ibid. p.180)

This statement recognises that “The Beatles work came to be conceived with the studio in mind ... a performance to tape.” whilst acknowledging producer Martin’s “technically experienced ears lent a disciplined sensibility to Lennon and McCartney’s ideas”, agreeing that “elements of the production become part of the song itself” (ibid. p.27). Whilst this suggests a vital input from the producer, it perhaps glosses over the people who were ‘hands on’ reworking the ideas into stylistic innovations, such as engineer Emerick and the technical staff.

This point is picked up in Reising’s *Every Sound There Is*, a collection of scholarly essays, which considers the *Revolver* album from various viewpoints such as influence, musicality, recording, and themes. Overall, the consensus is that it was The Beatles psychedelic breakthrough, and influenced by LSD. McDonald and Kaufman focus on ‘the creative team’ and acknowledge the input of mixing engineer Emerick and maintenance engineer Townsend “who was responsible for many new studio inventions pioneered during these recording sessions” (Reising, 2002, p.140). In particular, the

invention of Automatic Double Tracking, a vocal effect to electronically create the sound of physically singing twice (to 'fatten' a vocal) that became a Beatles signature sound is discussed. Emerick is also credited for enhancing the bass sound on "Rain" by using a loudspeaker as a microphone. The analysis borrows from Beatles biographer, Lewisohn and EMI historian, Southall as sources for descriptions of techniques. Everett (*ibid.* pp.43-45) describes the role of 'soul' influences on the songwriting and discusses the plans to record at Stax or Atlantic studios, "to take advantage of superior technology" later abandoned.

Academics who concentrate on the cultural aspects of music production also provide material relevant to the recordings, but tend to focus on a generalisation of the technological breakthroughs. Moorefield's *The Producer As Composer* describes Martin's 'evolving role', and provides detail of the recording of "Tomorrow Never Knows"¹² (2010, pp.29–32), attributing the 'mysterious sounds' to tape loops, and the 'surreal quality' of the vocal affected by ADT, (although Ryan and Kehew confirm Lennon doubled his voice by physically singing twice, not by employing ADT). The use of multiple 4-track machines to get around limitations of equipment at EMI is discussed, and he suggests Martin was "unaware of America's 8-track Ampex recorders." (*ibid.* p.28).

This is surprising given McCartney's 1965 visit to Columbia studios (Rogan, 2011, p.179) and The Beatles plan to record in America with Martin,

¹² The first recording session of "Tomorrow Never Knows" was April 6th 1966, left unfinished, and was returned to following the "Rain" recording.

specifically at Stax or Atlantic, (which was an 8-track studio) (Everett, 1999, pp.43–45). Schmidt-Horning points out that while independent studios could quickly adapt to new technology, company policy constrained corporates like EMI, stating:

If a company like RCA or Columbia changed recording equipment in one of its studios...it would mean significant investment to equip all their studios with the same technology. (Schmidt-Horning, 2013, p.203)

Quoting Abbott's *Pet Sounds* book, Moorefield also asserts that Columbia Studios used an 8-track recorder explaining:

With the notable exception of his use of Columbia's new 8-track technology¹³ for "California Girls", Brian¹⁴ would record all the instrument tracks on one of the four tracks and use the remaining three for vocals. (ibid. p.18).

However, this simplistic statement avoids a description of how the 8-track was used,¹⁵ so does not reveal how and if it was employed to record The Byrds at Columbia.

Zak's *Poetics of Rock* also discusses the impact of technology in all aspects of recording through to mastering, and the roles of producer and engineer in

¹³ There were only four Ampex 8-track recorders in use in the whole of America in 1966, Atlantic, Columbia's own hybrid and Les Paul had two.

¹⁴ Brian Wilson, writer, performer and producer of The Beach Boys.

¹⁵ Wilson used the 8-track at Columbia to stack vocals while monitoring the mono instrumental track. (Badman, 1980, p.120)

the studio. American recording formats are considered as he describes Spector's predilection for using familiar 3-track formats he had been successful with, over available 8-track recorders while recording at Atlantic Studios:

He had better ways available to him, but if it impaired, impeded or made him insecure, technology means nothing ...You don't make a Phil Spector the victim of technology. (Zak, 2001, p.99)

Zak makes a key point that "equipment contributes to a record's unique sonic pagination, and is often chosen more for its perceived aesthetic properties, its 'musicality', than its technical specifications" (ibid. 2001)

Discussion of differences between British and American recording has centered on tape recording and number of tracks, with an implication that effects and innovation were freely available, while ignoring differences in studio working practice. But Cunningham in *Good Vibrations* states:

Until the late 1960s there was a marked difference between the production and engineering methods in America and Britain, almost as if there was an impervious technological barrier set up in the Atlantic Ocean. (Cunningham, 1999, p.45)

Often cited in academic literature, *Good Vibrations* is an interview based "generic history of record production, focusing on technological milestones"

(ibid. p16). Cunningham notes that in 1964 UK Decca producers Meehan and Atwood conducted a tour of American studios to discover how they made their distinctive records, concluding that records sounded the way they did because of the musicians, and the room, noting that:

A Decca engineer could play an EMI record and tell which engineer recorded it, because they each have their own style, and which room it was recorded in, because they each have their own sound. (ibid. p89)

Zagorski-Thomas provides support for this observation by considering differences in the sounds of American and British recordings in the 1970s, arguing:

British forms of innovation in recording practice thus centered more on emulating experimental and art music, whilst American innovation focused more on novel forms of clarity and separation. (Frith and Zagorski-Thomas, 2012, p.67)

noting that “the way social fields judge aspects of creative musical practice are also reflected in the way that creative practice was developed in record production”, concluding that “while trade restrictions meant that studios used different equipment, the training and habitus for sound engineers was also different in each country.” (ibid. 75)

Schmidt-Horning also points to key differences, noting that in American corporate studios such as Columbia, RCA, Capitol and Decca:

Staff engineers were unionized and governed by certain rules, including exclusive control over the equipment and designated tasks...non engineers were prevented from touching the controls, called “jurisdiction”... to protect union engineer’s jobs. (Schmidt-Horning, 2013, p.201)

In British corporate studios,¹⁶ a similar demarcation of roles pervaded the industry, and Thomson notes how this reflected social hierarchy or ‘class’, describing how the relationship to the EMI establishment of engineers Norman Smith, Malcolm Addey and Geoff Emerick reflected different levels of investment to the cultural system and expectations of rewards; Smith who served in the army, was a dedicated company man, Addey who was Grammar school educated, bought technical and musical knowledge, and Emerick who evaded Secondary School career choices, became the studio risk taker. (Thompson, 2008, p.130)

Whilst a demarcation of roles between musician, producer and engineer is identified, it still does not describe the value input of each member of the team, and how they interact during the creative process. Zagorski – Thomas concurs:

¹⁶ BBC engineers are represented by BECTA and the Film Industry is also unionised.

The notion of creative authorship has expanded to include creative management and editing or the supervision of a creative performance or production process in the definition of 'artist'. This reflects the fact that many forms of artistic practice have moved from a solitary craft-based activity towards technologically complex manufacturing processes. (Zagorski-Thomas, 2014, p.22)

Toynbee also acknowledges that creative authorship and recognition, regardless of desires for autonomy and experimentation, relies on creating successful recordings within a commercial environment for access to the public and points out that:

Working methods of collaboration and exchange ...was a flexible division of labour between The Beatles, producer Martin and engineers Smith then Emerick, based on exchange of cultural capital as much as strict professional expertise" noting that "Smith and Emerick's roles was important too, in enabling the array of tape and pro-phonographic effects that were used. (Toynbee, 2000, p.90).

However, he does not differentiate between the individual skills of Smith or Emerick, regarding them as servants to the process, rather than having any difference in approach, or control over the final sound of the recording.

Gracyk pursues a similar art vs. commerce philosophy and linking creativity to the record label's commercial process, uses a workshop metaphor to acknowledge a collective enterprise:

Martin alone does not deserve credit for the recordings of The Beatles. Theirs was a collaborative achievement, crafting detailed representations of musical performances... like a Renaissance workshop where masters and assistants are responsible for different parts of a complex work. (Gracyk, 1996, p.57)

While the above analyses are insightful when discussing sociological aspects of record production, there is limited information relating to the case studies recordings, and academic literature has not successfully revealed detail of the role of the technology in the process. Although there is recognition of innovation, it is no more than a generic overview of various experimental techniques, for instance identifying ADT and backward sounds, but no information on how the techniques were developed, simply that they were 'electronic gimmickry', with an implication that these effects were discoverable by anyone who wanted to employ them, in a fully formed state, a 'black box', which Latour describes as:

The way scientific and technical work is made invisible by its own success. When a machine runs efficiently, when a matter of fact is settled, one need focus only on its inputs and outputs and not on its internal complexity. (Latour, 1999, p.304)

Overall, there is an overreliance on secondary sources when discussing innovation in studio working practice, hence the literature is considered

unreliable, and often sidesteps the impact of the recording process by defaulting to a musicological interpretation.

Warner, in “Approaches to Analysing Recordings In Popular Music” in *Popular Musicology*, illustrates this point, observing that whilst Allan Moore states the recording of Sgt. Pepper is “The only thing we have approaching an authoritative score ... is the recording itself”, he then analyses it from the viewpoint of pitch, harmony and rhythm, “making only a few minor passing references to the hugely significant roles that the recording studio technology played in the making of this seminal album” (Scott (ed.), 2009, p.133), suggesting music commentators may also hold a negative view on recording technology on ideological grounds. This mirrors Zak’s concern that perhaps ideological resistance as well as technological limitations held back the creative use of manipulation, and any musicological recognition, beyond the generation of novelty sounds:

Woven throughout the history of sound recording is an ideological conflict that has resulted in varying degrees of ambivalence towards the machines presence in our midst. The technology of sound capture and manipulation has confronted traditional notions of music making with a new kind of musical ontology. Whilst this has meant new possibilities for musical expression and reception, the realization of these possibilities has been a very gradual process over the course of the twentieth century. For if, in an ideal sense, sound recording opened up to music an unprecedented world of exploration, technical limitations and

ideological resistance meant that the course of exploration would be slow and that the consequences would take some time to emerge. (Zak, 2001, p.3)

Insider perspectives

The main academic and scholarly texts that have addressed the recordings, or considered techniques relevant to the production of the two case studies have been considered. However, they tend to rely on other sources for technological detail, often from participants in the recordings such as the musicians, producers or engineers. The main eyewitness accounts are now considered.

The Byrds

The Byrds recorded “Eight Miles High” at Columbia Square studios with producer Allen Stanton (credited on record label) and engineer Ray Gerhardt¹⁷ (identified in photograph). The only published information regarding the session is a diary entry stating the band entered Columbia studios on 24th January 1966 to record the B-side “Why”.¹⁸ The session for “Eight Miles High” started on 25th January 1966 at 7pm and ran over two days. (Hjort, 2008, p.80)

Further details about the recording from an insider perspective discloses information about the studio room, the use of compression to create the 12-string guitar sound, and the apparent frustration of recording with union

¹⁷ Engineer for Tony Bennett, Johnny Mathis, Percy Faith, Paul Revere & The Raiders (Columbia), The Carpenters (A&M)

¹⁸ “Why” was re-recorded on February 11th 1966, at Columbia studio A, making it the third attempt

engineers. This information comes from interviews between band members and John Nork undertaken to coincide with album re-releases on CD:

Columbia Record Studio A in Hollywood. It used to be Jack Benny's radio program studio... It was a huge barn of a place. They had these echo chambers that were physical rooms... That was how we got our echo sounds on the early records. – Roger McGuinn (Nork, 2004d)

Using compression was the idea of Ray Gerhardt, one of the house engineers at Columbia. They had no experience working with rock 'n' roll bands and were scared we'd blow out their equipment, so they used compression in an attempt to protect themselves! – Roger McGuinn (Cianci, 2008)

We were in a union room, and these guys ... this was the era when engineers wore white shirts and ties, and they'd take union breaks. As soon as you were ready to do another take, it would be their break time and they would take a half hour break. – Dave Crosby (Nork, 2004c)

The Columbia union engineers that used to take breaks in the middle of a song and stuff - Chris Hillman (Nork, 2004a)

I remember back at the Columbia studios, the guys were really strict about how you couldn't touch the knobs on the boards. And one time I did -- I did a fade, a practice fade, and they walked out. Although I would

have loved to be involved in the recording end of it, I wasn't allowed to. –
Roger McGuinn (Nork, 2004d)

These accounts suggest the practice was a compromise between established ways of working and the demands of a group that craved autonomy in the studio, hence their attempt to produce themselves at RCA studios the month before. The use of compression on the guitar is the only technical revelation, while working practice is described as fitting around union session protocol, and interruptions for statutory breaks.

The Beatles

Information about The Beatles recording sessions from an insider perspectives include two publications from producer Martin, *All You Need Is Ears* (1979) and *Summer of Love: The Making of Sgt. Pepper* (1994), engineer perspectives from Emerick's *Here There and Everywhere* (2007) and Scott's *Abbey Road to Ziggy Stardust*, (2012) supported by McCartney's 'official' biography *Many Years From Now* (Miles, 1997). Martin often repeats the same scripts when addressing the subject of innovation in techniques, and cites famous examples such as "Tomorrow Never knows" and "Strawberry Fields Forever". Discussion of his move from corporate producer to independent in 1965 (Martin, 1979, chap.10) reveals how the change of contractual relationships with EMI resulted in a change in engineer from Smith to Emerick, in time for the *Revolver* sessions. McCartney discusses "Rain" from the songwriter perspective, mentioning he enjoyed the "slowing down of the tape" idea. (Miles, 1997, p.280) Emerick's book reveals many of the

techniques used on “Rain”, but too often the anecdotes appear as elaborations of the facts as to how the ideas appeared. Scott provides useful detail of equipment such as consoles and the method of creating Automatic Double Tracking. (Scott and Owsinski, 2012, p.61)

Frequent contradicting explanations from various sources are illustrated by the following anecdotal descriptions of the novel way that the bass guitar was recorded with a loudspeaker wired as a microphone to capture more bass resonance, in answer to McCartney’s demand for a deep Motown bass sound, during the “Paperback Writer” and “Rain” session.

Ken Townsend, EMI technician, is quoted in Ryan and Kehew’s “Recording The Beatles” book, and corroborated by technical engineer, Dave Harries:

I thought one day, why not use a big EMI loudspeaker as a microphone...one of the big white ones we used to call The White Elephants... direct onto the recording console... the first track to benefit from this speaker –as –microphone technique was “Paperback Writer” (Ryan and Kehew, 2006, p.420)

Geoff Emerick, engineer on the track, also claims to have come up with the idea: “...inspiration struck. It occurred to me that since loudspeakers are in fact simply loudspeakers wired in reverse....” (Emerick and Massey, 2007, p.115) Glyn Johns, engineer for The Rolling Stones amongst others, recounts a conversation with McCartney:

My favourite bass sound, for years and years and years, was Paul McCartney's bass on [The Beatles'] "Paperback Writer."...I'd never asked Paul anything about what they'd done in the past before. I asked, "Okay, how'd you get the bass sound on "Paperback Writer"?" He thought about it and said, "Oh, the mic was about a couple of feet away from the cabinet. The cabinet was a Fender. It was a [Neumann U] 67. (Crane, 2015, p.62)

Although the claims are all plausible applications of technology, the inconsistency highlights a problem with remembering events from the 1960s, which is explained by engineer Scott who worked with Emerick:

We never ever thought, 40 years on, 50 years on, we'd be talking about this. So it was just another day at the office kind of thing. (RBMA, 2013)

Weber's *The Beatles And The Historians*, analyses the bands historiography using strict methods to separate history from mythology. Discussing Emerick's book *Here, There and Everywhere*, he notes that Scott had:

Criticized several factual inaccuracies, and argued that, prior to writing the book, Emerick had quizzed his fellow Beatles engineer for information to compensate for his own poor memory" noting that given the abundance of Beatles memoirs, it is "impossible to determine to what extent eyewitness recollections have been retrospectively influenced by other accounts. (Weber, 2016, p.203-204)

In his chapter, *History and Mnemohistory in Memories of Working with the Beatles*, Chapman agrees that this includes the engineer's claims to being the first to apply techniques that had clearly already become standard practice, and following a "public set of Internet exchanges between the two recording professionals", Scott chastised Emerick by saying:

As part of that history Geoff did amazing things, but if one can't remember or take the time to double check facts, don't write a book. (Levine and Bohlman, 2015, p.292)¹⁹

Emerick and Scott employed co-writers Massey and Owsinski, both engineers turned writers, to translate the mundane details of studio interaction into dramatic insight, behind the scenes descriptions of technical wizardry and forgotten truths, in order to communicate events as entertaining prose to create a commercial product. Despite the volume of texts available on every aspect of The Beatles existence, investigations and recollections into the world of popular music tend to avoid dry history for a romanticised approach, embellishing stories and making the times seem more interesting. The glamour and drama of the entertainment industry demands its characters share in the same sense of showmanship and collective myth building. Unfortunately, with no written records, practitioners who lived in the moment are left grasping for anecdotes, and spurious insights are mixed with celebrity

¹⁹ Thomson recounts conversations where Scott admits to regression therapy trying to remember key events in his recording of the Beatles, and notes that he is prone to explain the same stories whether on the telephone to an academic or entertaining a class of undergraduates during his book promotion tour. (Levine and Bohlman, 2015).

interpretation, so the dissemination becomes part of an information dialogue rather than contemplation of historical archive.

Biographical perspectives

The two key biographers for the Byrds and Beatles, Rogan and Lewisohn provide a wealth of relevant historical background. Rogan's work on The Byrds, *Requiem For The Timeless Volume 1*, first published in 1990 as *Timeless Flight*, has extended to over 1000 pages covering the entire career and post Byrds output. Although "Eight Miles High" is only discussed from a historical perspective, the RCA session tracking is mentioned. A valuable glimpse of studio working practice at Columbia is provided by his transcription of *Journals* (Cedrem 1994). This nine CD 'bootleg' edition of studio outtakes from the 1965 and 1966 period (ibid. pp. 1097-1114}, includes the 'between take banter', and illuminates the working relationship with Melcher, and Stanton who replaced him and produced "Eight Miles High". As well as arguments and tensions, it provides vital clues to instrument volumes, tuning methods, contrasts Stanton's lackadaisical approach compared to hands on suggestions from Melcher, so provides a document which supports many audio outtakes from the sessions that have appeared in the public domain.

Lewisohn's work started as an assistant researcher in the 1970s with Philip Norman for *Shout!* (1981) (Weber, 2016, p.157). This research has since become a life's work and he is the foremost Beatles historian. Beyond the

extended biographies,²⁰ he spent seven years in the EMI archives cataloging all the literature, track sheets and tape boxes, transcribing vital information that make up *The Complete Beatles Recording Sessions (1994)* providing dates, times and recording details such as who played what instrument or sung harmonies, incomplete takes and suggested arrangements.

Research into the detail of The Beatles recording sessions has been extended greatly by Ryan and Kehew's definitive work *Recording the Beatles (2006)*. This huge undertaking combines their expertise as studio professionals with ten years of research cataloguing every single piece of recording equipment used in The Beatles sessions in minute detail. Section IV (pp. 408-431) considers recording innovations in 1966, and provides a detailed account of the "Rain" recording session (p. 419).

While they cannot explain why certain pieces of equipment pieces were chosen over others, and how they were used, the book's investigative approach questions many previously published accounts that appear in the canon of recording mythology. For instance, Everett *et al.* state Lennon's vocal on "Tomorrow Never Knows" was distorted by recording through a Leslie rotating speaker in EMI Studio Three. Ryan and Kehew point out that a Leslie speaker requires connecting to a Hammond organ for power, and there was no Hammond or Leslie in Studio Three. The nearest Hammond²¹ and Leslie were situated on the floor below in Studio Two, and with no lift access between floors, only a stairwell, and an impromptu decision to try the device

²⁰ Volume Two, covering the 1966 period expected to be published in 2019.

²¹ A Hammond B3 weighs approx. 200kg; Leslie 147 weighs 70kg.

could not have occurred. They go on to deduce likely alternative scenarios, as well as debunking other claims ascribed to various Beatles sessions.²²

This thesis takes a similar investigative approach to solving the various mysteries that surround the recording of the original cases study performances. While much has been published and discussed about The Beatles “Rain” recording, little is known about how the techniques were developed, how the engineers used the technology, and how the working practice affected the outcome. Studies such as Ryan and Kehew confirm the input from the engineer, but similar studies of American studios are scarce, and there is no published detail relating to the recording of The Byrds “Eight Miles High” at Columbia.

Collaborative working practice

I now consider evidence of how the people and technology fitted together in the recording process. Zagorski-Thomas argues:

The academic study of record production often seems to be ...foregrounding technology over the study of the creative process....So alongside the study of this technology we need to look at how the technicians and the musicians work, train, communicate, interact with the technology and engage with the social and economic structures involved. (Zagorski-Thomas, 2014, p.36)

²² For instance, first use of loudspeaker as microphone on “Paperback Writer”/ “Rain” - Emerick had used a loudspeaker to record the bass drum a month earlier on Manfred Mann’s “Pretty Flamingo”; Close microphone placement was not unique to the *Revolver* sessions but standard practice, in 1966, EMI temporarily outlawed the use of AKG D20’s on bass drums closer than 18 inches on sessions in 1967 (except Beatle sessions) following an increase in repairs; and the Fairchild limiter was used by Smith during the *Rubber Soul* sessions, and not introduced by Emerick for *Revolver* etc.

In the 1960s, the culture and structure of large corporations often created a constraint to absorbing innovation into established working practices and was compounded by an institutionalised hierarchical deference, which tended to play down the role of support staff in the creative process, with tacit knowledge deemed common practice. In contrast to current definitions of recording engineer, which embraces a multitasking degree of involvement, supporting staff in the 1960s were regarded as 'unsung' "...specialists versed in some particular phase of an art or science but lacking, or not being expected to generate, creative thinking with regard to it." (Evan, 1963, p.8)²³

Kealy's (1979) article *From Craft to Art: the Case of Sound Mixers and Popular Music*, (Zagorski-Thomas 2014; Schmidt-Horning 2013) describes how the role changed from technician towards collaborative engineer, defining a craft/union, entrepreneurial and art mode. While he fails to distinguish between producer and engineer, he contrasts the different levels of involvement by the engineer in the process during the 1960s. The union /craft mode best describes the balance engineer within a strict demarcation of roles and responsibilities in studios such as Columbia, RCA, Decca and Capitol that were closed 'union rooms'. Working practice followed rules negotiated by collective bargaining, with strict adherence to session hours and breaks. This model suited the three-hour sessions working with union musicians, where the engineer's skill lay in balancing the live performance to tape.

²³ "The Engineering Technician: Dilemmas of a Marginal Occupation" -"The engineering technician occupies a position in the occupational hierarchy intermediate between that of the engineer and that of the craftsman. His ambivalence regarding his status and the ambivalence of others towards him contribute to his marginal position. (Evan, 1963, p.1)

Producer Al Schmitt²⁴ explains:

I engineered when I was on staff at RCA, and ended up producing. As an RCA producer, the only thing I couldn't do was engineer, and that was because the union wouldn't allow it. I would tell a guy what to do, but by the time that I told him and he did it, it was too late. So, I would sometimes reach over and grab the fader myself, but that was a no-no and I would be turned in and read the riot act. (Buskin, 1999, p.85)

Training was 'on the job'. Schmidt-Horning notes that:

Those with a radio license were considered fully fledged, and those without considered second rate ... and there was a pecking order established by the union that said this man can't do this, and isn't qualified to do that etc. (2013, p.126)

Although there was no unionisation in British corporate studios,²⁵ "there was a clearly defined hierarchy within Abbey Road, and the studio had a well established path that employees must take to progress through the ranks."(Ryan and Kehew, 2006, p.42)

Emerick describes the working relationship between producer Martin and his predecessor, Smith:

²⁴ RCA Engineer (Mancini, Sam Cooke), RCA Producer (Jefferson Airplane); currently Capitol Studios engineer (Madonna, Michael Jackson, Sinatra, Presley, Dylan, McCartney etc.)

²⁵ British corporate record labels were divisions of larger companies such as, EMI, Decca, Pye & Philips.

George would relay Norman's thoughts to the band as if they were his ideas. Norman tolerated that well; he knew it wasn't his place to speak up. In those days the producer was still very much in charge, and his methods were not to be questioned. (Thompson, 2008, p.125)

While Kealy's entrepreneurial mode best describes the rise of independent studios²⁶ allowing producers such as Meek and Spector to create signature sounds,²⁷ the art mode engineer took aesthetic decisions and was more involved in "the integration of the sound of the studio technology with the musical aesthetic of popular music." (Kealy, 1979, p.214) Although they were working in a corporate studio environment, 'art mode' best describes Emerick and The Beatles production team approach, as opposed to Gerhardt's 'union / craft mode' based role at Columbia for The Byrds recording, since The Beatles interest in experimenting with studio technology involved the cooperation of the producer and ingenuity of the engineer beyond his ascribed role. Thomson's overview of British pop recording in the 1960s *Please Please Me*, repeats many of the above observations and notes how the "nature of the role of recording technician at EMI shifted from servant to enabler." (Thompson, 2008, p.130)

²⁶ For example Goldstar and United Western in California, as well as Motown, Stax and Atlantic; and British studios such as Olympic, IBC, Kingsway & Olympic.

²⁷ The rise of the independent producer represents the underlying story of 1960s record production with producers and engineers increasingly stepping outside the corporate studios to go freelance, based on their inherent skills and track record, including Martin quitting EMI 1965 and returning as an independent.

Recording is variously described as 3-track, 4-track and 8-track in America (Schmidt-Horning, 2013, p.173) and 2-track and 4-track in Britain (Massey, 2015, p.10), and Joe Boyd, who produced early The Pink Floyd singles states:

Musicians in the '60s were still recording a large part of each track playing together in the same room at the same time, maintaining at least some excitement of a live performance, with vocals and solos added later...the acoustics of different studios varied widely, as did the styles of engineering and production. (Boyd, 2006, p.203)

Schmidt-Horning notes that in American studios, experienced engineers, used to recording four sides in three hours with professional session players:²⁸

Now had to exercise tremendous patience with musicians who came into the recording studio with just an idea for a song, frequently going over the same song, or section of a song, repeatedly until they felt they had gotten the right sound or best performance. (2013, p.181)

George Martin describes how he built up recordings at EMI London, revealing a method of working around the constraint of four tracks:

I tended to put bass and drums on one track, guitars on another, and then vocals with backing vocals on the third track, and keep the fourth

²⁸ The rejection of outside interference from session players prompted The Byrds to create self-contained arrangements that involved only the bands musical skills and performance. Meanwhile The Beatles began to embrace the input of Martins keyboard skills, and following "Yesterday" arrangement without any of them performing, became more curious to include exotic sounds, in opposition to other EMI producers methods such as Columbia's Norrie Paramor's dictatorial arrangement style to include his signature glissando string motif on his artists recordings (Helen Shapiro, Cliff Richard, The Shadows, Frank Ifield).

track up my sleeve for possible double tracking or solo work. (Kozinn, 1987)

Botnick reveals similar sounding working methods for The Doors at Sunset Sound in Los Angeles.²⁹

Everything was written, they had been playing it live, so when you rolled tape you got a performance. Maybe you overdubbed some things and enhance what was there, but there wasn't too much of that. We recorded to three tracks of a 4-track machine, and the only overdubs we did were some Fender bass with Larry Knechrel, and sometimes, another vocal from Jim. Apart from that the bass and drums were on one track, the organ and guitar were on another track. (Buskin, 1999, p.98)

Whereas this comparison of British and American methods provides a useful glimpse of working practice, it does not provide enough support for the two case study sessions. Other corroborative texts, such as Massey's *Great British Studios*, the US equivalent *Studio Stories*, *Temples of Sound*, *Sonic Alchemy*, *Behind The Glass*, *Inside Tracks* etc. provide interviews with recording industry practitioners imparting a wealth of information as anecdotes that make interesting reading with fascinating insights, but they provide no further detail when trying to assess the role of technology at the time.

²⁹ Recorded at Sunset Sound, Los Angeles in August 1966 with producer Paul Rothchild, and engineer Bruce Botnick.

Oral Accounts

The classification of techniques as company secrets, tricks of the trade and privately devised workarounds left them unrecorded, undiscovered and forgotten until media technologies provided a platform for contemporary revelation making memory a viable commodity. Oral accounts, where the practitioner is forced to go 'off script', can sometimes reveal unexpected tidbits of information, helping to contextualise studio processes. Zak notes that:

Interviews with significant figures in record production, the oral accounts of practitioners ... are among our most useful resources. If, for example, we are to engage the entire musical surface, it is helpful to know what kinds of concerns were paramount for those who made it. (Zak, 2007)

Ken Scott's lecture at Abbey Road Studio Two³⁰ provided not only scripted anecdotal evidence, but his apparent emotional connection to a workplace he may not have visited in years, triggered other unscripted and buried memories that illuminated the more mundane yet important aspects of the workplace. Emerick and Harries³¹ provided an unexpected wealth of informal information and reflection as engineer and technician conversed on equal footing, recalling long forgotten tasks relating to monotonous aspects of historic practices they had shared, evoking more of a dialogue of private remembrances than a one sided reminiscence to an unquestioning and prying

³⁰ The Sound of Abbey Road Studios, with Ryan and Kehew, with guest Ken Scott, 25th April 2014. (Eccleston, 2014)

³¹ Emerick and Harries were filmed for an informal post ceremony interview at 2016 Music Producers Guild Awards. (Music Producers Guild, 2016)

audience. Both these events provided information relating to day-to-day working practices, surpassing the usual recounting lists of successes and innovations they were party to, not least because information tailored to the interest of fans, is often superficial to research academics.

Implicit knowledge embedded in practice

In my investigations of technique, published written accounts have mostly centered on basic scientific explanations of outcome or user manual descriptions of what equipment may offer the user. Oral accounts have provided glimpses of forgotten practice with vague explanations. It is clear that the knowledge of technique cannot be passed on through literature or verbal description because the practice is remembered through tacit experience. In his book *The Tacit Dimension*, Polanyi states:

While tacit knowledge can be expressed by itself, explicit knowledge must rely on being tacitly understood, and applied. Hence all knowledge is either tacit or rooted in tacit knowledge. A wholly explicit knowledge is unthinkable.” (Polanyi, 1966, p.144)

Gherardi considers the importance of tacit knowledge in practice, describing it as a concept between habit and action, arguing:

Working practices are therefore the loci in which tacit knowledge is constructed, harbored, and transmitted to newcomers. But it is important to pay attention to the nature of this dynamic of knowing-in-practice so

as not to lapse into a vision of a tacit knowledge waiting only to be made explicit... this in particular concerns sensory knowledge incorporated in skills; but it also concerns distributed agency, i.e. the social nature of expertise, and the dynamics of “communities of practice. (Gherardi, 2009)

Engineers learnt their craft by watching and learning and finally being allowed to run a session using trial and error to refine their skills. In the relatively sparse technological environment that was the 1960s recording studio with few primitive sound manipulation devices,³² engineers discovered alternative ways to manipulate sounds and were not concerned by the technical aspects of the equipment.³³

Polanyi explains that tacit knowledge, tradition, inherited practices, implied values, and prejudgments are a crucial part of scientific knowledge and describes how scientists may make undefined commitments to an idea based on internal feelings that this commitment will be eventually be beneficial, and explains: “We can know more than we can tell.” (Polanyi, 1966)

Schmidt-Horning agrees that “the unarticulated implicit knowledge, non-verbal cognition and visual thinking are central to recording engineers.” (Schmidt-

³² George Martin looks back on the 1964 EMI studio: “The [mixing] desks in those days were tube operated, they weren't transistorised. All the outboard gear that we have today didn't exist. The EQ characteristics are quite different, much cruder. The echo facilities in Abbey Road consisted of a long cellar like room with old drain pipes standing around; they had nothing like electronic echo at all.” (Kozinn, 1987)

³³ In conversation, EMI sound engineer Haydn Bendall, described how there was no discussion of technology or electrical theory at his job interview, apprenticeship at Abbey Road studios meant years working in various departments until the staff felt he was ready to run a session as an engineer. (Bendall, 2014)

Horning, 2013, pp.125–130), noting that recorders retain elements of art and tacit knowledge, assisting the artist in presenting their ideas, such as voicing, leaving space in arrangement, staging, and by using a different microphone, or with some compression engineers can place voices ‘behind’ the lead vocal, but not all compressors work well on all instruments. “Like knowing which microphone to use, good engineers know which compressor works best on what instrument.” (ibid. 2013, p.214)

In the recording studio, the equipment is laid out in a fixed ergonomic arrangement, which not only helps the practitioners to work efficiently, but also reminds them of regular activities, allowing them to instinctively manipulate the equipment to shape the recorded sounds. The tacit knowledge allows the engineer to flow with the demands of the session, and to be able to anticipate the outcome of choices before they are made.

Bourdieu, in his Chapter *Structures and The Habitus*, explains how immersion in a particular field of knowledge gives the person a sense of knowing how it works, a ‘feel for it’ and this habitus, which is the product of a collective history, provides the structure that informs their actions and choices. (Bourdieu, 1977, p.78) Toynebee also points out that rather than choose from limitless possibilities, an engineer will select from a radius of possible choices based on his experience and day-to-day routine that makes up the habitus of his domain, or field of experience. (Toynebee, 2000)

The EMI mixing desks, in particular RED37³⁴ remained the same in each studio between 1963 and 1968, as did the equipment at Columbia Studios in Hollywood and New York, meaning an engineer who sat in front of the same layout day in day out, could eventually recall every nuance and button position without looking. This tactile knowledge, in contrast to today's need to stare at a computer screen as a visual map for interaction with the selected program, meant the engineer could 'play' the mixing desk like an instrument without looking at the hand positions:

The embodied cognition between thinking the action and the physical sensation of action helps us to understand not only how we interpret sounds as ecological manifestations of actions,³⁵ but how we prepare for actions, remember actions by constantly doing them, imagine doing things, and are able to repeat these movements by muscle memory rather than consciously looking at what we are doing. (Wilson, 2002)

Memorised tactile movements help the engineer to concentrate on the sounds and enter the 'flow' state rather than rely on visual feedback when selecting and changing parameters.³⁶ In this way, the engineer built up a repertoire of

³⁴ The REDD 37 mixing desk was designed and used in EMI studios throughout the 1960's preceded by REDD 17 (1957) and followed by REDD51 (until 1969) and the size and ergonomic layout remained the same between models. They were installed in every EMI studio in the world to allow engineers and sessions to move between rooms or studios if necessary.

³⁵ For instance we hear the sound of a bell not as a certain mix of frequencies with a metallic tone but of an imagined bell ringing, imagining its size and distance.

³⁶ Indeed, some accounts in pre-computer days describe engineers covering analogue desk VU meters so they have no visual distractions when selecting sounds, because even then it was considered an intrusion or hindrance.³⁶

responses and techniques in the relatively simple environment, which supported the day-to-day routine.³⁷

However, the inquisitive and adventurous engineer also discovered ways to manipulate sounds utilising what was available, tape machines, microphones, amplifiers, frequency equalisation, volume limiters and echo chambers. These new methods were often conceived without deliberation or focused attention, through a desire to explore beyond the parameters and an instinct not only about how to obtain desired end-states, but what to do in order to obtain them, and knowing when to do it. Gherardi suggests:

These actions are built around concepts such as, bricolage, and articulation, heterogeneous engineering, tinkering. All these terms express a search for a new lexicon that breaks away from the linearity of the end-directed instrumental action that privileges the rationality and intentionality of the human actor. (Nicolini et al. 2003)

It is the willingness of some engineers to explore the sonic possibilities via many paths and respond to the new ideas rather than constrain creative play by following the strict methodology laid down by studio protocol and best practice, that provided an enhanced sonic palate that made the records that are the focus of the research. It is the context of discovery rather than justification, learning to trust the process without explanation, how it worked rather than why it worked, that drives the research in the same way as in the

³⁷ This is backed up by research into how visual perception and selection are influenced by action intention, “when planning to act in that particular way, we tune our perception to what is action-relevant.” (Wykowska and Schubo, 2012)

studio “I don’t know how you did that - but it sounds great” was often the caveat applied to the outcome. In Feyerabend’s (2010) words “Anything goes.”

Researching techniques that are based on instinctive responses is complex, because they remain tacit, and cannot be explained easily in text. We are presented with a list of actions, equipment and no way of knowing how they fitted together.

Akrich & Latour’s (1992) notion of the antiprogram helps us to understand how the unorthodox demands of the artists resulted in engineers circumventing prescribed studio equipment working practices to discover new techniques, such as those used to create the aural equivalents of the distorted and warped sensory encounters enjoyed during a psychedelic experience following ingestion of LSD. By experimenting with equipment beyond the manufacturers intended operating design, and using the tape machine as a performance instrument, they created new ‘cutting edge’ sounds that became psychedelic signifiers and metaphors and were adopted as cultural frames of reference by other performers in their field. Even though secrecy normally surrounded what went on in the studio, engineers were often able to deduce techniques by experimentation and come up with similar effects albeit by different methods.³⁸ The concept of antiprogram is based on the perspective

³⁸ EMI created their method of phasing on The Beatles “Lucy In The Sky With Diamonds” by employing the ADT varispeed box to delay a copy of the vocal via the record head. The Olympic version used on The Small Faces “Itchycoo Park”, was created by physically touching the flange of the tape reel to vary the speed of a parallel tape machine, a cruder, but more dramatic outcome as it had to be applied to the entire song, both versions performative operations. (See Video Example 11)

of the observer:

All the programs of actions that are in conflict with the programs chosen as the point of departure of the analysis; what is a program and what is an antiprogram is relative to the chosen observer. (Bijker, 1994, p.261)

Discussing creative abuse, Keep also notes that:

Innovation in record production has developed through the creation of new sounds and is more likely to come from heuristic experimentation of existing equipment, rather than adaptation of new technology, while in search for an elusive new sound,

He describes 'creative abuse' as "a process by which forms of technology designed for one purpose have been applied in alternative ways." (Keep, 2005)

In particular he notes the influence of art music in the form of 'musique concrète', and suggests that:

Almost the whole technical palette of tape editing and manipulating, developed by pioneers such as Pierre Schaeffer, were adapted into key record production techniques by producers like George Martin in the late 1960s. (ibid. 2005)

When The Beatles requested similar experimental approaches, Martin was able to fall back on his early works, and embrace the demands for sound manipulation bringing his prior expertise to the new creative process, gained by constructing comedy recordings for members of The Goons in the late

1950s, and in particular his skill in combining intricate sound effects and orchestral word painting into songs like “Goodness, Gracious Me” by Peter Sellers & Sophia Loren (1960) and “Right Said Fred” by Bernard Cribbins (1962).³⁹

Creative flow

The above statements still provide an incomplete picture of a series of events making up the creative flow of recording, and the descriptions tend to objectify knowledge. They accept the retrospective explanations of how experimentation constituted the endeavors in the studio, but do not debate how the flow of these processes created outcomes and opportunities that may have allowed these discoveries to be made. Zagorski-Thomas refers to this gulf of understanding between the technological process of record production and creativity in the studio:

There can be no doing of something, especially something as

³⁹ Martin’s expertise in tape manipulation stems from his role as A&R manager of EMI’s comedy imprint Parlophone and his association and early work with comedians who had worked with The Goons in the 1950s, employing sound effects and creative editing. Songs such as “Bangers and Mash” Sellers & Loren (December 1960) exemplify his detailed work. Lewisohn states he poured weeks into the songs and EMI Chairman Sir Joseph Lockwood was charmed. (Lewisohn, 2015, p.637) while comedy records such as “Hurry Up Gran” by Joan Sims (March 1963) were still being recorded while he was producing The Beatles singles such as “Please Please Me” (January 1963) His own experimental recording as Ray Cathode, “Time Beat”/“Waltz In Orbit”, Parlophone R4801, (released 13th April 1962), was a collaboration with Maddalena Fagandini from the BBC Radiophonic Workshop who created the BBC Interval Signal. Barry Miles notes in 1965, Martin had played McCartney the 1962 Bell Telephone Labs IBM7090 computer generated “Daisy Bell” recording, and that had initially inspired an idea to commission a Radiophonic Workshop accompaniment for “Yesterday” before he settled on the string quartet concept. (Miles, 1997, p.207) McCartney’s interest in electronic music grew into experimenting with tape machines at home, and in February 1966 they all went to see Berio give a talk in London. Miles sums up McCartney’s approach to the avant-garde by explaining that after he became a member of the College of Pataphysics (an excuse for elaborate banquets rather than artistic ventures) McCartney heard a radio play about Pataphysics, and read a couple of play scripts. Three years later The Beatles song “Maxwell’s Silver Hammer” included the words ‘Joan was quizzical, studied pataphysical science in the home...’ (ibid. p.231)

complicated as record production, without an understanding of how the something works. Equally, there can be no analysis of a creative process unless there are people 'doing' the creative process to study. (Zagorski-Thomas, 2014, p.29)

Ingold (2009) concurs that, rather than objectified, knowledge is an activity and process that unfolds over time, making the distinction between making as a project, and the ongoing process of creating, entering "the grain of the world's becoming and bend it to an evolving purpose." Knowing, therefore, is 'understanding in practice', and is inextricably meshed with 'making' as an active engagement with the material world, arguing that rather than imposing of:

Form upon the material world, by an agent with a design in mind...the forms of things arise within fields of force and flows of material. It is by intervening in these force fields and following the lines of flow that practitioners make things. In this view, making is a practice of weaving, in which practitioners bind their own pathways or lines of becoming into the texture of material flows comprising the life world. (Ingold, 2009, p.91)

Studio recording is a socially recognised process, 'a shared way of doing things', based on recognised and recurrent patterns of action, but this perspective also recognises creativity rarely follows a fixed plan, responding to interactions and constraints that occur along the way, and the personality of

the soundscape may not emerge until much later in the process. Improvisation best describes the team constructing a song and engaging with the technology as the recording ensues, often providing solutions based on ingenuity in the moment. Further, Ingold notes that:

Material world is not passively subservient to human designs... If persons can act on objects in their vicinity, so, it is argued, can objects 'act back', causing persons to do what they otherwise would not. (ibid. p.94)

Here he employs the analogy of flying a kite to describe the relationship between persona and object as a trajectory of movement, responding to one another in counterpoint rather than interacting entities. In the studio, it is the feedback of what the practitioners are hearing at each stage that suggests choices, and leaves us to ponder what other choices were available or what was closed down. Instead of focusing on technology as objects, in which in their use, the "die is already cast", the objects become 'actors in the network' where the practitioner responds, and may abuse their original design and specified use to serve his requirements at the time. Miller notes:

We can strive for understanding and empathy through the study of what people do with objects, because that is the way the people that we study create a world of practice. (Miller, 1998, p.19)

It is a question:

Not of imposing preconceived forms on inert matter but of intervening in the fields of force and currents of material wherein forms are generated. Practitioners are wayfarers ... whose skill lies in their ability to find the grain of the world's becoming and to follow its course while bending it to their evolving purpose. (Ingold, 2009, p.211)

We can interpret these sets of flows and materials as representing EMI or Columbia studios. The differing working practice, equipment, architecture, and culture is the river you set the song into, and where individual expertise and contrasting interpretations of the outcome come together, and by 'going with the flow' they bring to life the recording, employing decisions, improvisations, experiments and ability, to become the best result under the surrounding circumstances.

In the recording studio, the trial and error of experience provides the knowledge and instinct of how to solve problems and move forward, and participants are often unable to account for the origin of the initial spark or impulse that launches a sudden idea or inspiration that allows the project to progress. It is these stepping-stones, which alter the conditions and affect what will develop, but do not determine from the outset what will actually emerge as the final outcome. The Beatles engineer, Emerick describes how creative decisions in the process presented themselves:

If it was the intention to overdub a piano in certain parts, in the planned production of it you'd realize once you'd cut your rhythm track that the piano didn't fit, because of the equalisation you'd put on the basic rhythm track, you'd use harpsichord instead. So gradually you'd build up the

finished sounds, and we made decisions, and once the decision was made it was great whatever we'd done. (GRAMMY Pro, 2015)

Olhsson concurs, "it was a solution - you didn't go in with those ideas."
(Olhsson, 2012)

John Lennon, McCartney's song-writing partner attested in 1974:

Even with ones where we'd have it 90% finished, there's always something added in the studio. A song is – even now when I write a song – not complete. I can never give my song to a publisher before I've recorded it, however complete the lyrics and the tune and the arrangement are on paper, because it changes in the studio. (Roylance, 2000, p.98)

Creating in the studio is not unidirectional. The flow of creativity is a constant movement between ideas, discarding takes, returning to previous songs to add further ideas inspired by current successes and slowly building a body of work that defines the recording session or period, rather than a collection of discrete songs and performances. Ideas attached to a particular song may be inspired by experiences or outcomes days before, and recalled in the moment rather than planned beforehand.⁴⁰ This toing and froing between songs creates an overall creative consensus that is recorded rather than any

⁴⁰ For instance The Beatles "Rain" includes the idea of slowing down the backing track. Ryan and Kehew indicate the idea originally emerged during the recording of the previous song, "Paperback Writer", an attempt to record high harmonies by slowing down the tape machine. Although the experiment did not produce a useful result and was rejected, the idea remained. Similarly, the success of adding a backward vocal on the "Rain" coda inspired a decision to revisit to the track "Tomorrow Never Knows", started a week earlier but left unmixed, in order to overdub a backward guitar solo, and so on. (Ryan and Kehew, 2006, p.419)

individual moment that collectively adds to the body of work produced. Rather than having a beginning and an end, the process is part of the everyday life of the creator, and is a process of constant trial and error, as initial ideas are developed:

Creation of a thing, and creation plus full understanding of a correct idea of the thing, are parts of one and the same indivisible process... the process itself is not guided by a well-defined programme, and cannot be guided by such programme... it is guided rather by a vague urge, by a 'passion'. The passion gives rise to specific behavior, which in turn creates the circumstances and the ideas necessary for analysing and explaining the process, for making it 'rational'. (Feyerabend, 2010, p.17)

This creative process does not start at the studio door but represents an amalgam of influence that informs the songwriting process and counts towards the sound. The Byrds were not only inspired by listening to raga and Coltrane on the tour bus,⁴¹ but also by their frustration with pop, being screamed at by fans to 'play the hits' knowing there was a 'Riot on Sunset Strip'. (Priore, 2015) It was The Beatles hiatus in early 1966 that allowed McCartney to explore the emerging London counter-culture, Lennon to muse at home on LSD, both to re-engage with the nightlife of fellow musicians, and return to work brimming with ideas.

⁴¹ The Byrds spent November 1965 on their tour bus promoting their songs on the 1965 Dick Clark Caravan of Stars package tour. To soundtrack the tour, McGuinn taped Coltrane and Shankar albums onto a new Phillips cassette player. "For the next few weeks the group forced themselves Coltrane and Shankar with no escape." (Rogan, 2011, p.222)

Toynbee notes that authors may arrive with a song idea but communicate with reference to intertextual agency. In order to involve the network, instructions are translated into known reference points, past oeuvre, influences, other records, genres, heard sounds etc. (Toynbee, 2000). This intertextuality⁴² and connectedness between songs and time characterises the recording as much as the words and lyrics, crystallising a temporary network of performances and influences into the recording, which in turn, influences and inspires further works, the distinct timbral features perhaps becoming signifiers of the genre. How it all gets interpreted post recording into something else entirely – that is not the musicians' concern, that is musicology and marketing and genre forming.

We have now considered the various perspectives of practitioners, the shifting dynamic in the studio, and how the forward motion of the creative process imposes many unexpected outcomes. However, as hard as we try and imagine how all this fits together into the actual experience of the working practice to understand how the recording session plays out, there are still too many pieces of information missing. Of course, we cannot go back in time, or assemble the original team in the original studio, but Davis suggests that:

There might be a number of similarities between considering the recording as evidence of an event, or series of events that led to the final production and the way that detectives approach a crime scene. (Davis, 2009)

⁴² Intertextuality defined as “any text is constructed as mosaic of quotations; any text is the absorption and transformation of another. The notion of intertextuality replaces that of intersubjectivity, and poetic language is read as at least double.” (Kristeva, 1986, p.37)

Kneebone & Woods (2014) provide a valuable study using simulation-based re-enactment to recapture historical practice. The environment of a surgical operating theatre and recording studio share many common areas of interest; both are closed environments, both employ techniques that rely on skill and teamwork. But the advancement of technology has meant that many procedures still in living memory have been superseded, and with them the valuable tacit knowledge and ways of working.

A similar study by the Royal College of Music and the Science Museum (Kolkowski *et al.*, 2015) to discover how historic technology affected the sound and staging of a historical orchestral recording,⁴³ recreated a wax disc recording of a large ensemble to ‘derive insights into the musicians experiences’.

My approach differs because I am investigating how the technology was deliberately used to affect the sound and create signifiers that became an integral part of the composition and creative process. I’m studying the working practice to discover what may be seen as arbitrary in the process, as vital of the outcome. I am comparing two different approaches, and I am an active performer within the process in order to understand the insider’s view, and capture the “tacit knowledge, embodied practices, self-discipline, gestural language and codes of conduct” (Kneebone and Woods, 2014), rather than record an observation of results.

⁴³ *Beethoven Symphony No. 5 in C minor, Op. 67* recorded in 1913 by the Berlin Philharmonic Orchestra / Arthur Nikisch.

Using Actor Network Theory to study collective activity

Gherardi and Polanyi help us understand how the day-to-day activities establish methods of working practice that become tacit responses supporting aesthetic judgments, and Ingold shows us that to understand creativity, we have to follow the flow of the process in order to identify, not only the positive outcomes, but also the failures, the decisions based on the unexpected, and the consequences of the cumulative choices as the process adapts to the limitations and constraints that create strategic opportunities over time, becoming a crucial part of the improvisation of intentions.

However, the point of investigating the two case studies is not just to stitch together a few known techniques and reproduce the songs by any means possible, but uncover the centripetal influences that were unique to that particular studio giving the recording its sound, on top of the inherent sound of the performers. So we also need a way to investigate what happens when normal practice is disrupted by unusual demands from the musicians and how the studio protocol responds to that, and how the network of interconnections differs between the British and American studios. To do this we need to understand the relationships not only between the individuals but how the different studio environments respond and vice versa.

Lakoff and Johnson (2003) use the term 'schema' to refer to the schematic representation of knowledge and Gibson's ideas of invariant properties (1979,

pp. 310-312) and their affordances⁴⁴ provides a model for procedural knowledge that fits with Ingold's 'doing as knowing'. Zagorski-Thomas combines these frameworks to illustrate how the schematic nature of mental representations leads to potentials of future activity that the perception suggests, stating that:

Patterns of stimulation and action that are encountered frequently become entrained into the structure of the brain ...creating frequently trodden pathways, which include the expectation about how a particular pattern of stimulation might continue and what it normally leads to, including bodily action...certain common features are established as invariant properties of different categories of events or objects through the reinforcement of certain paths and the revealed irrelevance (non-reinforcement) of others. (Zagorski-Thomas, 2014, p.8)

So a schema represents what we learn as the likely results of any set of circumstances (perception) and actions, and becomes a 'set of rules and expectations' for doing a particular thing. For instance, if the needle goes into the red when I'm recording, the sound is likely to distort. It doesn't have to be true; it is what I believe. The notion of creativity can be seen as the ability to create metaphorical or literal connections between different schemata. For example, distortion on a guitar sound can be good and create a sense of heightened energy, so I can try putting the needle into the red to see if a

⁴⁴ Affordance is the potential for future activity that perception suggests. (Zagorski-Thomas, 2014, p.8)

similar process works for drums, as Emerick did at EMI by overloading the compressor when recording drums on “Rain”, thereby making a connection between the invariant property of distortion in two different contexts (schemata) and creating a new possible affordance to try out. If it works, my recording schema is changed to include it. Koestler concurs that the combinational nature of creativity, which he terms ‘bisociation’ originates in the synthesis of connections:

Concerning the psychology of the creative act itself, I have mentioned the following interrelated aspects of it: the displacement of attention to something not previously noted, which was irrelevant in the old and is relevant in the new context; the discovery of hidden analogies as a result of the former; the bringing into consciousness of tacit axioms and habits of thought which were implied in the code and taken for granted; the uncovering of what has always been there. (Koestler, 1964, p.120)

Actor Network Theory (henceforth ANT), associated with Bruno Latour (1993, 2007) and John Law, (1994, 1999) among others, defines individual entities as actants, and the sum of their relations as a network. Latour characterises objects as actors in a network alongside people, posing the question “Does it make a difference in the course of some other agent’s action or not?” (Latour, 2007, p.71) By making objects participants in the course of action, we extend the list of agents that play a role and, rather than “serving as a backdrop to human action” (ibid. p.72) the things may afford, allow, influence, suggest or render possible courses of action, and the continuity of action relies not only

on human to human connections, but object to object and a relay between the two. Therefore, the actants can be anything, from human, object, or process, and what is important is “entities take their form and acquire their attributes as a result of their relations with other entities.” (Law, 1999, p.3) It is these connections that cause the network to be self-sustaining.

The feature of using ANT as a method for examining a process, is that it can be used to consider the micro level of the actor as well as the macro level which is:

Explained by and what is not directly visible i.e. cultural, structural, norms, values, etc. but rather than associate between the two, or have one explain the other, it explores them as a circulatory unity. (ibid. p11)

How the assembled network reaches consensus has both a technical and a social justification. Identifying the actors and how they are defined in the network therefore requires that relationships be considered from different levels of perspective, so activities can be understood as an ever changing dynamic. In the example of the flow of a recording session, the importance of certain actors at various stages of the developing project changes, and actors may only reveal themselves at points of conflict. Rather than accepting social norms to explain the influence of power relationships in a network, a deeper analysis of social structures, using ANT, helps to reveal the range of negotiations that often constrained the new generation of record makers demanding creative freedom. So for instance in the example of a recording

session, removing the pre-existing labeling of roles, such as producer, engineer or musician in the studio allows the researcher to contemplate how the team interacts, revealing that the team is neither hierarchical nor band centric but a shifting dynamic of motivations, compromises and opportunities.

Thus, ANT illuminates the wider structure to show that the recorded sound does not just depend on using certain pieces of equipment at certain times, but there are a myriad of activities that affect the outcome. Recording in the studio can be described as a creative process, but also as a representation of job functions, time keeping, rules and regulations, demarcation of roles, legal protections, safety considerations etc. So a recording session can be viewed not only as musicians in the live room, the separating glass window, the producer and engineer in the control room, and the song, but as members of the Musicians Union on a rate in a studio, a studio designed to meet specific building regulations relating to local safety laws,⁴⁵ union engineers restricted to certain roles, and a producer contracted to ensure it runs to time, is performed to acceptable standards and completes within budget.

An understanding of the points in the process where the decisions could have followed many diverging paths provides an appreciation of how these steps contributed to the unfolding of the recording. In this way we share in the mistakes and trial and error of reality. The investigations do not consider an idea or use of a piece of equipment based on their inherent properties, but

⁴⁵ In the case of Columbia, earthquake-building codes specified that walls had to be made of thick concrete with no acoustic covering beyond lightweight tiles, which precluded any effective control of reflections so the engineers had to take the live room as part of the overall sound. Hence the building was designed to meet earthquake specifications first and create an acoustically pleasing environment secondly.

consider whether the engineer chooses to use the equipment, then if and at what point were they used by the engineer, what he does to and with the ideas and equipment, what transformations did they undergo, and did it make a difference in the process. What we are searching for are the points of mediation that make the difference, where the input is changed and the result cannot be predicted, as compared to intermediaries that simply pass on the data without transformation, which we can note and ignore.

This methodology proposes a study of 'science in action' (Latour, 1988), which allows the investigation to follow the process and study the actors as they make the recording. We have to consider what the musicians and engineers do in their day-to-day activity, and Latour tells us we "must not settle for what they are prepared to tell us they do" nor accept the findings of one example, and use it as a model for all recordings. For example, the published details of a well documented recording session of The Beatles, or any group of musicians, at EMI studios in 1966, does not supply satisfactory data to allow us to understand how recording was conducted in the far away studios of Los Angeles, or even the nearby Decca Studios in London.

However, the creative process is messy, it will not follow a linear path, there are many decisions, some bad that have to be lived with or compromises made because of constraints on budget, time, approval or permission and of course, deadline. Creating music is often analogous to architecture. There may be a script or score but the conductor will adapt it to the resources at hand, the musicians and environment. We may comment on the design of a

building and what seems an innovative feature, to be told it exists in order to comply with local planning laws, which resulted in a novel adaptation of the original plan, but was not part of the architect's original scheme. Akrich notes that:

We must not believe for a moment those edifying stories which retrospectively invoke the absence of demand, technical difficulties or inhibitory costs. These questions are controversial when innovation is in the making. (Latour *et al.*, 2002, p.190)

further arguing that:

The famous linear model, where successive stages are distinguished whose chronological order cannot be disrupted, is the least well adapted model to account for this erratic movement. We propose to substitute it with the whirlwind model, which allows the multiple socio-technical negotiations, which give shape to the innovation to be followed. (Latour *et al.*, 2002, p.212)

In a relationship that relies on negotiation, the changing perspective of the various actors is as important as their relationship with the other actants. Considering these different viewpoints recognises that sometimes an apparent asymmetrical relationship is better understood from studying a social perspective rather than a technical level. The actor is then defined not only by connections to other actants, but also by the affordances that the relationships provide at that time.

So the investigation considers the wider social and technical aspects of the creative process at the time, by identifying the other actors in the network and revealing the connections between them, rather of reducing the research into a simple recreation of the sonic signifiers by any means possible. Zagorski-Thomas refers to a network of collaborative creativity that requires:

That the participants align plans and goals in some way. They don't have to share the same goals. They don't even have to share the same perception of what is and isn't happening during the process. If the activity that is planned and undertaken stimulates the perception by each individual of affordances, plans, and scripts that achieve their own individual goals, then the network can function. (Zagorski-Thomas, 2014)

This assessment concurs with Latour's notion of enrolment, a central concept in ANT analysis, which suggests that the best way to enrol others is to offer them something that will enable them to reach their goal, in such a way that their actions will advance your goal. Enrolment involves the translation of the other's interest into your terms and in the best case, you make yourself "indispensable" to the efforts of others. (Latour, 1988)

Callon (1986) describes translation as a process towards a passage point where a consensus is transformed into a new representation of the relationships:

Translation is the mechanism by which the social and natural worlds progressively take form. The result is a situation in which certain entities

control others. Understanding what sociologists generally call power relationships means describing the way in which actors are defined, associated and simultaneously obliged to remain faithful to their alliances. The repertoire of translation is not only designed to give a symmetrical and tolerant description of a complex process which constantly mixes together a variety of social and natural entities. It also permits an explanation of how a few obtain the right to express and to represent the many silent actors of the social and natural worlds they have mobilised. (Callon, 1986)

In music, this is the process through which a network becomes represented by their composed, performed and recorded output (or by a physical object, a cultural artefact or an embodied identity, for instance a personality, class of person or an organisation). Who and what makes a difference in this network? Composers, performers, engineers, the commercial sponsors/investors and the imagined and real consumers. Each of these groups of actors can also be seen to represent the 'influence' of other actors through other processes of translation. Thus, an engineer can be said to represent a translation of their education and training, technology they use, artists they have previously worked with, union protocol, corporate structure, and cultural geography.

Translation can also describe how the collective interests of a group of actors become transformed into the guise of an invisible actor, for instance, the engineers' unions who have the power to constrain the actions of an individual engineer in the studio, and the managers who determine the rules of professional employment etc. So it becomes not only a way of describing

influence, but is also evidence of all the individual actions, human and non-human, weaving threads of influence and bending the process towards doing things in a certain way on the day.

We can apply translation to consider how a recorded backing track becomes a representation of the song arrangement, and of the individual player's performances, together with the choice to employ audio devices to distort the sound. From that point onward, it is harder to go back and unstitch the relationships, so it constitutes an agreement to go forward, and the interactions in the network change from one dynamic to a different set of negotiations. This process may therefore result in the creation of a cultural artefact (like a recorded song), a physical object (like a piece of technology), an embodied identity (like a sound engineer, record producer, song writer, pop star – or even more specifically “John Lennon”).

To compare how the case study recordings were made, the group of actors that constitute the band is followed through the creative process. This allows consideration of the relationships between the actors defined by their interconnections. In the example of recording in the studio, the main three groups of actors (band, recording staff and record company staff) and the associated non-human actors (instruments, recording equipment etc.) can be followed through the process. Callon calls this, the “interdefinition of the actors”, and rather than consider the pros and cons of the situation based on common knowledge, he suggests to apply a problematisation of the argument to consider the context and details, which allows a re-evaluation of the actions taken to achieve the common goal, and understand how the translation

process evolves from alternative viewpoints. In this way the research question allows an appreciation of how they engaged not only with the technology of the time to create those records, but how the process differed between the two continents by understanding the differences and similarities between the two networks, and how the different dynamic between the actants in each network affected the outcome.

Callon expands the notion of translation into four identifiable phases or 'moments', problematisation, intersement, enrolment and mobilisation, also emphasising the continuity of transformations and displacements over time, and I will use these terms to identify a series of translations in the progress of the network that lead to the ultimate translation of the network's activities, into the recorded song.

Problematisation: defining the nature of the problem to enrol other actors, describing a system of alliances that allow the enrolled parties to achieve what they want in terms of 'obligatory passage points' or action program, which affords the local network a degree of autonomy from the larger global network the actors are involved with. Law and Callon make the distinction that networks and actors mutually shape one another, that the influence of context or content is impossible to evaluate, and propose a concept of a global network and local network, defining global network as:

A set of relations between an actor and its neighbours on the one hand, and between those neighbours on the other. It is a network that is built

up, deliberately or otherwise, and that generates a space, a period of time, and a set of resources in which innovation may take place. Within this space... the process of building a project may be treated as the elaboration of a local network that is, the development of an array of the heterogeneous set of bits and pieces that is necessary to the successful production of any working device. (Bijker, 1994, pp.21–22)

Zagorski-Thomas (2017) notes that problematisation may be an explicit process but in most instances the way that a problem is framed flows implicitly from existing schemata, using tacit experiences and invoking Ingold's (2013) idea of improvising a path through a field of practices. Using ANT as a framework to study musical creativity involves exploring which aspects of the network's activity can be ascribed to the habitus of existing schemata and which cannot. Those aspects that step outside the existing schemata can then be analysed in terms of where those ideas came from. By reading the creative process forwards, we may deduce what metaphorical connections (lateral thinking) the individual or group of individuals may have made.

For example, the research discusses how The Byrds spent weeks on a tour bus listening to a single tape of Coltrane and Ravi Shankar over and over. This serendipitous occurrence along with the normal flow of touring to promote the current hit records may have triggered an idea of a solution to a problem The Byrds were experiencing. This can be framed as: how do we move away from Dylan, be taken seriously as musicians, employ the 'on stage' sound volume and improvisation that reflects the 'real us' and helps us

step away from the manufactured pop with screaming fans identity Columbia locked us into. They wanted to move towards the model that was emerging out of the counter-cultural experimental ideology, especially in San Francisco with bands like Jefferson Airplane, who were recording down the street at RCA in Los Angeles. Hence they problematised the new single in terms of a new direction, which developed into combining the schema of studio practice with the trope of experimental performance inherent in raga and jazz to create a new schema.

Interessement: the series of processes of locking in the other actors into the defined roles in the program in order to stabilise the identities and consolidate the relationships, at the same time creating the balance of power. However, the actual shape of these alliances will be tested during the activity of the project. Hence in the above Byrds' example, the interessement phase locked each of them into roles based on the creation of this new musical schema that blended their previous folk-rock hybrid with the new ingredient that they decided reflected the experimental element they wanted.

Enrolment: the strategy of defining and interrelating the various allocated roles. The ongoing negotiation between the enrolled parties reveal the way the parties are involved and influential, consenting or coerced into action. At this stage the actors adjust their schemata (i.e. invest themselves in the new roles) and non-human actors are altered to be better suited to the new roles. Hence the enrolment is transformed into a consensus to continue. Again, at

the enrolment stage, The Byrds taking artistic control further strengthened McGuinn's adopted role of arranger.

Mobilisation: methods to ensure the various assigned spokespersons truly represent the collectives. This highlights the decision-making roles inherent in the network. For example, the producer, the arranger, the union, the label, who act as intermediaries.

So the different stages in the process produce different spokespersons, which reflect the continual negotiations and devices of interessement to ensure the alliance continues towards the ultimate goal, and the translation process is effectively carried out. In the above Byrds example, the recording is successfully completed.

However, the multiplicity of network relationships opens the possibility of disputes as each node demands that the status quo is preserved since the (agreed) existing systems represent a fragile equilibrium of responsibilities that is not a matter of fact but a way of life, and how humanity responds to a call to change. Callon concurs that consensus and alliances can be contested at any moment resulting in the failure of the interessement stage and ultimately the equilibrium can be lost. For instance, in the above examples, The Byrds may decide McGuinn is taking too much creative control. Callon states:

The social and natural 'reality' is a result of the generalised negotiation about the representatively of the spokesmen. If consensus is achieved, the margins of manoeuvre of each entity will then be tightly delimited. The initial problematisation defines a series of negotiable hypotheses on identity, relationships and goals of the different actors. At the end of the four moments described, a constraining network of relationships has been built. But this consensus and the alliances, which it implies, can be contested at any moment. (Callon, 1986, p.15)

These various stages in the process of translation are continued strategies to impose the definition of the situation onto others, revealing not only any asymmetry of influence, but also when it changes, which is crucial to understanding how consensus is reached. Removing accepted hierarchical connections and identities allows the different actors contradictory points of view to explain the various versions of outcome during the project. Callon notes that "translation is a process, never a completed accomplishment, and it may fail." and Zagorski-Thomas argues that these stages are not always sequentially distinct and can overlap.

Therefore ANT helps to explain constraints and opportunities that inspired different approaches to creativity, and guides us to explore how the interconnections in the network affect the outcome and how the perspective of these relations may change as they transverse crucial passage points. It is within this creative framework in the studio that the balance of power started to tilt as the musicians, becoming not only expert at understanding the

possibilities of the recording studio, but having gained economic and cultural capital, demanded a change in working practice and more time for experimentation of ideas. So practice in the studio switched from a formal arena where previously rehearsed songs were recorded, to a playground where sonic possibilities were explored and sound manipulation became normal practice.

Conclusion

- Existing texts do not give enough information to understand why there was a difference between British and American staging techniques.
- They simply describe either the historical context or through anecdotal biography, various snapshots of involvement from voices from the past
- Even well researched books like Ryan and Kehew stop short of describing practice, because it is mundane, merely listing equipment without considering what was normal - as if the recording studio is always a laboratory of innovation and experimentation - they all wear 'white coats'.
- Interview collections, such as Massey, mention continental differences in terms of technical reasons such as tape machines but do not analyse the working practice - it is assumed an engineer can instantly work in both environments – this is an over simplification of the facts
- No consideration is given to why certain pieces of equipment were chosen over others, and how they fitted in and influenced the creative process

- By researching and re-enacting two key case studies, I can consider what is missing - a glimpse of working practice to capture and reveal the tacit knowledge never recorded in text.
- Then we can recognise what was experimentation and what was normal.
- By understanding the flow of creativity and analysing the videos, I can point to innovation, and overlooked standard practice.
- ANT can discuss the wider network of influences into the recording.
- The knowledge gap is the tacit knowledge in context and joining the dots of creativity through the working practice to reveal innovations.
- The contribution to knowledge is also the application of practice based research and re-enactment to capture the mundane aspects of tacit knowledge and working practice.
- This method explains the outcome by demonstration rather than literal description, which cannot describe the experience of performative tasks.

Practice based research

When generating transferable knowledge of techniques, there is an implication that this knowledge can be transferred by textual analysis in a verbal or numerical form. However, this method cannot convey the tacit knowledge derived from day-to-day operating in the studio, the emotional impact from experiencing the multidimensional aspects of combining the different techniques, or the effect of contrast, and the various constraints that

influence the outcome cannot be expressed in words alone.

To answer these questions, I adopted an ethnographic approach by employing the practice based method of re-enactment. The research employs my unique knowledge as an insider. My practice as a professional recording and performing musician, and competence as a recording engineer affords a degree of practical knowledge, empathy and understanding to experience the flow of creativity, interaction, options, and adds a tacit understanding of the opportunities not experienced by normal ethnographic studies. Performing inside the creative process also allows a unique perspective and avoids the possibility of reluctance by other participants to share or be observed from an ethnographic perspective.

The research combines three different stages of methodology. 1) Archive digging and evidence gathering (including history, iconography, video/film, production analysis, studio information, microphones, strings etc.) 2) An experimental stage of reproducing particular technical processes in my own studio employing historic equipment; a skill phase which is essential for acquiring tacit knowledge and understanding. 3) The reconstruction phase which allows me to put the objects and tacit knowledge into a practical situation by staging the recreation of the recordings. Although they are presented as discrete sections of the analysis, each stage informs the others during the research to create a circular process of investigation, insight and reflection, and:

Combine the theoretical understandings of the meanings and potentials of images media, technological possibilities, researchers skills, biographies subjectivity and reflexivity. (Pink, 2007, p.5)

This visual ethnography frames the research and findings into a practice that creates its own repertoire, and describes methods of creation through a series of videos incorporating carefully edited illustrative sequences that both show the evidence and analyses the evidence, corroborating aspects of historical and anecdotal research.

This technique of practical trial and error discovers the processes, which uncover the true creative moments, the experiments discarded as well as the successes that explain the methods used. Therefore the practice not only embodies the research, but in its expression, also becomes the research itself.⁴⁶ Whilst there may be a strong alignment between practice based research and qualitative paradigms such as grounded theory and action research, the traditional research approaches are carefully constructed to exclude researcher subjectivity, creating a linear and ordered methodology. Practice based research embraces the dynamism and disorder that embodies creative production, leading to insights in research that arrive out of the making of the work. For the case studies, it identified the ingredients and decisions that transformed the songs from ordinary performances to experimental soundscapes, categorised as psychedelic.

⁴⁶ For instance, how better to describe the emotional content, and emphasise that the sound is a vital part of the record, than to actually play and hear the sound?

Ingold argues that rather than an agent with a design in mind, making is an alchemy of working with the resources at hand, and describes the historical divergence when the generative process of formation and learning by doing gave way to rational systems and analysis of participant observation:

Embodied within the very concept of technology was an ontological claim, namely, that things are constituted in the rational and rule-governed transposition of preconceived form onto inert substance, rather than in a weaving of, and through, active materials. (Hallam and Ingold, 2008, p.312)

Although a historical study of the development of the techniques, using available sources such as photography, film and the original recordings as well as notes, track sheets and interviews etc. supports my investigation, this unique combination of experimental archeology and creative practice leads to a distinctive musicological approach, and provides a different kind of knowledge, illuminating the creative process, as well as producing interesting and stimulating findings and artworks.

My literature review uncovered academic analysis on socio-political, psychoacoustic, ethnographic, historic and technical considerations, and useful supportive papers on staging and semiotics amongst others, along with more commercial biographies, memoirs and critical appraisals ruminating on technique, meaning, interpretation and relevance (see bibliography). I extended this knowledge by interviewing original practitioners, undertaking field trips and investigating archives of descriptions of recording techniques

and historic sessions. This research, along with the practical experiments, supplied evidence that corroborates and provides insight into the uniqueness of the methods involved, and an understanding of how emergent technologies affected the compositional process. And by applying ANT, I concentrated the research towards why they did it, in order to understand how they did it.

Davis argues that the investigation of the circumstances of a recording session would benefit from applying methods used in the re-staging of a crime scene in order to extract a better understanding of the circumstantial evidence hidden deep in the recorded artefact, that is not revealed in photographs, statements, lists of equipment and even the original session multi-track recordings, suggesting that:

It is not enough simply to know who did a particular act, if we are to truly understand a recording it would be necessary to understand the motives and dynamics that led to certain choices and configurations being made. In doing this, we may begin to unravel the confusion and the mythology of the production process. (Davis, 2009)

Although various text and film documentary accounts of popular music historic recordings informed the research, they are inclined towards delivering a potted history through anecdotal recollections and sensationalism for entertainment, neglecting more day-to-day aspects such as the skill of the assembled team, constraints of historic equipment or scientific analysis.⁴⁷

Scientific based re-enactments such as 'The Art and Science of Acoustic

⁴⁷ The Wrecking Crew, Muscle Shoals, Tom Dowd & The Language of Music BBC4, David Grohl etc

Recording',⁴⁸ support my approach as they deliver insight by combining study of recording techniques with historically informed performance. However, whereas reverse engineering may lead towards a practical understanding of a particular process, it cannot reveal the creative decisions that lead to the construction of an improvisatory approach to recording. To uncover this flow of decision-making that leads to opportunities and decisions in the production process, Tim Ingold states that:

Rather than reading creativity 'backwards', from a finished object to an initial intention in the mind of an agent, this entails reading it forwards, in an ongoing generative movement that is at once itinerant, improvisatory and rhythmic. (Ingold, 2009, p.91)

My research considered how the studio manipulation became part of the compositional process by comparing the record production on two continents, contrasting the centripetal forces of inherent working practices, providing hands on demonstrations of commonplace tacit mechanisms of the time, from guitar pick through tape manipulation to vinyl mastering. Repeating the repertoire in the alternative setting removes the original veneer of experimentation to reveal how the assembled networks guide the outcome. By considering the participants as a single network of interaction, post video analysis highlights the collaboration and negotiation through various crisis points creating the soundscapes. Commenting on the recording process of *The Beatles Sgt. Pepper's Lonely Hearts Club Band LP*, as an example of

⁴⁸ The Art and Science of Acoustic Recording: Re-enacting Arthur Nikisch and the Berlin Philharmonic Orchestra's landmark 1913 recording of Beethoven's Fifth Symphony. (Dr Aleks Kolkowski, Duncan Miller, Dr. Amy Blier-Carruthers 2015)

creative practice in 1967, Bob Olhsson states:

Sgt. Pepper's is not a recording, Sgt. Pepper's was the solution to the various problems they came up with in the process of producing the record. You put something on and then you have to figure out something to put with it that'll make it work and you couldn't go back. (Stevenson, 2001)

While texts allude to the innovation of various well-known techniques, recreation of these techniques suggests that testimony is often unreliable. Mundane yet important facts remain hidden beneath the anecdotal recollections, the wrong people are taking credit, and archive pictures are often posed as press shots rather than corroborating actual events. Hence the support staff that were responsible for the day-to-day working in the studio remain anonymous, only identified by uniform; they wore 'white coats' etc., and written descriptions of recording practices are often based on current technological assumptions supplied without detail of affordances, for instance an inference that 8-track must be technically superior to 4-track, rather than discussing the sociological and cultural arguments such as tacit knowledge, practice and day-to-day needs of the user. (Bijker *et al.*, 2012)

Indeed, I discovered that details of what actually happened in the studio fifty years ago have been dissolved into a generalised impression, and largely forgotten. Practitioners tend to confuse experiences with techniques they developed using later equipment. This is often a consequence of an historic culture of secrecy about what happened in the studio pervading the industry

of the past, where individual practitioners' innovative working methods were not written down nor incorporated into standard practice, while records in progress remained unheard until publically released, by which time the rationale behind various creative decisions had been consigned to oblivion.

To return to Davis's analogy of recreating a crime scene, the aim of the re-enactment was thus to focus on the forensic and find the motives to uncover the course of actions. Was it the musician or engineer? Were there outside influences? What are the clues? What is the evidence? Where is the tacit knowledge and what does it reveal? By remaining patient and paying attention to the background, the research not only allowed the investigation and comparison of apparent contradictions, but also provided valuable insight of particular techniques, helping to illuminate the creative contribution and expertise of support staff that performed day-to-day operations as part of a collective team:

Like people who know their way around their own parish, but cannot construct or read a map of it, much less a map of the region or continent in which their parish lies. (Ryle, 2000, p.8)

Creating videos of various methods lead to the realisation that tacit knowledge was the key to understanding the techniques and mastering the processes, where I was also able to demonstrate the performative nature of the procedures, since "when we acquire a skill, we acquire a corresponding understanding that defies articulation" (Polanyi, 1966)

Recapturing historical practice

Although short video examples revealed some tacit knowledge, proved some anomalies, and explained how many of the manipulation techniques were discovered, often by accident or by pushing the equipment beyond design limits, these insights lead me to approach the subject through combining the investigation of methods with case study re-enactment, to understand how the employment of similar equipment in the social context of the different studios was affected by unique cultural perspectives shaping social construction of technology, anti-program, and creative abuse into an acceptable working practice. This involved constructing a team to perform and scrutinise the creative flow of ideas, which allowed the innovations to happen.

In order to investigate the techniques used and best illustrate the differences in approach, the research analysed historical recordings by re-creating the closed environment of the 1960s recording studio, through the re-enactment of The Byrds “Eight Miles High” session in an authentic vintage recording studio in Nashville, Tennessee, and The Beatles “Rain” session in a similarly authentic recording studio in London.⁴⁹

By following a similar structure to the original sessions, and interacting with historical technology I was able to pose specific questions and investigate:

- How the methodology was influenced by collaborative actions,

⁴⁹ “Eight Miles High” The Byrds (January 1966) Columbia Studios, Los Angeles California; “Rain” The Beatles (April 1966) EMI Studios, London.

situational awareness and the demarcation of roles. (Kneebone & Woods 2014)

- How the session adapted to the tensions between musicians demanding innovation and experimentalism and the constraints of unionised methodologies and established methods.
- How interaction with the technological constraints recreated 'forgotten' techniques that were deemed everyday practice at the time and were vital to the outcome of the soundscape.
- Understand key differences between British and American studio working practices that contributed to their definable and recognisable sounds. (Zagorski-Thomas 2012)

Through re-enactment and by applying Actor Network Theory, investigations considered how entities take their form and acquire their attributes as a result of their relations with other entities, paying attention to the micro level of humanity and the relationships of local situations, not only between people but technology and how the actants are defined by their connections and tensions, while also considering the macro level influences of what is not visible, i.e. cultural, structural, and in the case of Columbia studios, the union room ethos. In this way, re-enactment derived both social and technical aspects of historical practice, highlighting how the ideological resistance to new ways of music making were being challenged, creating a new ontology

that embraced technology and sound manipulation as part of the creative process in popular music, creating a union between craftsmanship and innovation. (Zak 2003).

The Byrds “Eight Miles High” represented an opportunity to investigate not only the sonic differences between the RCA recording and Columbia recording, but consider why the band may have preferred the choice of 4-track autonomy at RCA over 8-track technology at the unionised Columbia facility, and how industry practices including use of session players affected production. Replicating the session on historic equipment in America provided an appreciation of how advanced or different recording standards were to their British counterparts.

Similarly, tracing the journey of “Rain” from writing to release, studying alternative takes, consulting supporting evidence and memoirs with practitioners, supported by extensive documentation archived at EMI, and replicating the sequence of recording in the studio, illuminated the key moments in the creative process that propelled the song from idea to psychedelic artefact, and revealed the influence of British recording techniques and protocol.

Repeating the songs in American and British studios, provided a greater understanding of American and British conditions, and a consideration to how the influences and ability of the musicians, the training of the engineers and

the tension between commerciality and experimentation, compromise and constraint affected the outcome in both countries.

Re-enactment

The research used re-enactment triangulated with interviews and documentary evidence as the primary data source. The re-enactment followed field trips to Los Angeles, Nashville and London to discover suitable studios for case study recording, attend seminars and interview practitioners. Recreation of the historic recordings, corroborated by original recordings, iconography and documents such as track sheets and equipment remained the main method of data collection since the interviews and texts often provided a generalised and often inconsistent story based on the personalities and equipment but not how they interacted and why items were used, abused, or employed in unexpected fashions at various points, nor the tacit knowledge that connected these details together.

Videos provide the main support for the thesis, combining research, re-enactment and demonstrations of techniques into audiovisual programmes that are self-evident and need no further textual explanation. Demonstrations of tacit knowledge provide a vehicle for understanding the importance of human interaction with the equipment to make the equipment do what you want it to do rather than a passive connection of actors and actants.

Video 1 introduces the thesis and presents examples of the repertoire under consideration.

For The Byrds “Eight Miles High”

Video 2 compiles historic research, visual evidence and scrutiny of recordings, which provides the basis for the re-recording.

Video 3 captures the re-enactment in the Nashville studio following the exact sequence of events of the original, using historic techniques and equipment. The film describes the studio and personnel, the setting up of equipment, recording and overdubbing of the performances and final mixing. Important steps are discussed, capturing vital aspects of the interaction and the final output is analysed. The Nashville recording is also mastered onto vinyl 45 r.p.m. disc to understand how manufacturing and playback affects the reception of the song.

Video 4 re-enacts The Beatles “Rain” in the Nashville studio using the exact settings as the previous session, and approaching it in the same way that session players may have recorded the song, rather than replicate the extensive manipulation of the original. This is an important step in the case study analysis as by stripping away the veneer of experimentation of the previous recording, it exposes the standard working practice of the studio at the time, and so provides a model of how the track may have sounded if recorded in Los Angeles, bowing to the constraint of unionised working practices.

Video 5 provides a reflection of the American case study and highlights important findings, such as the impact of union protocol, 3-track stereo working methods, and why experimentation was constrained to the live room.

For The Beatles "Rain", Videos 6, 7, 8 and 9 provide the same analysis for the London re-enactment. "Rain" follows the exact sequence of manipulation and overdubbing as the original, and "Eight Miles High" uses the model of the original discarded version, recorded at RCA studios a month previous to the Columbia recording (also the bands preferred version).⁵⁰ This alternative version duplicates standard recording techniques employed in London in 1966. The reflection video considers the number and sequence of creative steps in "Rain", from detuning to manipulation that appear independently conceived during the flow of the session.

Videos 10 to 20 provide a repertoire of manipulation techniques recorded in my own studio, to test and discover embodied experiences of performing with, and using equipment beyond design limits, and captures the hidden tacit action. The experiments used vintage microphones and tape machines to capture the authentic effects, also allowing me to understand how all the parts fitted together, provide a 'dress rehearsal' and audio map to refer to in the later studio ensemble recordings.

For example, Video 10, replicates tape manipulation techniques used in

⁵⁰When asked "What's your opinion of the RCA versus the Columbia versions of "Eight Miles High?" Roger McGuinn said: "I like them. I think the RCA has a little more fire" (Frerner, 2004)

“Rain” and reveals not only the psycho acoustic effects such as ADT and phasing, but how the EMI method used two tape machines, whereas phasing at Olympic studios, demonstrated in Video 11, needed three machines due to technological constraints. The demonstration shows how the invariant properties of the varispeed control allows the engineer to affect the speed and depth of the phasing sweep in time with the music by gestural manipulation, and how tape reel inertia acts as a dampening control providing a smooth operation.⁵¹ Further videos demonstrate how microphones, amplifiers, tape machines and echo chambers were employed in ingenious ways to distort and add temporal illusions to recordings.

Videos 21-26 demonstrate not only how musicians experimented with instrumental tunings and overloading of amplification, precipitating a desire to demand studio manipulation as part of an extended repertoire of distortion techniques, but how historic consumables such as guitar strings, affected the tonality and playability of instruments and hence the sonic characteristics of performances. Videos 27-30 consider the impact of microphone choice and placement, and the passing on of skill by example.

The recorded data provides a self-evident collection of investigations as I created the sessions. Although I was a practitioner at the centre of the research, any bias can be measured against the detailed map provided by the session data, which provided a means to interrogate every step. The assembled peer group of musicians and engineer also questioned ideas in the

⁵¹ Later technologies regulated sweep and depth based on a low frequency oscillator removing the musicality of the performative aspects of the original technique.

moment and the process added a self-checking control. The thesis supervisor was present at both re-enactments to observe the methodology and witness some of the recording, also taking part by recording some video footage, chatting with the engineer while I rehearsed with the musicians, so forming an opinion of the expertise, underscoring the academic interest but at the same time becoming the academic agent who's subsequent departure closed the hypothetical discourse and left me as part of the group of the performers. Video, final recording and multi-track session recordings document the process. Triangulation allowed comparison to published accounts for verification or even repudiation. Post session interviews further clarified working methods.

Understanding in practice

Pre-session research for each case study was summarised and compiled into a single programme combining audio and visual analysis. Post session reflection describes the process and importance of key points. Even though research was necessarily scattergun, the data is presented and analysed in a systematic and detailed way because the case studies follow the flow of the creative process in the studio sessions, with annotations and voice overs to discuss aspects and highlight important points. Though I don't point to every nuance, so not to interrupt the flow, the differences between American and British practice are evident, the re-enactment of the songs in alternate settings reveals the underlying working practice and the final recordings not only succeed in capturing the steps in the process that contributed to the overall sound, but the similarity to the original sound underscores the confidence in

the methodology.

Recreating the day in the studio, focused research on the motivations and opportunities available with reference to a theoretical framework that helped to explain how the engineers in both continents engaged with the creative process in the studio, and how the cultural geography, training and habitus influenced the outcome, rather than decoding which buttons they pressed, or looking to recover a chain of connections from an end point. In this way I discovered that anti-program (Akrich and Latour, 1992) and creative abuse (Keep, 2005) formed a new working method beyond which the existing technology and working practices were supposed to provide.

Bijker's concept of Social Construction and Akrich & Latour's notion of the anti-program helped to understand how the radical demands of the artists resulted in engineers circumventing prescribed studio equipment working practices to discover new techniques, and Keep concurs that innovation in record production included engineers pushing standard equipment beyond specification parameters. (Keep 2005) Together they not only describe the techniques, but also illustrate the different ways in which different practitioners approached the same outcome. The theory is the same but the innovation is different. For example, by creating videos of two different ways to generate a phasing effect, I understand that it's not about how they did it exactly, it's what they were trying to achieve and how it was approached, with what they had.

Further, by contrasting the way British and American musicians brought their own experiences to the recording studio, I could compare the two different types of musical creativity, and understand how they influenced each other. Both case study studio engineers possessed extensive knowledge of techniques of the period and provided explanations of tacit procedures during the sessions. Similarly the musicians' referred to their own practice and knowledge of performance demonstrating tacit knowledge otherwise unavailable in literature. Overall the practice based research provided a wealth of data and material that allows further consideration of the details of the sessions, so the methods can be demonstrated and analysed illuminating the creative process from alternate viewpoints of the actants in the network.

Important steps in the creative flow had been researched beforehand, or analysed afterwards and re-enacted in my studio to demonstrate the performative aspects of the tacit points. – i.e. guitar tuning, with examples. The sessions provide examples where tacit knowledge gives insight into different approaches to the same theory that is not described by explicit knowledge of best practice or rules. Further analysis is provided by the ANT model, which describes how the various constraints and affordances guided the process of creativity, allowing for the unexpected, and attempts to explain the reason why, rather than the matter of fact.

Assembling the team

Initial research indicated that veteran practitioners are often suspicious of academic enquiry and occasionally become gatekeepers when urged to

reveal techniques and insights, used to defending the view of the studio from the prying eyes of investigative publishers and inquisitive academics, lest secrets are published for free.

I have to pre-warn you that I'm immensely cynical about the idea of music recording, studios etc. being an academic subject. The number of people being churned out who all reckon they know it all is disturbing! I'm very much from the old school, I wrote to every studio in the country, pedaled round knocking on doors then made the tea and shut up and watched. (Harris 2014)

Re-enactment allowed me to use my identity and skill as a musician and engineer to enter the recording world, allowing me to look at the simulation through the professionally attuned eyes of the fellow musician, but with the brain of a trained investigative academic. I found it easier to appreciate nuances of interaction as an insider than observer. Though the participants were aware of the research intentions, the anomaly was forgotten as the roles crystallised and the temporary network emerged in the studio to get the job done. Taking part in the process of re-enactment also established the bonds of friendship that occur in the studio, sharing the informal banter and appreciating the emotional pressure, fatigue and establishing peer relationships first hand. So by participating in the behavioral aspects of the performance, I shared in the experience, and could understand when things go wrong, what the tensions are and how they affect the flow, and since I'm singing and playing, it adds constancy to both sessions.

In Nashville I nominated guitarist, Buddy Woodward, who recruited the local musicians, to be musical director, which allowed me to focus more on ensuring the session was achieving the research goals as well as the final recording, stopping the session to clarify what just happened and record aspects such as film of crucial decisions. In London, the engineer Ed Deegan assumed the role of surrogate producer to guide steps, allowing me to remain in the live room. The tacit knowledge is picked up in an overview of the choreography of his movements rather than recording where and every time he pressed a button or turned a knob, and the confidence in his actions underscored his role in the manipulation of the recorded sounds. Indeed, sharing the case studies with lesser known participants who are nevertheless experts in their field and knowledgeable of the era and techniques, produced better results than enquiring from 'the usual suspects' who are prone to deliver stock answers.

To return to Davis' analogy of recreating a crime scene, re-enactment provided a vehicle of enquiry that combines knowns with unknowns, jogs memories, assembles clues, and allows the consideration of not only 'who done it', but when, why, where, how and with what, meeting the same challenges of combining science and hunches employed by investigative criminologists when faced with conflicting alibies, missing data, and the unexpected, since creativity does not follow a logical path from motive to outcome, but is the result of "choices made through social interaction and involvement with the music itself." (Davis, 2009)

Chapter 2: Re-enactment of techniques

When asked if he was aware that engineers at EMI in the mid 1960s were creating sounds that would emerge as psychedelic signifiers, Dave Harries, 1960s EMI sound engineer replied:

Did we? I thought we were just fooling around. It was all that flower power nonsense. We were just doing what we were being asked to do.⁵²
(Harries, 2015)

While the bands were exploring counter-cultural excesses and demanding hallucinogenic inspired soundscapes, they still depended on the engineers and technicians support, patience and skill, to actually conjure up an electronic version of their imagined sounds, and translate the concepts into a pragmatic solution. The LSD inspired techniques the engineers invented created a canon of psychedelic recordings that are often referenced as set texts, providing a veritable encyclopedia of sonic clichés for those intent on perpetuating the genre. In reality, the closest Columbia or EMI engineers got to sharing in the era's hedonistic lifestyle was probably with a beer at lunchtime, which makes their legacy of creating musical characteristics that simulated a drug trip all the more remarkable, given the primitive tools at

⁵² Dave Harries created an early version of ADT, and worked with The Beatles, 'turning the tape over' on the backing of "Strawberry Fields Forever" to create the coda. He was studio manager for George Martin at AIR, now studio manager at British Grove, London, and is APRS Executive for JAMES (Joint Audio Media Education Support) (Harries, 2015)

hand, and the amount of time they had to come up with something to move the recording forward. Yet they continued to delight the musicians and played a major role in the creation of the otherworldly soundscapes. Before the consideration of the case study recordings and re-enactments, I will briefly contextualise the meaning of the psychedelic experience to explain the altered state that the recordings evoke.

The Psychedelic experience

Timothy Leary⁵³ defined the psychedelic experience in 1964 as

A journey to new realms of consciousness.... its characteristic features are the transcendence of verbal concepts, of space-time dimensions, and of the ego or identity ... available to anyone through the ingestion of LSD. (Leary 1964, p.11)⁵⁴

His publication *The Psychedelic Experience*, goes on to explain that the drug LSD does not produce the transcendent experience but acts as a chemical key to free the nervous system of ordinary structures and patterns. The book was published as a step-by-step guide, based on *The Tibetan Book Of The Dead*, and describes the experience as safe, created in your mind, and that,

⁵³ From 1960 to 1963, Leary lead the Harvard Psychedelic Research Project involving over 200 visionary-drug sessions involving faculty members and graduate students from the Psychology and Divinity departments, and including “distinguished visiting advisors including Allen Ginsberg, Aldous Huxley, Alan Watts, William Burroughs, Marshall McLuhan, Charles Mingus, Arthur Koestler, etc.” (Leary, 1995, p.12)

⁵⁴ “...a journey to new realms of consciousness, the scope and content of the experience is limitless, but its characteristic features are the transcendence of verbal concepts, of space-time dimensions, and of the ego or identity. Such experience of enlarged consciousness can occur in a variety of ways, sensory deprivation, yoga exercises, disciplined medication, religious or aesthetic ecstasies, or spontaneously. Most recently they have become available to anyone through the ingestion of LSD, psilocybin, mescaline, DMT etc.” (Leary 1964, p.11)

“Whenever in doubt, turn off your mind, relax, float downstream”(ibid. p.14), promising that, “All individuals ... will be set face to face with the ecstatic radiance and will win illumination instantaneously.”(ibid. p.25)

LSD was first invented in 1938,⁵⁵ and marketed as an aid to migraine and psychiatric uses. By 1965, over 2000 research papers had been published extolling its effectiveness as an aid to psychological disorders including schizophrenia and autism, with key research showing benefits in treating alcoholism, pain and end of life anxiety. Recreational use of the drug was promoted by key figures in the emerging San Francisco counter-culture, and by 1966, the drug had moved from counter-cultural phenomenon, where the drug’s intellectual and spiritual associations tuned in to the youthful disaffiliation and search for alternative society, to the cultural forefront with the media documenting the exploits of Kesey and Leary,⁵⁶ climaxing with Leary’s address at a gathering of 30,000 hippies at the ‘Human Be-In’⁵⁷ in San Francisco in January 1967, where he advised them to, “Turn on, Tune in, Drop out.” DeRogatis explains that:

LSD captured the popular imagination by 1966 to the point where people who had never had a psychedelic experience thought they had a fairly good idea of what one was like. (DeRogatis, 1996, p.9)

⁵⁵ By Swiss pharmaceutical company Sandoz

⁵⁶ Owsley Stanley manufactured LSD in his bathroom, distributing the drug freely, fueling the ‘Acid Test’ parties run by Kesey (Author of “One Flew Over The Cuckoos Nest (1962)”), and the Merry Pranksters who travelled across America handing the drug to whoever asked, while Dr. Leary on the East Coast bought the drug to mainstream attention advocating its use for personal development and internal reflection.

⁵⁷ The Human Be-In on 14 January 1967 (followed the banning of LSD in California in October 1966)

But following articles chronicling acid overdoses, suicides and even murders,⁵⁸ on April 7th 1966 Sandoz announced it would halt production of LSD-25,⁵⁹ cancel all research contracts and turn over stocks to the federal government, and by the end of 1966 LSD was illegal in California and banned federally in October 1968. (Erowid, 2014) Although LSD is associated with the 1960's San Francisco originated 'hippie' subculture and entwined with the social, political, racial and sexual upheavals that defined the questioning of the status quo by the coming of age baby boom generation, it had originally emerged in the 1950's as research into the effects focused on its hallucinogenic properties.

Long before the acid underground surfaced in San Francisco as the vanguard of the hippie movement, Los Angeles was an intellectual hub for psychedelic research, and its acid salons drew adventurous celebrities from Anaïs Nin to Jack Nicholson, Aldous Huxley to André Previn. (Whalen, 1998)

Key research by Dr. Oscar Janiger into the effects on LSD as a tool for enhancing intellect and creativity provided a qualitative series of descriptive statements about the experience, distilling the essence of the quintessential LSD experience. (Rios, 2003) Descriptions of the drugs effects centered on the person experiencing loss of ego and sensory distortion:

⁵⁸ Notably Diane Linkletter, daughter of 1960's prime TV host Art Linkletter.

⁵⁹ "Leary's brand of in-your-face publicity would spur the government to move against LSD. LSD had seeped into the underground youth culture, and the forces of prohibition were already in play. Long before LSD was outlawed, Sandoz, under international pressure, cut off researchers' access to the drug." (Whalen, 1998)

The drug altered the user's perception of time; it came in waves; it made colors seem more intense; it induced the sensation that all elements of the world were organically connected in some way. (Whalen, 1998)

In her diary entries, Nin revealed that to her "the world opened by LSD was accessible to the artist by way of art" describing how the chemical removed resistance by shutting out '*la condition humaine*'

The chemical did not reveal the unknown world. What it did was to shut out the quotidian world as interference and leave you alone with your dreams and fantasies and memories. The drug added a synthesis of colour, sound, image a simultaneous fusion of all the senses which I had constantly aspired to in my writing. (Nin, 1974, p.260)

An alternative study by Gerald Oster observing moiré patterns while under the influence of LSD, concluded:

My experiments demonstrate that the primary effects of LSD are the tremendously heightened awareness of optical phenomena which are present but which are only vaguely (if at all) seen under normal conditions. ... it makes us more aware of the visual world without the usual rejection of "useless" information. (Oster, 1966)

David Nichols,⁶⁰ notes that research on animals leads to the belief that LSD may stimulate the serotonin receptors of the brain.

The drug remains in the brain for a relatively short period, disappearing at about the time the mental light show begins... the hours of hallucinations and consciousness-warping experienced by acid eaters is due not to the drug itself, but to some little-understood neurochemical chain of events unleashed by LSD. (Whalen, 1998)

Considering Janiger's research into LSD and creativity, Rois concurs:

The content and nature of LSD experiences are not artificial products of pharmacological interaction with the brain but authentic expressions of the psyche revealing its functioning on levels not ordinarily available for observation and study. The artist is the one who can transform these experiences into a creative work of art, music or poetry. (Rios, 2003, p.80)

He stresses the point that LSD does not enhance creativity in the moment, and would not make an artist out of someone who was not. Rather, it gives the artist a different perspective, an exploratory tool:

The psychedelically inspired artistic products are not ipso facto superior to those performed in ordinary state of consciousness, nor inferior...the artists felt that the LSD experience produced some desirable lasting

⁶⁰ Nichols is Founder of the Heffter Research Institute, a nonprofit group that funds and conducts clinical studies of psychedelic substances.

change in their understanding of their work, which continued to influence the form and direction of their artistic development. (Rios, 2003, p.88)

Visual Imagery and aural effects of the psychedelic experience

The described altered sensory effects of LSD range from mild changes in sensory perception to cognitive shifts. Visual experiences such as intensification of colour and brightness, blurred vision, images morphing into new shapes, after image trails, solid surfaces becoming liquid, moving geometric patterns, inanimate objects becoming animated, changes in spatial dimensions, are all common manifestations of the drug. (Masters and Houston, 2000, p.5) Sonic enhancements are also experienced, such as reverberation, repeating echo on sounds, intensification of experience of music, a loss of intelligibility and jumbling of sources, changes in temporal cohesions such as slowing down time, jumping in time, suspension of time.

These descriptions match closely with the technological interpretations the engineers were able to produce in the studio following descriptions by musicians, and there is a strong correlation between the verbal descriptions of psychedelic experiences and the aural signifiers created using studio technology, or captured in the recording process. These aural signifiers include Indian raga with endless improvisation, reverberating instruments, doubling of instruments, out of tuneness, jumping between time signatures and speed, phasing, doubling voices, altered speeds, distortion, Doppler effects with Leslie speakers, artificial sounds, Theremin, synthesizers, tone

controls, compression of transients, backwards playback, multiple recording of same voice, jump cut, time shift radio etc.

DeRogatis notes that:

The word psychedelic came to signal a set of sonic clues.... circular mandala like song structures, sustained or droning melodies, altered or affected instrumental sounds, reverbs, echoes and tape delays, that created a sense of space, and layered mixes that rewarded repeated listening by revealing new and mysterious elements. The presence of all or any of these sounds is enough to earn a piece of music the label 'psychedelic'. (DeRogatis, 1996, p.10)

In contrast to studio engineers creating ever elaborate soundscapes by employing tape, distortion, reverberation and temporal alterations, musicians playing live on stage struggled to evoke these sounds with limited technology, resorting to distortion, echo and raga influenced improvisations. Hicks describes the San Francisco concert sound as:

Extremely loud, reverberant, contrapuntal rock, slowed in tempo, unstable in harmony. And juxtapositional in form...at least some of the music's parameters must go through devices that create 'molten' shapes in timbre, articulation, and spatial placement. (Hicks, 2000, p.73)

The creation of aural effects by technical manipulation

Recording engineers devised innovative techniques to manipulate sounds that interpreted the verbal descriptions the musicians were demanding, often relying on ingenious application of existing technology that was at hand at the time. The 1960s studio was equipped to record live performances utilising microphones, pre-amplifiers, tape machines, basic equalisation, limiters and compressors and echo chambers. But by using the equipment in new ways, often through overloading circuits and 'going into the red', engineers came up with 'on the spot' solutions to unorthodox requests. Since much of the technique relied on physical interaction with the equipment, textual descriptions cannot convey the tacit knowledge inherent in the engineers individual way of working, and they invented their own methods, often keeping them 'secret'. In addition, different pieces of the same equipment responded in unique ways, and studios were mostly equipped with 'in house' designed bespoke apparatus, so applications not only differed between engineers, but also between studios and continents.

The following video demonstrations investigate some of the diverse techniques, and reveal how tacit interaction was an important ingredient in the creation of these sounds. These video examples of methods are also referred to in the later case study re-enactments (Video Examples 2-9) at points in the creative process where the particular techniques are incorporated.

Tape effects:

Example 10: Tape Speed Manipulation & ADT in “Rain” by The Beatles

This video uses the tape manipulation that affected the recording of “Rain” as an example. It shows how the variable speed of a tape machine affects tempo and pitch of recorded performances. The difference between doubling a voice by physically singing twice and ‘Automatic Double Tracking’ is demonstrated and how the ADT method was devised in EMI studios. The effects are illustrated on “Rain” The Beatles (1966).

Example 11: Tape Phasing

This example shows how creating the effect of phasing uses a similar technique to ADT, but whereas EMI could produce both effects using two tape machines, the phasing effect was achieved by a different method using three tape machines at Olympic studios. The demonstration shows how physical interaction creates the sweeping sound, and later illustrates what happens when you try and sweep the sound between two loudspeakers in an attempt to evoke a stereo version of phasing. The effect is illustrated on “Itchycoo Park” The Small Faces (1967).

Example 12: Reverse Tape & Valve Mono playback

This video re-creates reverse playback of a sound, and demonstrates how switching playback between the play and record heads (simul-sync)

generates other effects, such as tape echo. The difference between EMI and Olympic tape machines is illustrated and the playback characteristics of a mono valve tape machine is considered as evidence of decisions based on 1960s fidelity and monitoring in a monophonic soundscape. The backwards effect is illustrated on the coda of “Rain” The Beatles (1966).

Example 13: Tape Looping

The use of two tape machines is further investigated to show how continuous loops of sound can be combined to produce an abstract collage. The effect is illustrated on “Tomorrow Never Knows” The Beatles (1966).

Distortion effects:

Example 14: Distortion - Microphone Pre-amplifier

The example shows how increasing signal level ‘into the red’ overloads the electrical circuits to generate a distorted signal. The effect is illustrated on the lead vocal of “I Am The Walrus” The Beatles (1967).

Example 15: Distortion - Tape Recorder

The example shows how increasing signal level ‘into the red’ overloads the tape circuits and saturates the tape to generate a distorted signal. However, tape saturation also ‘compresses’ the signal and produces a unique type of

distortion. The effect is illustrated across the entire track of “Go Now” The Moody Blues (1964).

Example 16: Distortion - Overloading the Compressor

This video shows how the unique features of the Chandler TG1, a copy of the EMI device which emulates the Fairchild limiter circuit, produces a peculiar type of distortion not achievable on other makes of compressor and limiter, and its use by engineer Emerick, especially on drums, provided a distinct character to The Beatles recordings from the *Revolver* album onwards. The effect is illustrated on the drum recording of “Rain” The Beatles (1966).

Example 17: Using a loudspeaker as a microphone

The demonstration compares the sound of a bass guitar played through an amplifier being recorded with a microphone, to the same configuration being recorded with a loudspeaker used as a microphone, and illustrates the unique aural characteristics of the ‘loudspeaker as microphone’ recording. The effect is illustrated on the bass guitar recording of “Rain” The Beatles (1966).

Reverberation effects:

Example 18: Reverberation - Tape Echo

Tape echo exploits the physical distance between a tape machine record head and play head (about one inch apart) to produce a repeat of the signal

slightly out of time with the original. Feeding the affected sound back into the tape machine and overloading the circuits results in multiple echoes that evolve into a new distorted sound. The effect is illustrated on the 'fade-out' of "Penny Lane" The Beatles (1967).

Example 19: Reverberation - Echo Chamber

Echo chambers were the primary source of adding reverberation to a recording in the 1960s. This example creates an echo chamber in a tiled room and describes the characteristics. The effect is illustrated on the vocal recording of "Eight Miles High" The Byrds (1966).

Example 20: Reverberation - Spring Reverb

Reverberation could also be created mechanically, by plate or spring. This video compares three different spring reverberation devices to illustrate how different units create different timbres, and explores the distortion characteristics on voice, guitar and drum. The effect is illustrated on the vocal recording of "Riders On The Storm" The Doors (1971).

In addition to effects produced by engineers manipulating recorded sounds, musicians also experimented with their own stage equipment, amplification, guitar tunings etc. so the experimentalism in the studio is often an amalgam of both the engineers processing and the musicians' performance innovations.

Guitar effects:

Example 21: Guitar sounds - Portfolio of techniques

This example shows how the combination of various stylistic performance attributes and amplification effects such as guitar tunings, slide guitar, distortion, tremolo and echo can be combined to turn a guitar into a sound generator. The effect is illustrated on the guitar performance of “Interstellar Overdrive” The Pink Floyd (1967).

Example 22: Guitar Sounds - Wah-Wah

The wah wah pedal was originally manufactured for guitarists as an expressive device that emulated the characteristics of a performer playing a trumpet with creative use of a trumpet mute. The performative gestures play a key role in the effects performance as demonstrated. The effect is illustrated on the guitar sound on the intro of “Voodoo Child (Slight Return)” Jimi Hendrix (1970).

Example 23: Guitar Sounds – Feedback

Guitar feedback is a distortion caused by the guitar strings resonating in sympathy to the sound coming out of the amplifier loudspeakers creating a loop of amplifying signal. The effect can be ‘controlled’ and played by the guitarist by changing position in relation to the amplifier and becomes a

gestural performance. The effect is illustrated on the intro of “Its All Too Much” The Beatles (1968).

Example 24: De-tuning guitars in “Rain” by The Beatles

This video demonstrates how detuning the guitar pitch also affects tonality and performance. This method was key to the guitar sounds on “Rain” The Beatles (1966), where Lennon’s guitar was detuned to E flat and McCartney’s guitar was tuned to an open chord of G sharp.

Example 25: How Guitar Strings & Tuning affect sound and tonality - Rickenbacker 12-string example

This video example demonstrates how differences in guitar strings and methods of tuning between 1960s and later recordings affected playability and timbral characteristics, and these tonal attributes were key in recreating an authentic 1960s soundscape. Comparing the intro of “Mr. Tambourine Man” The Byrds (1966), and recordings from the 1980s onwards, illustrates the differences in sound.

Example 26: 1960s Guitar Tuning

Without electronic tuners, 1960s guitarists used other methods to ensure instruments were in tune within themselves and with each other. However, discrepancies in tuning also added a richness and character to the sounds

and this is demonstrated in this video. The effect is illustrated on the intro of “Mr. Tambourine Man” The Byrds (1966).

Sound capture:

Example 27: Microphone Choice

This video demonstrates the difference in tonal characteristics between valve, condenser, ribbon and dynamic microphones to determine if certain microphones contributed to the character of the 1960s soundscape.

Example 28: Microphone Polarity

This video considers differing tonal characteristics between omniphonic, cardioid and ‘figure-of-eight’ polarity pattern microphones to discover if certain configurations contributed to the overall 1960s soundscape.

Example 29: Microphone Spill & Room Ambience

This example demonstrates how microphone proximity to sound sources and capturing spill affected the creation of ambience in 1960s soundscapes

Example 30: Transference of Tacit Knowledge

This compilation of examples shows how the impromptu transference of tacit knowledge occurs in the studio as participants share and demonstrate techniques that would be otherwise impossible to communicate.

Chapter 3: The Byrds “Eight Miles High” re-enactment

This chapter will discuss a brief history of The Byrds to establish the cultural setting, consider the influences on the writing and recording of “Eight Miles High” and why the song emerged with an unexpected experimental soundscape, followed by an analysis of the Columbia recording session that provided the data for the re-enactment session.

Background

In contrast to The Beatles, a provincial group who spent three years performing before signing to a London centric record business, the individual musicians who formed The Byrds migrated to Los Angeles, the emerging dominant centre of the recorded music industry⁶¹ with the intention of becoming professional musicians, and achieved a number one record guided by session musicians before actually performing live in concert.⁶² Scott (1999) notes the agglomeration of a specialised industry attracts not only communities of skilled workers and firms but:

“preserves accumulated traditions and conventionalized sensibilities... act as frameworks of cultural reproduction and arenas of socialization...offering endless combinational possibilities for such encounters, so that the number of different 'experiments' that can occur

⁶¹ Followed by New York, Nashville and lesser regional centers.

⁶² A J Scott refers to Denisoff and Bridges (1982) study of the recording careers of musical performers, which observed that migration to major recording industry was a critical step on the way to professional success for 37% of the performers they sampled. (Scott, 1999)

in production is effectively unlimited. The latter point is doubly decisive given that novelty is the lifeblood of the recorded music industry.” (Scott, 1999, p.1975)

Hence the story of The Byrds is important as it not only outlines the speed at which they formed, became successful and moved into experimental territory, absorbing counter-cultural ideas while adapting jazz and raga influences, but sets this against the backdrop of the American corporate broadcast industry with longstanding collective agreements regarding the production of recorded music.

The individual musicians that became The Byrds first met in Los Angeles in 1964.⁶³

Each member had already served an apprenticeship in folk and bluegrass music ensembles, and all had gravitated to Los Angeles in order to ‘make it in the music business’. In contrast to the tight knit relationship of The Beatles, The Byrds represented differing objectives, influences and opinions, and disagreements regarding repertoire, song writing credits and musical direction created an unstable proposition for the record company, Columbia, that eventually grew tired of the unpredictable business relationship. McGuinn states “We were competitive in The Byrds, and wouldn’t have thought of protecting each other like The Beatles did.” (Rogan, 2011, p.177)

⁶³ McGuinn (from Chicago, Illinois), had previously worked as a songwriter for Bobby Darin Productions at the Brill Building in New York, and moved to LA. While covering Beatles songs on acoustic guitar at the Troubadour club, he was joined by Gene Clark (Tipton, Missouri) and then David Crosby (the only native Angelean) who added a crucial high harmony to the sound before finally recruiting Chris Hillman (San Diego, California) and Michael Clarke (Spokane, Washington) for bass and drums.

Their sound, an amalgam of folk and pop was crystalised following a cinema visit in 1964 to watch The Beatles film *A Hard Days Night*, which also helped inspire their choice of instruments: 12-string Rickenbacker, Gretsch 6-string, Ludwig Drums, etc.⁶⁴ Their early sound was a take on Merseybeat, lifting 12-string stylings from The Searchers as well as copying The Beatles harmonies.⁶⁵ McGuinn explains “The only one we avoided was Paul McCartney’s Hofner, which would have been too obvious a Beatles copy” (Rogan, 2011, p.66)

In contrast to the Beatles years of performing from clubs to world tours, The Byrds honed their sound in the recording studio. Manager and mentor, Jim Dickson allowed them to use out of hours time at World Pacific studios,⁶⁶ where they could record and play back to craft their unique sound and harmonies, the intention being to bridge the gap between the soft folk of Peter, Paul & Mary, and the British beat group sound.

Using Callon’s notion of translation, in order to gain commercial success in the music business, they modified their existing schema of ‘folk musicians’ to include the schema of British commercial pop groups to make themselves attractive to record companies, at the same time locking themselves in with a drummer who ‘looked right’, an asset that outweighed his playing ability.

⁶⁴ 12-string Rickenbacker 360/12, Gretsch Tennessean, Ludwig drum kit, Fender bass.

⁶⁵ The Byrds 2nd single; Dylan’s “All I Really Wanna Do” is reminiscent of The Searchers, “Needles & Pins”, The Beatles “Things We Said Today” from *A Hard Days Night LP* also featured in their early live set.

⁶⁶ Pacific Jazz Records released West Coast Jazz and World Music, recorded at their World Pacific Studios where Dickson was an engineer. Chet Baker and Ravi Shankar were amongst the notable artists. David Crosby watched Shankar record in 1964.

McGuinn admits “he really couldn’t play when we hired him.” (Rogan, 2011, p.43)⁶⁷

After a short life as The Jetset and then The Beefeaters, an obvious attempt to align with the British invasion, and months in the studio recording and studying hundreds of hours of rehearsals, their sound developed away from Liverpool sound copyists towards their signature stylings of double lead vocal and single high harmony, creating the recognisable musical blueprint, as they sang along with the rehearsal tapes creating a double track vocal sound. Dickson describes how they rehearsed song arrangements:

Gene and McGuinn would both be singing melody, like a double lead, and Crosby would sing the only harmony, which gave David more freedom... Crosby later found the chords that would fit the harmonies. (Rogan, 2011, p.57)

Crosby admits “It might have taken a couple of years to learn how to play and sing together, but because of that we were ready in eight months, but it was brutal” (Rogan, 2011, p.55), while Dickson concurs: “They did those songs thousands of times on tape.” (Rogan, 2011, p.56) Dickson finally found the song, Dylan’s “Mr. Tambourine Man”, to introduce the band to a major record deal. Rogan explains that Dickson invited Dylan to hear The Byrds perform

⁶⁷ Michael Clarke, a bongo player, hired more for his resemblance to Brian Jones than his skills, played on cardboard boxes before graduating to a full drum kit as he learnt to play the instrument.

the song at World Pacific,⁶⁸ and in the wake of The Beatles impact in America, and with The Animals “House Of The Rising Son”, which combined folk with pop, heading up the chart, Dylan was intrigued to hear an electric version of his song and he “Understood the financial and cultural potential of having his songs cross over to a younger audience.” (Rogan, 2011, p.64)

Recording Contract

In November 1964 they were introduced to Columbia records⁶⁹ as The Byrds, and were signed by A&R executive, Allen Stanton, for a singles deal. Due to Columbia company policy, only the singers McGuinn, Clark and Crosby signed the contract and it was expected they would use session musicians for the recording. Terry Melcher,⁷⁰ who was the youngest by twenty years of the Columbia staff producers, was assigned to the band and agreed that “Mr. Tambourine Man” should be recorded as the first single. The protocol of recording for a major label in 1964 is exemplified in The Byrds recording contract.⁷¹ The recordings had to be made at the Columbia studios with “no unauthorised dubbing”.⁷² There was no advance, studio performances were

⁶⁸ Though Dickson suggested “Mr. Tambourine Man” to the Byrds, they were reluctant to cover it until McGuinn swapped to lead vocal and also championed the idea. Dylan’s presence and immediate approval at the studio rehearsal sealed their decision. Clarke’s military style drumming, still on a cardboard box, amused Dylan with its ‘jug band’ charm. (Rogan, 2011)

⁶⁹ Columbia artist Miles Davis acted as an intermediary (after a tip off from his agents daughter who had seen and recommended the band).

⁷⁰ Melcher (son of Doris Day), had joined Columbia as a staff producer in 1962, (hits including “Hey Little Cobra” by the Rip Chords, and “Move Over Darling” for his mother) before producing The Byrds, and would go on to work with Paul Revere & The Raiders amongst others during a long and successful career.

⁷¹ The twelve-page six-month contract with options reveals a contact template conceived in the 1950s referring to 78rpm or equivalent, and also specified that the band contribute to musical soundtrack albums by performing show tunes if required.

⁷² This Musicians Union stipulation was to ensure that every recorded performance by session players was paid, and, for instance, doubling of performances counted as two instruments.

paid at union rates, and held against royalty. It specified the recording of four songs without guarantee of release; titles to be chosen by the company, not the group, and the master recordings were subject to the company's approval. Since Hillman and Clarke were not contractually members of the group, nor session players, they did not perform.

The first recording, "Mr. Tambourine Man", featured the Wrecking Crew⁷³ on drums bass, guitar and piano, and they lent the rhythmic arrangement for The Beach Boys "Don't Worry Baby" that they had recently recorded, to the song, with Roger McGuinn playing the signature 12-string Rickenbacker motif. McGuinn, Clark and Crosby overlaid their signature 3-voice harmony. Accounts of the session describe Melcher as an enthusiastic producer able to inspire both musicians and engineering staff, who were used to working with professional session players and MOR artists who understood the studio formalities, and found themselves uncomfortable and suspicious of the scruffy teenagers in front of them. (Rogan, 2011, pp.81–28) Hal Blaine describes the session:

Back in 1965, a single had to be tight and jump out of the radio with a crisp pop if it stood a chance of becoming a hit. And studio time was expensive, which is why we were called in. Back then, like today,

⁷³ Hal Blaine (drums), Bill Pitman and Jerry Cole (guitars), Leon Russell (piano), Larry Knechtel (bass), Roger McGuinn (12 string guitar). The original choice was Wrecking Crew member Glen Campbell to play the 12-string part, but his style was found inappropriate which opened up the opportunity for McGuinn. Melcher suggested the bass slide, which disguises McGuinn's shaky intro. Hal Blaine later overdubbed the original military snare motif. Take 22 was deemed the best backing track.

economics played a significant role in recording as well as the end result. (Myers, 2012)

Thus in opposition to the Beatles extensive live performance experience, which lead to their record deal, The Byrds were created specifically as a recording outfit, and they recorded “Mr. Tambourine Man” without actually performing as a group on the record, and before ever having undertaken a paid public concert.

The Byrds were Columbia’s first beat group signing, and the head of A&R was still Mitch Miller,⁷⁴ responsible for the label’s success since the 1950s by creating a roster of ‘easy listening’ artistes and film soundtrack releases, that in the early 1960’s, still sustained the company with minimum promotion. Unconfident with their first pop signing and preferring the safer Beatlesque B-side recording “I Knew I’d Want You”, the label held back the release of “Mr. Tambourine Man” for three months. This illustrates the difficulty the new wave of musicians would have with the existing corporate structures that still regarded pop as a passing fad with little cultural merit.

A later, post release residency at Ciro’s nightclub on Sunset Strip, provided their only serious period of live performance practice, where they quickly attracted an entourage of beatniks and hipsters. Since they had moved to a

⁷⁴ Millar defined the 1950’s Columbia sound, specialising in novelty pop productions, soundtrack and singalong, and eventually established a roster of MOR artists including Percy Faith, Doris Day, Tony Bennett et al. However his dislike of rock and roll and “difficult to handle artists” lead to his passing on Elvis Presley, Buddy Holly and The Beatles, with Columbia missing out on the burgeoning teen market. He retired from CBS in 1965, becoming a consultant to MCA (Gilliland, 1967, 7m00s)

dance studio for rehearsals they also added an artistic troupe of ‘free thinking exotically dressed dancers’ (Rogan, 2011) to their entourage who became a crucial addition to the live show. The final ingredients to The Byrds public campaign, before embarking on a schedule of touring and TV appearances to promote the record, were the appointment of Derek Taylor, ex-Beatles publicist who had recently arrived in Hollywood, and Bob Dylan lending his endorsement by supporting the band in public.

Following the singles release and success, an LP was suggested, Hillman and Clarke’s names were added to the Columbia contract, and that completed the ensemble’s official line-up, at which point the band proposed to record the rest of the first album by themselves. Crosby states that “Columbia wanted us to do the first album with session men, and we threatened to quit, we didn’t like that at all.”(Rogan, 2011, p.114) Although against industry standard practice, especially as session players had created the now number one record, the strength of material and unique ensemble sound convinced the producer to proceed, and the band rose to the challenge and completed the album.⁷⁵ However, six months later, by the time of the recording of the second album in August 1965, the band had split into two factions; McGuinn’s friendship with Melcher gave him leverage over arrangements and direction, while Crosby aligned with manager Dickson in an effort to get more of his songs recorded, and Dickson pursued his own agenda of creatively

⁷⁵ “Bells of Rhymney” and the last track to be recorded “Chimes of Freedom” provide a good example of The Byrds blueprint folk rock sound of chiming 12-string guitar, beat group accompaniment and harmonies combined with lyrical intellect and social consciousness.

influencing the band.⁷⁶ Main songwriter Gene Clark found himself alienated from the rest of the band as resentment grew due to his superior earnings.⁷⁷

Columbia Records translation of The Byrds into a 'signed act' employed the existing schema of only signing the vocalists of pop acts and using session players for accompaniment. The unexpected success of the song allowed The Byrds to force changes in the existing structure of interest, by having the whole band sign and play on future recordings. This locked the band into the new roles of recording musicians. The label, having achieved a number one after delaying the release, perceived a shift in their understanding of the market, losing confidence in their historic ability to manufacture or recognise potential successful records, and The Byrds continued display of tacit knowledge by being able to create hit records intensified their confidence leading to a desire for autonomy.

Songwriting

Gene Clark started the composition of "Eight Miles High" during their first visit to the UK, where in contrast to the adulation of their domestic audiences, they found themselves in an alienating mix of tabloid controversy and criticism.⁷⁸

⁷⁶ Rogan suggests Dickson was keen for the Byrds to continue to cover Dylan repertoire, rather than original material, citing 'Hollies Sing Dylan' as a similar conceptual outcome. (Rogan 2011)

⁷⁷ The fact that Clark bought a Ferrari on the day McGuinn travelled to the studio on public transport as his own car kept breaking down is indicative of the growing disparity and display of egos in the band. (Rogan, 2011, p.219)

⁷⁸ Surprised on their arrival at London Airport not by screaming fans but by being served with a writ threatening legal actions (part of a publicity stunt by UK band The Birds capitalising on the name similarity), they set off on a UK tour as part of a variety line-up of pop stars. However, their casual banter and cool persona, more suitable to the small stages of Sunset Strip, was lost to the teenage screams in British theatres, and compensating for unfamiliar WEM equipment by turning up loud, produced shows that came across as introspective and

Nevertheless, the British groups befriended them as they were introduced to the London club scene, and when back in America and touring with The Rolling Stones, Brian Jones encouraged Clark to document the London experience, (McGuinn made an experimental film of the visit and Clark captured the imagery of the plane trip to London in the lyric). Returning to Los Angeles, the band then joined the Dick Clark 'Caravan of Stars' package tour promoting their "Mr. Tambourine" single, electing to drive separately from the entourage of other groups. Their own van was equipped with a newly acquired cassette tape player,⁷⁹ and the one tape they had containing recordings by Coltrane and Ravi Shankar provided the 'soundtrack' for the trip. By the time they had completed the tour, the song melody and arrangement had been completed and the sound had crystallised into a raga borrowing from Coltrane's "Africa" motif. Contradictory claims of authorship surround the song, credited to Clark, McGuinn and Crosby. However, Clark is assumed to have written the words, chords and melody with McGuinn contributing the freeform raga motif.⁸⁰

The process of songwriting to final arrangement involved many translation moments including implicit compromise to ensure the song was chosen as the next single. Clark adapted his songwriting schema to involve the others'

disheveled performances, drawing criticism from the press who had been bombarded with 'Americas answer to The Beatles' PR.

⁷⁹ The cassette tape player acquired in London and used to capture screams of fans at 15th August 1965 Bournemouth concert, later used on "So You Want To Be A Rock and Roll Star" two years later, was so new, most people had never seen one. (Rogan, 2011, p.170)

⁸⁰ Rogan quotes Clark as stating "I wasn't going to get a single out of this deal because I'd written so many songs that they were going to grab the singles for their own stuff, so I split it with them to get the single. That and they really helped me to write it too" McGuinn claims authorship of all the lyrics and concedes Clark, "Had the chord changes and melody" Clark later explains, "I had all the words except one line, Crosby contributed the line 'Rain Grey town', and then McGuinn arranged it." (Rogan, 2011, p.258)

minor contributions as writing credits to ensure support from McGuinn and Crosby. The problematisation of a new direction combining the established sound with what they heard on the tour bus resulted in the interestment of locking McGuinn's new style of playing into the line up, a style he likely found while playing along with the Coltrane and Shankar recordings on the tour bus, and he adjusted his performance practice schema to reflect a modal way of playing, forsaking accuracy to embrace a type of free improvisation. This was supported by his uncontested role of arranger in the studio,⁸¹ which gave him power to enforce new ideas. By adapting the schema of improvisation onto his 12-string guitar playing, along with 'on stage' amplifier volume levels that achieved a distorted sound, he created a sitar like ingredient, which reflected the experimental element they desired. Hence the instrument's new sound was enrolled into the translation creating an effective connection to the desired end-state.

While a discussion of the recording session and techniques follows in advance of the re-enactment, it is important to note the cultural importance of The Byrds soundscape against the surrounding popular music landscape.

Ensemble Sound

The Byrds singles, "Mr. Tambourine Man" recorded January 1965 and "Turn! Turn! Turn!" recorded September 1965 both reached number one, and confirmed the bands prominence in spearheading the new folk rock sound.

⁸¹ During the "Mr. Tambourine Man" session, Melcher told McGuinn that the arranger always gets double rate in the studio. McGuinn states "From that point on I was the 'leader' of The Byrds." (Rogan, 2011, p.82)

The sound reinterprets folk within a standard pop format, borrowing from their bluegrass and country stylings with banjo picking replaced by a 'jangling' electric 12-string guitar, supporting a melody sung in two part harmony redolent of doo-wop arrangements, and had inspired a myriad of sound-alike 'bandwagon jumpers' to follow in their wake. However, frustrated by Melcher's conservative approach in sticking to the successful formula of mining the Dylan folk catalogue, and inspired by the experimental sounds of other contemporary groups they had met in London, such as The Yardbirds and The Rolling Stones, the band elected to abandon this successful formula, instead searching for a more experimental approach.

Although recorded only weeks after their *Turn! Turn! Turn!* LP sessions, the new song captured the essence of an Indian raga,⁸² combining it with the unrestrained modal jazz stylings of Coltrane, providing a raucous undisciplined backing, without obvious verse or chorus sections, to support their signature harmony vocals singing a melody that carried the listener into a wistful story of illusion. This seemingly 'time stretched' vocal performance, set against a frenzied backing track of tension and release fused exotic musical stylings of classical Indian music and freeform jazz within the format of electric folk rock to create a sound as yet unheard in mainstream popular music. While Indian influences had already been heard (for instance The Kinks "See My Friends" (1965), The Yardbirds "Heart Full of Soul" (1965)), "Eight Miles High" placed the sitar raga sound and tonalities centre stage, at once setting

⁸² Their manager Jim Dickson had introduced The Byrds to the music of Ravi Shankar. Shankar was signed to World Pacific Records where Dickson was a studio engineer.

the comparatively formal structures of the 'rhythm and blues' and blues influenced British Invasion groups as passé.

The song's unusual arrangement mimicked LSD's sense of time dislocation, while the spiritual overtones of the rich softly sung harmonies mirrored the sense of religious awakening which accompanied the LSD experience and resonated with the counter-cultural embrace of Eastern religions in a search for meaning within a western society that embraced materialism, competition and the H bomb.⁸³ Savage suggests that "Along with the bomb, LSD was the single most powerful dissolving agent in sixties culture. After its arrival, nothing would be the same." (Savage, 2015, p.111)

Although a sitar did not feature on the recording⁸⁴ the band bought one to the record release press conference in New York on 28th March 1966. McGuinn used it to illustrate the Indian influences, citing The Beatles and The Yardbirds as similar proponents, while Crosby alluded to the "genuine meaning of psychedelic awareness", talking publically about LSD, his intention was to explain the concept of raga rock. The outcome was to link the song to the effect of hallucinogenic drugs, which damaged the songs potential as a hit record. The influential Gavin Report, a radio trade publication that published a weekly Top 40 airplay performance listing and tip sheet, advised radio stations to remove the song from playlists citing the drug overtones.^{85 86}

⁸³ The sound of Indian music was to become a signifier of hallucinogenic experiences – note George Harrison's entrance in the "Yellow Submarine" film is a sitar arpeggio.

⁸⁴ The sitar sound is weak with no sustain and unreliable tuning - it was replaced by a 12-string electric Rickenbacker on the recording.

⁸⁵ The single reached 14 Billboard and 12 Cashbox, and 28 in UK singles chart. Though not expected to reach number one, Teehan's research points out that the song suffered from the

Recording session research

This section collates all the available data, from photographs, interviews and available texts to create a recording plan for the re-enactment session.

The RCA recording session

The Byrds continued complaints to Columbia Records about their producer Melcher had resulted in him being removed,⁸⁷ and frustration with Columbia's prohibitive studio rules,⁸⁸ lead to the band electing to produce the next single themselves at RCA studios in Hollywood,⁸⁹ in an attempt to express their autonomy and follow their own production ideas, with their manager Dickson acting as producer while RCA's Dave Hassinger engineered the session.⁹⁰

The recording sessions on 12th and 13th December 1965 reveal a ragged

influential Gavin Report suggesting the song's lyric was drug promoting and advising that it could not support the song. Meanwhile, radio stations had already found the difficult arrangement and soundscape did not sit well with its normal programming and chose to either play the B-side or drop the song from the playlists. The combined affect meant that the single failed to reach the Top 10 and damaged The Byrds reputation as a singles band. (Teehan, 2010)

⁸⁶ Rogan notes that although The Byrds audience was changing from original 'teenybop' to college audience, they had remained an AM radio band and retained an international audience as evidenced through their fan club whose average age was under 16. (Rogan, 2011, p. 931)

⁸⁷ Melcher's insistence to continue to mine Dylan's folk rock catalogue, over their own original material, and his request to share in their publishing as a reward for producing the hit singles caused friction. He subsequently produced Paul Revere & The Raiders, and their single "Kicks", an anti-drug song beat "Eight Miles High" in the chart, peaking at No.3.

⁸⁸ Columbia sessions had to be produced by Columbia 'in-house' producers, while the union engineers had control of technical operations.

⁸⁹ The Byrds had supported the Rolling Stones previously and Brian Jones had encouraged Gene Clark to write "Eight Miles High". It is likely they chose RCA studios, where Jefferson Airplane album recorded sessions from 18th December 1965, above independent Goldstar or United Western that characterised a more Californian surf sound they were trying to escape from. (Beach Boys etc.)

⁹⁰ Hassinger had also engineered The Rolling Stones when they recorded at RCA. Their first recording together in May 1965, "(I Can't Get No) Satisfaction" was their first number one single, and the band had recently returned to complete the *Aftermath* album, and had recorded "Mothers Little Helper" in December 1965 while the two bands were touring together in California.

attempt at a live raga sound, with instruments recorded while performed ensemble. Since the intention was to overdub the vocals back at Columbia studios and use their 8-track facilities to combine tracks, the completed RCA mix only features rough guide vocals. However, Columbia refused to allow further progress on the recording on contractual grounds. Company policy provides that records can only be released if recorded in Columbia studios by Columbia producers and unionised personnel. Hence, the RCA session recording was abandoned, and the session was repeated, this time with stand in producer Alan Stanton,⁹¹ along with regular engineer Ray Gerhardt. Crosby explains:

We were signed to Columbia, whose studios were union-controlled with regular breaks and everything. We thought they were dicks. Meanwhile, Jefferson Airplane were recording down the street at RCA with Al Schmitt, one of the greatest recording engineers in history. So I said to the band: "What if we sneak out and cut it with real guys in a real studio?" So we snuck out and cut a version. When Columbia found out, they threatened to cancel our contract, sue us, everything. Battle raged until eventually our management caved in and we cut another version for Columbia, which became a classic. I still think the first version is better, though. (Simpson, 2014)

Crosby's recollection highlights not only the frustration with the unionised working practice, considered below, but that the band felt at odds with their

⁹¹ Allen Stanton was the A&R executive who had signed The Byrds.

record company's preference to continue with the same successful formula. The RCA Studios recording,⁹² provides valuable support for this analysis for various reasons: firstly it presents an early draft of the song, still recognisable in arrangement but much looser in performance, and similarly recorded live in the studio. In this session the band recorded the two guitars, bass and drums direct to four tracks; guitar, bass and drums to Track One, 12-string guitar to Track Two, and scratch vocals recorded on Tracks Three and Four, which they performed in their signature style of three voices in ensemble, recorded twice resulting in six voices. The electric Rickenbacker 12-string guitar sound was further enhanced during recording by sending the amplified signal through an echo chamber during the performance, which was recorded along with the guitar part onto Track Two.⁹³ (Rogan, 2011, p.243)

What stopped The Byrds at RCA, was not the failure of the creative process, but the definition of the process by political agency of the labour union, which required that the company and engineers conform to certain modes of working as part of a collectively agreed commitment on labour contracts. Hence the translation of The Byrds problematisation of autonomy resulting in the interessement of producing themselves along with manager Dickson at RCA studios, to create the experimental record to their own specification did

⁹² Released in its partially mixed form as a bonus track on the Fifth Dimension re-release CD as part of the Sony Legacy recordings in 1996 (previously on *Never Before 1987*, a compilation album of Byrds out-takes), and again on vinyl in 1999.

⁹³ Dickson also states: "The way we had intended to do it was to take the four band tracks that had the drums and guitar separated, transfer them to 8-track at CBS, and then do the vocals and a new guitar." This suggests there may have been an earlier stage in the 4-track recording, which was sub-mixed to two tracks of another 4-track machine, so they could record two tracks of demonstration vocals, and this earlier multi-track tape would allow them to get back to the original separate tracks. However, since there were only 3-track or 8-track recorders at Columbia, its not clear how 4-tracks would have been transferred to the 8-track machine. (Rogan, 2011, p.243)

not extend to being allowed to experiment with contractual obligations and the translation collapsed as the label and unions refused to allow the continuation of the alternative network. These complex negotiation documents were a blanket agreement covering all sessions, regardless of the musicians in attendance, or song being recorded, or studio used. So although the performance of audio engineering duties appears a social norm, the engineers in the Columbia corporate studios in America were deployed by virtue of union agreements rather than by creative partnerships, (though there may have been side agreements based on familiarity). The world of agreements and union rules are not made visible, but affect the working process. They are referred to in passing, in frustration by the artists citing arbitrary constraints, etc. Nevertheless, this RCA session allowed the band to test their arrangement and performance, and the musical arrangement stayed the same for the Columbia session.

The Columbia recording session

The template for the re-enactment session was provided by analysis of the Columbia Square recording of “Eight Miles High”, recorded on 24th and 25th January 1966, along with various out-takes that reveal the instrumentation and spill of the instruments into adjacent microphones.

The available track sheet, analysis of the recordings and between takes studio banter from bootleg session tapes, provide an understanding of not only the technological constraints of the time, but also how the constraint of

unionised personnel affected studio working practices and use of equipment during the session. Photographs⁹⁴ of the band positioned in the Columbia studio (see Video Example 2) provide further evidence of instruments and amplification, number and placement of microphones, the use of screening to separate sound sources, while proximity of sound sources provides evidence of the practice of employing aural spillage in the soundscape.

A copy of the original track sheet was provided by Bob Irwin, remix engineer for The Byrds' Sony Legacy vinyl reissue series on Sundazed records.⁹⁵ Email correspondence confirmed that the session had been recorded to an 8-track tape machine:

Somewhere up in NY, I have the original session sheets for the 8-track recording.... From memory, I can tell you this - the real "sound" and texture of the recording was created during the reduction mix to 1/2" 3-track tape - that's where balancing was done, where most effects were added, and that's where the compression (and accompanying distortion) took place. (Irwin, 2014)

This note and accompanying track sheet were crucial clues, verifying that the recording used the 8-track machine and providing support for the continued practice of ensemble recording even though the multi-track provided

⁹⁴ Few photographs remain of the Byrds in the Columbia studio, but they do give an impression of the size and height of the room used. Although contracted to record at Capitol, Brian Wilson, as producer, was allowed to record outside of the corporate Capitol studios - at United Western and Goldstar, and even rival corporate Columbia (which The Beach Boys used to take advantage of the 8-track facilities for multi-layering of vocals, especially for the *Pet Sounds* Album), and these photos also provide valuable clues.

⁹⁵ Sundazed produced a vinyl only re-issue of the *Fifth Dimension* LP in 1999 for Sony.

opportunities for piecemeal recording, also revealing the practice of mixing to a 3-track half inch tape format, left, centre and right, unique to American studios.

It appears The Byrds always recorded the complete backing track of drums, bass, guitar and 12-string guitar for each song as an ensemble until the producer was satisfied with the performance. There were no 'drop-ins' of instruments into sections of song, as this was precluded not only by the tape machine adding an electrical click onto tape as it started and stopped, but the engineers were neither skilled in, nor enthusiastic about the art of 'drop-ins'. Indeed, replacement of instruments was impossible given the amount of spill of the original performance on adjacent microphones. All the takes were kept, even breakdowns and false starts, (in a similar fashion to EMI studios recording The Beatles), and remained in the recording vault, suggesting tape cost was not an important ingredient to session costs.⁹⁶

Now watch Video Example 2, which outlines the research and analyses the recording of "Eight Miles High" at Columbia Square Studios.

"Eight Miles High" research - Video Example 2

The video introduces the song and considers the unusual arrangement, distortion and experimentalism in contrast to the previous folk styling as The Byrds sought autonomy in the studio, introducing influences from Coltrane and Indian raga into the soundscape (2.15). They recorded in the large

⁹⁶ The 1965 master tapes were later stolen from CBS and appeared in 1994 as a limited edition 9 CD bootleg which provides vital evidence of between take banter.

Columbia studio 'A' room. The setting up as a live band, and the distant microphone technique that deliberately captures the ambience in the large space is discussed (3.00). The 'sound department' also served the radio and TV stations, and sessions followed the same closed shop union room working practice method, which favoured pre-arranged material and session musicians in specific time slots. The live room and adjacent control room that The Byrds, and all Columbia artists used for recording can be seen in a documentary clip (6.00), and pictures of the band in the same room show them with instrumentation (7.50).

The control room employs a 3-track stereo protocol, which favoured capturing an ambient stereo soundscape with vocal on third track (9.00) and this method was common practice for the corporate American studios. The Byrds were recorded in the same way and though they employed an 8-track recorder, it acted as a staging post to allow double-tracking of vocals and overdubbing the second 12-string guitar before being mixed to the 3-track as a final master (10.45).

The ensemble plays the track live and the role of amplifier volume, driving rhythm guitar and 12-string improvisation (11.50) is evident in the analysis of the recording. The backing track can be heard after removing the centre track of vocals and 12-string guitar from the mix (13.00), the isolated left channel contains 6-string guitar and bass, (13.45) and right channel has drums and percussion (14.25) - the vocals and 12-string guitar on centre track appear on

the left and right track in equal volume to place them in the centre of 2-track stereo.

A memo from Bob Irwin, remix engineer, confirms this arrangement with a description of the tracking and mixing (15.15) and provides the track sheet and explanation of eight to 3-track mixing (16.00), McGuinn also provides anecdotal evidence of how he achieved his unique Rickenbacker 12-string guitar tone (17.00). The control room pictures include evidence of outboard equipment likely to have been used on the sessions (17.20).

The complex hierarchy of producer, union balance engineer and tape engineer is considered (18.20). The union working practice affects the use of the various tape machines seen in the background (19.15), as protocol constrains overdubbing by American Federation of Musicians members (19.15). As mentioned, The Byrds had previously recorded the song at RCA studios, producing themselves, only to find they were unable to release the version that had not been recorded by Columbia union personnel, and this version (21.10) acted as a demo for the final Columbia arrangement, and also provided a 4-track example that became the model for my London recording.

Pictures of The Rolling Stones in the same RCA studio in 1965 provide further evidence of the practice of distant microphone placement, with figure of eight microphones picking up room ambience (22.10), while film of a rock band (Buffalo Springfield) in the recording studio (24.15) underscores that ensemble performance and high volume is common practice in group

recording, however there are differences to be explored between how the studio practice of recording in Los Angeles and London affects the soundscape.

Studio recording

Columbia Studio Interior and layout of musicians

Columbia's West Coast studio had been remodeled in 1962 with a new studio taking over the existing KNX Studio 'A' radio hall, which had accommodated an audience of 1000 seats. The huge size⁹⁷ was comparable to EMI Abbey Road Studio One. (Schmidt Horning, 2013, p.124) The control room measured 18 by 22 feet, looked down over the live area, and allowed the recording engineer and producer to monitor stereo recordings. The studio was shared between Columbia Records, CBS Television and KXLA Radio as a sound department, responsible for all recorded sound output. The in-house designed mixing desk had three busses switching left, centre or right and this matched the standard practice of recording a stereo soundscape with separate track for vocal onto a 3-track recorder.

Dennis Weinreich⁹⁸ engineered at studios in Los Angeles during the mid 1960s and describes the room from memory as “twice the size of Abbey Road

⁹⁷ Columbia studio 'A' was 115 feet by 65 feet with a 40 feet high ceiling. The size could be reduced with a movable curtain. The control room measured 18 feet by 22 feet. For comparison, EMI Abbey Road Studio One – 93 feet by 52 feet, Studio Two – 60 feet by 38 feet. The studio at Columbia was repurposed in the 1970s as a CBS newsroom, and the building was abandoned in 1990s when Sony moved to Television City in Burbank.

⁹⁸ Dennis Weinreich is currently Chair of JAMES (Joint Audio Media Education Support) (Weinreich, 2015)

Studio Two, and much more live sounding.” (Weinreich, 2015) The construction was designed to withstand earthquakes so precluded acoustic treatment apart from thin acoustic tiles, which accounts for the lively ambience. The retractable curtain cut the room in half and helped reduce reverberation for smaller ensemble recordings and this was in place for The Byrds session (seen behind the drummer in the studio photo).

Photos of the band in session show they sat in a tight circle facing each other, with drums and amplifiers separated by portable gobos.⁹⁹ The amplifiers are lifted off the floor on boxes to avoid transmission of vibration affecting adjacent instruments, and there are Telefunken C12 condenser microphones¹⁰⁰ at a distance of one or two feet. The drums are recorded with one overhead and one bass drum microphone. Al Schmitt provides an insightful description of recording practice in Los Angeles at the time:

Actually leakage is one of your best friends because that’s what makes things sometimes sound so much bigger...I try to set everybody, especially in the rhythm section, as close together as possible. I come from the school when I first started where there were no headphones. Everybody had to hear one another in the room, so I still set up everybody up that way. Even though I’ll isolate the drums, everybody will be so close that they can almost touch one another. (Owsinski, 2017)

⁹⁹ Go-betweens or ‘gobos’, also known as baffles, especially in UK, are movable acoustic boards designed to absorb sound waves, and are placed between sound sources to reduce spill onto adjacent microphones., so used for separating the sounds.

¹⁰⁰ The AKG C12 was marketed as Telefunken C12 in America and is the same design.

Instruments are placed close together to avoid phase cancellation issues, rather than far apart to lessen noise spill. Any instrument volume imbalance is treated with gobos rather than telling the performer to ‘turn down’.¹⁰¹

Craft union working practice

Columbia studios was a ‘union room’ and Chris Hillman recalls the recording sessions for *Turn! Turn! Turn!*

It took a lot of takes, but remember that we were in a union room, and these guys ... this was the era when engineers wore white shirts and ties, and they'd take union breaks. As soon as you were ready to do another take, it would be their break time and they would take a half hour break. (Nork, 2004a)

Engineering staff employed at the large American studios; RCA, Columbia, Decca and Capitol, all union closed shops, “controlled access to the technology of recording by forbidding collaborators, such as musicians, composers and record company personnel to even touch the studio equipment at recording sessions.” (Kealy, 1979, p.7)

While technological advancements and experimentation in recording studio practice during the 1960s signaled the emergence of multi-tracking, labour agreements dating back to the second world war between the broadcast and

¹⁰¹ Between take discussions indicate energy and frustration considering the intimacy of the physical arrangement of instruments, suggesting they are playing at loud volume, which has energised them.

recording industries, and the American Federation of Musicians in USA (and Musicians Union in UK) established modes of working that continued to favour live performance. These unions sought to protect their members from a post war music industry based on selling records rather than on live music, dictating terms such as no recorded overdubs that lasted into the 1960s. Schmitt-Horning concurs:

Because tracking could affect musicians' employment, the union attempted to regulate its use. The American Federation of Musicians saw tracking as another way record companies could use technology to reduce labor costs, and routinely had its representatives to observe studio practice. (Schmidt Horning, 2013, p.175)

Consequently, American labour relations¹⁰² and complex union involvement¹⁰³ at Columbia meant that only 'balance engineers' were allowed to touch the mixing console. Tape operators belonged to a different union and were employed as such (and there would be no direct path of promotion). They could not do each other's jobs.¹⁰⁴ Although producers could ask for specific engineers to be allocated to a session, it was normal practice for engineers to

¹⁰² For example in New York 1965 Columbia employed 100 engineer union members and 700 technicians union members as a dispute arose over Columbia assigning work to one union and not to engineers in a breakaway group even though they remained employees. (Waterman, 1969)

¹⁰³ Radio & Television Broadcast Engineers Union represented engineers, American Recording And Broadcasting Association represented recording engineers, International Brotherhood of Electrical Workers represented broadcast technicians.

¹⁰⁴ Early in 1977, after a lengthy dispute with the engineers' union, RCA announced it was shutting Nashville Studio 'B' down as part of the label's broader effort to get out of the studio business. According to a Billboard report dating from January 15 of that year, the dispute concerned "more artistic and technical control demands by the creative side of the business." An RCA spokesperson stated, "We have not had the greater flexibility of operation needed to make continued use of our studios economically feasible." - RCA folds Nashville, LA. Studios: N.Y. next? Billboard (15 January 1977)." (Billboard, 1977)

be allocated to sessions by a union controller, which often resulted in the next available engineer to be allocated on a time basis.¹⁰⁵

The Columbia method of working designated the 'set up' technician to arrange the microphones, the tape operator to operate the tape machine, and the balance engineer to operate the mixing console to balance to tape, setting the levels so playback at unity with no equalisation played back the balance. Effects were recorded. There were no 'drop ins' and the ensemble played until the producer was satisfied. This demarcation of roles precluded any creative involvement by the engineer who became desk operator, and his skill at mixing live performance direct to master became the benchmark of good practice. (Holden, 2011)

Although the Columbia studios had 8-track recorders, inherent union established procedures resulted in their employment as part of existing working practice which favoured balancing direct to 3-track rather than serial multi-tracking.¹⁰⁶ Therefore the Columbia machine was used for synchronous rather than selective multi-tracking and so the instrument leakage that was evident on stereo recordings was still captured on the individual tracks even though the instruments were separated onto individual tracks.

¹⁰⁵ These conflicts eventually lead to the rise of the independent studio that operated outside the union control, United Western being the first non union studio to open in Los Angeles.

¹⁰⁶ Serial multi-tracking, such as Martin and The Beatles were undertaking to create complex arrangements by bouncing between 4-track machines became common practice when artists began to replace session musicians and overdub all the instruments themselves, often composing in the studio.

The sound engineers at Columbia represented a translation of previous practitioners, who directly or indirectly educated them about technical procedures, union regulated ways of working and the design of the equipment they used, and they employed techniques based on the schema of recording for radio broadcast, existing since the 1950s. Regardless of affordances of 8-track technology, existing industry agreements locked in the historical working practice. Not only did the session musicians union ban overdubbing but the tacit experience of engineers favoured the faster live to tape stereo approach, so the machines were simply used as back up, or in the case of The Byrds, to record each instrument on a separate track during ensemble performance, including spill from adjacent instruments, which precluded any later repair work. The engineers did not alter their schema of live recording methods of microphone placement, but simply used the 8-track machine as a staging post to allow later overdubs of guitar and vocals. In addition, the early design machines could not record 'drop-ins' as switching into sync record also recorded an audible click onto tape, In fact many union room machines did not include the 'sel-sync' options installed, as it was not required. Hence the interessement which was controlled by outside agreements affected the potential affordances of similar model machines, supplied with and without the 'sel-sync' option, affecting the recording of performances to comply with musician union restrictions on the overdubbing of parts after the recording of the song.

When employing union musicians, the vocal performance had to be performed along with the backing, to stop the backing being used on more

than one recording. Machines without 'sel-sync' cannot synchronise a second part in time to the original take. The visual verification of recording to the non-'sel-sync' machine was enough to satisfy union representatives of correct procedures. Although this restriction could be circumvented by later copying the tape to a second machine while overdubbing, with the additional generation of tape noise, the 'price to pay' for adding extra parts, was part of an unofficial anti-program (Akrich and Latour, 1992) of workarounds.

Understanding how the relationship with the tape machine affected the recording, and reproducing the same approach in re-enactment produced not only an equivalent sound, but directed the practice towards ensemble performance and the importance of spill to the soundscape.

Sound Recording

The various outtakes of the developing track reveal that although the song has a basic structure, no two takes are completely alike and the backing supports a cacophony of improvisation. The drum part appears to be constantly developing, and the 12-string guitar solo is a raga-esque improvisation of runs and discordant notes. The rhythm guitar part is raucous and loose. Crosby describes his role as rhythm guitarist:

Well the drummer couldn't play...never could. He looked right but he never was a very good drummer, he was a nice guy. That's one of the reasons I learned to play that chop and smack kind of rhythm because I had to learn how to play drums on the guitar. (Nork, 2004b)

The structure of the song follows previous narrative folk stylings with repeated verse structure rather than a popular music verse chorus bridge model of their earlier output (for instance “I Feel A Whole Lot Better”).¹⁰⁷ The original Columbia track sheet¹⁰⁸ suggests the backing track was recorded to an 8-track machine with each instrument separated as follows:

Multi-track master:

Track 1: Bass

Track 2: *not used¹⁰⁹

Track 3: McGuinn 12-string guitar

Track 4: Crosby 6-string guitar

Track 5: Drums

Track 6: *not used

Track 7: *not used

Track 8: *not used

Following the recording of the instrumental backing, they overdubbed two separate three-part vocal tracks to Tracks Six and Seven that were bounced to Track Eight to make way for new 12-string overdub on Track Six (though

¹⁰⁷ That the band and label picked this song to be the follow up to two previous number one singles suggests an impasse between fractious artists and an exasperated label. The recording became their last UK single release for 2 years and signaled the end of their commercial success in America.

¹⁰⁸ It is assumed they used the same layout for “Why” and “Eight Miles High” since they recorded both songs at the same session.

¹⁰⁹ Although Track Two has a recorded part, it was not clear from the track sheet whether it was a Gene Clark guide vocal or percussion part.

the original on Track Three was retained), and a second percussion/drum overdub on Track Seven.

The final multi-track master contains:

Track 1: Bass

Track 2: *not used

Track 3: McGuinn 12-string guitar

Track 4: Crosby 6-string guitar

Track 5: Drums

Track 6: McGuinn 12-string overdub

Track 7: Additional Percussion / Drums

Track 8: Double tracked Vocals

The studio had both Ampex 3-track and 8-track recording facilities,¹¹⁰ and original producer Melcher preferred to use the 8-track machine to record The Byrds as it allowed the double tracking of the all important harmony vocals, and The Byrds continued this method with Stanton. The recording session followed the standard practice of recording the band live.¹¹¹ Since spill picked up errors from adjacent instruments, they were obliged to continue the performance until they had achieved an acceptable take. In this instance, it

¹¹⁰ Although only one 8-track machine can be seen in photographs, it is assumed there was a second machine to make safety copies, so the vocals could have been combined either while copying the eight tracks onto a second machine, or by bouncing internally on the first machine.

¹¹¹ The majority of Columbia sessions, MOR, jazz and orchestral, required the engineers record to 3-track, and this employed the tacit skill and speed of balancing while recording (hence the term balance engineer) with minimal equalisation or compression, which created fast paced sessions, with repertoire played by skilled session musicians following a written arrangement.

was 'Take Nine'. The sessions took place in three-hour slots with coffee breaks, and these timings were strictly adhered to.

The stereo recording allows the analysis of the soundscape by separately isolating and listening to the left channel and right channel. Listening to the left and right combined in mono while reversing the phase on the right channel, removes the elements in the centre of the sound field, and clearly reveals the backing before overdubs, and confirms the vocal and 12-string guitar overdubs were placed in the centre since they have now disappeared. This confirms that the bass and rhythm guitar are panned hard to one side, drums and percussion on the opposite side, and the vocals, with 12-string guitar centered. This also reveals the ghost performance of the original 12-string guitar played ensemble, as although the track is muted, adjacent microphones picked up the sound. The degree of spill of all instruments in all microphones is also evident. It confirms the track sheet suggestion that the 12-string was performed along with the backing track, and again as a separate overdub on a new channel.

Video Example 29 demonstrates how instrument spill into adjacent microphones can add depth to the recording when the signals are panned in stereo.

The multi-track recording was finally mixed to three tracks along with added distortion and effects, as confirmed by Irwin, and playing back the tape with the mixing desk set at unity reproduces the final balance. This is because the

Columbia engineers balanced the instruments as they recorded to tape, rather than maximising any signal to tape and then re-balancing the instruments through the desk to create the mix. The Columbia desk only allowed switching between left, centre, right or off when playing back the 8-track or 3-track machines, so there was no method to attenuate the signals on the mixing desk when monitoring playback. The 3-track tape was then sent to the editing department to prepare the mono and stereo mixes and then to the mastering department for final transfer to aluminium disc. An interview with Columbia engineer Frank Laico describes the Columbia studio process as a factory of different departments where the final recording could still be altered by engineers not present.¹¹² (DansoundSeattle, 2008)

The above data provides the template for the re-enactment process, which clarifies many of the above steps, and provides further insight into how the working practice affected the creation of the soundscape, and how the engineer used the technology.

Callon's translation process incorporates negotiations concerning the band members agreeing on an arrangement for the backing track and vocal arrangement based on the songwriter's original ideas. Once the arrangement is decided, McGuinn, as musical arranger¹¹³ becomes the official spokesman who liaises with the producer, and the band members dialogue is replaced by their musical parts, which unify to become the soundscape. The discussions subsequently turn towards whether the take was good enough, occasionally

¹¹² Playback of the mono mix reveals a 2nd drum flourish on fade out, whereas the stereo version fades before this is heard.

¹¹³ Which also pays McGuinn double session fee, as arranger and as musician.

breaking off to consider individual performances, tuning or tempo. Once consensus is agreed between band members and producer that the recording is acceptable, then to quote Callon “the margins of each entity to maneuver will then be tightly delimited” (Law (ed.), 1986, p.6) since the recording cannot be changed and the musicians move on to overdub vocals onto the agreed backing track. The schema for choosing the best take (Take 9), and accepting the track as the potential next single was delegated to Stanton, and his judgment is accepted by Columbia in his role as producer and A&R executive. Whereas previous producer Melcher took an active role in critiquing the recorded performances, Stanton allowed the band to ‘produce themselves’ and was not enrolled into the translation process beyond overseeing the sessions. Hence the translation from song to recording was allowed to proceed without apparent judgment. The engineer’s schema of good recording practice involved his capturing whatever sound was made in the live room, and he enrolled the technical equipment following the established schema of recording live ensembles using additional processing to constrain levels rather than as a creative device. Hence the evidence suggests although The Byrds got their wish to create an experimental soundscape, it happened without assistance from the control room personnel who followed standard practice.

Musical performance

The musicians played their allotted roles: Lead guitar, McGuinn (12-string Rickenbacker); Rhythm guitar, Crosby (6-string Gretsch Country Gentleman); Bass, Hillman (Guild Starfire); and Drums, Clark (Ludwig Drums). The

guitarists all used Fender 100 Watt Dual Showman amplifiers. These are extremely loud and more suited to live stage performance requirements.¹¹⁴

The sheer volume in the studio adds to the raucous performance, spill, distortion and general looseness of the backing track. Later TV performances provide clues as to the gestural nuances and fingering positions of the individual parts.

The studio was more familiar to recording session musicians who could produce four satisfactory backing tracks in a three hour session, but lesser competent musicians were still expected to provide well performed tracks, and as an extreme example, “Turn! Turn! Turn!” took seventy-seven takes over five days before producer, Melcher was satisfied, since it had already been earmarked as a single release.¹¹⁵ ¹¹⁶ Timing and tuning were paramount. Weinreich recalls seeing a notice in the Columbia producer’s green room that stated, “In time, in tune, on budget, everything else is optional” (Weinreich, 2015)

The song is performed in the key of G at concert pitch and between take banter¹¹⁷ provides evidence that the band tended to tune ‘internally’, rather

¹¹⁴ Smaller portable combo amplifiers are more common in studios, as timbre can be achieved at a lower volume, with the added benefit of portability for session players.

¹¹⁵ Labels preferred experienced session players over inexperienced group members on economic grounds since both were paid the same per hour rate, leading to the eventual negotiation of an artist exception agreement, which set a per song rate for band members playing on their own songs.

¹¹⁶ It is suggested Hal Blaine was hired to play the drums on the single “Turn! Turn! Turn!”, but after Clarke’s protest, he showed a part to Clarke to learn and it took 77 takes for him to perfect it. McGuinn states: “It took about 75 takes to do that song. Michael couldn’t keep a beat. That was a problem.” (Nork, 2004d)

¹¹⁷ See ‘other evidence’ below based on Rogan’s transcript (Rogan, 2011, pp.1097–1102)

than tune to a fixed tone like a tuning fork or tuned piano note¹¹⁸ often using the bass guitar as the most stable instrument.¹¹⁹ However time saving this may be in the moment, in the long-term they are unlikely to be in tune with pianos, brass and strings, should they choose to embellish tracks with strings or keyboards later, and though there are no additional instruments on early recordings, later recordings that employ additional instrumentation tend to sound 'sour' or slightly out of tune.¹²⁰

Video Example 26 demonstrates methods of guitar tuning in the 1960s.

Vocal Recording

Following the recording of the backing track, vocals were performed to Tracks Six and Seven. Dickson describes the signature vocal style consisted of Gene Clark and McGuinn singing unison on the lower harmony, allowing the Crosby the freedom to harmonise above. They performed together on separate microphones and the balance was blended to one track. Photographic evidence (in Video Example 3) and between take discussion provide evidence of this configuration. The voices were balanced by varying proximity to microphones. They then doubled the performance, which means there are six voices on the track. Analysis of "Mr. Tambourine Man" isolated vocal indicates echo chamber reverberation¹²¹ and compression were added to the track

¹¹⁸ This is an era before electrical tuners were common

¹¹⁹ McGuinn's position in the hierarchy and the difficulty of tuning a 12-string guitar also found bassist Hillman instinctively retuning to McGuinn.

¹²⁰ 12-string Rickenbacker and Gretsch guitars are both notorious for going out of tune quickly

¹²¹ There are two types of reverberation on recordings, 1) the natural ambience of the live room, and 2) the added artificial reverberation created in the 'echo chamber'; a small ultra reverberant space into which a signal is sent and played through a loudspeaker and the resulting sound and reflections are picked up with a microphone and sent back to the control

during the performance. In contrast to the strident accompaniment, the singers approached the vocal take in their usual gentle folk singer style.

Rickenbacker 12-string overdub

Following the bounce down of two vocal takes onto one track, McGuinn added his 12-string overdub on Track Six, to replace his original part. In contradiction to published accounts that suggest he plugged direct into the desk via two Teletronix LA-2A compressors (Ohara, 2014), or alternatively used his cigar box speaker,¹²² consideration of the recording verifies he again used the Fender Showman amplifier, since you can hear the 60Hz earth buzz from the amp, picked up by the single coil pickup, amplified by the built in treble booster on the guitar, and magnified by the compression, not from an LA-2A, but a RCA BA-6A limiter, shown in the adjacent equipment rack in the studio (seen in Video Example 2), that appears to have been added to the track during recording to attenuate the input signal.¹²³ The difference in sound between recording the guitar by plugging directly into the equipment versus using an amplifier can be heard in Video Example 3 during the re-enactment of the 12-string overdub. Also of note is the different tonality and performance affordances by using 1960s style flat wound strings instead of modern round wound strings on the Rickenbacker 12-string guitar, as demonstrated in Video Example 25.

room to be mixed with the original dryer signal. This was still a preferred method over mechanical devices such as plate or spring reverbs.

¹²² Heard on the B-side "Why" to achieve a sitar sound.

¹²³ This is the session McGuinn more or less found his classic sound. The BA-6A (History of Recording, 2011) can be used for gain reduction and compressing the sound, and is a vari-mu type limiter, rather than the LA-2A optical method.

Drums

Though the complexity and proficiency of the drum part, in light of Clarke's other recorded performances, suggests there was a second drum overdub on the recording,¹²⁴ there was no evidence of this on the track sheet,¹²⁵ or in published interviews. The initial track (on Track Five) has Clarke focusing on snare (he mostly plays side-stick during the intros and solo sections), a mounted cowbell, hi-hat on the verses, with additional ride cymbal and a couple of tom rolls. The overdub appears during the intro, outro, and solo sections, and tends to focus on the toms and cymbals, plus some snare. Joel Larson, member of Grass Roots, claims he was brought in to do drum overdubs during the *Fifth Dimension* album time period, but there is no clear indication that this extends to the "Eight Miles High" session.

"One of the guys I lived with was Michael Clarke, who was drummer for The Byrds.I was actually very close friends with all of the Byrds, and even played on some of their recordings." (Patterson, 2012)

Since there is a cowbell on The Byrds recording, this was added on a separate track along with percussion during the re-enactment. Following the recording, evidence was provided that a second drum track was recorded, which explains the apparent virtuosity of the drums on this song.¹²⁶

¹²⁴ A second drum take was recorded onto Track Seven after the vocals were reduced

¹²⁵ The available track sheet is for the B-side "Why" which lists Track Seven as 'claps'

¹²⁶ A bootleg recording of a rough mix separates the two drum tracks on left and right channels (demonstrated Video Example 5).

Other evidence

Compared to the rich documentation of The Beatles recording sessions, research material for The Byrds is scarce. However, scrutiny of studio banter between the musicians and producer, available on the Legacy reissue, and also 'bootlegs' of session tapes yields vital information that affords the reconstruction of the working practice in the studio. Transcripts and recordings provide evidence of constant tension in the studio, frustration at the drummer's inability to come up with acceptable performances, and his apparent antipathy towards studio drumming precision and the discipline of multiple takes. There are constant breakdowns, and internal tuning to the bass guitar, especially of the 12-string guitar, which results in the band drifting away from concert pitch, evidenced whenever they overdubbed fixed pitch instruments such as keyboards or horns in later recordings.¹²⁷

The unique document transcribed by Rogan from the *Turn! Turn! Turn!* and the *Fifth Dimension* album sessions (Rogan, 2011, pp.1097–1115), provides evidence of The Byrds' habitus in the studio, and contrasts Melcher's hands on involvement that frustrated them, to Stanton's lassie-faire approach that gave them the autonomy they desired, but left them without a critical ear in the control room. It confirms separate vocal microphones were used for singing, the attention to detail with phrasing with phonetic spelling of words, Melcher's suggestion where to play even to the detail of recalling single hits,

¹²⁷ For instance *Byrdsmaniax LP (1971)*

the use of bar numbers as a reference, the constant stopping of the sessions for tune-ups, an assistant also pointing out tuning issues, a lack of guide vocals, and the stopping of takes due to excessive string noise.

A suggestion to leave cymbal hits out and overdub with mallets later, not only reveals the availability of spare tracks for overdubs that confirms the use of the 8-track recorder, but also sets the precedence of overdubbing additional drums and percussion after the backing track has been recorded. The constant frustration with Clarke the drummer, who's drum parts often appear to be prescribed rather than improvised, is evident when Melcher comments "You missed a cymbal hit that time, I think, once." It would appear that they regularly record up to twenty takes to complete a backing track, which includes initial warm up takes as they find a groove and settle into the comfortable tempo and arrangement.

At one point, Ray Gerhardt the engineer remarks to the drummer "where the hell are you going with the microphone?" The drummer has moved the microphone lower on the kit as he "doesn't want to hear so much cymbal in it", to which Gerhardt points out "I'll drop it in here a little bit, tell me if you've got too much." It appears the drummer has too much cymbal in his headphones, and has taken matters into his own hands, and illustrates that the engineer, usually quiet, is sensitive to any interference with the technical side of the session over which he has sole jurisdiction. Although the band wear headphones for vocal recording, it is not usual for them to wear them while

tracking ensemble.¹²⁸ The fact that the drummer is wearing headphones for drum recording is interesting, because it suggests either that the drums cannot be heard over the volume of the guitar amplifiers, so he has to perform to a mediated sound, or he is recording an overdubbed part.

At one point they turn off the studio lights to add atmosphere. The song “Satisfied Mind” illustrates how McGuinn has established himself as de facto leader and musical arranger, and is forcing the band to arrange around a tremolo guitar sound, which is eventually abandoned after twenty takes.

“Set You Free This Time” reveals Melcher has added echo chamber reverberation to McGuinn’s guitar performance at the same time as recording. He asks for the amplifier volume to be reduced, so the engineer can get a better blend of amp and echo onto tape, the resulting cleaner amp sound reveals more of the echo. Songs are worked up in the studio with the author teaching the structure and chord sequence while the tape is constantly running. Melcher advises if McGuinn wants to fade the track in (in the same way as The Beatles “Eight Days A Week”), “The idea Jim, about fading a track in, the track should have everything going when we fade it in. It should sound like the fade, you know. It should sound like the whole track coming in.” implying the band is naïve to the affordances of record production. The band’s constant breakdowns for tuning always result in the session losing momentum. A common complaint throughout the tapes is where the song has

¹²⁸ The only time headphones are seen in The Byrds ensemble photographs, or similar pictures of the ‘Wrecking Crew’ or Rolling Stones at RCA, is when vocals are being recorded.

an intro that stops momentarily, before the verse comes in, the band tends to race into the song after straining to perfect the intro.

Melcher's ear for detail between takes is illustrated when he reveals for Take Twelve of "Wait and See", "Somebody missed a guitar note in the place where the drum drops out, so we'll take it again, and suggests a drum pick up to signal the verse's start to pull things together, and confirms he's turned Clark's tambourine microphone off "since we're not taking the tambourine on this, it doesn't make much difference. He and Michael aren't really together anyway." This implies Gene Clark's involvement in the recording session is simply to play the tambourine which he does regardless of whether it's recorded or not, suggesting that as he waits to sing, he joins in rather than sit it out, but his playing may be distracting. Take Nineteen reveals some feedback indicating the amplifier volume is very loud in the studio. Take Twenty-four is another tune up "Jim, tune with Chris will you." This shows that Chris Hillman's steady bass playing keeps his instrument in tune and it is reliable enough for the guitars to use as a tuning reference, rather than a piano or tuning fork etc.

Again on "Its All Over Now Baby Blue", Melcher states McGuinn and Hillman's instruments aren't in tune, and "When it comes together on a mono, that's when it gets noticeable." This point is interesting because it illustrates the producer and engineer are listening to the recorded soundscape in stereo, with bass and guitar in counterpoise, and so the panning is already set by the engineer who is used to recording stereo backing tracks onto the 3-track

machine, leaving Track Three for vocals. In this instance, they are either following the same procedure or capturing individual instruments simultaneously on the 8-track machine, yet still approaching the recording as a 3-track session. The stereo mix is being monitored but the producer is already thinking ahead to the final product, and a mono mix will be made, as the LP record was released in mono and stereo, with the seven inch single in mono. In addition, stereo records will be played back on mono equipment with stereo compatible cartridges.

In complete contrast is the *Fifth Dimension* recording session with new producer Allen Stanton who also produced "Eight Miles High". His approach is much more 'hands off' and he oversaw the session as an 'old school' producer rather than an enthusiastic participant. Though Crosby says "he left us alone", studio banter reveals that he was hardly interested in what was happening, providing no input to the process. Indeed he hears the song develop over twenty-six takes without input, apart from offering a playback. The various false starts and breakdowns occur without explanation. It appears that the band is producing themselves. Crosby later exclaimed:

He was Columbia's idea of just having someone there to make sure we didn't [hurt] the place... he just sat around reading the newspaper and didn't say a word- he was like totally out of it. (Nork, 2004c)

Conclusion

In summary, using Callon's translation frames The Byrds desire for autonomy, and their determination to play on their own recordings regardless of ability as

a problematisation of mirroring the freedom they sensed the British and San Francisco groups were enjoying, which ultimately lead them to reject the original producer and spurn the employment of session musicians. However, an attempt to circumvent contractual arrangements by producing themselves at RCA resulted in a failure of interessement since they were unable to enrol Columbia and the unions into their problematisation of a desired end-state. A further difficulty existed since union engineers' roles were described by historical relationships, based on orchestral performances by trained musicians, so the rock group who expected to work outside this formal arrangement found the engineers unable to change their working practice to satisfy an exceptional demand. The union room ethos and musician union agreement in the America was a significant problem for the creative process. It purported to represent the interests of all members, but the 'one-size fits all' collective agreement produced a generic relationship between musician and creative process that favoured live performance practice and constrained experimentation and curiosity in the studio. Hence any experimentation was contained within the timbral arrangement or song structure, and any seemingly creative use of technology was actually an engineering attempt to rein in the distorted sounds they were obliged to record.

The Nashville “Eight Miles High”/“Rain” re-enactment recording session

Introduction

Although the above data collects together all the discoverable recording information, it is incomplete and based on conjecture, describing snapshots of practice with no detail, there is no indication of how it all fits together, what the important steps are, what is missing and when the sound of the recording emerges. What needs to be established is if pieces of equipment were vital to get the sound, why they were used and where in the process they were used, if there were any alternatives at that point, and what affect the decision had on the flow of the recording session? The re-enactment allows the interrogation of every step to understand how the interactions between the players and the technology altered the creative flow of ideas, and if there are undocumented steps in the process, discover what they are. Understanding what was allowed to happen, and what was not allowed to happen can separate the innovation from the standard ways of doing things and discover how ideas interlocked to inspire the next move forward.

Location and studio choice

The re-enactment recording session for The Byrds “Eight Miles High” took place at Fry Pharmacy studios, in Nashville, Tennessee, on 14th and 15th November 2014. Preliminary research and interviews with practitioners in the Los Angeles area lead to the consideration of Nashville as a more suitable

location, as the recording of bluegrass and traditional music was supported by existing analogue studios that continued to employ similar working methods of ensemble live recording, which supported a pool of skilled session musicians.¹²⁹

The studio was chosen for its extensive collection of vintage analogue equipment that included many of the items used in the original session. For instance, the Ampex 8-track and 3-track recorders, Ampex valve microphone preamplifiers, valve compressors and limiters, and a good selection of vintage Fender guitar amplification and Ludwig drums, that matched closely to those used on the original Byrds session. Most important was the knowledge of the owner and engineer, Scott McEwen, in the capability of the analogue equipment and knowledge of historic recording techniques,¹³⁰ and colleague Buddy Woodward, a session guitarist who acted as 'fixer', arranging the session musicians of drums and bass, providing authentic instruments, and liaising with the studio prior to my arrival in Nashville. His knowledge of The Byrds' repertoire and influences, and skill as a bluegrass and folk banjo player also informed the performance aspects. The engineer's understanding and enthusiasm of the project's aim created an ideal venue for experimental research techniques and exploration of tacit skills. Though the studio is smaller than the original Columbia Square room, the employment of the technology and potential interaction between the participants was deemed

¹²⁹ The original field trip to Los Angeles to investigate a suitable studio and musicians resulted in a realisation that the industry was focused on current recordings and any remaining analogue studios were boutique offerings of equipment in modernised spaces unable to re-create the ambience of the 1960s studio.

¹³⁰ The studio is mainly used for ensemble recordings and bluegrass / rockabilly musicians wishing to capture the authenticity of 1950s / 1960s productions.

more important to the outcome than recreating the track in an exact replica of the original session location.

Finally, there was an additional advantage to recording in Nashville as the area provides a pool of session players that are practiced in the art of ensemble performance, and this not only allowed the session network to be created, but replicated the same session player ethos and level of professionalism that was inherent in the Los Angeles music industry in the mid 1960s. Further, the input of American musicians' knowledge of cultural geography and local working practices informed the session with anecdotal input and influences, providing a vital point of reference when comparing to the British recording session. This allowed critical comparisons of the impact of cultural references and tacit ways of doing things, handed down through the apprenticeship of engineers and musicians, illuminated the dissimilarities in the approach of some common processes, exposing the source of many accidental occurrences that lead to innovative outcomes.

This American ensemble also performed a version of The Beatles "Rain" embracing the concept, based on The Beatles intention to record in America during 1966 to take advantage of advanced technology and employ professional musicians, providing an interesting counterpoint for discussion when comparing to the facsimile recording in London.

The session was conducted following normal ethical considerations. The musicians were paid the standard Nashville rate per song per player and they

agreed to be filmed. The informal banter revealed enough field interview material without the need for more formal discussion.

Pre production

On arrival in Nashville, pre-production consisted of rehearsing vocal parts to decide who would take the higher harmony, becoming familiar with the 12-string guitar, as I would be performing McGuinn's part, a general discussion of the aims of the research, and an introduction to working practice in the Nashville area.¹³¹¹³²

Session Instrumentation

Authentic instruments such as Rickenbacker 370 12-string guitar with vintage 'toaster' pickups, a Gretsch Electromatic (as substitute for Crosby's Gretsch Country Gentleman) and Epiphone Rivoli Bass (as substitute for Guild Starfire), provided acceptable instruments that could reproduce the timbre and playability of the original recording. All had flat wound strings as opposed to round wound, to recreate a vintage tone, (as demonstrated in Video Example 25), and this seemingly minor detail provided crucial insight into timbre and performance affordances that resonated throughout all the re-enactment

¹³¹ In particular, the Nashville session players use a unique form of notation, similar to figured bass, called the Nashville number system, that allows them to follow the song arrangement and move between keys if necessary, rather than use manuscript form.

¹³² I was also grateful for my supervisor's presence at the recording session, which coincided with a book tour, providing an opportunity to capture moving video rather than fixed position filming, as all other participants in the room were involved in performing or engineering.

sessions. The studio provided a Ludwig Black Oyster Pearl kit as standard, similar to The Byrds' and The Beatles' setup.

The Fender amplifiers were session size, not road amps, although the bass amplifier was actually an ex-Columbia studio 1960s unit, exactly the same as used on the session. However, the relative volumes are the same and in the smaller room, likely to be just as intense, but allowing the drummer who is playing acoustically, to hear the arrangement. I elected to play the McGuinn Rickenbacker 12-string part and Buddy Woodward played the 6-string rhythm, with Jack Sundrud on bass and Raun Shultz playing drums.

Recording Plan

Fry Pharmacy is located in a converted single story stand-alone building, and consists of two adjacent rooms; 25 feet by 50 feet each with 20 feet high ceilings. Photos show an array of vintage equipment, and anecdotal descriptions by veteran musicians compare it to the feel and atmosphere of the original Stax studios in Memphis. The two rooms have a live sound, with parallel walls, and no sound baffling attached to the walls. The main recording room has a linoleum tiled floor, while the second room has a hard tiled floor with harsher brighter ambience, and acts as the best vocal and percussion room.

The mixing desk, a 1960s Sphere Eclipse is sited in the live room, providing a more informal arrangement from the original Columbia architecture of separate control room and live room, and is ideal for research sessions where

between take discussion invoked not only performance aspects but triggered reminiscences of previous work and experiences providing vital information regarding shared knowledge of American recording practice.

The layout and specification of the equipment followed the spatial template of the original Byrds session, with the caveat that the drums remained in the 'sweet spot' that the engineer recognised captured the best drum sound, and the amplifiers were placed in a line in front with gobos separating the amps and drums, providing the same configuration and eye contact as The Byrds session,¹³³ whilst accepting the engineer's knowledge and understanding of the acoustic properties of his room. Since spill was to be a vital part of the research, this consideration was more important than slavishly recreating photographic evidence, especially as the room did not replicate the size and acoustic print of the Columbia studio. Condenser microphones were chosen over available vintage ribbon microphones to capture a similar full frequency response to the Telefunken C12s, used at Columbia.

It was decided to record onto eight tracks of an early 1970s 16-track two-inch Ampex machine rather than the original concept of using a 1960s vintage Ampex 8-track one inch recorder. The reasoning followed practical considerations of reliability to maintain the creative flow, rather than use a 'museum piece' for the sake of authenticity, combined with similar sonic characteristics, since both were set up to use the same tape formulation.

¹³³ Rather than modern 'screening off' sound sources into separate alcoves.

Instrument Recording

The musicians performed without headphones, and the amplifier volumes were balanced with reference to capturing the tone of the individual instruments. Rather than try to match any bpm,¹³⁴ the band simply played at a comfortable tempo that found its own pace, obviously informed by memory and muscle memory of previously playing along with the original record. As well as being authentic,¹³⁵ this method indicates that rather than being best matched to the original tempo of the song, performances tend to settle at tempos that allow certain set pieces of fills, vocals and solos to be performed with a studied grace and intention rather than feeling rushed and insincere, or beyond the players' ability or range.

Although the instrument blend in the room, as recorded by the video recorder, indicates a good balance, I was surprised not to be able to hear the detail of my own performance due to the relative volume of Buddy's adjacent amplifier and rhythm playing dominating the frequency range. Nevertheless this delivered a good replication of Crosby's intense performance and the relative volumes also injected an urgency and energy into the track, which would not have been achieved at lower volume or on headphones. Further, the Crosby rhythm guitar drives the original track so its intensity was vital for the overall feel and for the drums and bass to follow. Later panning separated the two guitars in the soundscape.

¹³⁴ Beats per minute tempo reference

¹³⁵ The Byrds did not record with reference to a fixed tempo.

As the engineer's mixing desk was in the room, he monitored the takes on headphones but we were able to listen back to the test take immediately on the room monitors which lifted the spirits of the band as the playback sounded just like the record. The sound in the room was instantly familiar and so there was no need to refer to the original to check timbre, and it was more important to understand the tacit experience than the authenticity of exactly matching the tonality of the original instrumentation.

Following a run through to check relative levels and signal to tape, four takes were recorded and the second was deemed the best. It was an entire ensemble performance and no editing or 'drops ins' were considered.

Vocal recording

The vocals were recorded copying the original with three singers on three microphones, in simultaneous performance with headphones, in the adjacent room with hard floor. The balance was achieved by microphone proximity moving the performers' relative position to the microphones rather than adjusting the attenuation on the mixing desk microphone input, and blending onto one track with reverberation and compression added during recording. The performance was recorded one verse at a time and a satisfactory blend was achieved quickly since eye contact, watching gestural movements and the general spirit of singing together, made it easy to pitch and synchronise performances. The vocal recording was doubled, and there was no need to

combine the tracks onto one track to make room for the guitar and percussion overdub since the original was recorded on seven out of eight tracks.¹³⁶

12-String overdub

In contrast to the original 12-string part played during the ensemble performance, the later 12-string solo overdub on headphones lacked the intensity of performance as a result of the lower headphone volume and more relaxed atmosphere, which required turning up the guitar amplifier to match the original 12-string timbre. The direct into the desk method via two Teletronix LA-2As was attempted and abandoned, as it did not achieve the expected sound of the original.

Mixing

Following the addition of a percussion part to add the cowbell audible on the original, the tracks were balanced hard left, centre and hard right to match the soundscape placement of the original track. The engineer had recorded the instruments using microphone placement at a distance of one foot to capture spill, with minimal equalisation and no compression apart from on the vocals and 12-string overdub, and the final blend was a mixture of panning and volume. Initial phase issues between the bass guitar track and the sound of the bass picked up in the drum microphones caused the bass to 'disappear' at a certain level setting, and confirmed the importance of the tacit skill of ensemble recording by placing the instruments close together to avoid phase issues, while at the same time capturing spill, to add depth in the track.

¹³⁶ The mystery Track Two was available.

Now watch Video Example 3, which shows the “Eight Miles High” re-enactment recording session.

Nashville Re-enactment session “Eight Miles High” – Video Example 3

The video introduces the studio, and explores the two recording rooms, comparing the ambience of each (2.10). The layout of the amplification in relation to the drums follows photos of The Byrds and the geography of the open plan studio is described (3.20). The informal layout and atmosphere supports discussions of historic methods and the positioning and choice of amplifiers, drums and microphone placement is considered further (6.00). The musicians are all Nashville session players and will be following the arrangement using Nashville number system, which provides an insight into American session player working practice (7.00).

The players and their instruments are introduced and the guitars use flat wound strings, providing important insight into how manufacturing progress of consumable technology has influenced timbre and playability between historic and modern styles (7.45), and similarly the players comment on how the recording and playback on historic technology affects the overall sound. The condenser microphones are set at a distance from the equipment to capture a mix of performance and spill (9.00) with each instrument recorded on a separate track per the original track sheet. (9.45).

The musicians' first run through the song (10.45) reveals that performing ensemble with the correct instrumentation, amplification and room balance instantly creates the recognisable sound of the recording. A second take (12.45) underscores how the performative interaction and loud volume adds to the feel of the track, and how physical gestures can be used to signal the boundaries between the structured verses and unstructured solo passages (13.30). The session players are following charts based on the unique Nashville number system (15.00) while I rely on their gestures as a guide while playing the 12-string improvised solos.

The 12-string guitar, 6-string rhythm guitar, bass and drums are recorded to separate single tracks, and the individual recordings are now considered (15m 20s) and listening to each microphone demonstrates that distant microphone placement also captures varying degrees of room spill from the other instruments, and the distortion of the guitar amplifiers is evident. For the vocal recording, the ensemble of three singers perform simultaneously onto separate microphones (18.45), mixed onto one track with added reverberation and compression, and then repeat the performance to create the vocal tracks. The balance is achieved by standing position and distance from the microphones. Each section is sung from beginning to end to avoid drop ins which may create accidental changes in volume mid line due to changes in position and performance. The room sound and manipulated recording are contrasted, and compared with an example of The Byrds isolated vocal track (21.10). Following the vocal recording, a percussion track was recorded to add the cowbell sound that is evident on the Byrds version, (21.50).

The additional 12-string guitar overdub initially follows McGuinn's account of plugging his guitar into the mixing console and affecting it with two LA-2A compressors in series (22.30). However, playing through a guitar amplifier and compressing that signal achieves the correct sound, contradicting the original account. Also noted is the effect of headphone mediation compared to loud in-the-room ensemble playing on performance (24.00). The 12-string overdub recording matches the sound of the original, but has no ensemble spill (24.40).

The engineer records all the performances in full frequency relying on microphone placement and proximity to capture the tone of the instruments and the inherent balance and ambience in the room. The individual tracks allow any later individual equalisation manipulation compared to the combining of instruments onto a single track as in the London session (23.10). Only the vocals and 12-string overdub are recorded along with compression and reverberation, so the backing track is a natural unaffected room sound.

The mixing and panning of the recording from 8-track to 3-track left, centre and right is illustrated (27.00). The impact of combining the left and right ensemble with the centre vocal and guitar is demonstrated (28.00), and the discovery that the original 12-string was employed to double sections of the overdubbed replacement, in particular the motif, and replace sections of solo to create a composite, rather than being muted is considered (29.00). Final mixing to the Ampex 300-3 3-track valve machine further distorts the sound as

compared to mixing to the modern Ampex ATR-102 2-track machine (30.00). Final transfer from tape to acetate and manufacturing as a vinyl record further affects the sound as cartridge playback adds crosstalk and harmonic distortion (30.50).

The final mix is a stereo mix 'Audio Example D', and the mono mix is achieved by simply mixing the 3-track master to mono 'Audio Example E', in contrast to the British EMI studio method of recording in mono, and having to re-create a stereo mix from the 4-track multi-track which often placed the backing and vocals of The Beatles stereo recordings in an unusual counterpoise.

Re-enactment of "Rain" in Nashville

Following on from the recording of "Eight Miles High", an arrangement was considered that would capture the possible approach The Beatles may have taken if recording in Los Angeles. Lennon's original inspiration for the song derived from a folk influenced homage to The Byrds sound that emerged alongside "She Said, She Said"¹³⁷ inspired by their stay in Benedict Canyon whilst on tour in California in August 1965. It was here that both McGuinn and Crosby came to visit and shared stories of Ravi Shankar and the Sunset Strip counter-culture. (Priore 2005) It was also noted that whereas The Byrds had first been inspired by Harrison's use of 12-string Rickenbacker on *A Hard Days Night* LP, prompting McGuinn to take up the instrument, so The Beatles had similarly been inspired by The Byrds folk rock sound in their version of "If

¹³⁷ The Beatles recorded "Rain" with guitars tuned to E flat, prior to varispeeding the backing track and "She Said, She Said" is also in the key of E flat.

"I Needed Someone" and "Nowhere Man" on *Rubber Soul*. Indeed, Harrison considers *Revolver* as a *Rubber Soul* 'Part Two' before the manipulation skewed the soundscape towards the avant-garde. (Godley *et al.*, 1995)

Embracing the affordance of working with session players created an opportunity to construct a 'Wrecking Crew' driven track,¹³⁸ which hinted at a more professional version of The Byrds with a pop aesthetic of The Monkees. Using the same instrument and tracking template, the session quickly provided a version that evoked the soundscape of sunshine pop.¹³⁹ In this way it was discovered that the inherent sound of Los Angeles studios was driven by a working practice that embraced fidelity recording of session players along with a 'double helping' of echo chamber reverberation¹⁴⁰ captured direct to stereo, which exemplifies the 'sunshine pop' sound. The Byrds had affected this sound with distortion, raga and arrangement and by an insistence of performing on their own tracks, creating a hybrid sound of novelty that nevertheless echoed the inherent sounds. Therefore, the input of the band masked the otherwise clear sound the studios were famous for.

Recording Session

I switched to playing the Gretsch 6-string guitar to provide simple rhythm and I provided a guide vocal. Buddy played the 12-string in the style of McGuinn

¹³⁸ The 'Wrecking Crew' group of session musicians played not only on "Mr. Tambourine Man" but also a remarkable number of hit California recordings (Phil Spector, Brian Wilson, etc.). (Tedesco, 2015)

¹³⁹ This was a sound prevalent in 1966 with bands like Mamas & Papas, and Turtles etc.

¹⁴⁰ The use of reverberation emerged in the 1950s and was also used to sell the idea of stereo to consumers, becoming a signifier for big stereo soundscapes

and later doubled the part. The song reverted to its original G Major key, which allowed folk stylings compared to the relative rock and roll energy of 'A shape' guitar chords of the original. (Weisbard, 2007, chap.6)

Now watch Video Example 4, which shows the 'Rain' re-enactment recording session.

Nashville Re-enactment session 'Rain – Video Example 4

The recording of "Rain" in Nashville provided a unique opportunity to evoke a similar scenario of Los Angeles working practice using session musicians such as the 'Wrecking Crew' as employed on the majority of popular recordings of 1966. The recording used the same instrumentation and settings as the "Eight Miles High" session, and the arrangement ignored the electronic manipulation of the London recording, changing the key to G major to suggest Lennon's original pop folk concept (1.20). The instruments and amplifiers are discussed (2.20), and the tracking follows the instrument per track model of the previous session (3.00).

The ensemble play through the track, with a performed guide vocal which ensures the track is at a comfortable tempo for the later vocal recording (3.50). The individual tracks reveal a simple recording of sparse parts and so the spill from other instruments on all the microphones is much more evident than the "Eight Miles High" recording which is aggressive and distorted in comparison (5.30). The 12-string guitar is doubled as a separate performance, and again, the use of headphones and lack of ensemble

accompaniment results in a more studied performance (7.50). Following the recording of tambourine, the lead vocal, and two-part harmonies are recorded along with coincident compression and reverb. The harmonies follow the ensemble and balance by proximity model (8.40).

The recording evokes a recognisable soundscape reminiscent of Los Angeles 'sunshine pop' of the mid 1960s (10.00). The eight tracks are mixed left centre and right to the 3-track Ampex recorder, as illustrated by the track sheet (10.30), and the spill and room sound is more obvious without the fullness and distortion of The Byrds performance, so the depth is noticeable, for instance, the guide vocal, picked up by adjacent microphones, appears in the room rather than hard left. The lead vocal and 12-string guitar on the center track (11.30) display a familiar mono soundscape with the additional compression helping the mix by ducking the guitar when the vocals are present. Played together, the combination is further affected when recorded to the valve Ampex 300-3 3-track recorder which adds a layer of distortion, compared to the Ampex ATR-102 2-track mix that provides a clearer sound (13.00).

The final mix is a stereo mix 'Audio Example F'.

“Eight Miles High” and “Rain” Nashville Session Insights

The re-enactment session highlighted how the recording working practice at Columbia was essentially capturing a live ensemble sound with minimal overdubs, employing room spill as a vital ingredient to the stereo soundscape, further adding artificial reverberation that amplified the impression of a stereo

soundscape. Although the instruments were panned hard left and right, the spill of the instruments created a depth, while the dominance of the centre track performance disguised the counterpoise panning. Mixing to 3-track allowed the creation of a mono and stereo master from the same source, compared to the London protocol of recording in mono and having to create a stereo image from disparate groupings of performances.

Although some American studios had the relative advantage of 8-track recorders, it was the British studios that first embraced the methodology of piecemeal assemblage of individual tracks as they already employed this practice in 4-track recording. The American musicians considered the practice as inauthentic or novelty, such as Les Paul's work some ten years earlier. The 8-track machine at Columbia was a repurposed 4-track 'dynamic stereo' machine,¹⁴¹ while another 8-track machine in use in Los Angeles was designed as a 4-track 'Dynatrack' machine,¹⁴² the emphasis on fidelity rather than providing the opportunity to overdub performances. Indeed, the musicians union prohibited overdubs by its members, speed of working favoured musicians playing in ensemble simultaneously, as did engineers tacit skill of balancing to tape, and strict three hour sessions precluded experimentation in the studio, and so many studios chose to buy tape machines without sel sync simply because it was not used.

¹⁴¹ Columbia technicians, combining four stereo machines, with special order 8-track record/play heads from Ampex, built a hybrid 8-track tape machine. Dynamic stereo was a marketing term to sell an enhanced style of stereo using four pairs of stereo microphones placed at distances to allow blending of ambience. However, the idea did not excite the consumer market and was abandoned. The unused machine was 'discovered' and used by Melcher in 1963 to record the Rip Chords, and he continued to use it on all his productions.

¹⁴² The 8-track Dyna-track 3M machine for Wally Heider was used as a 4-track machine, which automatically switched the signal between parallel low gain or high gain tracks depending on input volume, in an effort to reduce tape noise and increase fidelity and dynamic range.(Manquen, 2005)

In particular the Ampex 3-track recorder had become a standard in the mid 1950s and ten years later was still the dominant format, adding a recognisable layer of valve harmonic and tape distortion to the sound. Finally the rise of the independent studio, producer and autonomy of the rock star who insisted on playing multiple parts became the catalyst for change and a generation of engineers left the industry as they found their tacit skills of live balancing to tape gradually became redundant. (Schmidt Horning, 2013, p.184)

The combination of tape,¹⁴³ valve distortion, blending of sounds and incorporation and control of spill utilising gobo positioning, sound manipulation by microphone choice and positioning rather than electronic equalisation, ensemble performance, no edits or 'drop-ins', ensemble singing balanced by performers proximity to microphone, recording effects such as reverberation and compression onto performance, panning left, centre and right, levels balanced during recording requiring zero attenuation during playback, no headphones during tracking, primitive tuning, American amplifiers, flat wound strings, underpowered guitars requiring excessive amplifier volume; all these contributed to the overall sound, captured by union engineers who moderated any experimental intentions that the band may have had beyond creating a novel soundscape in the live room. This list represents an era of everyday procedures and constraints that seemed too obvious to write down at the time

¹⁴³ The 3M '111' tape brand had not been updated for ten years and became a constraint on fidelity regardless of technological innovation, prompting Ampex to enter the tape business themselves, 3M eventually produced a low noise 200 series tape, which made the 3M 'Dyna-track' method unnecessary and helped usher in the sales of 3M 8-track M23 machines.

yet provide clues to lost tacit knowledge and ways of working that created the unique recordings under investigation.¹⁴⁴

Further post session consideration of the snare drum tone lead to the discovery that the 1960s players used Remo Diplomat heads on the snare that were very thin, so tended to be played softly otherwise they would split, which promoted a lighter feel. They have a brittle, more resonant sound. Heavier Remo Ambassador heads, introduced later were more durable and suitable for heavy hitters, and are the modern standard single ply head, but do not have the resonance of the Diplomat sound.¹⁴⁵

Now watch Video Example 5, which discusses the revelations from the re-enactment in Nashville.

Nashville Analysis and revelations – Video Example 5

Whilst the “Eight Miles High” recording focused on the flow of the creative process and revealed how the experimentation in the studio live room challenged the constraints of the control room procedures, recreating a version of “Rain” exposed how the standard working practice produced the unique soundscape of left, centre, right recording of an ensemble recording

¹⁴⁴ The recording was more like live performance than a modern edited to click mediated session. Jack, the bass player commented he remembered the feel and freedom of 1970s sessions, Raun the drummer unconstrained felt his skill was finally being used, and as session players used to a “daily diet of listening of digital”, their entrainment of digital techniques and playback produced an astonishing reaction when hearing the depth, warmth and usual clichéd descriptions of sonic characteristics of analogue playback.

¹⁴⁵ Diplomats are now normally used as under snare heads, or sometimes on tom drums to achieve a resonant sound. Thin snare side skins also promote a buzz in sympathy with other sounds i.e. the bass causing the snare to vibrate heard on the intro of “Eight Miles High”.

with room spill, which emphasised the importance of musicianship and virtuosity (1.30).

The constraint of union protocol, and how it impacted on the process, especially the way the tape machines were employed to fit into the established methods is discussed (2.30), while evidence of frustrations with the system exposes the tensions between appearing as autonomous creative musicians (5.00), and having to compromise to achieve the high standard set by session players. This is illustrated by examining the use of overdubs to fix performance issues and reveals a general mistrust and misunderstanding of studio practice while wishing to appear in control. This emphasis on the virtuosity of performance (10.20) and rejection of the status quo of record companies employing session musicians lead to the rise of the non union independent recording studio and adoption of serial multi-tracking, replacing the sound of blended instruments in a live room as evidenced on this recording (11.30).

The formal demarcation of roles (12.30) in contrast to the casual interaction within the hierarchy in London is considered, while the session uncovered subtle differences between British and American methodology leading to insights into how different ways of doing things explain unexpected creative opportunities (14.10). Ultimately, the dominance of both broadcast and musicians unions in America, resulting in the preservation of the live performance ethos, and constrained creativity to experimentation in the live room, (15.40), which influenced choices of microphone placement, use of

spill, and balancing direct to tape. The practice of recording live with overdubs while monitoring in stereo, compared to the British piecemeal overdubbing while monitoring in mono helps to explain the differences in approach to recording which results in the different soundscapes.

Key Decisions in the recording of “Eight Miles High”

The ideas, experimentation and arrangement were conceived outside the studio rather than achieved during the recording process. The band performed the song in the studio focusing on achieving a virtuosic performance that was an acceptable standard, as opposed to pursuing any concept of experimentation in the studio beyond constructing an interesting soundscape that was made from individual parts that were continually performed until they fit together. The constraint of union practice prohibited any experimental considerations in the studio, since the session would continually break for engineers’ rest periods, a working practice which favoured session musicians playing pre-determined arrangements, but not ensembles attempting to improvise and write parts. The engineers’ strict ways of working also precluded the employment of studio technology in creative ways beyond the normal recording of accompaniment and overdubbing of voice and solos. This is demonstrated by the constant feeling of frustration when things aren’t going right in the studio and the lack of solidarity between the musicians. Nevertheless, the demarcation between musicians and engineers also allowed the construction of the soundscape since it was the job of the engineer to record whatever was in the live room to the best of their ability, whether jazz, folk, orchestral or pop. Applying the same criteria welded

the experimental soundscape on top of the recognisable pop sound as demonstrated when the mannerisms of distortion and raga had been removed during the reconstruction of “Rain”

Identifiable steps in the creation of the soundscape are as follows:

- Band devise soundscape and arrangement for song with reference to raga stylings
- McGuinn emulates sitar using Rickenbacker 12-string, treble boost and distortion through amplifier
- Band play customary roles and instruments in concert pitch tuning
- Band arrange song through improvisation in studio
- RCA recording provides a demo/dry run of arrangement and confidence of parts
- Band required to re-record at Columbia Square studios
- Band play song as ensemble in studio until ‘perfect’ take – Take 9
- Loud volume in studio affects playing style
- Instruments recorded with greater microphone distance to capture spill and ambience
- Tape, valve tape machine, valve microphone pre-amps, valve microphones add harmonics and distortion
- Band recorded one track per instrument onto 8-track machine
- Three-part vocals recorded
- Three-part vocals doubled
- Reverberation and compression added to vocals during recording

- Eight tracks transferred to new machine to combine vocals and provide spare tracks
- Rickenbacker 12-string overdubbed with reverberation and compression added during performance
- Percussion / drum overdub added to bolster performance
- Mixed to 3-track Left Centre Right

Chapter 4: The Beatles “Rain” re-enactment

The Beatles recording of “Rain” represented a seismic shift compared to their live performances,¹⁴⁶ as their recording career progressed as the primary focus of activity. Authors such as Lewisohn have extensively documented the history and biography of The Beatles, which need not be repeated here. This chapter will focus on specific evidence that points to why The Beatles emerged in 1966 with a new experimental sounding recording.

Background

By the end of 1965, The Beatles had completed six albums for EMI Parlophone and were tired of the constant touring and promotional schedule of supporting the Beatlemania image and repertoire. In particular, being unable to hear themselves on stage above the screams of fans while playing through primitive equipment frustrated the band, as manager Epstein continued to follow the path of repeating the successful routine of previous years schedule of albums, tours and film.

Studio compositions had become increasingly elaborate and difficult to reproduce on stage, and the constraint of live performance and time restrictions impacted on their artistic output. In addition, they were becoming aware how difficult it was to compete in the market against American recordings that displayed superior musicianship and recording fidelity. For example, The Beach Boys Brian Wilson had retired from live performances

¹⁴⁶ The set list of their final 1966 world tour performed in front of thousands of screaming Beatlemania fans reveals they opened with Chuck Berry’s “Rock and Roll Music”.

with his band, staying in Los Angeles to concentrate on writing and record production, and employed session players instead of his band to construct sophisticated arrangements. Similarly, labels such as Motown and Stax were coming to dominate the airwaves, and employed house bands to create the records that had a superior sonic sound quality, especially in the bass frequencies.

In 1962 Epstein, a provincial manager with few London contacts or record business experience was happy to have secured any kind of recording contract, and had signed The Beatles directly to EMI,¹⁴⁷ Yet just two years later, contemporaries such as The Rolling Stones, The Yardbirds, Donovan and many other British groups were taking advantage of different business relationships via independent production companies that did not tie them to the corporate A&R structure and took advantage of their freedom to choose where to record.¹⁴⁸ Indeed, all the above had recorded in America, and in particular Los Angeles. With this in mind, The Beatles had instructed manager Epstein to arrange for part of the next album to be recorded in America. Press releases from Motown suggest that the band were expecting not only to record in Detroit but to co-write with successful Motown songwriters Holland, Dozier and Holland. Records also show that although this plan fell through, the band further enquired about recording in Memphis and these negotiations continued during their sessions at EMI in April 1966. (Everett, 1999, p.33)¹⁴⁹

¹⁴⁷ The Beatles were signed on 9th May 1962 to a four year contract.(Lewisohn, 2015, pp.646–648)

¹⁴⁸ The Rolling Stones had a production deal with Decca via Impact Sound rather than being directly signed.

¹⁴⁹ Motown was a major influence on The Beatles. Owner Berry Gordy recounts the story that Epstein, having visited Motown, called for permission to record three Motown songs for the

However, The Beatles problematisation of a way of achieving a superior sound by combining the existing schema of songwriting with American techniques and session musicians eventually failed not because of contractual constraints but was abandoned due to safety reasons.

An enforced hiatus where they did no recording, touring or promotion from January to April 1966, their first break since signing to EMI,¹⁵⁰ underscores the notion that the band had demanded a change in approach to their ongoing career, their aim was to retire from live work and proceed as a studio recording band. In the face of The Beatles dissolving, Epstein agreed and arranged a final 1966 tour for them in America and the Far East and they never played in front of a live audience in UK again.¹⁵¹

This allowed the band members to explore extra cultural activities in the early part of 1966. Whilst Lennon stayed at home in Weybridge and experimented with LSD, McCartney, based in London, explored the counter-cultural social life of London, investing time and money supporting the Indica Gallery and its associated art events and publications such as *International Times*.¹⁵²

second *With The Beatles* album, at a discounted publishing rate. After deliberation and last minute permission was granted, Gordy discovered the songs had already been recorded, mixed, pressed and due to be shipped to radio. The Beatles recognised great songs and were obviously prepared to pay full rate.(Gordy, 2013, p.204)

¹⁵⁰ For the "Paperback Writer" single, they filmed a performance to show on TV rather than travel to promote the song in person.

¹⁵¹ The Beatles played a final impromptu 'rooftop concert' on top of their Apple headquarters at 3 Saville Row, London on 30th January 1969, filmed for later use in the *Let It Be* movie (1970).

¹⁵² Paul McCartney went on a skiing holiday where he wrote songs, and later 'hung out' with the London counter-culture scene, John Lennon stayed at home in Weybridge where he took LSD and was visited by McCartney for various songwriting sessions, George Harrison got

In his chapter *Where Do They All Come From*, Everett makes many musical connections between the construction of several songs on *Revolver* and the American soul music that was dominating the UK and USA charts. (Reising, 2002, p.25) During this time the idea of recording a soul influenced album morphed into an LSD influenced period of experimentation in the studio where the need to perform the songs live was abandoned in favour of exploring the sonic possibilities of the studio shared with fresh ideas from a new production team and with the added freedom of being able to spend as much time as needed on the recording process. Indeed, White notes that The Beatles recorded "Rain", five days after the American chart debut of The Byrds "Eight Miles High",¹⁵³ and though the song was originally written as "an homage to The Byrds electrosonic interpretation of Dylan "Mr. Tambourine Man", The Byrds venture towards experimentalism seems to have motivated The Beatles to consider a similar move. (White, 1995, p.253)

The Beatles four year recording contract was due to expire on 8th May 1966, and sensing frustration and dissent from the team surrounding their most successful act, EMI management may have given in to demands for more creative freedom and unlimited studio time in order to sweeten discussions surrounding the impending renegotiation of the recording contract (which was

married on 21st January 1966 and went on honeymoon to Barbados, Ringo Starr stayed at home with family.

¹⁵³ Released March 14th 1966 in USA

eventually signed on 27th January 1967 for another 9 years).¹⁵⁴ Emerick recalls how the Beatles started to break the rules:

Most EMI sessions weren't allowed to run past 11pm but The Beatles were big enough by then that all the rules went by the wayside. They could work as late or as long as they wanted to, and we had to be there with them the whole time. (Emerick and Massey, 2007, p.113)

Songwriting

The Beatles had recorded their previous album, *Rubber Soul*, their 6th UK release¹⁵⁵ at EMI during October to November 1965,¹⁵⁶ and Lewisohn notes that these songs were mainly written following the end of their North American Tour on 31st August 1965 (Lewisohn, 2006, p.202). The album's song and lyrical style displayed a move away from the bubblegum pop of their previous albums, towards a more mature folk rock influenced style. The acoustic based message songs and musical influences drew from the burgeoning folk rock scene that included The Byrds and Bob Dylan, while the rhythm and melody of the more up tempo songs were influenced by the soul of Motown and Stax that were successful on the worldwide pop charts at the time.¹⁵⁷

¹⁵⁴ Capitol Records memos note that The Beatles had been signed to a 'lower royalty' recording contract, which provided for uncharged recording time, as opposed to an American style contract where the studio time was charged to the band. At the time of signing, creative demands from artists were unheard of and time in the studio was under the jurisdiction of the A&R department. (Dexter, 1964)

¹⁵⁵ It was The Beatles 7th USA album release due to USA Capitol re-sequencing The Beatles repertoire to create shorter albums to capitalise on their success.

¹⁵⁶ Released on 3rd December 1965 in time for the Christmas market.

¹⁵⁷ Capitol Records had reprogrammed USA release of *Rubber Soul* as a folk rock album and were also considering releasing a compilation album of McCartney only performances following the No. 1 American single success of "Yesterday" (Dexter, 1964)

The bulk of *Revolver* LP was written during their extended hiatus in England from January to April 1966, and Lennon describes the enforced writing sessions (Dean 2005), with McCartney usually visiting Lennon at his house in Weybridge to work through ideas, subsequently recording demos in Lennon's home studio.¹⁵⁸ McCartney refers to the writing of "Paperback Writer", which was written specifically to be a single release:

I arrived at Weybridge and told John I had this idea of trying to write off to a publishers to become a paperback writer... and I proceeded to write it just like a letter in front of him, occasionally rhyming it... And then we went upstairs and put the melody to it. John and I sat down and finished it all up... Then I had the idea to do the harmonies, and we arranged that in the studio. (Miles, 1997, p.279)

Similarly, McCartney refers to the collaborative effort that created the arrangement for "Rain"

¹⁵⁸ Whereas Lennon had been the dominant songwriter in the Lennon/McCartney partnership, the previous single "We Can Work It Out" had proved to be the tipping point where McCartney songs were more commercial and picked for singles. At the same time, Lennon became lazier in his songwriting and increasingly relied on McCartney to help him finish off ideas. For example, "She Said She Said", a last minute addition to *Revolver* had been conceived as early as August 1965 but left unfinished. Lennon indicates that their extended stay in Benedict Canyon, Los Angeles during their 1965 American Tour had influenced the song: Interviewed by Rolling Stone in 1980, Lennon stated "She Said She Said" "That's mine. It's an interesting track. The guitars are great on it. That was written after an acid trip in L.A. during a break in the Beatles tour where we were having fun with the Byrds and lots of girls. Peter Fonda came in when we were on acid and he kept coming up to me and sitting next to me and whispering, 'I know what it's like to be dead.' He was describing an acid trip he'd been on. We didn't 'want' to hear about that. We were on an acid trip and the sun was shining and the girls were dancing, and the whole thing was beautiful and Sixties, and this guy-- who I really didn't know-- he hadn't made 'Easy Rider' or anything... kept coming over, wearing shades, saying, 'I know what it's like to be dead', and we kept leaving him because he was so boring! And I used it for the song, but I changed it to 'she' instead of 'he.' It was scary... I don't want to know what it's like to be dead!" (Wenner (ed.), 1971)

I don't think "Rain" was just John's. We sat down and wrote it together. It was John's vocal and feel on the song, but what gave it its character was collaboration. On "Rain" I remember we couldn't get a backing track and we decided to play it fast and slow it down, which is why its so 'goo goo goo' and ploddy. We had to play it fast and accurately, but I don't think that was John's idea. I don't remember whose it was, but it was very collaborative. (Roylance, 2000, p.212)

The arrangement is based around the Lennon and McCartney 'two electric guitar' interplay devised during the writing and demoing process. The song was subsequently presented to Harrison and Starr in the studio, with arrangement ideas already sketched out. Harrison, who would normally play lead guitar for The Beatles, does not play on either "Paperback Writer" or "Rain", delegated to providing backing harmony in the studio.¹⁵⁹ McCartney's guitar performance and the Lennon/McCartney guitar arrangement on "Paperback Writer" and "Rain" became the backbone of the studio recording. McCartney is a left-handed musician so bought his own guitar to the studio, (unable to play Harrison's or Lennon's right handed models). Further, the guitar 'riff' in "Rain" is a simple ostinato figure suggesting that while McCartney helped Lennon develop his song idea into an arrangement, he may have considered leaving space for a more elaborate counterpoint bass line.

¹⁵⁹ Studio notes recall that John and Paul recorded the guitars in unison onto the same track, relegating George to harmony vocals only. (Lewisohn, 2006)

Further research, discussed later, reveals that both guitars had been detuned, with McCartney's further open-tuned allowing him to overlay standard chord shapes to discover exotic chords, exploring innovative ways to introduce the raga stylings of drone strings into their writing and demoing process. Lennon states that McCartney was very good at making intricate demos with multiple instruments at home whereas Lennon often just sang his ideas into a tape recorder accompanying himself on guitar or piano at the same time. (Wenner (ed.), 1971)¹⁶⁰ "Rain" was the second Lennon composition to be recorded during the *Revolver* sessions,¹⁶¹ and was also recorded in the smaller and dryer sounding Studio Three, ("Tomorrow Never Knows" on April 6th being the first, also in Studio Three) and expands on the use of tape manipulation that had been explored extensively during that song's composition.

Applying Callon's translation of turning "Rain" from idea into a completed song reveals they combined their schema of songwriting using Lennon's song idea as a template, with McCartney's skills at recording demos, allowing the arrangement, including experiments with tuning, to be decided before presenting the song to the others. Referring to another song "In My Life" McCartney states:

"For these co-written things, he often just had the first verse, which was always enough: it was the direction, it was the signpost and it was the

¹⁶⁰ MacDonald observes that whereas McCartney's melodies imply he arrives at his tunes independently, only afterwards working out the chords, Lennon's melodies feel their way through their harmonies "in the style of a sleepwalker evolving the unconventional sequences and metrically broken phrasing typical of him" (MacDonald, 2005, p.87)

¹⁶¹ "Tomorrow Never Knows" on 6th April being the first, which was completed after "Rain" adding backwards guitar on 22nd April,. The backwards technique was first employed on the 16th April "Rain" session which added a backwards voice.

inspiration for the whole song. I hate the word but it was the template”
(Miles, 1997, p.277)

Role of Producer and Balance Engineer

Since starting their recording career with Parlophone Records, The Beatles had made all their recordings at EMI studios in Abbey Road, London. It was a contractual requirement that their sessions were produced by the record label A&R Manager George Martin, and along with original balance engineer Norman Smith, the team had recorded all the Beatles singles and albums to date.

The 1960s studio still followed a hierarchy of strict demarcation. Martin’s role as A&R/producer was primarily overseeing the sessions and interpreting their repertoire, either the band’s own song compositions, or cover versions,¹⁶² into commercial arrangements, with particular emphasis on intros, endings, arrangement of vocal harmonies, sometimes performing additional instruments,¹⁶³ scoring and arranging orchestration for session players,¹⁶⁴ and finally deciding which takes were good and which final mix was best.

This left all the sonic decisions and engineering to Smith whose initial concept¹⁶⁵ had been to record The Beatles in a live performance arrangement, setting the instruments in a stage configuration and blending a

¹⁶² Usually recordings of other composers songs that they had played in the live set if there were not enough original songs to complete the album session.

¹⁶³ Martin performed the double-speed piano in Lennon's “In My Life” from *Rubber Soul* 1965.

¹⁶⁴ For instance the string octet on McCartney’s “Yesterday”, appearing on *Help!* LP in 1965 was also the first Beatle song that didn’t include the band’s ensemble sound.

¹⁶⁵ Smith was The Beatles engineer from their first *Please Please Me* LP to *Rubber Soul* LP

distance microphone to add the Studio Two room character to the overall mix. As balance engineer, he sat in the control room at the mixing desk, which included basic equalisation and volume controls to balance the mix of the instruments and voices being recorded, plus limiting equipment to maximise overall volume, and access to an echo chamber which provided additional reverberation effects, and he was responsible for capturing the sound and how the musical performances were balanced to tape. In the live room, he decided the placement of musical equipment, any use of gobos¹⁶⁶ to separate sound sources, amplifier volumes and choice of microphones and placement to capture sound. Therefore the sound of the Beatles was in the hands of the engineer, Norman Smith, and he was more responsible for the early Beatles sound than George Martin, who focused on arrangements and repertoire.

The photographs in the following Video Example 6 (Research into the recording of The Beatles "Rain"), illustrate the similarity of the band's equipment set up arrangement, in EMI Studio Two in April 1964 *A Hard Days Night* sessions, and in February 1965 *Help!* sessions. Smith kept to his formulaic set up even as they developed their sound and changed guitars and amplifiers. Emerick concurs:

Norman ... had a fixed mic set up; he always put the drums and amplifiers in the same place, and he nearly always used the same microphones and equalisation. The mic positioning was mapped out in writing beforehand for the technical guy...Norman simply had a formula,

¹⁶⁶ Smith did not use gobos apart from around the bass speaker, as he wanted to capture the live room sound.

set way of doing things – all of which changed when I later took over as engineer and experimentation became the key. (Emerick and Massey, 2007, p.91)

In addition to the Producer and Balance engineer, a second engineer operated the tape machine, often positioned in a separate room away from the control room because the sound of the machine was overpowering and distracting. He was only contactable by telephone. So the performance of any 'drop-in's'¹⁶⁷ was made more complicated because of communication problems. Finally, studio technical staff was responsible for setting up and positioning the microphones in the studio and again, they followed strict technical guidelines regarding distance from instruments etc.¹⁶⁸

The recording process with Martin and Smith usually found the musicians performing the backing track as an ensemble, playing their chosen instruments of Lennon: rhythm guitar, Harrison: lead guitar, McCartney: bass and Starr: drums, so the overall approach and sound hardly changed from their first recording with Martin/Smith "Love Me Do" in September 1962, to their final "Girl" in November 1965.

Changes in production team

¹⁶⁷ The technique of recording sections of performance required the skill of setting the machine in and out of record at precise points so not to erase previously recorded material on the same track.

¹⁶⁸ There are many documented examples where the balance engineer has requested the microphone be moved closer to the amplifier and the technician be reprimanded for breaking the rules. (Ryan and Kehew, 2006, p.411)

However, dramatic changes followed the completion of the previous album *Rubber Soul*. Firstly, Martin had tried to negotiate an additional royalty from EMI to recognise his involvement in nurturing The Beatles to become the prime earner for EMI,¹⁶⁹ but EMI refused to pay more than a salary so he resigned from the company to become an independent producer.¹⁷⁰ In establishing his independent production company AIR, he also took other key EMI staff producers Ron Richards responsible for producing records by The Hollies amongst others, and engineer John Burgess, creating a staff shortage at EMI.¹⁷¹ Subsequently Norman Smith was promoted from engineer to A&R / producer for Parlophone, leaving the role of Beatles engineer vacant. Although the role of Beatles engineer carried prestige, it also involved additional pressure and unsocial hours for a salaried position, and senior engineers Malcolm Addey and Peter Bown refused the position, which left the role open to 'up and coming' twenty year old Geoff Emerick.

Hence the translation of Martin from corporate producer to independent originated with the problematisation of modifying the schema of EMI producer to receiving an additional royalty in recognition of the financial reward the label were enjoying as a result of his success with The Beatles, but it failed to enrol EMI as they perceived it would set a precedent that would affect the contractual relationships of all producer staff. This forced Martin to risk leaving

¹⁶⁹ Earning the band individual MBE's for export services in 1965.

¹⁷⁰ With no guarantee that he would continue as The Beatles producer, though they did retain his services.

¹⁷¹ "When Richards went to California in 1965 to make a live album with Gerry and the Pacemakers, he talked to his American counterparts and discovered that they received royalties from their hit records. He convinced Martin and John Burgess of EMI and Peter Sullivan of Decca (the godfather of one of his sons) that they should establish an independent production company, AIR." (Leigh, 2009)

the established network in order to coerce EMI into accepting a new relationship based on a mutually desired passage point, that he would remain The Beatles producer at Epstein's request, and this move locked them into the new relationship.

When Geoff Emerick took over from Norman Smith as balance engineer, The Beatles' recorded sound changed dramatically. Whereas Smith, had recorded the band set up in a live position and used Studio Two exclusively, capturing the natural ambience of the large room, Emerick was more open minded, willing to experiment and change the formula. This suited The Beatles yearning to find a new direction, frustrated at being overtaken sonically and creatively by a plethora of younger bands who had developed their new sounds inspired by the success of the 'British invasion'.

Just prior to joining the Beatles as engineer, Emerick had enjoyed the success of his first engineered number one record, Manfred Mann's "Pretty Flamingo", which he states marked the first time he went after "new sounds that had never been heard before:

I began thinking up ways to create new sounds and new colors despite - or perhaps because of - the very limited and primitive technology we had on hand. While I was assisting I had pretty much adhered to the rigid rules management had passed down, but the truth was I had never been satisfied with conventional sounds or recording techniques. (Emerick and Massey, 2007, p.107)

Indeed, Emerick's approach to recording reflects the changing involvement of engineers in the recording process and frustration with the 'old ways', and contrasts with Smith's standardised approach learned when he joined EMI as an apprentice in 1959.

Training at EMI followed a strict apprentice protocol that ensured trainees were exposed to all areas of record production before being allowed to control a session. Emerick notes that the EMI way was to:

Move inexorably upward from assistant to playback lacquer to balance engineer, whether that's what you wanted to do or not.... you learned every aspect of the recording process. (Emerick and Massey, 2007, p.105)

It was this exposure in the mastering room to recordings from other studios, for instance American recordings from Capitol, and licensed product from Tamla Motown that exhibited superior bass reproduction, and in particular UK independent Joe Meek productions, that inspired the possibility of colouration from customised equipment. (Emerick and Massey, 2007, p.106-108). George Martin states:

Geoff Emerick used to do things for the Beatles and be scared that the people above would find out. Engineers then weren't supposed to play about with microphones and things like that. But he used to do really

weird things that were slightly illegitimate, with our support and approval.

(Roynance, 2000, p.211)

These sonic embellishments became part of the recorded performances, and Emerick notes that when it came to mixing *Revolver*:

We were mixing as we went along and it was mostly down to balancing instruments.... because most things were recorded right along with their effects. (Emerick and Massey, 2007, p.129)

Emerick explains that it was during this time that the tape machines were finally installed in the control room rather than down the hall with communication via intercom. Overdubs and 'drop-ins' during *Revolver* had become complex, and would have been impossible to achieve with the machine and operator located remotely in another room, with instructions relayed by intercom.¹⁷²

Analysis of the recording diary suggests that all stereo mixes for *Revolver* were done in a single day,¹⁷³ so the focus was on mono mixes that were the real mixes. Emerick notes that the session not only marked the first time the band were able to participate in the mixing process, but also the beginning of

¹⁷² Emerick describes the process of a written request rejected due to possible machine damage concerns, and an intervention by producer George Martin resulting in maintenance staff wearing brown coats moving the machine, overseen by technical staff wearing white coats, similarly observed by be-suited management. (Emerick and Massey, 2007, p.125)

¹⁷³ Few people had stereo record players in 1966 and it was not considered an important medium.

the blurring of the control room /live room divide as the band demanded more creative input into the mixing process:

Revolver also marked the first time the Beatles regularly began attending mix sessions. The Beatles just concentrated on the music itself. They trusted George Martin and me to do our job in the control room, and they did theirs in the studio area. That was just the way it was. That was the system. Prior to *Revolver*, mixes weren't even given to them to approve beforehand. But by 1966 they were starting to assert themselves a bit more, wanting more control, more say in the sound of the final product. (Emerick and Massey, 2007, p.130)

Translation helps to understand how innovative moves surrounding The Beatles created opportunities. First, Martin altered his schema of corporate producer to independent, creating a change in power relationships, as he was no longer encumbered by EMI protocol. Also, Emerick's youthful eagerness afforded the team an opportunity to experiment and explore new ways, as he familiarised himself with the equipment while the band rehearsed in the live room with Martin. Finally, moving the tape machines into the control room not only adopted them to new roles of intricate overdubbing, but also gave Emerick a second engineer in the room as companion to partner his ideas and rehearse techniques to later impress the 'schoolmasterly' Martin and The Beatles. At the same time, Lennon and McCartney modified their songwriting schema to transfer more of the process into the studio to take advantage of creative opportunities, influenced by Martin encouraging them to re-write and

embellish arrangements with other instrumentation creating a habitus of continuing the creative process in the studio.

Recording session research

The EMI Abbey Road Recording Session

“Rain” was recorded on 14th and 16th of April 1966, and was released as the B-side to “Paperback Writer” on 30th May 1966.¹⁷⁴ It was the fifth song to be recorded during the *Revolver* sessions and bears all the hallmarks of the Beatles new direction as a studio based recording outfit.¹⁷⁵

Now watch Video Example 6, which introduces and illustrates the recording of ‘Rain’ in EMI Studio Three.

“Rain” research - Video Example 6

The video introduces the mono version of the song (1m 30s), and demonstrates the speed manipulation during the recording session that slows down the instrumental track of the song and drops the pitch from G sharp to F sharp so the vocals can be performed, using a special varispeed controller designed by EMI. The set up of instruments and choice of Studio Three by engineer Emerick is illustrated (6m 30s) and compared to their previous working practice in Studio Two with engineer Smith.

¹⁷⁴ “Paperback Writer” released 30th May in US and 10th June in UK, had already been chosen as the A-side of the single and neither song appeared on the *Revolver* album release.

¹⁷⁵ The first recording session for “Tomorrow Never Knows” on April 6th in EMI Studio Three, (which eventually included tape loops, human voices effected through and Leslie type rotating speaker cabinet, ADT, distortion, backwards guitar and echo), marked the start of the *Revolver* recording sessions. Two further compositions, McCartney’s, “Got To Get You Into My Life” and Harrison’s “Love To You” recorded in the larger Studio Two, found the band had settled down to their new found creative surge, and they returned to Studio Three to record two songs which had been purposely written to be the next single release.

The choice of instruments and amplification including the recording of vocals is considered (12m 30s) along with microphone choice and placement. The backing tracks are then analysed to demonstrate the sound, speed and pitch of the two guitars and drums backing track (17m20s), the low guitar notes played on the coda (18m 0s), the lead vocal track with doubled lines (18.40s), ADT added over double tracked voice (19m30s), the introduction of reverb in the second verse (20m 10s), Lennon's high harmony (20m 30s), the three part answering harmony (21m 0s), the falsetto harmony in the coda (22m 10s). The creative flow in the studio where the arrangement is pieced together, including the apparent drum mistake which remained in the arrangement (22m 50s), is illustrated by examples of between take banter (24m 10s), followed by the detail of the tracking process to the 4-track tape machine (24m 45s), and consideration of the efforts to include backward vocals in the coda (26m 30s).

The above video summary of the research into the session indicates the complexity of the new approach compared to the prepared arrangements and fast recording schedule of previous albums. Emerick claims that:

The tracks on *Revolver* were created in the studio before my eyes. The Beatles had done no rehearsing beforehand; there had been no pre-production whatsoever. Almost every afternoon John or Paul would come in with a scrap of paper that would have a lyric or chord sequence scribbled on it. (Emerick and Massey, 2007, p.118)

Ryan and Kehew provide an extensive account of the session and note that following on from the recording and mono mixing of “Paperback Writer”, completed at 8pm, the band took a half hour break and launched straight into arranging and recording five takes of instrumental backing and lead vocal overdub between 8.30 pm and 1.30 am. The entire backing track consisting of two guitars and drums were played together onto Track One. The vocal overdub at slower song speed was then recorded on Track Four, leaving two tracks of the 4-track tape machine free for further overdubs. They took a break the following day and returned to the studio on Saturday 16th April to complete the recording and mixing. The second session lasted from 2.30pm to 1.30am. The final session added bass, tambourine, harmony vocals and a backward vocal added in the coda. Four mono mixes were recorded with the third considered best.¹⁷⁶ (Ryan and Kehew, 2006, p.419)

The performances were recorded onto the 4-track multi-track as follows:

Track 1: Two Guitars and drums

Track 2: Bass

Track 3: Doubled lead vocal

Track 4: Lead vocal

The tracks were then copied to a second 4-track machine to free up Track 4 for overdubs. Tracks 1 and 2 were direct copies, and track 3 and 4 were combined onto Track 3 along with ADT.

¹⁷⁶ A stereo version was not mixed until 2 December 1969 for the “Get Back” LP American release.

Final 4-track master:

Track 1: Two Guitars and drums

Track 2: Bass

Track 3: Lead vocal (3 and 4 combined with ADT) and backward vocal

Track 4: Backing vocals and tambourine

The choice of Studio Three¹⁷⁷ appears a deliberate move away from their normal set up of recording in the larger Studio Two. Ryan and Kehew provide a detailed description of Studio Three, and the layout and employment of equipment. (ibid, pp.416–417) For the session, Emerick also separated the guitar amplifiers with gobos to avoid spill and achieve a dryer ambience. However, this account belies the myriad of tape manipulation techniques and unusual recording procedures that shaped the sound as the team collaborated and devised various solutions to the tsunami of requests and new ideas flowing through the session.

Studio recording

Speed Manipulation & ADT

In the previous recording of “Tomorrow Never Knows”, the band had built up a soundscape utilising sounds on loops of tapes played back at half and double speed, and following an attempt to vary voices by as much as five semitones on “Paperback Writer”, the band had clearly noticed how the change in tempo

¹⁷⁷ The choice of Studio Three, which is a similar size to most American studios, (for instance, Stax, Motown) may have been a deliberate attempt to emulate the sound on American records they had been listening to.

affected the timbral identity of the instrumentation, and although the instruments remained recognisable they also sounded unearthly, thicker and more interesting. (ibid, p.419)

Early in the arranging of the song, they decided to play the backing track at an intentionally higher speed and then slow the tape down, which would also lower the pitch so that the lead vocal could be performed. This is also discussed in various published accounts that indicate Lennon wrote the song in the key of G (Everett 1999, MacDonald 2005), but note it was performed in the key of G sharp for recording and dropped back down to F sharp for vocal overdub before being mixed somewhere between F sharp and G. (Ryan and Kehew, 2006, p.419). Playback of the track at the original recorded speed reveals the drumming style is a recognisable Starr pattern, accompanied by normal spirited guitar performances, rather than a rush through the song.¹⁷⁸

This speed manipulation had recently been made available by EMI technicians, who at the request of Lennon to find a way to avoid the time consuming and laborious process of physically double tracking his voice,¹⁷⁹ had devised a method of varying the tape speed with a variable oscillator and mixing it with the original signal,¹⁸⁰ to create Artificial Double Tracking or ADT, described by Martin as “Taking an image of the sound and delaying it slightly

¹⁷⁸ It may be that the original arrangement was at the faster speed, and the speed was manipulated at McCartney’s suggestion to differentiate it from the tempo of “Paperback Writer” and make it sound more adventurous and experimental.

¹⁷⁹ The process of thickening vocal sounds by physically singing an identical performance so the two performances sounded as one, but with the human nuances providing a blend that emphasised high frequencies and gave the voice more presence.

¹⁸⁰ Lennon had requested the process, and Ken Townsend; technician at EMI studios is credited for ‘inventing’ ADT. However, Harries is also credited with devising a similar ADT process by other means that was used on Billy J Kramer’s “Trains and Boats and Planes” single just days before, to fatten the orchestral recording. (Massey, 2015, p.35)

or advancing it slightly so that it forms double ... in photographic terms, it's like having two negatives." (Roylance, 2000, p.211)

The variable speed oscillator not only allowed the variation of tape speeds to create ADT, phasing and the illusion of two voices, but also allowed the pitch and tempo of the track to be altered after recording by a chosen amount rather than double or half.¹⁸¹ Slowing the speed on playback made the drums sound deeper and thicker, and the drum breaks and fills sound deliberate and unnatural. Yet these descriptions do not convey the ingenuity of combining the signals of two tape machines or how the tacit control of the varispeed in real time creates the effect.

Now watch Video Example 10, which describes the effect of tape speed manipulation in the construction of the "Rain" soundscape, and how speed manipulation is vital to the creation of ADT.

Speed Manipulation & ADT – Video Example 10

The video demonstrates the detail of tape manipulation (0m 0s), varispeed, the sound of performed double tracked vocals (1m 50s), and the performative application of ADT (3m 10s).

Ryan and Kehew indicate that while there is no record of varispeed when the original track was recorded, studio notes record Lennon's voice was taped at 42 cycles a second and the final mix was done at 44 cycles raising Lennon's

¹⁸¹ Studer tape machines were available at 7 1/2, 15 and 30 ips allowing doubling or halving of playback speed

voice by $\frac{2}{3}$ of a semitone. This suggests the varispeed manipulation was an impromptu decision, so the vocal recordings suffered from a slightly lower fidelity at slow speed, whereas future varispeed Beatle songs were recorded at speeds in excess of 50 cycles with the final speed locked at 50 cycles.¹⁸²

Finally, playing along with the finished record, and at these various reference speeds and pitches suggests guitar tuning had also been altered compared to published descriptions of key and manipulation, and this is discussed later when considering the role of instrumentation during performance.

Viewing these decisions using Callon's translation shows the problematisation of how to electronically double a vocal set into motion a series of events that would radically alter the way The Beatles would record in the future, by using the tape machine as a manipulative device. The interessement stage relied on the technical department to devise ways to electronically replicate the process of physically singing twice which enrolled the machines into the creative process in new ways by altering tape speed with a special device. This also allowed pitch and tempo to be altered, and further inspired temporal manipulation experiments and similar performance ideas on instruments.

Bass Guitar Recording

On Saturday 16th April, McCartney performed the bass part, recorded on Track Two. Although there is no mention what speed the tape, and therefore the song pitch and tempo, was running at, this is likely to have also been done

¹⁸² This makes 'engineering sense' because slower speeds are lower in sonic fidelity and matching from one machine to another is best achieved if both machines are running at the reference 50 cycles without the mediation of a varispeed controller adding variation.

at the original speed at 50 cycles a second since it would match the tuning of the recorded backing track rather than McCartney try to tune his bass to an unusual varispeed key of the song, which would also be unstable given the inaccuracy of choosing the speed on the varispeed control. In addition, the performance at original speed would match Starr's original spirited playing and breaks, rather than using the slower speed to inspire a bass part out of context with the original character of a backing track slowed down to create an unnatural feel.

The bass recording is unusual in three ways. Firstly, McCartney had previously used a Hofner violin bass but had recently moved to a Rickenbacker that had more definition and modern sound. Comparing the sound of the Rickenbacker bass to his Hofner, McCartney states that:

It stayed in tune better and that was a major problem for the Hofner.... normally you were buried in the mixes, it wasn't until "Paperback Writer" that the bass and drums came up in the mix. (Babiuk, 2002, p.172)¹⁸³ ¹⁸⁴

Secondly, in pursuit of a more defined bass tone, the engineers had experimented with recording not with a microphone but with a loudspeaker wired in reverse, The 'White Elephant'¹⁸⁵ speaker was normally used for monitoring in the studio but with the introduction of headphones for the first

¹⁸³ Original interview by Tony Bacon Nov30 1994 the Rickenbacker book.

¹⁸⁴ McCartney purchased the $\frac{3}{4}$ sized Hofner, mostly because of its symmetry could be played upside down and turned into a left-handed guitar, (and he later had the electrics moved to the other side), staying loyal to that guitar for most of his career. And it was light so perfect for on stage. The sound was also dull with no sustain which promoted a more rhythmic style.

¹⁸⁵ Seen in the foreground of the Studio Two photograph in Video Example 6.

time during the *Revolver* sessions, the speaker was redundant and could be used for the bass recording. Finally the bass was given its own track rather than being recorded together with the ensemble backing track of guitars and drums, allowing detailed equalisation and compression of the isolated sound.¹⁸⁶

Emerick's explanation of recording with a loudspeaker suggests a complex technical triumph, whereas re-enactment (demonstrated in Video Example 17) reveals a simple process to produce a similarly recognisable tone.¹⁸⁷ But claims of ingenuity to create a more prominent bass guitar sound also conceal the fact that this was more than a mere passing request by McCartney during the session, who was taking an active interest in the creation of sounds in the studio and questioning the deficiencies of British studios unable to match the superior fidelity of American recordings. McCartney states that:

"By then bass was coming to the fore in mixes, you listen to early Beatles records and bass and drums aren't there. We were starting to take over ourselves and bass was coming to the fore in many ways. So I had to do something. I was listening to a lot of Motown, Marvin Gaye

¹⁸⁶ The 'White Elephant' speaker used as a microphone only survived this session before the procedure was outlawed by EMI because of impedance mismatch concerns. However, a loudspeaker as microphone technique had been used many times beforehand, as recently as Emerick's recording the month before with Manfred Mann "Pretty Flamingo". (Ryan and Kehew, 2006, p.421)

¹⁸⁷ Although Emerick's description alludes to a complex array of manipulation, recreation of the technique reveals a simple process with later processing referring to the use of ATOC during mastering to preserve the bass level on vinyl record. "Automatic Transient Overload Control" used an advanced second play head to anticipate loud transients. (Ryan and Kehew, 2006, p.420)

and Stax stuff who were putting some nice little baselines in" - Musician August 1980 (Babiuk, 2002, p.182)

McCartney was engaging directly with the engineer, rather than through producer Martin in the creative process. Engineer Emerick concurs:

Paul would often complain that the bass on Beatles records wasn't as loud or as full as on the American records.... We would often get together in the mastering room to listen intently to the low end of some import he'd gotten from the States. (Emerick and Massey, 2007, p.115)

Hence the problematisation of how to achieve a stronger bass sound in the low end enrolled a new bass guitar and Emerick into finding a solution. Emerick modified his existing schema of recording to include the use of a speaker as microphone, having experimented with one a month earlier on a session, he adapted the idea to include the unused monitor speaker, and recorded it onto a separate track to allow for later manipulation.

Further Vocal Overdubs

Following the bass recording, Lennon added a further vocal recording, on Track Three, emphasising certain words in his original performance by physically double tracking it. The vocal on Track Three and Four were then combined by copying the entire tape onto a second 4-track machine so Tracks One and Two were direct copies, whereas Three and Four were combined onto Three, leaving Four for further overdubs of backing vocals and

tambourine. However, adding ADT to the already doubled vocals during transfer diluted the original effect of physically singing twice, suggesting Lennon's desire to emphasise words was trumped by his later enthusiasm to manipulate his voice with ADT. Yet more three part harmony vocals were added throughout the song, harmonies in verse one were muted during final mix-down, and the lead vocal was further treated with yet more ADT.

Backwards Vocal on Coda

At the end of the first night's recording, Lennon recalls that he took a tape copy home to consider what next to do with the song and inadvertently played the tape backwards.¹⁸⁸ However, hearing the song and voice play backwards, prompted Lennon to request the performance of an additional backward vocal take on the coda. (Wenner (ed.), 1971). Lennon recalls:

The first backwards tape on any record anywhere. Maybe there was that record about "They're Coming To Take Me Away Ha Ha!!" maybe that came out before "Rain" but it's not the same thing. (Roylance, 2000, p.212)¹⁸⁹

As a final overdub, the request for a backward vocal performance was complied with, by copying sections of the lead vocal onto a quarter-inch mix

¹⁸⁸ This is possibly a cause of engineering protocol spooling tapes tail out – that is a tape is wound to the end for storage since this protects the beginning of a song, which is likely to start at the beginning of a tape, from damage whereas there is often a minute or two of unused tape after the end of a song.

¹⁸⁹ "Rain" was released in May 1966, "They're Coming To Take Me Away Ha Ha!!" a novelty song which includes a gradually rising vocal pitch and B-side where the entire song is repeated backwards was released in July 1966.

down machine, flipping the tape over to make it play back in reverse and dubbing it onto the coda of Track Three after the end of Lennon's lead vocal.

George Martin's experience with Goon Show comedians and creating novelty records helped him to embrace the idea of alternative and surreal sonic realities. Hence The Beatles were able to lock him in to the problematisation of enhancing the existing ensemble sound with studio manipulation techniques and pursue a new creative direction.

Construction of unreal soundscape

Emerick previously discussed how his approach to recording the *Revolver* sessions contrasted with Norman Smith's formulaic approach, and frustration with technical constraints imposed by EMI management:

Concerned about wear and tear.... The top studio brass had warned us never to place mics any closer than two feet to drums, especially the bass drum which put out such a wallop of low frequencies. (Emerick and Massey, 2007, p.12)

Regardless, encouraged by the band and Martin, he explored ways to alter the sound by overloading the circuits and circumventing studio regulations, methods that would become standard studio procedures as record production moved away from capturing a live performance as accurately as possible. The drums were recorded by moving the microphones in close, and dampening

the bass drum by filling it with a sweater.¹⁹⁰ (Emerick and Massey, 2007, p.13)

To complete the sound, he:

Connected the studios Fairchild limiter so that it affected the drum channels alone, and then turned its input up. My idea was to purposely overload the circuitry ... The resulting pumping would add an extra degree of excitement to the sound of the drums. (Emerick and Massey, 2007, p.13)

Emerick notes that Martin and The Beatles continual vocal arranging in the studio,¹⁹¹ afforded time to experiment and consider unique ways to affect the soundscape in the control room:

Looking back I think one of the main reasons I was able to come up with so many innovative sounds was the sheer amount of time George Martin spent in the studio working out complex vocal harmonies with John, Paul, and George. The four of them would gather around the piano for hours practicing their parts endlessly. (Emerick and Massey, 2007, p.123)

Compared to today's unlimited options, engineers in the 1960s faced limited resources and quickly mastered the techniques of recording to capture performances. So extending the palate of options was driven as much by

¹⁹⁰ Starr's habit of leaving his cigarette packet on the snare drum while playing also contributed to the dampened sound of the instrument.

¹⁹¹ Martin's role in arranging The Beatles vocal harmonies contrasts to The Byrds skill at constructing their own arrangements.

boredom as by curiosity when younger apprentices took over the recording responsibilities from those trained in the 1950s. Thompson makes the point that Emerick's promotion followed the development of pop music from representing an acoustic medium as accurately as possible to a medium of virtual soundscapes, that engineers like Meek¹⁹² had helped to invent. Whereas engineers before him such as Addey¹⁹³ and Smith straddled the divide between the two eras, facing resistance to change, Emerick knew almost nothing else and was ready to experiment. (Thompson, 2008, p.126)

Thus the translation process provided an opportunity for Emerick to become enrolled into his new role and adjust his recording schema as he considered new ways to do interesting things with the technology while Martin and The Beatles worked in the live room on vocal arrangements.

Musical Performance

The above descriptions concentrate on the engineering aspects and innovations of the production process, however the bands habitus as performing musicians also played a vital role in constructing an experimental soundscape.

¹⁹² Joe Meek produced "Telstar" by The Tornados in 1962 and is considered Britain's first independent producer and studio owner who created 'futuristic sounding' records using layering of parts and manipulation

¹⁹³ Malcolm Addey engineered records by Cliff Richard, The Shadows, Helen Shapiro, Adam Faith etc.

Musical Equipment used on the recording

The Beatles sound had continually evolved, from a frenetic Merseybeat rhythm guitar and walking bass line accompaniment style, (for instance “All My Loving” on *With The Beatles*), through to a Rickenbacker 12-string driven sound, which not only gave their recordings a distinctive vibrancy from *A Hard Days Night* LP¹⁹⁴ onwards, but had inspired The Byrds to duplicate the soundscape. The instruments exhibited on the “Paperback Writer” and “Rain” promotion films display yet another combination of guitars.

However, the chance arrival of new prototype Vox amplifiers with built-in distortion, tremolo and reverb circuits, plus an untried new guitar for Lennon, a gift from Gretsch, combined with a recently acquired free Rickenbacker bass for McCartney, provided the band with the opportunity to sculpt yet another new sonic soundscape in direct contrast to their current sound. So they chose to record a follow up to a number one single¹⁹⁵ with neither the instruments shown on the film they made to promote “Rain”, nor the instruments they played during the 1966 live tour, but a unique mix of recently acquired instruments and free gifts.

¹⁹⁴ During their 1964 American tour, Harrison received the gift of a Rickenbacker 12-string which he debuted on the *A Hard Days Night* album and which became a signature sound of that period (last played on the 1965 single “Ticket to Ride”, when he changed to a new model for “If I Needed Someone”), influencing many bands including The Byrds in America to feature the instrument. In August 1965, McCartney received one of the first left-handed Rickenbacker 4001 bass guitars, which he used on the *Revolver* sessions. In 1962, Epstein asked Vox for a set of amplifiers for the Beatles in return for endorsement, free use of publicity photos and a promise they would only use Vox amps on stage while he was manager, a promise that he kept. (Babiuk, 2002, p.67)

¹⁹⁵ The previous single “We Can Work It Out” / “Day Tripper” was their 9th consecutive No. 1 single (12th in America).

The image of McCartney the bass guitarist belies the fact that before forming The Beatles he had started out on six string guitar and used various right handed models re- strung 'upside down' in a left handed fashion so he could play them in the studio and make demos. Since McCartney was left handed, he could not simply pick up the other players instruments and work out a part, but had to deliberately bring his own instrument to the studio in order to play guitar. The move from 2-track to 4-track allowed the bass to be recorded on a separate track, so McCartney emerged as multi instrumentalist in the studio, and had assumed the role of musical director of the band and, as a better musician than Harrison,¹⁹⁶ often took the role of main guitar player, as well as suggesting rhythms to Starr (for instance "Tomorrow Never Knows"), leaving Harrison and Starr without roles to play as various overdubs were done,¹⁹⁷ while Lennon noted "Paul's been doing a lot of lead guitar work this week.... I reckon he's moving in."¹⁹⁸

Hence part of the enrolment of McCartney into this new translation of The Beatles as an experimental band included him bringing his guitar into the studio and adopting more of an arranger's role as a result of their increased artistic control.

¹⁹⁶ McCartney was considered a better guitar player than Harrison and Emerick notes that Harrison often took ages to provide lackluster performances so Martin would allow McCartney to take Harrison's place to save time.(Emerick and Massey, 2007)

¹⁹⁷ Harrison countered this by introducing exotic instruments (and later introducing his friend Clapton to play his parts).

¹⁹⁸ Melody Maker February 27 1965

Guitars

By 1965, Lennon had swapped to playing an Epiphone Casino guitar that had a full-scale neck and more powerful pickups compared to his 3/4 sized Rickenbacker. Harrison bought the same model, and although Lennon and Harrison are shown in 1965 publicity shots holding Epiphone Casino semi acoustic electric guitars, it was actually McCartney who had first bought one in 1964 for composing. He played it on “Paperback Writer” and “Rain”¹⁹⁹ and noted it was his favourite guitar, “If I had to pick one electric guitar it would be this.” (Babiuk, 2002, p.149)

Photographs of the ‘Paperback Writer’ sessions (documented for the Beatles Monthly book) (ibid, p.162) also show Lennon playing an orange Gretsch 6120 and Harrison holding a Burns short scale Nu Sonic bass guitar both bought to the studio to try out and never seen again in publicity photographs. Although Lennon would normally use his Epiphone Casino, he experimented using the Gretsch to contrast the sound to McCartney’s Casino, and O’Mahony confirms he used the guitar for the “Paperback Writer” sessions,²⁰⁰ also confirming the use of headphones for overdubbing and commenting on the improvised flow of ideas:

John, George and George Martin huddled round Paul, who was seated at the piano trying to work out a bass bit, before asking George Martin to

¹⁹⁹ The guitar choice was influenced by John Mayell (Bluesbreakers) and purchased for its ‘blues tone’ and vibrato arm. (Babiuk, 2002, p.162) McCartney’s first recorded use of the Epiphone Casino was to play the solo on “Ticket To Ride”. (ibid, p.159) and he is filmed playing it during a Tokyo 2013 live performance of “Paperback Writer”.

²⁰⁰ In October 2014, Lennon’s cousin, who confirmed he had been given it in 1967, put up the guitar for auction.

play it. John leaned on the piano while he listened to Paul's ideas for a while. Then he picked up his orange Gretsch guitar and proceeded to pick away at it. At the same time Paul transferred to a Vox organ" ... "They were now all set to go. George Martin gave the OK. The recording light went on and the basic sound track was played back through the 'cans' they each had clamped over their heads. They did several takes. (O'Mahony, 1966)

Since McCartney and Lennon had already worked out guitar parts, Harrison did not play any guitar on the recording. The sound of Lennon's part is simple strumming of chords which contrasts to McCartney's single note guitar part played through the built in fuzz circuit on the new Vox 7120 amplifier.

So the 'breadcrumb trail' of clues provides vital support of the enrolment of different instruments and amplification that contributed to the new soundscape.

Detuning of Guitars

Although replicating guitar choice and amplification is crucial to recreating the timbre of the soundscape, tuning, choice of strings and even style of guitar pick affects the tension, tone, sustain and therefore playability of the instrument and how it responds to the player, and this also inspires the player to create the part. Above research indicates the song was conceived in the key of G and transposed to the key of G sharp for the faster performance,

subsequently the track was detuned again by slowing the tape speed. The choice of key also required consideration of Lennon's vocal range since the pitch of the song would drop. Trial and error reveals that the guitars were also detuned by a semi tone to E flat which allowed an A shape chord to be played but would sound at G sharp (or A flat), which allowed performance of familiar chord shapes but within Lennon's vocal range.²⁰¹

Also missing from descriptions of the recording session is the electric guitar in the coda that plays an arpeggio of notes lower than the lowest note of the bottom string of a 6-string guitar. Session photographs show a Burns Nu Sonic short scale bass guitar in the studio, and commentators suggest that Harrison was 'fooling around' with it, implying he overdubbed a guitar part on the bass on the coda to make a contribution to the song.²⁰² However, by detuning McCartney's guitar to an open G sharp 'blues tuning' the notes are revealed as part of his performance.²⁰³ However the bottom string on a regularly strung guitar has so little tension tuned to G sharp below E, that it is just a buzzing string with no note. By substituting flat wound strings for standard round wound strings, and repeating the process, it is apparent that the flat wound strings have much more tension for the same gauge strings and the vital bottom notes come to life.²⁰⁴ It follows that the vintage style strings mostly

²⁰¹ Also of note is that the transposition moved the guitar chord from G – C – D shape guitar chords to A and E shape chords that are darker and heavier, therefore moving the folk based idea into a rock and roll tonality

²⁰² Although there was no spare track available for such an overdub

²⁰³ Referring to McCartney on "Yesterday", Cooper notes that "He sings it in the key of F, but he actually plays it on the guitar in G, so the acoustic guitar has been dropped a tone. He probably did this because the open string sound of the G chord was a better sound, but he wanted his vocal to be in F. So he dropped the acoustic guitar a tone so that he could play G, but he was actually forming a G chord." (Coleman, 1995, p.83)

²⁰⁴ The drop tuning also lessens the tension and allows for easier string bending, otherwise impossible on the higher tension flat wound strings.

used for jazz guitar nowadays because of the lower volume and sweeter sound, play a vital part in the creation of this track and in the re-creation of 1960s music in general.

Now watch Video Example 24, which describes the importance of guitar detuning and flat wound strings for the recording.

Detuning of Guitars in “Rain” - Video Example 24

Video Example 24 considers the vital role of the detuning of the guitars from concert pitch E to E flat (0m 0s), methods of guitar tuning, the chords played in the song (1m 40s), the importance of flat wound strings over modern round wound strings to achieve the correct timbre and pitch (2m 20s). McCartney’s Epiphone Casino is further tuned to an open key of G sharp (3m 10s), the experimentation of overlaying of standard chord shapes on open tunings (3m 30s), the notes played during the coda (4m 10s) and comparison of the same tunings with round wound strings to demonstrate the affordance of guitar string technology and playing style (5m 10s).²⁰⁵

This information illustrates how the ‘non-human’ actors, the guitars, were altered to better suit their new roles in the translation process by detuning and open tuning, allowing them to be enrolled into the recording process in an experimental fashion.

²⁰⁵ McCartney also detuned his guitar a whole tone from E to D for the recording of “Yesterday” (*Help!* LP 1965) and “She Said, She Said” (*Revolver* LP 1966) is also in Eb.

Bass and Drums

Until 1965, the Hofner Violin bass had been McCartney's sole bass guitar for studio and live performance, but the short scale and imperfect intonation caused tuning problems above the 7th fret, and this constraint informed his original rhythmic melodic style. On being presented with a Rickenbacker 4001 during their American tour in August 1965, he swapped to the more definable bass sound for the *Rubber Soul* sessions onwards.²⁰⁶ At the same time, McCartney tried Fender amplification in the studio, instead of the usual Vox amplifier, in his pursuit of a more American sound.

Starr's drum kit, received for the 1965 USA tour,²⁰⁷ was a Ludwig Super Classic black oyster pearl with 22 inch bass drum, 13 inch rack tom, 16 inch by 16 inch floor tom and 14 inch by 5 inch jazz festival wooden snare,²⁰⁸ with Remo Weather King drum skins (Babiuk, 2002, p.129),²⁰⁹ and this was the kit used for the session, enhanced by dampening the snare with a cigarette packet placed on the snare skin, and a jumper used to fill the bass drum.

Guitar Amplification

For live performances, the band had continually upgraded their amplifiers from Vox AC30 valve 2 *12 inch speaker combo units²¹⁰ to Vox AC100

²⁰⁶ While relaxing in Los Angeles in their Benedict Canyon home during the 1965 American tour, McCartney was presented with one of the first left handed Rickenbacker bass 4001s by the American company and met The Byrds in Columbia studios recording *Turn! Turn! Turn!* rather than relaxing mid tour. (Babiuk, 2002, p.168)

²⁰⁷ Ringo Starr was sponsored by Ludwig, and this was the forth kit presented to him.

²⁰⁸ Given to him by Ludwig in 1964

²⁰⁹ In 2014, Ringo still uses the same hi hat cymbals

²¹⁰ One of the unique features of the Vox AC30 was the open back design, so a dry sound projected from the front of the amplifier and the sound projecting from the back, bounced off

amplifiers with 'Beatle' 4*12 inch speaker cabinets as they needed maximum volume on stage in America.²¹¹

In late 1965, the USA Vox licensee had developed a modified transistor input section that included a built in fuzz box, vibrato, and a tuning tone. This circuit was copied by the UK Vox design team and modified to provide a transistorised FET solid-state input with built in vibrato and fuzz, added to a 120-Watt valve output stage, designed for the band to use on their upcoming 1966 American Tour. Vox delivered prototypes of this new design, to the studio for the band to test (model 7120 seen in the "Paperback Writer" film), in time for the *Revolver* sessions in April 1966.²¹²

Even though they understood that using the smaller amps in the studio provided a better and more controllable sound,²¹³ the band were used to playing stadiums at intense volume levels, and the new effects of fuzz distortion and vibrato added to the palate of sounds available, and compensated for the bland and unremarkable transistorised input stage sound. The modern distortion effects were a useful feature of the design, being superior to available fuzz distortion pedals,²¹⁴ and the sound is featured

the back wall of the theatre and provided a crude reverberation. (Petersen and Denney, 2006, p.67)

²¹¹ The 120-watt 'Super Beatle' transistor amplifiers made under license in America were never used by The Beatles but looked exactly the same. (Petersen and Denney, 2006, p.59)

²¹² Study of the backing track to "Paperback writer" Take 1 and 2 on Unsurpassed Masters Volume 2, reveals Lennon used the built in vibrato effect on "Paperback Writer", and McCartney engaged the fuzz box effect, and it is likely this same amplifiers were used on "Rain" as well.

²¹³ The Vox AC30 valve design added up to 7% harmonic distortion, which coloured the sound. (Petersen and Denney, 2006, p.14)

²¹⁴ A Vox tone bender fuzz pedal had previously been used on *Rubber Soul* "Think For Yourself" (Babiuk, 2002, p.162)

throughout the *Revolver* album (i.e. “Taxman”),²¹⁵ a thinner and fuzzier sound compared to earlier guitar tones such as “Day Tripper” and “Ticket To Ride”, but it gave more sonic space for the enhanced bass guitar. (Petersen and Denney, 2006, p.61)²¹⁶

Loudness levels in the studio

Discussing volume in the studio, Emerick makes the point that:

The Beatles played considerably louder than other rock bands of the era. Although their equipment was quite primitive by today’s standards, it sounded quite forceful in the studio and that became an integral part of their driving beat. Lennon in particular was always turning his volume up, and then Harrison would try to match it. That would lead to overloading problems in the mics positioned in front of the amps (usually sensitive and expensive Neumann U47s) at which point George Martin or Norman would tell them to turn down. (Emerick and Massey, 2007, p.94)

He goes on to state that “Lennon was more prone to breaking strings than Harrison – he attacked his guitar harder and with less finesse...”(Emerick and Massey, 2007, p.95) McCartney concurs:

George Martin would be saying, “Can you turn the (guitar) amps down please? And John would look at George (Harrison) and say, 'How much

²¹⁵ And later *Sgt. Pepper* in 1967

²¹⁶ Fuzz guitar sounds had featured on 1965 No. 1 singles “(I Can’t Get No) Satisfaction” by The Rolling Stones and “Keep On Running” by The Spencer Davis Group and continued as the current guitar sound i.e. “Shape Of Things” by The Yardbirds etc.

are you going down? Let's go down to five, alright?' John would go down to six... (Miles, 1997)

The description of the volume and playing style underscores the fact that The Beatles were primarily a live band and used to playing at volumes based on being heard in either large cinemas in UK or vast stadiums in USA. Their inability to hear themselves play on stage, overwhelmed by constant screaming fans, resulted in their playing style becoming forceful and combined with the habitus of their earlier apprenticeship in Germany and building an audience in the UK playing driving rock and roll, created an understanding of how to control and work with loud volumes. In contrast, The Byrds who were primarily folk musicians turned electric, focused their attention on arranging songs for studio, later learning them for live work.²¹⁷ Similarly, Brian Wilson had retired from live work to become a studio producer, leaving The Beach Boys to tour the old hits while he concentrated on creating new recordings without them or their inherent ensemble instrumental sound. While The Beatles had built their reputation on live work, they were also moving towards The Byrds/Wilson model of studio first while still incorporating timbres that occur on stage at high volume, which played a crucial compositional role in the construction of the studio soundscapes. So the “in studio” sound was adrenalin inducing intense volume and Starr would have to play loud as well to match volume levels.

²¹⁷ Nightingale notes that “they hardly knew the songs” when playing live in the UK, while descriptions of their live shows as a shambles, and their choice of equipment based on opportunity rather than an aesthetic choice to recreate their “in studio” sound confirms the live work was simply for promoting the records rather than an integral part of the band identity. (Rogan, 2011, p.158)

So combining the schema of live stage performance practice with loud amplifier volumes together with the recording schema contributed to the palette of distortion that inspired the creation of the soundscape.

Conclusion

Following the clues and applying the translation rhetoric to describe the network that created The Beatles recording; problematisation, interessement, enrolment and mobilisation, reveals that though the relationships followed the same triangulation of band, song and producer/engineer as The Byrds recording, the representations were different and allowed the movement of ideas between nodes. Firstly, the musicians delegated themselves to the song, and so their fixed roles as guitarist, vocalist etc. were fluid and did not constrain the arrangement, since McCartney played both bass and guitar and Harrison did not perform. Secondly, they enrolled the engineer into the creative process. The engineer was in the service of the band, unhindered by any union regulation. The producer had recently redefined his relationship with the record company from employee and A&R manager to independent producer and this new freedom was exemplified in his open approach to the experimentation, which also called on his previous experience, providing a theoretical and radiophonic counterpoint to the Beatles musical instinct. Although hindered by primitive technology, the engineer employed the tape machines and limiters in unique ways with the trust of the participants. Finally, the band were in the midst of re-negotiating the recording contract, and were granted open access to the studio facilities which further acted as a catalyst to experimentation.

The London “Rain”/”Eight Miles High” re-enactment recording session

Introduction

Compared to The Byrds recording session, the research into the recording of “Rain” has uncovered a wealth of data, overlooked mundane but vital information, and forgotten tacit knowledge. However, accuracy is compromised by the many contradicting accounts, with no discourse supporting why certain processes were carried out, and no information on the hidden failures that lead to choices being made.

What is evident is that this was no ordinary recording session, everything surrounding The Beatles previous ways of working had changed, so this and future recordings would be based on precedent rather than employing or relying on any standard model to explain the steps in the process. Indeed, re-enactment reveals the session was even more complex than the evidence proposes.

Location and studio choice

The re-enactment of “Rain” and ‘Eight Miles High’ session took place over two days at Gizzard Studios in East London on 12th and 13th May 2016. The studio was chosen, not only for the availability of the analogue equipment, but for the vital knowledge of the engineer, Ed Deegan’s understanding of 1960s recording techniques, and willingness to embrace the experimentation, manipulation and creative abuse that the session demanded. It was apparent that the degree of post performance manipulation, distortion and temporal

adjustment were the main criteria for consideration, having a greater impact than the harmonic input of vintage circuitry.

The session was conducted following normal ethical considerations. The musicians were paid expenses and also agreed to be filmed. Again, the informal banter revealed enough field interview material without the need for more formal discussion.

The Engineers role during the re-enactment

The session demanded an unspoken reliance on the engineer to maintain control of the technical aspects of the recording, which depends on tacit skill to place microphones, achieve a balance of instruments on the mixing desk, including filtering to achieve clarity and make space, vital in mono recordings. Mono soundscapes rely on syncopation and equalisation so instruments do not mask each other when playing back from a single speaker, in contrast to a stereo reproduction, such as the Nashville re-enactment where the engineer concentrated on phase issues to ensure a stable stereo soundscape with depth, with less emphasis on equalisation, since clarity in stereo recordings has the advantage of separation by panning as well as timbral manipulation.

The engineer also ensures the tape machines are recording in highest fidelity, setting up tape machine correctly before the session and cleaning the heads periodically between recording and playback, keeping note of times, takes and tracks, and where they lie on the tape, tape speed if we have engaged varispeed, and ensuring there is enough tape on the spool to record the

performances. So the engineer makes decisions we don't know about to ensure the session runs smoothly, anticipating the next stage of recording and preparing microphones and tracks, planning ahead for eventual mix down, and making decisions such as balancing to tape, recording effects along with the performance, combining performances to one track that can't be undone later, monitoring at correct levels to ensure frequencies can be heard, acting as a surrogate producer to check tuning, pitching and timing anomalies, and making sure we run to time to achieve our goals.²¹⁸

Session Instrumentation

Since the session was based in London, I was able to provide the majority of instruments, Epiphone Casino, Rickenbacker 4003 bass, Gretsch Electromatic (substituting for Lennon's Gretsch 6120). Similarly, valve Vox AC30 substituted for the hybrid Vox 7120 valve amplifiers and the built in transistor treble boost and reverb circuits were replicated by adding a specially designed solid state preamp based on the original circuitry to the 7120 valve amplifier to create a recognisable timbre to the recording.²¹⁹ I elected to play the McCartney Epiphone Casino part, while James Meynell played both the Lennon guitar part and McCartney bass part. The Ludwig Black Oyster Pearl kit was hired in, and played by Hugo Dag, latterly of The Bootleg Beatles, who had mastered all the nuances and gestural stylings of Starr's drumming technique.

²¹⁸ Although other London studios, such as British Grove, retain authentic EMI equipment such as an original mixing desk, the studio acoustics are modern in comparison to 1960s standards, and for research purposes, the additional cost was unnecessary.

²¹⁹ Lumpys Tone Shop 7 Series Lemon Drop Overdrive pedal is specifically designed to emulate the Vox 7120 circuitry.

Recording Plan

Unlike The Byrds historic recordings, The Beatles sessions are extensively researched, with Lewisohn, Ryan and Kehew and various 'bootleg' recordings providing ample detail to allow an understanding of the steps in the re creation of the "Paperback Writer" / "Rain" sessions. Various contradictions, for instance whether the bass was recorded using a loudspeaker, a microphone or combination of the two, opened obvious avenues for consideration. One aspect not documented apart from speed manipulation discussions, was how guitar tunings and strings also played a vital role in the timbre of the soundscape and added yet another path in the experimental research approach.

In a similar manner to the Nashville sessions, the layout and specification of the equipment followed the spatial template of the original with the caveat that the drums remained in the 'sweet spot' that the engineer recognised captured the best drum sound, and the amplifiers were placed behind gobos in front. Although the room is much smaller in size and volume than the 1960s EMI Studio Three, Emerick's technique of close micing, creative use of filtering and limiting, and mixing piecemeal to mono rather than capturing the room sound meant that spill was not a crucial ingredient to the sound as it was for the American recording.

The session followed the detail outlined in Video Example 6 with McCartney and Lennon's guitars recorded along with Starr's drum part performed at the faster speed and combined directly to Track One, with the guitars filtered to

separate them into contrasting frequency ranges and the drums further distorted by the Chandler TG1 limiter (substituting for the Fairchild 660) to create an aggressive sound. The ensemble recorded the backing track without wearing headphones. Published accounts of The Beatles in the studio refer to the high amplifier volume creating problems, for example the feedback on "I Feel Fine" was turned to advantage by using the effect as an intro. It was found the combination of treble circuit; hollow body guitar and high amplifier volume created similar feedback and this became the loudness constraint for the 'McCartney' guitar part. The other guitar and amplifier was balanced to this.

The bass was then recorded to Track Two with the loudspeaker used instead of a microphone, processed by the Chandler TG1 (on RS124 compressor setting). On the Beatles recording, lead vocal on Track Three was doubled on track four in certain phrases then both were combined while being further affected by ADT onto Track Three of a new tape as Track One and Two were transferred unaffected. Since the ADT replicated the effect of actual doubling of the lead vocal, the doubling of certain phrases could not be heard on the final record so I missed this step of actually singing twice to save time and so added ADT to Track Three during mix down. Lennon's high chorus harmony was recorded to Track Four, and the three-part ensemble verse harmony and tambourine, and coda falsetto harmony were also recorded onto Track Four. The first line of verse one and chorus one were then copied onto a separate machine, reversed in time and direction, and added to the coda.

Instrument Recording

The amplifiers were recorded with replica Neumann U47 valve microphones set to omni directional, and the drums similarly follow the detail in Ryan and Kehew's research data (Ryan and Kehew, 2006, p.411) of dynamic AKG D19 microphone overhead, a condenser microphone under the snare drum to record the unique metallic sound of the springs on the snare, and an AKG D20 bass drum microphone.²²⁰

Although Ryan and Kehew describe the Fairchild limiter as an ingredient of the sound, the Chandler TG1, (which replicates both the RS124 compressor and Fairchild 660 limiter), displays the same unique distortion characteristics when overloaded, and alters the sound of the recorded drums compared to the live sound in the room. In this way the engineer manipulated the sound of the recording to create a 'cartoon' version of the sound capturing the mid range energy and pumping rhythm of the guitar and drum interplay.²²¹

The bass guitar was auditioned with a microphone, loudspeaker and combination of both. The loudspeaker has a paper cone allowing for a more sensitive response. It was immediately clear that the speaker combined with

²²⁰ The use of a dynamic rather than more sensitive condenser overhead constrains the frequency response so the cymbals do not interfere with the voice in final mixing and mastering, while capturing the rhythm rather than the subtle nuances of fidelity.

²²¹ A combination of overloading the input and performed drum style (the bass drum affects the degree of compression which is held for seconds while the following parts are performed, as opposed to instantaneous compression/release) the result is a manipulated sound difficult to achieve with other limiters.

the TG1 set for the alternative RS124 setting re-created the signature sound of the recording.²²²

The simplicity of capturing the entire backing on two tracks with effects meant playback instantly evoked the sound of the record when the tape speed was dropped to match the pitch of the song for vocal recording.

Vocal Recording

The vocals were sung through from beginning to end of the song, dropping in for whole sections of verse or chorus if repairs were needed. 1960s technology did not allow for accurate 'drop-in' of single words since the sync head and replay head playback switching had to be done manually.²²³ Similarly, a singer changing standing position or volume during a phrase 'drop-in' creates an obvious jump or change in volume, style or phrasing, so any re-recordings always focused on singing through complete sections. The vocal was doubled on choruses with the high harmony.²²⁴

On the original recording, a second lead vocal track, doubling certain words had been recorded, and then combined with the original when transferring the four tracks to another machine. The bounce was necessary to free up a single track for harmonies and tambourine. Although the objective was an eventual monophonic recording, Emerick clearly preserved the bass on its own track

²²² The RS124 compressor is unique to EMI as a modified Altec design.

²²³ During record, the erase head also wiped the previous recording some 200ms in advance creating an audible break in programme material such as front of words or ambience in the track.

²²⁴ It was noted that the Neumann U47 style microphone produced a recognisable valve distortion when the singer 'pushed' notes, for instance, similar to the *A Hard Days Night* vocal sound on "I Should Have Known Better".

rather than consolidate with the guitar and drums on bounce down to retain control over the level and clarity in the final mix session. This step was skipped in the re-enactment, and ADT was added to the lead vocal during mixdown.

When performing harmony vocals, The Beatles tended to sing around one omni microphone, rather than sing ensemble into three microphones as The Byrds had done. This highlighted the importance of balancing and blending by standing position. This was achieved by inviting another performer, Paul Bevoir, to join for the vocal harmony recording, while the drummer stood away from the microphone for the simultaneous tambourine performance.

Further Manipulation

The final, yet vital ingredient to the recording was the copying of the opening vocal line and reversing it for the coda. Martin describes taking the first line of the verse and reversing, to the delight of Lennon. In fact, the procedure was more complex as the coda section includes the first line of the verse and the first line of the chorus, each reversed, and then reversed in order so backwards you hear the first verse line reversed, then the first chorus line reversed. After copying and editing onto a ¼ inch machine, the result was played into the multi-track by timing the dubbed performance, taking into account the time it takes for the machine to start from position. A 'chinagraph' mark on tape provided a visual cue for adjusting for time.

Mixing

Since the song was recorded in mono, the tracking had been monitored in mono and the backing provided a simple mix. The drums and guitars backing track already evoked the signature sound. The inherent shelving of the bass guitar, a product of the loudspeaker method, created a timbre with no clear top end, so the combined drums, guitar and bass backing produced the recognisable sonic soundscape. The Chandler TG1 compressor on final mixing provided further balancing, as it tended to duck the backing track as the vocals came in, providing a natural dynamic type of fader automation.

The four tracks highlighted the difficulty in creating a stereo master from the source material, and provided the opportunity to experiment with various permutations of soundscape. Zak (2001, p.148) describes how the oppositional counterpoise of early Beatle stereo records created their own novelty, compared to the American method of capturing a stereo soundscape of assembled musicians, or mirroring the British method of hard left / right panning, but with the additional advantage of spill producing a depth of field.

Now watch Video Example 7, which shows the re-enactment recording session.

London Re-enactment session “Rain” – Video Example 7

The video introduces the studio and players, the recording live room and control room (1m 30s). The instrument microphone placement and proximity

are considered as well as the use of loudspeaker as microphone for the bass amplifier (4m 30s). The drums and bass run through the arrangement (5m 15s) allowing a comparison of room drum sound and manipulated drum sound heard in the control room affected by compression and filtering. The performers do not wear headphones, allowing them to respond to the high volume and energy in the room. The guitars are roughly in tune from previous use, and are tuned to each other rather than using an external tuning reference.

Following adjustment of guitar tones and volume, and positioning to allow better sight of drummers performance gestures, a take is recorded and playback considered for performance and balance (10m 0s). Of particular note are the coda low guitar notes (9m 15s), the different guitar balance between room sound and recorded sound and how the engineer has matched the timbre of the Beatles original. The final recording (11m 40m) captures the correct speed and energy. The way the two guitars chords combine on the chorus can be heard (12m 30s) and the faster speed provides the performance gestures that recreate the excitement of the drum breaks and syncopation compared to the more deliberate sounding parts when played back at the slower speed.

As well as recording directly to one track, the engineer records the separate performances on spare tracks to allow later demonstration of what each individual microphone is hearing (13m 10s). The drum microphones also capture the spill of guitars, which rise in the mix when only the hi-hat is played

(14m 10s). The pumping and distortion effect of the compressor, and the ducking of the guitars when the drums come back in, is evident. The individual guitar tracks are vibrant and distorted with complimentary timbres.

The bass guitar is recorded on its own track (15m 0s) and the bass is tuned to the recorded backing track by ear. The amplified Rickenbacker bass is recorded with a loudspeaker and compressed with the TG1 on compressor setting, and captures the authentic bass sound exactly (16m 50s). The completed backing track is slowed by varispeed with reference to the pitch of the Beatles track rather than its tempo (18m 30s). This is slightly below the eventual pitch of the song and allows the lead vocal and high harmony to be performed (19m 0s). The three part verse harmonies are performed together in the same way as the Nashville recording, using distance to blend the voices, but in this case the three singers perform to one microphone rather than individual mics (20m 15s).

The track is sped up slightly which also raises the pitch, and the lead vocal is affected with Automatic Double Tracking (ADT) (21m 15s), and reverberation is also added to one word on the track (22m 0s), auditioned first to set level, then added during final mix down. Finally, the complex reverse coda voice idea is engineered (22m 50s) and falsetto harmony (25m 20s) is also added to the coda.

The final mix is a mono mix 'Audio Example G', and it is also obvious when a stereo version is attempted 'Audio Example H' that as the recording process

places backing on Track One, bass on Track Two, lead voice on Three and harmonies on Four, the unusual counterpoise of Beatles stereo recordings is unavoidable. 'Audio Example H' matches the slower speed of the stereo version on *Unsurpassed Masters* 'Audio Example C' to illustrate the tempo before the mix was sped up slightly for the mono mix.

Re-enactment of "Eight Miles High" in London

By employing the same conceptual approach as imagining The Beatles recording "Rain" with the 'Wrecking Crew' in Los Angeles for the Nashville re-enactment, so The Byrds in London provided a similar unique prospect. The song was inspired by the London visit in July 1965, where they also visited clubs and made acquaintance with bands such as The Yardbirds. In addition, The Byrd's early musical stylings were based on The Beatles, down to choosing the same equipment, and a later Rolling Stones companionship that extended from touring together, to both recording at RCA studios. So the concept emerged that they may have approached an RCA style recording in a London studio such as Olympic which provides an independent dynamic.

Using the RCA session as the basic template, but committing to mono recording, the approach mirrored the early Beatles recording criteria of performing ensemble with guitar, bass and drums mixed live to Track One, guitar solo on Track Two, and three part vocals on Tracks Three and Four.

Recording Session

For this recording, a Gibson EB2 was used for bass to mimic The Byrd's semi-acoustic bass sound, along with the Gretsch Electromatic semi-acoustic 6-string and Rickenbacker 12-string as the Nashville session. The bass was recorded with a microphone rather than a repeat of the loudspeaker method, and the drum overhead AKG D19 was replaced by a Coles 4038 Ribbon microphone, similar to the one used in EMI Abbey Road for the *Rubber Soul* recordings, and prevalent in all British studio at the time. This not only allowed the focus of the process to rest on the performance aspects, but also allowed comparison between the different microphone arrangements.

The 12-string guitar also used the Jangle box treble booster between the guitar and amplifier, which emulates the tonal characteristics of McGuinn's built in treble booster, unique to his guitar. A crucial difference between the American and British recordings was the use of Vox amplifiers instead of Fender. Also, rather than employ an echo chamber, reverberation was created by spring reverb via a tape pre-delay, which was also common practice in UK studios at the time. (Massey, 2015, p.35)

Now watch Video Example 8, which shows the "Eight Miles High" re-enactment recording session.

London Re-enactment session "Eight Miles High" – Video Example 8

The video discusses how the session is modeled on the original 4-track recording of the song which took place at RCA Studios in December 1965, and the change in drum microphone choice (1m 30s) to match a typical Olympic studios set up (which was also EMI Norman Smith's preference). The drummer has written out the part (2m 0s) so the ensemble relies on his gestural moves and drum breaks to guide the arrangement. The bass guitar amplifier is recorded with a microphone (3.00), and the guitar also uses close microphone placement.

The ensemble performs the song, again without headphones, and relies on an energetic performance to provide the tempo, enhanced by high volume and eye contact to create the feel (4m 15s). The guitar, bass and drums are recorded to Track One, and individual recordings (5m 20s) demonstrate the distorted guitar, microphone capturing a distorted full frequency bass compared to the compressed filtered sound created by the loudspeaker as microphone, and uncompressed drums sound more natural while the figure of eight ribbon microphone seems to reject much of the spill from the guitar and bass. The 12-string solo part is recorded to Track Two (6m 40s), and the engineer records reverberation along with the performance (8m 00s).

The three part harmonies are performed together in the same way as the Nashville recording, using distance to blend the voices, but in this session the three singers perform to a single microphone rather than individual microphones (9m 0s), recording to Track Three. The performance is repeated

on Track Four so there are six voices, which have been recorded along with compression and reverberation (9m 30s).

This mono recording demonstrates a much simpler process than the complex “Rain” session or the Nashville stereo “Eight Miles High” recording and reveals the standard London studio working practice method of the time.

The final mix is a mono mix ‘Audio Example 1’

“Rain” and “Eight Miles High” London Session Insights

In contrast to The Byrds recording of “Eight Miles High” in Los Angeles, The Beatles pursuit of experimental techniques rather than focusing on virtuosic performance clearly helped in creating an interesting accompaniment. The simplicity of the harmonic structure carries an arrangement that is still in progress, for instance Starr adds an extra half bar before the first chorus in hesitation, which is kept and his drum pattern represents ideas developing rather than a studied attempt to support the song with a regular rhythm. Indeed, he states he cannot remember much about the session apart that it is his favourite performance, but has no idea where it came from. Meanwhile, since the rhythmic ideas and tunings were the result of a collaboration between Lennon and McCartney, it follows that Harrison does not play guitar on the track, whereas The Byrds were careful that each member played their allotted role and instrument for recordings.

Prior to the *Revolver* sessions, all tracking was performed in front of a loudspeaker (dubbed the 'White Elephant') that played the previous recordings into the live room. So the band literally played or sung along to the speaker's output, which often meant a modicum of spill was also captured with the recording. With the introduction of headphones, the working practice not only changed, but the speaker was repurposed to experiment recording the bass guitar as mentioned above.

Headphones provide a compromise of mediation. The headphone mix of instruments needs to provide a balance that the singer can pitch against, but hearing your own voice in the headphones can be distracting, affecting performance, and if the volume is too loud in the headphones, the sound can not only spill into the microphone, but also the sound pressure creates a psycho acoustic affect of raising the pitch of the music in the headphones causing the singer to sing sharp. Nevertheless, The Beatles were keen to embrace the use of headphones as a technological advance. Video Example 14, Microphone pre-amp distortion also demonstrates how headphone volume affects vocal pitch performance.

Now watch Video Example 9, which reflects on the London re-enactment session.

London Re-enactment session Reflection & Analysis – Video Example 9

The session exposed the degree of experimentation during the flow of creativity, (1m30s), the employment of the studio as an instrument (3m 0s),

how the abuse of technology inspired innovation, and the role played by the variable tape speed oscillator which helped to inspire novel approaches to constructing the soundscape (3m50s). Of particular importance was the involvement of the engineer in the creative process to facilitate these ideas (4m30s). The continuous revelations of forgotten techniques and tacit examples of procedures unique to the era demonstrate important details of working practice that are not recorded in available research, for instance the role of speed manipulation in the creation of ADT (5m50s).

The session revealed the prevalence of detuning guitars and tuning methods in the era (6m40s). Obvious yet overlooked aspects such as the difference in the sound of playback from valve equipment and modern equivalents (7m30s), how mono soundscapes hide mistakes which add to the feel of the track, how the sound relies on ensemble performance which is shaped by the sheer volume and energy (11m00s), the impact of noisy equipment, irregular tuning of instruments, creative abuse (Keep, 2005) of equipment and constraint of track count create an urgency to the creative flow and requires that the final outcome is the result of the flow of process rather than the construction of a preconceived blueprint (14m00s).

Key Decisions in the recording of “Rain”

The re-enactment recording revealed how the flow of creativity inspired steps in the recording that acted as triggers for further ideas. Ingold discusses how each divergent path is a choice that leads to another choice, and this engagement with the process not only by the musicians but the producer and

engineer provided openings for support staff to also respond to the moment and create unique sounds rather than guide the session towards a preconceived intention. The concept of anti-program (Akrich and Latour, 1992) and creative abuse (Keep, 2005) is applied at each step, not only to the technology but how the users circumvented existing systems that controlled the technology in order to exploit unused capabilities. On another day, the outcome may have been entirely different, as ideas may have been used on other songs, or a divergent path lead to a new approach.

The following long list of critical moments in the flow of ideas, compared to a similar list relating to The Byrds recording “Eight Miles High” helps to illustrate just how unknown the outcome was. Whereas reverse engineering may reveal how a discrete process has been created, such as ADT or distortion, it does not reveal why the process was used at that moment and what lead to it, or what lead from it, since creativity is a sense of improvisation rather than a conscious pursuit of innovation.

Each item represents a commitment to an idea on the creative path that affects the next step and cannot be reversed.

- McCartney & Lennon work out syncopation between two guitars that creates the rhythm of the song – no role for Harrison.
- Lennon’s guitar is detuned to E flat.
- McCartney’s guitar is detuned to E flat, and then retuned to an open chord of G sharp.
- McCartney brings left handed guitar to studio – a deliberate decision to play guitar on track.

- McCartney plays notes on coda that are out of range except with flat wound strings.
- Lennon chooses an untried guitar, possibly to contrast to McCartney's Casino - an unknown guitar will affect his playing style.
- Untried guitar amplifiers used with built in distortion circuits at high volume.
- Choosing Studio Three over Studio Two – a dryer sound.
- Track recorded with close microphone placement and gobos to avoid spill and create a dry track.
- The band decide to play the track fast so it can be slowed down.
- Perform song faster so choose higher key – crucial.
- Tape speed set to 15 ips / 50 cycles per second when backing track recorded so idea of reducing final speed may not have been conveyed to Emerick.
- Play dual guitar and drums onto one track - sets arrangement in stone so looking for best take – Take Five.
- Drum mistake adds half a bar but kept so arrangement still fluid - mistake kept
- Arrangement has a false ending, opening up an improvised coda.
- Drums at fast speed - nuances and fills based on fast speed.
- Microphone under snare and dampening with cigarette packet on top for crisp snare sound.
- Emerick distorts drum sound and adds creative compression so unnatural pumping sound.

- Emerick's use of tape, valve tape machine, valve microphone pre-amp, valve microphone - all add harmonic distortion to sound.
- Harrison tries out new 6-string bass but doesn't play on track.
- McCartney's guitar playing allows him to create a sympathetic and elaborate bass line.
- Choosing Rickenbacker bass – more clarity.
- Overdub bass later - clarity and better part.
- Using 'White Elephant' speaker instead of microphone for more prominent bass sound.
- Bass at fast speed still - alters tone later but matches better.
- Track slowed down for vocals – fixes final speed.
- Slow speed based on feel rather than reference to concert pitch tuning
- Drums drop in pitch and length.
- Drum fills sound unnatural, cymbals have longer sustain.
- Guitars and bass drop key - so fixed equalisation steps now in wrong frequency range for mastering.
- Song now sounds unsteady and darker.
- Slowing of track makes lyric long deliberate drawl – prosidy.
- Lead vocal recorded.
- Double track only some words - in final mix
- Harmony vocal recorded.
- Lennon still strains for top harmony note – compromise over tempo and key.
- Vocals at slow speed - can't speed up now.

- Tape reduction of vocals to make space for backing vocals and tambourine - fixes vocal performance with added ADT.
- Reverberation added to first word of second verse, word painting rather than the creation of space or ambience.
- These effects are printed with the performance to the next machine.
- Transfer adds more distortion as valve line amps maintain level during transfer
- Three part harmony backing vocals and tambourine on same track - fixes performance balance.
- First line of verse and chorus edited, reversed and added to coda backwards – possible because of stasis of single chord on coda - fixes idea.
- Falsetto three part harmony added in coda on beat two of bar eight of vocal, very difficult to perform – added because space on tape?
- Tape speed increased slightly for final mix raising pitch of vocal and making vibrato unnaturally fast -- fixes final tempo and pitch.
- Dropping out backing vocals on first verse on mix - they were there, is a mixing decision to grow arrangement.
- Tambourine part was arranged to become more complex– because it was recorded on harmony track, it is now lost on first verse.
- More ADT on mix down - effect permanently recorded.
- Song mixed in mono with added compression.
- ATOC limiter in mastering – louder final record.

Chapter 5: Analysis and reflection - Key differences between British and American studio working practice

Performance practice in the studio

Although the research focused towards the role of studio manipulation to achieve experimental soundscapes, the musicians had instigated the idea of creative expression beyond that achievable in live performance using the medium they knew – their instruments and amplification, informed by hours of performance and ‘fooling around’. These performative aspects of the re-enactment, combined with primitive interaction, blend of ideas and commitment to sounds created the arrangement, and revealed the tacit experiences of recording as an ensemble, in contrast to the singular performances, layering, mediation and deferment of choices taken for granted as part of the modern process.

The musicians brought a wealth of performance lead ideas into the studio. Video Examples 21 to 23 illustrate how guitarists experimented by combining various techniques such as slide and open tunings, de-tuning strings to reduce tension allowing easier bending of notes, altering timbres with additional effects, such as McGuinn modifying his guitar with a built in treble booster in an attempt to capture more sustain, overloading amplifiers, inducing feedback and timbres discovered at on-stage volume levels, therefore applying an ethos of creative abuse (Keep, 2005) and anti-program (Akrich and Latour, 1992). The imprecise tunings delivered an unmistakable

character and fullness to the soundscape, providing rich harmonics compared to modern tuning methods, as demonstrated in Video Examples 24 to 26.

Playing guitar on the sessions provided unique insights into the performative nature of 'forgotten' tacit knowledge. For instance, using heavy gauge flat wound strings,²²⁵ revealed an important input into the timbral character of 1960s 12-string guitar, a sparkle rather than brittle sound. Heavier gauge strings add tension, and more tone to the sound and this alone, rather than turning down the volume of the modern 'hi-gain' pickups to 1960s levels, created a recognisable sound, which coupled with the American Fender amplifier achieved an unmistakable character in Nashville, brighter than the fuller British Vox amplifier sound in London. The weight of the strings encouraged a more discerning playing style than the more frenzied performance that newer style guitar strings seem to promote with their built in buzz and distortion. Although these new round wound strings, demanded by musicians who desired a lighter gauge, afforded a versatility suitable for rock music, they also removed many of the playing attributes that produced 'forgotten' techniques that were deemed everyday practice at the time and were vital to the outcome of the soundscapes, such as allowing McCartney to detune, and McGuinn to adopt a 'rolling' picking style. Vox's new amplifier with built in fuzz circuit also provided additional loudness and distortion, further manipulating the guitar tones in London.

²²⁵ Of the type available in the 1960s, before lighter round wound were available

The contrast between the Nashville and London drumming styles matched the original recordings. Massey concurs that American drum sounds were a product of performance and training, not recording. (Massey, 2015, p.2) While the Nashville musicians found their own playing velocities, I was surprised how lightly the session drummer played, compared to my own experiences of playing concerts with 'live' drummers, but the nuance and dynamic created an authentic timbre, and research confirmed drummers in the 1960s played softer because of the fragility of the vintage thinner 'Mylar' heads, or even calf heads. Distance microphone placement brought out the dynamics and tone of the kit as opposed to close microphone placement, gating, equalising and compressing to achieve the modern equivalent.

In fact the Nashville ensemble played at a relaxed session musician pace rather than with live aggression, considering the volume, and The Byrds also seem to be tame in the studio, relying on distortion rather than an imprecise 'punk' approach. This mirrored the inherent difference between a session player approach, used to playing an average nine hour day, and conscious of the need to produce a constant overall dynamic and tone, versus a live drummer responding with adrenalin to an audience in a live environment, in the early 1960s lasting no more than thirty minutes.

The Byrds were a studio band with minimal live experience and played lightly, compared to The Beatles background of constant touring, which informed their studio practice. These different styles are evident on the 'performance videos' of the original songs on Video Example 2 (0m30s) and Video Example

6 (1m35s) This was replicated in the re-enactment, Ruan, in Nashville provided the script of a session drummer, while Hugo who had played over one thousand live dates as a member of The Bootleg Beatles, reproduced the script of a live drummer, incorporating rim shots as accents etc.

Nashville post-session reflection confirmed 'all together ensemble' playing with no repair work created the feel of the track. Any timing differences between musicians added a further patina of character rather than evoking looseness in performance.²²⁶ It felt perfectly natural to play together in the room in that manner, with neither headphone nor click track for mediation or temporal guide, with no overdubs apart from a guitar solo and vocal.

The room balance was achieved via natural blending rather than secondary mediation via the desk and monitor mix back to the musicians. The relative loudness of amplifiers also affected the spill of instruments into other microphones, so if one was overly loud, its ambience was also prominent. Since the musician sat in front of his amp so the interaction between sound and sensitivity informed the playing rather than an amp in a room and monitoring off speakers or headphones, and so the balance was a matter of where you stood rather than what you got in the headphones.

Nashville also provided insight into session player working practices (and the Nashville 'number system'), simulating the mainstream pop record production model of Los Angeles in 1966, so I could compare the efficiency of the

²²⁶ Keil refers to the power of music in its 'participatory discrepancies' (Keil, 1987)

professionals against The Byrds struggle to create a usable take. The London re-enactment of “Eight Miles High” also relied on the ensemble performance and matched the experience of the Nashville session.

The “Rain” session in London followed the original recording decision to manipulate the sounds from the inception, recording too fast to slow down etc. This untried experimental approach had relied on Emerick’s taste to create the sonic mediation as the performance was captured on tape. The live room sound and control room playback sound were entirely different. The Beatles, combining drums and guitar onto one track as a foundation, knew they had to overdub, and didn't seem to bother to perform well either, since the clarity of the detail would be lost in a mono soundscape along with tape noise, valve distortion, overdubs and combining tracks. The Byrds instruments remained separated, a track for each instrument, which allowed a greater clarity on playback in the control room to scrutinise the individual performances, while monitoring in stereo.

The Byrds remained in the studio and concentrated on performance, without input from the engineer regarding volumes, distortion or internal balance, he simply captured the backing track in ensemble. So there was more ‘feel’ on the West Coast recording since there was an interaction between all players while recording the backing track, as if that was going to be it. Indeed, performance was ingrained in the Los Angeles system because of the use of session players. In contrast, by taking the bass out of the backing track, The Beatles had effectively abandoned this ensemble approach that exemplified

their earlier recordings, and were relying on the additional input of studio manipulation to add a third layer of meaning to the soundscape.

Engineering protocol in the studio

Positioning in the room

Both recordings show how recording culture was adapting to small ensemble performances. The EMI and Columbia studios were originally designed for live orchestral recordings, with engineers capturing the sound of performance in a room, rather than individual instruments for later blending. Although both studios employed gobos and panels to cut down reverberation time, engineers were trained to use spill to advantage.

The Byrds were arranged as a live ensemble, physically close enough to avoid phasing issues, but microphones placed to allow spillage to be captured, which was a normal working way of adding ambience to an accompaniment. Though The Beatles were arranged in a similar way, the backing track was recorded piecemeal, two guitars and drums, recorded with close microphone placement to avoid room sounds followed by bass. This allowed a dryer bass sound with no spill, and opportunities to affect the sounds as they went to tape.

The Byrds re-enactment proved that spill between microphones provided a characteristic sound when panned left, centre and right, enhancing the depth of field, and amplifying the room sound. The reverberation on the centre

channel of the vocal performance, along with the 12-string guitar in the centre, masks the sound of the room, and in turn, the tape distortion masks the remarkably long tail of the added reverberation, but the result is depth of field while the reverberation on the high frequencies creates a sound of large natural ambience. The artificial reverberation masks the natural reverberation, but panning makes the room re-appear as depth.

In London, the reverberation introduced to the vocal in the second verse appears as an artificial enhancement since it is introduced mid song on an otherwise dry mono soundscape. So it appears as a signifier or other voice rather than a natural ambience.

So although the instrument layout in each studio appears the same, the recording methods created a different soundscape by virtue of the control of room practice. At Columbia, engineers tended to employ live radio broadcast techniques to save time, in EMI, in order to affect the sounds later, they isolated sounds, either physically using gobos, or temporally by overdubbing later. Martin adapted this method in order to build up recordings from multiple performances when constrained by 4-track.

Microphone placement

Engineers used microphones as primary sources of sound capture and balance (see Video Example 27 – Microphone Choice), if the sound was harsh they tended to change the microphone rather than adjust the sound using equalisation. If the source was too loud, they would adjust the

microphone distance or add a gobo. The blend of instruments and the spill was an integral part of the sound of the era. Al Schmitt discusses using omnidirectional microphones as a matter of course, and the importance of microphone choice, using no equalisation, and riding the fader setting during performance rather than relying on a compressor. The cleanest path was preferred, since additional processing also introduced noise. The American engineers were trained at live radio broadcast and this informed their techniques and expertise.

Though the Byrds instruments were recorded on individual tracks, the spill from each instrument was picked up on the adjacent microphones so separate manipulation of instruments was not possible. The engineer's main challenge was to maintain recording levels above inherent tape and equipment noise level to create a high fidelity recording. One microphone per instrument was normal as more microphones meant more phase issues which resulted in a smaller sound. Phase was the primary reason to group the musicians close together, allowing better isolation of direct sounds while taking advantage of ambience. In The Beatles case, part of the sound design was to avoid this spill by close microphone placement and by scheduling the bass part on a separate track, as its frequency would affect all microphones. This allowed greater control of bass definition in later mixing. Although both recordings distorted soundscape masked the inherent noise, this did not allow the engineer to relax the standard of recording.

Recording, Tracking & Monitoring

Engineers balanced to tape during recording so the relative balance of every instrument, along with effects was already determined as the session was proceeding. Although this is evident when combining instruments onto one track as The Beatles backing track, this practice was also followed by the Columbia engineers even when recording to 8-track, since this not only applied their tacit skill of balancing live (hence the title balance engineer), but there was no separate monitor mix available on the desk. Individual track playback could be switched left, right, centre, or off, with no volume control. So they monitored with the tracks already switched to their final positions, and mixed this positioning to the 3-track to fix the final balance. This 3-track master would then go to the editing department so the chosen masters could be edited into a final reel for the cutting engineer to make master discs. The 3-track master allowed the creation of stereo and mono mixes from the same performance. At each stage, engineers could alter the relative balance of the master and add reverberation, limiting or fades. Columbia engineer Frank Laico concurs with the conveyor belt factory method and Melcher's stereo to mono tuning comment confirms monitoring as well. (DansoundSeattle, 2008)

At EMI, the need to bounce performances to free up tracks for later overdubs added further tape and valve distortion to the recordings. Any clarity was achieved by filtering the sounds to make room for other overdubs while monitoring from a single speaker, since the engineer was creating a mono recording. In addition, recording protocol usually placed the instrumental backing track on Track One, bass on Two, vocals on Three and harmonies

and overdubs on Four. Since Tracks One and Four could only be switched left, right or centre, so the design of later stereo mixes from the same source multi-track were constrained by the initial method of combining instruments onto single tracks, which resulted in the unusual stereo positioning of The Beatles records.

The clarity achieved in America is mostly due to the stereo panning. The American stereo expanse allows the harmonics to add air to the soundscape, the guitars seem more separate in tone as well as space, and the vocals sound richer.

The UK sound has an urgency that highlights the rhythmic interplay rather than the instrument interplay. It is difficult to pick out the instruments and attention focuses on a wall of sound rather than a backdrop of sound. The manipulation changes the acoustic sound and the mono mixing demands greater equalisation control to blend the sounds together as they fit into separate layers of the frequency range. The midrange masks the higher frequencies and the sound appears 'lo-fi', individual guitar tones are lost and the vocal stands out because of the ADT.

Tape recorders

The Ampex 300-3 3-track on half inch tape valve-mastering machine evoked a very recognisable 1960s sound. The 1980s Ampex ATR-102 stereo machine mix was too clear, revealing the reverberation tails and space between the voices. In comparison, the Ampex tape, valve and noise

distortion hid everything in the 'soup'. This was a crucial step in the recreation of the American soundscape,²²⁷ providing a distinctive, and absolutely vital character to the final record.

Yet although, the 3-track mix down is really what gave the recording 'the sound', it was not a deliberate attempt to manipulate the recording in the same way as Emerick had distorted the sounds in London.²²⁸ When the machine is used within the parameters of correct engineering practice to capture acoustic live recordings direct to the 3-track machine, it reproduces a clean sound, but distorts really quickly (in the same way as a valve guitar amplifier) when levels are high. Since most of the distortion was coming off the guitar amplifiers, via a lower fidelity 8-track machine, the recorded signals were affected by the build-up of tape and valve circuitry distortion, resulting in a midrange distortion fizz. The distortion was not deliberate, indeed it was the best fidelity that the engineers could achieve, but given the recordings were aimed at a teen market they appeared to accept this result.

The Ampex 8-track on one-inch machine allowed the Byrds to be recorded per track along with double ensemble vocals, and the affordance of multi-tracking outweighed its inferior fidelity.

²²⁷ One of the main reasons most of the Sony Legacy remasters were done from the 3-track mix down master, as opposed to new mixes being made from the available 8-track one inch multi-track session tapes (which only happened in a few instances where the mix down master was too worn out), was because mixing to the 3-track Ampex added a whole new layer of tape compression, generational loss, tape wobble/wow and flutter, and a layer of harmonic distortion to the mix.

²²⁸ The Ampex 300-3 3-track master is the same model machine used for Mercury 'Living Stereo' and Capitol 'Full Spectrum' stereo recordings; both often regarded as exemplary examples of high fidelity.

By comparison, although The Beatles seemed at a disadvantage with the EMI Studer 4-track one inch machine, its superior fidelity combined with the tacit skill of the engineers to 'drop in' on tracks with different performances and even combine different instruments on a single track, afforded the opportunity to 'bounce down' three times, allowing nine or more separate tracks before tape noise became a constraint, as evidenced during the Sgt Pepper sessions (Ryan and Kehew, 2006, p.450)

Working practice

Both sessions revealed that technical limitations played a large part in not only the sound but also the working practice. What was surprising was that although the Americans had superior equipment, the constraint of union practice negated any advantage and the tape machines were used as if recording the backing direct to stereo. Strict control over session length, demarcation of roles and strict 'to the book' practice precluded any opportunities of experimentation which stayed in the live room

Although EMI engineers were not unionised, they were constrained by a historical practice and gentleman's agreements, to protect techniques regarded as 'secrets'.²²⁹ Massey refers to the practice between EMI and Decca of not poaching each other's staff and this resulted in differences in working practice, even though the studios were less than a mile apart. (Massey, 2015, p.66)

²²⁹ "For instance, in Kingsway Hall the microphone connectors for Decca were wired one way, either 'male' or 'female', while EMI's were the opposite way round. So even though they both shared facilities there until the hall closed in 1984, they were entirely separate configurations and couldn't be used by the others.

Similarly, the unique specification of company-designed equipment lead to engineers developing specific techniques, that meant skills did not translate between the London studios.²³⁰

EMI engineers customised the equipment i.e. RS124 to their own specification which made the response unique to EMI, and because of their standard 200 ohm system, many valve line amps were used in circuit which also boosted the valve harmonic distortion of the recordings, when matching levels during reduction sessions.

Tape formulations in the 1960s, such as the 3M 111 and 140 series, distorted at high levels, increasing propensity for tape noise on playback, so level to tape was kept low compared to modern tape equivalents. Subsequently, any boosting of high frequencies was done pre-tape as 'turning up the treble' on playback or mix down would increase tape 'hiss'. Also, engineers tended to over emphasise the high frequencies on record as iron particle shed meant tape would gradually lose its top end sensitivity over multiple playbacks and sound dull. Often the master tape was saved and a slave reel was employed for overdubs. The London method of 'spinning in' overdubs to the master reel is demonstrated on Video Example 7- Re-enactment of "Rain' In London (22m50s), where the engineer adds the backward voice overdub from the 2-track to the multi-track.

²³⁰ EMI, Decca, Pye and Philips studios used equipment designed by their R&D department.

Compared to recording time, tape was relatively cheap so companies continued to use new tape rather than wind back and re-use old tape with abandoned takes, which resulted not only in the multiple failed takes being saved, but being available through various sources for research. The re-enactment also uncovered various differences in 'ways of doing things' such as winding or turning tape reels, which may account for Lennon's reverse tape anecdote and other serendipitous recording outcomes as detailed in Video Example 5 (14m00s).

The lost art of analogue recording

The 'lost art' of analogue recording is hidden behind the veil of industrial secrecy and forgotten ways of doing things that were implicit in the engineers day-to-day practice to 'get the best' out of the limited equipment. Machines were specifically set up and biased to respond to tape formulas that are no longer manufactured. Remaining machines have either been re-calibrated for new tape, or do not play back on new tape efficiently. Since old tape stock is scarce, differences could not be considered during re-enactment. However a comparison with an old tape on a 1960s valve Brenell recorder²³¹ and modern tape on a relatively new machine allowed consideration of playback characteristics revealing an emphasis on mid range enhanced by harmonic distortion. See Video Example 12 (13m0s).

Tape machines were not designed for rolling record, as they did not automatically switch from record head to replay head for monitoring. In

²³¹ The same model Lennon & McCartney used in their home studios

addition to this anomaly artists were also prevented to partially repair recordings as the machine often printed an audible click on the intro and outro of the piece (due to the ramping up of bias voltage). Various discovered tacit 'workarounds' included switching into forward instead of stop at the end of recording.²³² Nevertheless, engineers tended to record entire performances or at least long sections of overdubs to guarantee ensemble consistency, and the many takes are evidence of ensemble breakdown, unable to complete the long parts to standard.

Rocking the tape speed from forwards to back instead of stopping to avoid tape stretch was a normal method of transport control, as was hand spinning the take up reel to help the machine achieve optimum speed as the motor torque was often too weak to spin the tape reel up to speed from a standing start. It was found tape speed over the head on the Ampex 300-3 was variable depending on whether recording was at the beginning or end of the reel, which precluded any edits more than 10 minutes apart, as they could be noticeably different on speed and pitch when played back in their new positions on tape.

Recording to multi-tracks allowed engineers to alter the bias on individual tracks to enhance the bass response, at the cost of reducing treble response on bass tracks, and they chose what to record on adjacent and outside tracks of the tape to avoid cross talk from low frequencies. Engineers often recorded

²³² Another method was inserting a temporary section of leader tape at the 'record out' section.

additional performances during mixing or bounce down to avoid another generation of tape noise.

The recording to tape playback produced a recognisable analogue sound of tape saturation, depth and warmth, with the odd harmonic distortion peculiar to tape increasing the grittiness, detail and brightness of the guitars. However, recording to tape also revealed that engineers were constantly fighting the medium to retain clarity and a low noise floor. The recording altered the sound and never played back what the engineers heard pre tape, making the job difficult. The engineers seemed glad to 'say goodbye' and have limited nostalgia for tape as a day-to-day medium which required constant aligning, head cleaning, biasing, and maintenance of machinery.²³³

Experimental soundscapes

The Byrds blended influences of Indian raga, jazz improvisation and amplifier distortion into an arrangement, which created a soundscape suggesting a loss of time and direction. The 12-string solo represents a surrender of control over technical mastery in order to convey the freedom of approach to playing in an abstract way hence each take is different. However this was an instinctive process rather than a deliberate attempt to re-create a sonic impression of an LSD trip. The practitioners' personal involvement and knowledge of the counter-culture, adaptation of musical influences outside their normal sphere,

²³³ The research uncovered the importance of NAB and CCIR pre emphasis curves that increase certain frequencies to tape to avoid hiss on playback. Different standards in UK and US resulted in American recordings sent to UK play back bassy, and UK recordings to appear dull and thin on US machines. This also accounts for the 'brighter' British sound.

and use of LSD, allowed them to tap in to their own experiences that informed their playing rather than a collectively contrived arrangement.

The recording, although distorted in the live room, was recorded uncompressed to standard level. The arrangement was overlaid on top of a standard pop stereo soundscape, with the engineer using the compressor on the 12-string guitar to reign in the level and protect equipment rather than as a creative tool. Nevertheless it created McGuinn's signature 12-string sound, providing the sustained signal combined with amplifier distortion that afforded the style of performance that emulated a sitar.

The Beatles experimentation was much more an exploration of the opportunities that the equipment provided to alter the sound, incorporating a cultural zeitgeist that combined modernism and pop art, with free form and the avant-garde; they pushed to the limit what could be included on a pop record. Martin focused their enthusiasm into a coherent soundscape, resulting in a combination of ideas that built upon a serendipitous session of playful creativity after a long break. The band took ideas forward to other tracks and revisited older backing tracks i.e. "Tomorrow Never Knows", sharing the ideas between songs, which produced an overall theme to the final *Revolver* album, seemingly unintentional since weeks earlier, their plan was to record in America to take advantage of superior recording opportunities.²³⁴

²³⁴ Under the recommendation of Dylan, who was recording *Blonde on Blonde* at Columbia Nashville augmented with session players in early 1966, having abandoned his earlier October 1965 live band sessions at Columbia New York.

Instead, they embraced the change in engineer from an older Norman Smith, who had set ways of doing things, to Geoff Emerick who shared the same curiosity at age twenty, as they did. His stature, having engineered a UK number one hit record “Doo Wah Diddy” by Manfred Mann, fueled his confidence in coming up with ideas to impress the band, encouraged by Martin who was enjoying the same air of freedom, having moved from EMI staff producer to independent producer. The teams relationship with the band who seemingly kept coming up with creative ideas, good songs and an unbounded enthusiasm to explore the art of record production, allowed Martin to show off his previous skills in creating sonic collages to good effect. In all, the timing of the moment was more important than the technology and the new songs. The Beatles were bored with their live repertoire, and their only recording in 1966 so far had been overdubbing onto a live Shea Stadium performance, replicating and replacing mistakes for a possible film release. They were ready to move away from the constraint of the live arena.

The EMI recording was distorted not only on the amplifiers and built in fuzz, but by electronic manipulation of the compressor and ‘into the red’ level to the tape machine. The peculiar breathing sound of the cymbals, the squashed drum sounds and the overall energy of the backing track was made possible by the forward planning of recording the bass, captured with a loudspeaker to enhance the lower frequencies, on a separate track. This further affected the sound by allowing the clearer bass sound²³⁵ to be separately balanced and limited during recording and final mixing. The constraint of the mono playback

²³⁵ Contrast this to the Byrds ‘all in one go’ ensemble recording where the bass is also distorting, rattling the snares on the drums, but is inaudible once the guitars and vocals come in.

further affected the sound, as instruments were filtered into discrete frequency ranges to provide clarity, and Emerick's experimentation by overloading equipment beyond design parameters is key to the overall sound of the recording. As described on Video Example 10, the use of speed manipulation and ADT, this creative abuse of technology matched the demands of the musicians.

Creative abuse of equipment

The inventiveness of abusing equipment or applying unorthodox methods, such as detuning guitars or overlaying known chord shapes on unknown tunings, to placing microphones under snares instead of above, jumpers in bass drums, moving microphones closer to allow further manipulation, helped shape the timbres of the records in unusual ways. Although the re-enactment uncovered instances where McGuinn misremembered the technical details of achieving his 12-string sound, or McCartney contradicted Emerick's account of using a loudspeaker as microphone, misremembering instead a microphone and amplifier arrangement, it does not take away from McGuinn or Emerick's impulse to claim some propriety right over moments they were involved in that contributed to the unique character of the recordings. Musicians are focused on performance aspects rather than technical details and do not question every microphone placement or engineering judgment. What is demonstrated is how decision making in the moment often produces unquestioned ingenious solutions during the flow of creativity to allow the process to continue unhindered.

Though engineers and technicians may discover novel ways to distort sounds, it is important to note that, however innovative a technique, until the musician or producer considers it appropriate to employ on a particular song, it remains just an idea in waiting. Similarly, a musician may describe something he wants, or hear a sound and recognise its creative potential, like Lennon's experience of reverse tape playback, but its incorporation depends on the engineer's endeavors, or willingness to produce a solution.

The creation of the phasing technique exemplifies the various approaches to creatively employ technology to produce an experimental sound. Lennon's demand for a way to achieve the sound of double tracking vocals without laboriously singing twice, lead to EMI technicians devising a varispeed controller that allowed electro mechanical alteration of machine speed in real time to effect ADT. This could also achieve the sound of phasing, a novelty effect previously used on record.²³⁶ The method of creating ADT and phasing is demonstrated in Video Examples 10 and 11. The sound of ADT is prevalent on the *Revolver* album and the adaptation of the process to create phasing appears foregrounded on "Lucy In The Sky With Diamonds" on the subsequent 1967 *Sgt. Pepper* album. The engineers at Olympic²³⁷ discovered an alternative method to achieve the same effect with different equipment that did not display the same affordances. The difference between the EMI method and the Olympic method is illustrated in Video Example 11. As a hit

²³⁶ Toni Fisher "The Big Hurt" 1958, subsequently recorded by Del Shannon in 1966 featured the same effect which is running throughout the song.

²³⁷ Olympic engineer George Chkiantz devised the method and showed it to engineer Glyn Johns who demonstrated it to the Small Faces, first used on "Green Circles" on their first album and perfected on "Itchycoo Park".

single,²³⁸ “Itchycoo Park” established the sound of phasing as a psychedelic signifier.²³⁹

Differences between American and British recording culture

Recreating the recordings under the different studio conditions uncovered many unexpected mundane explanations demonstrating why the engineers at Columbia and EMI engaged with the technology at different levels and how this affected the sound. The process revealed not only forgotten techniques but also how the creation of the soundscapes still followed standard practice for that studio. It may be considered if other studios followed the same protocol?

In the Los Angeles area, studio-working practice was dominated by the relationship between session musicians employed for skill, speed, and economy at the four major corporate studios, Columbia, RCA, Capitol and Decca. The primary medium for recording was the Ampex 3-track recorder, prevalent from the late 1950s to mid 1960s, which captured a stereo accompaniment and centre vocal to a unique 3-track stereo. Engineers balanced to tape so playback at unity and zero equalisation replayed the mix. This tape was then used to create stereo and mono records. The rise of non-union independent studios such as United Western, during the 1960s served producers such as Spector, who used the 3-track to record mono ensemble performances with vocal and Wilson, signed to Capitol yet allowed to work outside their union studio, worked in a similar fashion, preferring mono

²³⁸ The single reached number three in UK chart in August 1967

²³⁹ Since The Beatles “Lucy In The Sky With Diamonds” was an album track and banned by the BBC for drug references, it remained unheard by the general public.

soundscapes. Experimentation focused on musical arrangements creating unique timbres by employing interesting combinations of session players, while manipulation was restricted to unreal levels of reverberation. Wilson used session players, at first to augment, later to replace his own band in creating the backing tracks for increasingly complex vocal recordings. Other producers such as Lou Adler with the Mamas & Papas created similar soundscapes in stereo. The stereo was a product of capturing room sound and doubling it with chamber reverb to underscore the largesse of the stereo experience. The habitus of the session players to arrange their performances to support rather than dominate the soundscape afforded clarity, and the skill of balancing themselves in the room and recording ensemble allowed producers to arrange complex orchestral timbral soundscapes. In addition, the session players developed a Los Angeles 'regional' sound, in contrast to Nashville, Detroit, Memphis etc. where similar groupings of musicians connected to the studio system performed on recordings rather than groups.

The emergence of popular music ensembles playing on their own recordings followed the British model, which resulted in the post 'British Invasion' explosion of regional 'garage bands' in America. This style of arranging provided a denser more primitive and emotional backing as individual players concentrated on their own parts, and arrangements were improvised until a compromise was established. These arrangements were by definition more characterful and represented the 'group' sound.

In Los Angeles, Columbia's unique 8-track facility,²⁴⁰ a product of a foray into dynamic stereo, a '4-track stereo' method of recording orchestras that failed to differentiate itself enough from existing high fidelity offerings to persuade a discerning public, meant the studio was left with an underutilised 8-track machine. Melcher incorporated the machine as a modern approach, which also provided a way to double track The Byrds vocals, and Wilson used the same machine to overdub up to seven tracks of ensemble vocals with The Beach Boys before mixing them to a single master and returning to independent studios to complete mixing. The strict timetabled recording slots hindered recording beyond pre arranged recording and contributed to the delays of his more complex recordings.

Since the American corporate studios separated the roles of balance engineer and tape operator, not only by demarcation, but also into discrete career paths, so the interaction and interest in each other's roles beyond carrying out specific duties was minimal. So creative opportunities like going into the red, creative use of compression, 'drop-ins' and tape manipulation were outside the remit of the engineer's role. Whereas in London, apprentices' invariably found the time and opportunity to explore the craft by surreptitiously messing with equipment, there were no similar opportunities in the American corporate studios. So any experimentation came from the engineers at independent studios who were unencumbered by strict procedures and able to answer the demand of producers and musicians. However the dominance of the session musician and economic forces dissuaded any fooling around. The economic

²⁴⁰ The hybrid 8-track recorder was constructed by Columbia technicians from 4 Ampex 300 stereo machines with a special 8-track head block and sel sync.

model in America favoured the fast creation of successful records and producers waited for new sounds to be proven by success before incorporating them in to practice, and the 3-track still remained the key format in 1966.²⁴¹

There was no equivalent common format in the London studios that dominated the UK recording market. Whereas EMI designed their own equipment, they had acquired 4-track Studer machines primarily for classical use in 1960, however Martin had demanded their use in 1964 for pop, and The Beatles used 4-track recorders starting from “I Want To Hold Your Hand” up to mid 1968.²⁴² And while Martin was able to employ 4-track recording for some of his priority artists, other EMI producer’s still continued to use 2-track in Abbey Road. Other London studios had 4-track half inch, 3-track and 2-track recorders.²⁴³ Nevertheless, British pop music was primarily a mono medium and producers preferred the speed and fidelity of recording to manipulation. So, recordings such as The Who, ‘My Generation’ in 1966 were recorded to a 3-track with the feedback dubbed during the mixing process.²⁴⁴ British independent producers who were also monetarily responsible for creating the recording for license, would restrict creative experimentation and

²⁴¹ The emergence in 1965 of 4-track machines into a working practice that had so long been based on recording AFM union musicians without overdubs to 3-track found corporate engineers often wondering what they would use the spare track for, while independent studios adapted faster.

²⁴² EMI acquired 3M 8-track machines in 1968, yet the majority of 1968 *The Beatles White Album* was still recorded on 4-track while the band waited for the 8-track machines to be modified to meet EMI technical specifications.

²⁴³ Decca, Olympic, Advision, Lansdowne used half inch 4-track, while IBC and Pye had half inch 3-track, most others used 2-track or straight to mono. (Palao, 2016)

²⁴⁴ Alec Palao, Consultant for Ace Records, who has extensive experience in handling original master tapes explained that producer Shel Talmy often recorded the backing to one track and overdubbed performances, including the feedback as the master was mixed; hence the master tapes are often incomplete. (Palao, 2016)

often employ session players to speed the session up, avoiding pushing the recording into overproduction, and would tolerate bad notes and technical imperfections as long as it felt right.

The British groups were influenced by American recordings generally, regardless of regional production, so created a sound based on an amalgam of influences, Blues, Rhythm 'n' Blues, Soul, Country, Brill Building pop, as exemplified by the early Beatles repertoire. Since British labels were looking inward to a smaller market, the sound was generally based on the performance of amateur musicians enhanced by a session drummer if needed. Using fewer musicians required overdubs for layering of vocals and solos, so the fidelity tended to be lower than the ensemble direct to stereo American sound. In Britain, pop was considered a 'poor relation' to classical music, in contrast to American recordings where jazz, folk and pop shared the same fidelity approach. Following the explosion in international sales post 'British Invasion', groups found themselves able to demand more autonomy in the studio, and the habitus of group performance extended into group experimentation, unable to be imitated in America due to the practice of session players still recording direct to stereo, so any experimentation stayed in the musical arrangement, and the studios were slow to adapt to piecemeal recording, needed to manipulate aspects of the soundscape, even though they had the advanced capabilities to accommodate it, due to the culture of using skilled session players and union domination of working practice in the large studios.

What was learned?

Re-enactment Performance Revelations

- Tuning 'by ear' adds richness.
- Drum skins affect performance -lighter touch produces more tone.
- Flat wound guitar strings are tenser, more tone, don't distort as much – affect playing style.
- Amplifier distortion harshness is tamed by tape compression.
- Spatial configuration helps ensemble performance – all in one room.
- Superficiality of digital recording, tuning and editing - replaced with urgency of ensemble recording.

- Constraint of click and headphones gone – now more freedom and autonomy over speed, performance and provides a more passionate performance.
- One take, no repairs focuses on feel rather than accuracy.
- Ensemble performance crystallises arrangement in the moment, can't change anything.
- Overdubs based on previously recorded timbres and arrangement.
- Commitment to outcomes produces faster recording.
- Speed of destructive decision making develops into a 'trust your instinct' approach to recording, and a tacit knowing when something is right.
- Focus on how parts add to arrangement rather than adding parts to decide about later.

The Byrds recording

- Ambience on American recording crucial to overall sound.
- Level of reverberation astounding – the ‘sunshine pop’ sound.
- Reverberation masked by tape noise and distortion.
- Revelation that 8-track was not considered further than a multi-track live recorder that captured all the spill like a stereo recording – just allowed final panning.
- Left, centre, right, 3-track protocol affected panning.
- The band sound was recorded rather than enhanced by louder bass etc.
- Vocals and solo on center track mirrored 3-track ethos.
- The vocal balance by positioning created the signature sound.
- The double tracking of vocals added to the effect and richness.
- The studio equipment was under utilised in America.

The Beatles recording

- Level of experimentation shared between group and production team.
- Detuning, open tuning, new guitars, new amplifiers, fuzz, all alter sound before recording starts.
- Drier sound, close microphone placement, tape speed, compression as effect, ADT, loudspeaker as microphone, backwards tape, all add to manipulated sound.
- Mono protocol affects choice of filtering to provide clarity.

Different approaches to creativity

- The Byrds were primarily a recording band who desired the authenticity of live performance.
- The Beatles were leaving behind the constraint of live performance to explore the creative opportunities in the studio.
- The Byrds informed by desire to distance themselves from commercialisation of folk rock experimented with the complexity of raga & jazz.
- The Beatles informed by cultural impact of London on McCartney experimented with sound manipulation.
- McGuinn's arrangements a product of leadership, arranger fees and dominance – co-producer.
- McCartney's arrangements translated by Martin.
- The Byrds - union and new producer constrained any manipulation past protecting desk inputs
- The Beatles – producer's new contract and trust in young engineer enhanced experimentation
- The Byrds competitiveness affected writing credits and creative input- Clark says he involved the others to ensure "Eight Miles High" was an A-side.
- The Beatles more open to experiment and swop instruments – fixed publishing agreements settled disputes of authorship encouraging contributions.

General Findings

- The experimentation was a product of local customs and constraints, which guided the ideas of musicians into a soundscape that was commercial.
- The comparison of the two recordings provides a significant contribution into understanding the differences in soundscape creation of the time.
- Invisible inputs such as ambience, tuning, guitar strings and drum skins, tape machines under utilised, medium formats etc. also affected the sound.
- The use of technology was affected greatly by the union constraint of engineers and session players who crippled the LA scene and forced it into a live arena.
- The London recording focused the importance of the freedom to manipulate sounds and the early commitment to do so was crucial to the sound.
- The freedom granted to The Beatles and Martin coincided with the 'great race' and allowed them to take part, whereas other bands were constrained by authority, bad contracts and economic concerns.
- Both songs created sounds that were re-used by other bands as psychedelic signifiers as they attached themselves to the genre.

The difference in staging techniques using Actor Network Theory

The research provided scripts for the two re-enactment sessions, which allowed the different creative paths to be followed. The successful outcomes, evidenced by the close similarity of the recorded soundscapes to the originals, provided confidence that all the important steps were identified, but also opened further questions. Why did they choose to do certain things at certain times and why did they not take advantage of obvious technological opportunities?

The initial dynamic was the same in both networks, to create the song the band had to work in the recording studio and rely on the expertise of the engineers. Similarly, the studio had to produce a professional recording for the record label to release. Accordingly, they both created a temporary network of alliances. There were also obstacles to overcome. In each case, the recording had already been chosen as next single release that was following a previous number one record, so there were high expectations and the label expected another hit record. The bands had established successful sounds, yet wanted to create an experimental soundscape that had no precedent. The success of the recordings depended on the studios being able to create the sounds the musicians were demanding, while producing professional recordings the labels could release as singles. Therefore alliances were formed between the parties to satisfy all the demands. Zagorski-Thomas (2014, p.177) previously referred to this as a network of collaborative creativity.

Applying Latour's (2007, p.71) notion of 'did it make a difference' allowed

consideration of other roles inside the studio. It is important to understand on what terms actors are enrolled since this affects how further negotiations are determined. The two case study examples illustrated how the application of ANT informed the research by analysing the various actors in the studio from different perspectives. Consequently the definition of recording was no longer a natural state of performance being captured by electronic instruments and technology, but a network designed by the various contractual descriptions, constraints and negotiations. Though the musicians may want to experiment in technology, that intention does not extend to being able to experiment in the contractual arrangements that hold them into place, so the room to maneuver is restricted by arbitrary rules and regulations. They cannot be changed in the process because that sets a chain reaction of precedent, so the change has to come from somewhere else. This awareness focused investigations on how the musicians managed to work within the constraints, and still create something experimental that was accepted by the larger network.

The problematisation of The Byrds resolve to create an experimental soundscape set the individual musicians and instruments into new roles based on the interessement of blending their existing sound with the new musical schema of raga, improvisation and distortion. Although Columbia personel and technology were also enrolled, the producer and engineer were reluctant to adjust their schema to similarly explore new ways of working so the experimentation was constrained to altering musical performances and timbre in the live room. Indeed, once the backing track was completed, The

Byrds overlaid their signature style vocals on top following the previous blend of original folk schema and recording schema.

Applying the same approach to The Beatles move to incorporate experimental methods into the existing schema of recording, reveals how they were able to enrol the producer, engineer and label into the translation due to a fortuitous chain of events that lead to Martin's translation to independent producer resulting in a change of engineer, creating a new structure of roles within a new network, while contractual negotiations provided space to experiment unhindered by EMI. Lennon and McCartney adjusted their existing songwriting schema to completing song arrangements in the studio allowing them to enrol the technology in interesting ways that better suited their new approach, with the support of the engineering staff who became key agents in the creative process.

In both cases, Callon concurs that institutional or organisational configurations or routines cannot fully explain why procedures occur. Regardless of category of actor, human, contractual or technological, each is equally important in the balance of outcome. Though the Columbia studio was technically advanced, the technology was underutilised, the union ethos dominated the working practice in the facility shared between record company, radio and TV, and the A&R regime had not changed since the 1950's. EMI studio's more primitive equipment played a leading role in the creation of the soundscape, while Martin's newly independent producer status afforded a new era of innovation, not only in technique, but relationships as he left behind his corporate A&R responsibilities. The Beatles contractual bargaining also played a secondary

strategic role in establishing collective creative autonomy.

Although the ambitions of the bands appeared the same, the way they demanded autonomy was different, and the authenticity of ensemble performance was more a product of cultural expectation whereas manipulation owed its origins to a different type of improvisation. The influence of the relationships only becomes apparent after following the creative process, which allowed unknowns and uncertainties to become steps in the recording and the circumstances to propose their own solutions. In much the same way 'on the fly' decisions would have been made in the original sessions, so the continuity of the process drove the research towards exploring all possible outcomes, achieve a consensus and move to the next stage. In this way all the members of the team and expertise were involved.

A scientific knowledge is a local knowledge (Polanyi 1966; Latour & Woolgar, 1979). American recording knowledge was local to that continent and adapted to serve the record and media industry there. The British local variant was similar but served a different technology and distribution network. Columbia was a subset of the CBS corporate media industry and depended on a commercial broadcast market. EMI recordings were created in a network dominated by BBC radio and television, governed by Musician's Union needle time restrictions.²⁴⁵ The American engineering profession was protected by union agreement, the British profession by protocol. American popular music was designed and created mainly by record companies employing session

²⁴⁵ The work of Cloonan and Williamson considers the various attempts by the Musicians Union to protect its members interests, and its affect on the development of the UK recording and broadcast industries (Cloonan and Williamson, 2015)

players; British popular music was focused on the domestic market and could take more advantage of groups.

So although the matter of fact was the same, the recording of music in a studio, the locality was foregrounded because of the need to comply with the local customs and regulations affecting the recording studio. Columbia required specific timekeeping, the union room demarcation of roles, the restriction of manipulation, the local knowledge of how they employ the equipment to make the recording, i.e. they used an 8-track as a staging post for stereo recordings, whereas in London, Martin at EMI was using 4-track all the time to create 8-track assemblage methods. Although it would appear disingenuous for Columbia engineers not to take advantage of the 8-track like a double 4-track, as if ignoring obvious advantages to cripple performance advantages, in fact they were following local law. So now if we understand the American engineers felt threatened by the technology, or the UK musicians union were protecting their orchestral members jobs by restricting all performance in studios regardless of classical or pop, then we can come to an understanding why some obvious opportunities were not considered.

It is impossible to create a common practice when there are so many regional variables that relate to local custom and tradition. Even though Capitol Records in Los Angeles was a wholly owned subsidiary of EMI London, it also had to comply to American working practices, (much like hotels in different cities adapt to the local regulations and external rules, and the internal knowledge of the locally employed staff). The more you consider the influence

of different nodes and take them into account, the more you understand the possibility of discovering the pathways created by compromise solutions, or the application of ingenious strategies that allowed the recordings to continue forward as a collaboration of the assembled network. By reading the creative process forwards, errors and uncertainties are treated as endeavors rather than mistakes and bad judgment, since these points in the process reveal new pathways and choices whose impact can only be determined at the end of the project. To read the process backwards assumes these ideas were always in the minds of the creators whereas the flow of creativity relies on improvisation as opportunities unfold. By simulating the different situations, we can better understand how the musicians adapted their creative practice to work within the confines of the existing industry.

At the end of the project, the different opinions, motivations, technologies and abilities have been translated into one unifying outcome, the completed recording. At this point, the session has been translated into an artefact that is accepted or rejected by the record company and then accepted or ignored by the media and public. Nevertheless, the later outcome signals a change in equilibrium rather than a failure of previous passage points. The project transverses the various steps towards completion and it is the complex steps in the studio that are the subject of this research and how the actors were mobilised to create the eventual outcome.

Ultimately, The Beatles and The Byrds autonomy was afforded not by their creative prowess but by the statistical measurement of record sales, which provided them with number one records. Chart positions are a translation of

record sales into a score, that affects future creative opportunities, autonomy and trust. It is this chart that affords appearances on TV, radio play, jukebox, mainstream media exposure and the records being stocked in shops. Even though other experimental records may have existed, outside the chart they had minimal significance in disseminating ideas to popular culture that created the 'Summer of Love'. Indeed, the preceding British Invasion is similarly defined in ANT, not by genre, artist, label, attributes of fidelity, or creative merit, but as the translation to hit records by British acts in the American chart,²⁴⁶ and was so important that in 1966 The Byrds were still being styled as 'America's answer to The Beatles' with tacit interconnections to teen pop, rather than defined by folk, authenticity and the more obvious timbral characteristics of the 12-string guitar and harmonies.²⁴⁷

Final Conclusion

The primary aim of this thesis was to discover how recording studios used technology to evoke the psychedelic experience on recordings in the mid 1960s. My initial investigation revealed a marked contrast between how the two main recording centres of London and Los Angeles approached the musicians' unorthodox demands. British studios tended to foreground experimentalism by novel use of technology, while American studios tended towards producing performance based experimental soundscapes. This was a consequence of differences in staging techniques between the two countries

²⁴⁶ In 1965, 48% of Number One singles in the Billboard charts were by British artists. (Perone, 2009, p.161)

²⁴⁷ The Byrds failure to fulfill this role led the record label Columbia to prioritise another band, Paul Revere and The Raiders as their answer to The Beatles (with original Byrds producer Melcher), and 'Eight Miles High' was the last charting Byrds single release.

that impacted on working practices, compounded by collective agreements or protocol. History focuses on the musicians or recordings that utilised the techniques rather than the engineers that developed the practice. This new knowledge was rarely documented or the results credited because the culture and structure of large corporations often created a constraint to absorbing innovation into established working practices. So detail of how the technology was used and information on day-to-day practices remained hidden because mundane historical workarounds had either been forgotten, or confused with subsequent methods using different equipment that had superseded original procedures. These discoveries lead to the realisation that the tacit knowledge of forgotten techniques laid the foundation of the research.

In order to undertake the investigation I employed practice based research, first by staging short videos to recover detail of the historic interaction with the technology, and discover the tacit knowledge, then by re-enactment of two case studies, one in America and one in Britain to capture the flow of creativity that allowed these techniques to occur. Rather than take two songs that typified the 1967 'Summer of Love', I reached back to 1966 and two recordings that had acted as important catalysts, both first using and establishing many of the experimental sounds that were adopted as psychedelic signifiers on later recordings. The simulations of the techniques created original data and I was able to solve many of the contradicting accounts by replicating the methods and acting them out rather than accepting 'expert opinion' as an explanation.

By taking the argument further and applying the same methodology to the case studies, approaching the investigation as a type of experimental archeology, the research provided new insights into important yet overlooked evidence such as 3-track mixing and monitoring. Re-enactment methodology produces significant results, especially when simulating the closed environment of the recording studio, where privileged perspectives of original participants are often biased towards individual recollections of contribution, and it can be used as a model to apply similar investigative approaches in further research to uncover other stages in the development of recording practice and recover lost tacit knowledge.

The recreation of various techniques using historic equipment revealed not only the simplicity and ingenuity of the methods, but the importance of the tacit interaction to control the effects which allowed the practitioner to 'play' the machinery while responding to the soundscape and this in turn influenced the degree of manipulation creating a 'musical' performance that was different every time, often by employing a simple mechanical controller such as a speed dial or volume fader. The techniques were usually the engineers' own discoveries and tacit applications of existing equipment beyond makers' specifications, applying creative abuse, and this knowledge has not been passed on or easily understood by textual description, since much of the technique was improvisation in the moment, often as an ingenious response to an unusual request.

It follows that the best way to discover the various techniques was by re-enacting by trial and error. This is the same way the engineers worked, trying to emulate sounds they heard on each other's records that remained 'trade secrets'. An example of this is phasing, discovered by accident in 1958 at Goldstar Studios in Hollywood, rediscovered in 1967 using a different method at EMI studios in London, and copied weeks later using yet another process at Olympic in London. The first use was novelty and the second was a deliberate manipulation of the sound to place the song in an unreal environment to match the abstract lyrics, while the third was a combination of the two approaches to create a novel pop single that established the effect as a psychedelic signifier. The video examples illustrate how application of primitive technology using methods such as overloading electrical circuits to induce distortion, creative use of tape machines such as speed alteration, direction and using multiple machines, created the sounds. These processes were combined with seemingly mundane methods such as moving microphones closer to the sound source and recording performances piecemeal, to isolate instruments and separate them on individual tracks for subsequent manipulation.

The investigation relied on the re-enactment of two case studies in order to explain how these processes fitted into normal working practice and how the ideas were communicated and achieved. And here is where the differences between British and American approaches started to emerge, since the established working practice in American corporate studios were constrained by collective agreements involving engineers unions and musicians unions,

which created a barrier to innovation in the studios for artists wishing to experiment outside the normal boundaries of acceptable practice. This revealed two very different approaches to recording, not only technological differences but also a cultural divide.

The American studios created stereo soundscapes, using spill to enhance depth of field and reverberation to amplify the illusion of space, while advanced technology and professional practice ensured a high fidelity recording, the accepted use of session players in pop music (or accomplished musicians in folk & jazz), ensured arrangements and performers created professional sounding recordings. While pop groups were allowed to play on their own recordings, as long as they were creating hit records, it was more economical to use session players and the group to concentrate on playing the lucrative live circuit. The Byrds challenged this model, but their experimentalism and unprofessionalism lost the support of the label. Nevertheless, they set the blueprint for others to follow.

The British studios created mono records. Still years behind the technological advances of America, working methods were based around creating records for a domestic market. But the 'British Invasion' changed all that and the record labels' unexpected wealth from the global success of the bands, allowed them to demand more creative autonomy in the studios. The Beatles determination to explore the creative possibilities of manipulation coupled with the awareness of a counter-cultural revolution, coincided with a change in production personnel, yet in the familiar setting of EMI, that accepted artistic

eccentricity, was the turning point. The technology hadn't changed, but the way it was employed had.

Experimentalism in psychedelic pop recordings in America tended to involve novel combinations of instruments, and any timbral manipulation was confined to what the musicians devised in the live room. The limited use of compression and equalisation on the recording was a limitation by choice, as engineers concentrated on microphone selection, placement and live balancing to deliver a high fidelity recording. This sound is exemplified by the six million selling "San Francisco (Be Sure To Wear Some Flowers In Your Hair)" by Scott McKenzie.

In Britain, where technology was inferior, the fast take up of manipulated sounds reflected a love of novelty, represented by "Itchycoo Park" by The Small Faces, and engineers were freer to participate in the search for innovative techniques, quickly accepting the eccentric demands of a new generation of music makers, so the equipment was used in a deliberate abused way to add colour rather than enhance the quality of the recorded experience. Thus the study adds to the available literature by contextualising the methods within the historic working practices, shifting the debate from a technological argument to an investigation of assembled team and flow of creativity to identify the gaps in knowledge such as what allowed one group to use the technology in innovative ways and the other group not to?

Whereas Spector in America and Meek in Britain, who preceded the psychedelic era, had already applied creative approaches to construct novel soundscapes, what made these new records significant was not novelty but how the techniques and effects were drawn into a particular subculture and became signifiers of the genre, adopted by the musicians as matching the counter-cultural ethos of experimentalism in clothes, politics and lifestyle infused with LSD. Further, the records were pop records disseminated to the general public and caught the imagination of an adolescent audience, too young to go out and share in the cultural turmoil, but keen to embrace the sounds, hidden meanings and exotic soundscapes conjuring up a mysterious world of imagination.

Although re-enactment and practice based research techniques are not new, I discovered that they add a vital layer of investigation to research. Faced with an incomplete history of contradictions, lost memory, misinterpretation, with practitioners 'sticking to the story', and original studios and equipment gone, the re-enactment helped to recapture forgotten tacit processes, especially relevant when investigating experimental techniques devised by individuals who preferred to keep their methods secret. **Thus** addressing the inherent weakness of relying on anecdotal based descriptions or archived histories of recording practice that ignore common operations and tacit knowledge. Whilst it was impossible to re-create every aspect of the closed environment of a 1960s recording studio, the process captured similar ways of working. In particular, the engineers' familiarity with their own equipment exposed how

often sub-conscious routine procedures become part of the overall flow of a collective course of actions.

Undoubtedly, when re-enacting a recording, authentic replication of the soundscape tends to be foregrounded by the participants, and the outcome is measured by how close it matches to the original, since it is following a creative process that has already produced the sounds.²⁴⁸ But by piecing together the known steps in the process, the unknown steps started to emerge, and decisions had to be made, a different set to the original since they didn't know the outcome, especially in The Beatles case, but in the same way as the filming of the session is soon forgotten by the participants, the individual objectives also adjust as they become team members and start to behave in a realistic way. This allowed the interrogation of 'behind the scenes' activities such as anticipation, unspoken communication, general interaction, spatial positioning, the tension and relief of something not working and then finding a solution, and the way banter and socialisation conjured up reminiscences of related experiences and relevant insights that enriched the project.

As the main participant in both simulations, what was surprising was how different the cultural divide between British and American studios was, not just historically, but even during the re-enactment. I was made aware just how much the cultural history informs processes, expectations and learned ways

²⁴⁸ Obviously the simulation, especially in America, did not impose the strict union coffee break ethos (though the tea in London was a constant partner in the process).

of doing things. Thus it wasn't difficult to make the Nashville session sound American, and the London session to evoke an authentic British sound. So the ideas of simulating the sessions in both countries to allow comparison was an important factor and decision, rather than attempting to simulate both approaches in a common studio, which in hindsight would have been as fruitless as trying to re-create the soundscapes by any means possible.

Therefore the research was able to combine theory and practice to develop an understanding of what an engineer does by exploring tacit knowledge (Polanyi, 1966)), using the concept of antiprogram to frame what he can and cannot do (Akrich and Latour, 1992), using the mechanism of translation to identify relationships in the context of a network of practice (Law and Callon, 1986) and how this influenced the flow of a recording session (Ingold, 2003). Hence the answer to how did recording studios use technology to invoke the psychedelic experience rests not only on tacit interaction but with the social network authorising or permitting types of experimentation, while the difference in staging techniques was made obvious once the experimentation was stripped away revealing the day-to-day flow of working practice employed in the studio.

Traditional musicological driven analysis such as Everett *et al.* remains uninformed because they are focusing on the musician to explain the creativity and not the team. For instance Lennon's 'chanting monks' request represented by a voice through a Leslie cabinet is not a scripted outcome but one of a thousand interpretations dependent on the equipment being in the

room at the time, the engineer's ingenuity and a willingness to oblige. So regardless of The Beatles intentions and autonomy in London, in America their requests could not have been accommodated in the same way. The Byrds in London would have recorded a self-produced demo, lacking the fidelity of the American soundscape, and not releasable due to contractual constraints.

The results allowed further interrogation of sources, with contextual knowledge. The sharing of the results, especially "Eight Miles High", opened a vital discourse with original practitioners, (Roger McGuinn (2014) complimented the outcome, and asked how we got that sound). Triangulation of output with resources provided assurance of techniques.

One overriding concern was how to present the findings, and integrate the videos with the text to provide a seamless flow of discourse and revelations. I decided to collate initial research into a documentary style overview which, together with the re-enactment videos and reflection, provide a continual flow that matches the flow of the creative process, and provides a more coherent experience, while the short videos of technique supply supporting evidence and reveal important tacit aspects of processes, otherwise unavailable.

Actor Network Theory provided a way to compare these two case studies as an analytical model that would reveal the differences in use of technology without the impact of different social forces clouding the results. Then I could consider how the different relationships to what appears the same in each

recording affected the outcome. This moved the investigation away from what the pieces of equipment did, to what people did with the equipment, why they did or did not use certain pieces, and what other external forces were at play influencing the process, allowing an understanding of why the recording studio is a complex network of interactions rather than just a place full of equipment a band goes to and 'lay down tracks and make a record'.

Re-enactment and practice-based techniques are becoming accepted as a research methodology, supporting a move to investigating and archiving historical practices in new ways, such as oral histories and documentaries. I found the combination of practice based research the best method to answer the thesis question and provide compelling evidence that reveals the background knowledge and also points to the importance of the context of environmental and cultural constraints.

Closing Thoughts

One major characteristic that emerges from the study is how the era was built on precedence and was replacing an existing model that had used the same equipment and methods since the mid 1950s. Yet these new records were still being made using the old equipment, but in new ways, so there was always an atmosphere of creating the future, and many of the recordings under consideration exemplify that experimentalism in the soundscape. Because of this lack of fixed model, and the rapidly changing cultural influences, demands and interpretations, existing texts can only touch on various aspects of the creative process in the studio at that time, associating it with particular artists,

genres or cultural movements such as the Beatles, psychedelia and the 'Summer of Love' rather than presenting an epistemology of the process, thus ignoring the input of collaborative ways of working and embodied nature of expertise within the assembled team. This is compounded by a culture of the time where the studio techniques were either regarded as tacit knowledge, or kept secret as the new wave of engineers who became independent producers in their own right valued their reputation based on the creation of interesting and innovative soundscapes they had previously been associated with. So revealing their techniques as opposed to today's abundant culture of reveal was simply not done, but as the working practice of the 4-track studio was replaced by ever more sophisticated track count and outboard equipment, so the need to replicate the primitive methodology faded, and so did the tacit knowledge and the memory of their application. Fifty years later, interest in these techniques has grown as they are replicated in digital applications, and as older audiences are invited to share in the nostalgia of the era. However, memories have faded and the original equipment is scarce. Worse, the environments that created the recordings have disappeared, documents are lost and the authentic recollection of methodology is confused amongst an internet of various amateur explanations on how it may have been alongside inexpert opinion, hiding forgotten truths behind a veil of reinterpretations of the past which venerates a few key practitioners, and even glorifies key pieces of the original equipment, rather than the tacit input of the original working practice. So, the real story that lay with the disenfranchised support staff remains untold.

The embracing of counter-cultural ideas and experimentation was seen as a step that would continue. However, once the commercial potential was recognised, other acts adopted the signifiers and adapted their musical stylings to join in on the success and the genre quickly became passé. As third party manipulation by invisible collaborators on recordings became widespread, so suspicion over the use of mediation and session players helped to promote a new measure of musicianship, artistry and authenticity based on virtuosity and personal interpretation. In this way the thesis touched upon the ethics of performance. Did the drummer play or have his part overdubbed? Where do we accept the role of session musicians in the recording practice in America and Britain? Do the performers playing in ensemble suggest a greater virtuosity or creative impetus than overdubbing parts and replacing mistakes?²⁴⁹ It follows that the recollections of original practitioners focus on the anecdotal and mythology of the era, keeping to the script. Both Chris Hillman and Roger McGuinn of The Byrds are satisfied to 'let the past be', and remain unforthcoming rather than responding with candor when questioned about session men playing on various recordings. Perhaps Chapman's comments in the introduction invoke Lennon's "nothing is real"²⁵⁰ when he argues that "It's hard to judge where artifice ends and authenticity begins when you are dealing with a drug that weaves hallucinatory magic and casts illusory spells. (Chapman, 2015b)

²⁴⁹ The Monkees went to great pains to try and convince an invited audience they played on their records even though they were miming to a hidden group in a locked session in an adjacent room. (Blaine *et al.*, 2010)

²⁵⁰ "Let me take you down, 'cause I'm going to Strawberry Fields, nothing is real, and nothing to get hung about, Strawberry Fields Forever" (Lennon & McCartney 1967)

Today's version of the future often appears as a re-imagining of the past, adhering to a postmodern methodology referencing previous styles and techniques and offering them up in a new ways, and this in turn contributes to the shared memory of the past as texts, research, reminiscences and reinterpretations vie with a confused amalgam of current, historic and re-mastered recordings, all competing for attention. Hopefully, by sharing the experience of re-enactment, my research not only adds knowledge to historical practice, but questions our understanding of cultural, social, and material preconceptions of the era and demonstrates how interaction not only with technology but also by re-creating the working team provides a vehicle where specific questions can be answered by sharing in the experience, and expands the scope of research questions that can be posed.

Bibliography

Abbott, K. (2001). *The 'Beach Boys: The Greatest Album of the Twentieth Century: Pet Sounds*. London: Helter Skelter Publishing.

Akrich, M. and Latour, B. (1992). *Akrich & Latour (1992) - A Summary of a Convenient Vocabulary for the Semiotics of Human and Nonhuman Assemblies - Notes - Garnet Hertz*. [Online]. Available at: <http://www.conceptlab.com/notes/akrich-latour-1992-convenient-vocabulary.html> [Accessed: 28 October 2015].

Aldridge, A. (2009). *The Man with Kaleidoscope Eyes: The Art of Alan Aldridge*. London: Thames & Hudson.

Ampex. (1959). *Technical Notes on Multi-Channel Recording*. [Online]. Available at: http://www.ilkk.org/~ppk/Manuals/Ampex_Misc/Ampex-Tech_Notes_on_Multi-Channel_Recording.pdf.

Ampex. (1960). *Ampex Basic Concepts of Magnetic Tape Recording*. [Online]. Available at: <http://reel2reeltexas.com/AmpexBasicConceptsTapeRecording.pdf>.

Ashby, A. (2010). *Absolute Music, Mechanical Reproduction*. Berkeley: University of California Press.

Babiuk, A. (2002). *'Beatles' Gear: All the Fab Four's Instruments from Stage to Studio*. San Francisco, Calif: Backbeat Books.

Bacon, T. (2010). *Rickenbacker Electric 12 String: The Story of the Guitars, the Music, and the Great Players*. Milwaukee, WI: Backbeat Books.

Badman, K. (1980). *The Beach Boys*. San Francisco, Calif: Backbeat Books.

Bendall, H. (2014). *Conversation with Author*, 11 April

Bennett, S. (2012). *Journal on the Art of Record Production » Endless Analogue: Situating Vintage Technologies in the Contemporary Recording & Production Workplace*. [Online]. Available at: <http://arpjournal.com/endless-analogue-situating-vintage-technologies-in-the-contemporary-recording-production-workplace/> [Accessed: 13 January 2017].

Bijker, W. E. (1994). *Shaping Technology/Building Society: Studies in Sociotechnical Change*. New edition. Cambridge, Mass.: MIT Press.

Bijker, W., Pinch, T. and Hughes, T. (2012). *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*. Anniversary ed. Cambridge, Mass: MIT Press.

Billboard. (1977). 'RCA folds Nashville, LA. Studios: N.Y. next?' 15 January. [Online]. Available at: <http://www.billboard.com/#/archive>.

Bisbort, A., Puterbaugh, P. and Kaylan, H. (2000). *Rhino's Psychedelic Trip*. Softcover edition. San Francisco : Berkeley, CA: Backbeat UK.

Björnberg, A. (2007). Echo and Reverb: Fabricating Space in Popular Music Recording, 1900–1960. By Peter Doyle. *Music and Letters*, 88 (2), p.379–382. [Online]. Available at: doi:10.1093/ml/gcl095.

Blaine, H., Goggin, D. and Schwartz, D. M. (2010). *Hal Blaine and the Wrecking Crew: [the story of the world's most recorded musician]*. Alma, Mich.: Rebeats Publications.

Borwick, J. (1996). *Sound Recording Practice*. 3rd edition. Oxford: Oxford University Press

Bourdieu, P. (1977). *Outline of a Theory of Practice*. Goody, J. (ed.). Cambridge University Press.

Boyd, J. (2006). *White Bicycles: Making Music in the 1960s*. London: Serpent's Tail.

Bromell, N. (2002). *Tomorrow Never Knows: Rock and Psychedelics in the 1960s*. Chicago; London: University of Chicago Press.

Broven, J. (2009). *Record Makers and Breakers: Voices of the Independent Rock 'n' Roll Pioneers*. Urbana: University of Illinois Press.

Brown, P. (2010). *Are We Still Rolling?: Studios, Drugs and Rock 'n' Roll - One Man's Journey Recording Classic Albums*. Tape Op.

Buskin, R. (1999). *Inside Tracks: A First-Hand History of Popular Music from the World's Greatest Record Producers and Engineers*. New York, N.Y: Quill.

Callon, J. (1986). 1 Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay. In: *Power, action and belief: a new sociology of knowledge?*. London: Routledge, p.196–223.

Chanan, M. (1995). *Repeated Takes: A Short History of Recording and Its Effects on Music*. Verso Books.

Chapman, R. (2010). *A Very Irregular Head: The Life of Syd Barrett*. London: Faber & Faber.

Chapman, R. (2015a). *Psychedelia and Other Colours*. London: Faber & Faber.

Chapman, R. (2015b). *The Moody Blues – psychedelia's forgotten heroes | Music | The Guardian*. [Online]. Available at: <https://www.theguardian.com/music/2015/sep/17/the-moody-blues-psychedelias-forgotten-heroes> [Accessed: 20 March 2016].

Cianci, B. (2008). *Roger McGuinn: Rickenbackers, Martins & Byrds*. [Online]. Available at: <http://www.premierguitar.com/articles/roger-mcguinn-rickenbackers-martins-byrds-1> [Accessed: 6 November 2015].

Clark, W. and Cogan, J. (2003). *Temples of Sound*. Chronicle Books.

Clarke, E. (2011). *Ways of Listening: An Ecological Approach To The Perception Of Musical Meaning*. Oxford: Oxford University Press.

Clayson, A. (1995). *Beat Merchants: Origins, History, Impact and Rock Legacy of the 1960s British Pop Groups*. London: Blandford Press.

Cloonan, M. and Williamson, J. (2015). *The Musicians' Union: A History (1893-2013)*. [Online]. Available at: <http://www.muhistory.com/> [Accessed: 5 April 2016].

Coleman, R. (1995). *McCartney: Yesterday and Today by Ray Coleman*. Boxtree Ltd.

Crane, L. (2015). *Glyn Johns Will Make You Better*. Tape Op (109).

Csikszentmihályi, M. (1996). *Creativity: flow and the psychology of discovery and invention*. Harper Collins Publishers.

Cunningham. (1999). *Good Vibrations: History of Record Production*. London: Sanctuary Publishing Ltd.

Dansound Seattle. (2008). *2008-12-16 Frank Laico: Anatomy of a Session Pt 1*. [Online]. Available at: <https://www.youtube.com/watch?v=KJbhGHmY-UA> [Accessed: 2 April 2016].

Davis, R. (2009). *Journal on the Art of Record Production » Creative Ownership and the Case of the Sonic Signature or, 'I'm listening to this record and wondering whodunit?'*. In: October 2009. [Online]. Available at: <http://arpjournal.com/1365/creative-ownership-and-the-case-of-the-sonic-signature-or-%e2%80%98i%e2%80%99m-listening-to-this-record-and-wondering-whodunit%e2%80%99/> [Accessed: 9 January 2012].

Davis, R. (2011). *Modes of production, modes of listening: alternative realities and the sonic divide*. ASARP. [Online]. Available at: <http://arpjournal.com/1009/modes-of-production-modes-of-listening-alternative-realities-and-the-sonic-divide-2/> [Accessed: 14 April 2016].

DeRogatis, J. (1996). *Kaleidoscope eyes: psychedelic music from the 1960 s. to the 1990 s*. London: Fourth estate.

Dexter, D. (1964). *Capitol Records Memos*. [Online]. Available at: <http://library.umkc.edu/sites/default/files/images/spec-col/col-dexter-letter-all-beatles.pdf>. [Accessed: 12 April 2015].

- Eccleston, D. (2014). Inside Abbey Road With Beatles Engineer Ken Scott. *MOJO*. [Online]. Available at: <http://www.mojo4music.com/13343/inside-abbey-road-beatles-engineer-ken-scott/> [Accessed: 16 March 2016].
- Eisen, J. (1969). *Age Of Rock, The : The Sound Of The American Cultural Revolution*. Random House Trade Paperbacks.
- Eisenberg, E. (2005). *The Recording Angel: Explorations in Phonography*. New Haven, CT: Yale University Press.
- Emerick, G. and Massey, H. (2007). *Here, There and Everywhere: My Life Recording the Music of the Beatles*. New York: Gotham Books.
- Emerson, K. (2006). *Always Magic in the Air: The Bomp and Brilliance of the Brill Building Era*. London: Fourth Estate.
- Epstein, B., Martin, S. G. and Lewis, M. (1998). *A Cellarful of Noise: The Autobiography of the Man Who Made the Beatles*. Rhino Rediscovery edition. New York: Pocket Books.
- Erowid. (2014). *LSD Timeline*. [Online]. Available at: http://www.erowid.org/chemicals/lsd/lsd_timeline.php.
- Evan, W. M. (1963). *The engineering technician: dilemmas of a marginal occupation*. Nabu Press.
- Everett, W. (1999). *The Beatles as Musicians: Revolver through the Anthology*. Oxford: Oxford University Press
- Feyerabend, P. K. (2010). *Against Method*. 4th edition. London ; New York: Verso.
- Frerner, M. (2004). *Roger McGuinn Interview*. [Online]. Available at: <http://www.analogplanet.com/content/roger-mcguinn-interviewpart-ii-0>.
- Frith, S. and Zagorski-Thomas, S. (2012). *The Art of Record Production An Introductory Reader for a New Academic Field*. Farnham: Ashgate.
- Gherardi, S. (2009). *Organizational Knowledge: The Texture of Workplace Learning*. John Wiley & Sons.
- Gillett, C. (1996). *The Sound Of The City: The Rise of Rock and Roll*. New York: DaCapo Press.
- Gilliland, J. (1967). Show 23 - Smack Dab in the Middle on Route 66. [Part 2], The Music Men. [Part 1]. *UNT Digital Library*, Sound. [Online]. Available at: <http://digital.library.unt.edu/ark:/67531/metadc19778/m1/> [Accessed: 12 January 2016].
- Gordy, B. (2013). *To Be Loved*. Rosetta Books.

- Gottlieb, C. (2009). *How Does It Sound Now?: Legendary Engineers and Vintage Gear*. Boston, Mass: Course Technology PTR.
- Gracyk, T. (1996). *Rhythm and Noise: An Aesthetics of Rock*. I.B.Tauris.
- GRAMMY Pro. (2015). *Geoff Emerick At GRAMMY Pro Studio Summit | New Orleans*. [Online]. Available at: https://www.youtube.com/watch?v=rH_nXU9JVAY [Accessed: 3 March 2017].
- Granata, C. L. (2003). *I Just Wasn't Made For These Times: Brian Wilson and the Making of Pet Sounds*. London: Spruce.
- Halbwachs, M. (1980). *The collective memory*. Harper & Row.
- Hallam, E. and Ingold, T. (2008). *Creativity and Cultural Improvisation*. New York, NY: Berg 3PL.
- Harries, D. (2015). Conversation with author, 20 November.
- Harries, D. (2015). *JAMES Dave Harries*. [Online]. Available at: <http://www.jamesonline.org.uk/about/dave/> [Accessed: 6 April 2017].
- Harrison, O. (2011). *George Harrison: Living in the Material World*. 01 edition. New York: Abrams.
- Hartman, K. (2013). *The Wrecking Crew: The Inside Story of Rock and Roll's Best-Kept Secret*. Griffin.
- Hartmann, W. M. (1978). Flanging and Phasers. *J. Audio Eng. Soc*, 26 (6), p.439–443.
- Heiser, M. (2012). *Journal on the Art of Record Production » SMiLE: Brian Wilson's Musical Mosaic*. [Online]. Available at: <http://arpjournal.com/smile-brian-wilson%e2%80%99s-musical-mosaic/> [Accessed: 13 January 2017].
- Hicks, M. (2000). *Sixties Rock: Garage, Psychedelic, and Other Satisfactions..* Urbana: University of Illinois Press.
- Hill, S. (2016). *San Francisco and the Long 60s*. New York: Bloomsbury Academic.
- History of Recording. (2011). *RCA BA-6A Limiting Amplifier*. [Online]. Available at: http://www.historyofrecording.com/RCA_BA-6A_Limiting_Amplifier.html [Accessed: 2 April 2017].
- Hjort, C. (2008). *So You Want to be a Rock'n'Roll Star: The Byrds Day-by-day 1965-73*. London: Jawbone.
- Hoffman, S. (2014). History of CBS Records 30th Street Studio NYC (many pictures). *Steve Hoffman Music Forums*. [Online]. Available at: <http://forums.stevhoffman.tv/threads/history-of-cbs-records-30th-street-studio-nyc-many-pictures.388186/> [Accessed: 24 March 2016].

- Holden, B. (2011). *Bob Holden: Goodtimes in the Northwest*. [Online]. Available at: <http://tapeop.com/interviews/83/bob-holden/> [Accessed: 4 May 2016].
- Holmes, T. (2007). US and Them: American Rock's Reconquista. *Popular Music and Society*, 30 (3), p.343–353. [Online]. Available at: doi:10.1080/03007760600836288.
- Hoskyns, B. (1996). *Waiting for the Sun: The Story of the Los Angeles Music Scene*. London, England; New York, N.Y: Viking.
- Howard, D. N. (2004). *Sonic Alchemy: Visionary Music Producers and Their Maverick Recordings*. Milwaukee, WI: Hal Leonard Publishing Corporation.
- Ingold, T. (2009). The Textuality of Making. *Cambridge Journal of Economics*, 34, p.91–102.
- Irwin, B. (2014). Email to author 27th October.
- Johns, G. (2015). *Sound Man : A Life Recording Hits with the Rolling Stones, The Who, Led Zeppelin, The Eagles, Eric Clapton, The Faces...* New York, New York: PLUME.
- Katz, M. (2010). *Capturing Sound: How Technology Has Changed Music*. University of California Press.
- Kealy, E. R. (1979). From Craft to Art The Case of Sound Mixers and Popular Music. *Work and Occupations*, 6 (1), p.3–29. [Online]. Available at: doi:10.1177/009392857961001.
- Keep, A. (2005). *Does Creative Abuse Drive Developments in Record Production?* ARP. [Online]. Available at: <http://www.artofrecordproduction.com/index.php/17-arp-conference-archive/arp-2005/72-keep-2005>.
- Keil, C. (1987). Participatory Discrepancies and the Power of Music. *Cultural Anthropology*, 2 (3), p.275–283.
- Kneebone, R. and Woods, A. (2014). Recapturing the History of Surgical Practice Through Simulation-based Re-enactment. *Medical History*, 58 (1), p.106–121. [Online]. Available at: doi:10.1017/mdh.2013.75.
- Koestler, A. (1964). *The Act Of Creation*. London: Hutchinson.
- Kolkowski, A., Miller, D. and Blier-Carruthers, A. (2015). *Science Museum Group Journal - The Art and Science of Acoustic Recording: Re-enacting Arthur Nikisch and the Berlin Philharmonic Orchestra's landmark 1913 recording of Beethoven's Fifth Symphony*. [Online]. Available at: <http://journal.sciencemuseum.ac.uk/browse/issue-03/the-art-and-science-of-acoustic-recording/> [Accessed: 7 March 2016].

Kozinn, A. (1987). *Beatles on CD: Yeah, Yeah, Nah*. New York Times. [Online]. Available at: <http://www.nytimes.com/1987/03/08/arts/beatles-on-cd-yeah-yeah-nah.html?pagewanted=all>

Kristeva, J. (1986). *The Kristeva Reader*. Columbia University Press.

Kubernik, H. and Petty, T. (2014). *Turn Up The Radio : Rock, Pop, and Roll in Los Angeles 1956-1972*. Solana Beach, CA: Santa Monica Press.

Lacasse, S. (2000). *Listen to My Voice: The Evocative Power of Vocal Staging in Recorded Rock Music and Other Forms of Vocal Expression*. University of Liverpool. [Online]. Available at: www.mus.ulaval.ca/lacasse/texts/THESIS.pdf.

Latour, B. (1988). *Science in Action: How to Follow Scientists and Engineers Through Society*. Cambridge, Mass.: Harvard University Press.

Latour, B. (1999). *Pandora's Hope: Essays on the Reality of Science Studies*. Harvard University Press.

Latour, B. (2007). *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford: OUP.

Latour, B., Callon and Akrich, M. (2002). *THE KEY TO SUCCESS IN INNOVATION* PART II: THE ART OF CHOOSING GOOD SPOKESPERSONS*, 6 (2). [Online]. Available at: <ftp://ftp.ige.unicamp.br/pub/CT001%20SocCiencia/11%20de%20Outubro/Callon,%20Latour,%20Aldrich%202.pdf>.

Latour, B. and Woolgar, S. (1979). *Laboratory Life: The Construction of Scientific Facts*. Salk, J. (ed.). Los Angeles: Sage Publications.

Law, J. (ed.). (1986). *Power, Action and Belief: New Sociology of Knowledge?* London: Routledge & Kegan Paul Books.

Law, J. (1999). *Actor Network Theory and After*. Oxford England ; Malden, MA: Wiley-Blackwell.

Law, J. (2011). *Heterogeneous Engineering and Tinkering*. [Online]. Available at: <http://www.heterogeneities.net/publications/Law2011HeterogeneousEngineeringAndTinkering.pdf>.

Leary, T. (1964). *The psychedelic experience: A manual based on the Tibetan book of the dead*. University Books.

Leary, T. (1995). *High Priest*. Berkeley, Calif., USA: Ronin Publishing.

Leigh, S. (2009). Ron Richards: Record producer who worked with the Beatles, the Hollies, Gerry and the Pacemakers and Ella Fitzgerald. *The Independent*. [Online]. Available at: <http://www.independent.co.uk/news/obituaries/ron-richards-record-producer->

who-worked-with-the-beatles-the-hollies-gerry-and-the-pacemakers-and-ella-fitzgerald-1702080.html [Accessed: 15 July 2014].

Leroi-gourhan, A. (1993). *Gesture and Speech*. Cambridge, Mass: MIT Press.

Leslie, J. and Snyder, R. (2010). *History of The Early Days of Ampex Corporation*. AES. [Online]. Available at: http://www.aes.org/aeshc/docs/company.histories/ampex/leslie_snyder_early-days-of-ampex.pdf.

Levine, V. L. and Bohlman, P. V. (2015). *This Thing Called Music: Essays in Honor of Bruno Nettl*. Rowman & Littlefield.

Lewisohn, M. (1988). *The Beatles Recording Sessions*. New York: Harmony Books.

Lewisohn, M. (2006). *The Complete Beatles Recording Sessions: The Official Story of the Abbey Road Years 1962-1970*. EMI Records.

Lewisohn, M. (2015). *The Beatles - All These Years: Volume One: Tune In*. Little, Brown.

MacDonald, I. (2005). *Revolution In The Head: The Beatles Records and the Sixties*. Pimlico.

MacFarlane, T. (2009). *Journal on the Art of Record Production » Magical Mystery Tour: Mono or Stereo?* [Online]. Available at: <http://arpjournal.com/magical-mystery-tour-mono-or-stereo/> [Accessed: 13 January 2017].

Rolling Stone. (1974). 'The Rolling Stone Record Review.' New York: Pocket Books.

Mann, W. (1963). *The Times: What Songs The Beatles Sang by William Mann | The Beatles Bible*. [Online]. Available at: <https://www.beatlesbible.com/1963/12/27/the-times-what-songs-the-beatles-sang-by-william-mann/> [Accessed: 13 February 2017].

Manquen, Da. (2005). *Wally Heider's First 3M 8-track | Recording Wally Heider*. [Online]. Available at: <http://wallyheider.com/wordpress/2005/03/wally-heiders-first-3m-8-track/> [Accessed: 11 January 2017].

Martin, G. (1979). *All You Need Is Ears*. London: Macmillan.

Martin, G. and Pearson, W. (1994). *Summer of Love: The Making of Sgt. Pepper*. London: Macmillan.

Mason, N. (2005). *Inside Out: A Personal History of Pink Floyd*. Dodd, P. (ed.). London: W&N.

- Massey, H. (2000). *Behind the Glass: Top Record Producers Tell How They Craft the Hits*. San Francisco : Berkeley, CA : Milwaukee, WI: Backbeat Books.
- Massey, H. (2009). *Behind the Glass: v. 2: Top Record Producers Tell How They Craft the Hits*. Backbeat Books.
- Massey, H. (2015). *The Great British Recording Studios*. Milwaukee, WI: Hal Leonard Corporation.
- Masters, R. and Houston, J. (2000). *Varieties of Psychedelic Experience: The Classic Guide to the Effects of LSD on the Human Psyche*. Rochester, Vt: Park Street Press,U.S.
- McGuinn, R. (2014). *Email to Buddy Woodward 6th December*.
- Mcintyre, P. (2006). Paul McCartney and the Creation of: The Systems Model in Operation. *Popular Music*, 25 (02), p.201–219. [Online]. Available at: doi:10.1017/S0261143006000936.
- McIntyre, P. (2011). Systemic Creativity: The Partnership of John Lennon and Paul McCartney. *Musicology Australia*, 33 (2), p.241–254. [Online]. Available at: doi:10.1080/08145857.2011.596142.
- Mellers, W. (1976). *Twilight of the Gods: 'Beatles' in Retrospect..* Faber and Faber.
- Meynell, A. (2012). *Research Methods Presentation*. Unpublished Text, UWL. [Accessed: 4 January 2013].
- Miles, B. (1997). *Paul McCartney: Many Years From Now*. New York: Henry Holt & Company.
- Miles, B. (1992). *Dazed and Infused: The Summer of Love. By Miles : Articles, reviews and interviews from Rock's Backpages*. [Online]. Available at: <https://www.rocksbackpages.com/Library/Article/dazed-and-infused-the-summer-of-love> [Accessed: 12 April 2015].
- Miller, D. (1998). Material Cultures. In: *Why some things matter*, University College London.
- Moorefield, V. (2010). *The Producer as Composer: Shaping the Sounds of Popular Music*. The MIT Press.
- Morrison, C. (2008). *Psychedelic Music in San Francisco: Style, Context, and Evolution*. Craig Morrison.
- Moylan, W. (1992). *Understanding and Crafting the Mix: The Art of Recording*. Focal Press.

- Moylan, W. (2009). Journal on the Art of Record Production » Considering Space in Music. In: *ARP*, October 2009. [Online]. Available at: <http://arpjournal.com/considering-space-in-music/> [Accessed: 19 May 2016].
- Music Producers Guild. (2016). *Geoff Emerick interview - MPG Awards 2016 (with Dave Harries)*. [Online]. Available at: <https://www.youtube.com/watch?v=uJj-OXJ2Qes> [Accessed: 27 February 2017].
- Myers, M. (2012). *The Byrds: Who Played What? - JazzWax*. [Online]. Available at: <http://www.jazzwax.com/2012/09/the-byrds-who-played-what.html> [Accessed: 14 January 2016].
- Negus, K. (1993). *Producing Pop: Culture and Conflict in the Popular Music Industry*. Hodder Arnold.
- Nin, A. (1974). *Diary of Anais Nin Volume 5 1947 1955 1ST Edition*. HARCOURT BRACE JOVANOVIH.
- Nork, J. (2004a). *Byrds Expert John Nork Interviews Chris Hillman Interview Part 1*. [Online]. Available at: <http://www.analogplanet.com/content/byrds-expert-john-nork-interviews-chris-hillman-interview-part-i-0>.
- Nork, J. (2004b). *David Crosby Can Remember His Name and a Great Deal More Part 2*. [Online]. Available at: <http://www.analogplanet.com/content/david-crosby-can-remember-his-name-and-great-deal-more-part-ii-0>.
- Nork, J. (2004c). *David Crosby Can Remember His Name...and a Great Deal More Part 1*. [Online]. Available at: <http://www.analogplanet.com/content/david-crosby-can-remember-his-nameand-great-deal-more-part-i-0>.
- Nork, J. (2004d). *Roger McGuinn Speaks With John Nork*. [Online]. Available at: <http://www.analogplanet.com/content/roger-mcguinn-speaks-john-norkpart-1-0>.
- Ohara, M. (2014). *The Rickenbacker 12 String Guitars of Roger McGuinn*. [Online]. Available at: <http://uniqueguitar.blogspot.com/2014/03/the-rickenbacker-12-string-guitars-of.html> [Accessed: 1 April 2017].
- Oldham, A. L. (2003). *2Stoned*. London: Vintage.
- Olick, J. K. (1999). Collective Memory: The Two Cultures. *Sociological Theory*, Vol. 17, (No. 3), p.333–348.
- O'Mahony, S. (1966). *Beatles Monthly*.
- Oster, G. (1966). Moire Patterns and Visual Hallucinations. *Psychedelic Review*, 7, p.33–40.

- Owsinski, B. (2017). In The Studio: Al Schmitt's Microphone Approach. *ProSoundWeb*. [Online]. Available at: http://www.prosoundweb.com/channels/recording/in_the_studio_al_schmitts_microphone_approach/ [Accessed: 6 March 2017].
- Palao, A. (2016). *Email to Author 30 November*.
- Patterson, B. (2012). Something Else! Interview: Joel Larson, co-founder of the Grass Roots. *Something Else!* [Online]. Available at: <http://somethingelserreviews.com/2012/06/05/something-else-interview-joel-larson-co-founder-of-the-grass-roots/> [Accessed: 3 July 2016].
- Perone, J. E. (2009). *Mods, Rockers, and the Music of the British Invasion*. ABC-CLIO.
- Petersen, D. and Denney, D. (2006). *The Vox Story*. Bold Strummer Ltd.
- Pink, S. (2001). *Doing Visual Ethnography*. London: Sage Publications Ltd.
- Polanyi, M. (1966). *The Tacit Dimension*. London: University of Chicago Press.
- Porcello, T. and Greene, P. D. (2004). *Wired for Sound: Engineering and Technologies in Sonic Cultures*. Wesleyan University Press.
- Priore, D. (2015). *Riot on Sunset Strip: Rock 'n' Roll's Last Stand in Hollywood*. Revised edition. Jawbone Press.
- Ramone, P. and Granata, C. L. (2003). *Making Records: The Scenes Behind the Music*. New York: Hyperion Books.
- Rawlings, K. B. (1997). *Quite Naturally the Small Faces: A Day by Day Guide to the Career of a Pop Group*. Cherry Red Books.
- RBMA. (2013). *Ken Scott | Red Bull Music Academy*. [Online]. Available at: <http://www.redbullmusicacademy.com/lectures/ken-scott> [Accessed: 23 February 2016].
- Reising, R. (2002). *Every sound there is: the Beatles' Revolver and the transformation of rock and roll*. Farnham: Ashgate.
- Reynolds, S. (2012). *Retromania: Pop Culture's Addiction to its Own Past*. Faber and Faber.
- Riley. (2002). *Tell Me Why: The 'Beatles' - Album by Album, Song by Song, the Sixties and After*. Cambridge, Mass.; London: DaCapo Press.
- Riley, T. (2006). Abbey Road Reunion. *SoundCloud*. [Online]. Available at: <http://soundcloud.com/triley60/abbey-road-reunion> [Accessed: 8 August 2014].

- Rios, M. D. de. (2003). *LSD, Spirituality and the Creative Process: Based on the Groundbreaking Research of Oscar Janiger, M.D.* Rochester, Vt: Park Street Press, U.S.
- Rodriguez, R. (2012). *Revolver: How the Beatles Reimagined Rock 'n' Roll.* Montclair, NJ: Backbeat Books.
- Rogan, J. (2011). *Byrds: Requiem for the Timeless: Volume 1.* London: Rogan House.
- Rose, G. (2012). *Visual Methodologies.* London: Sage Publications Ltd.
- Roylance, B. (2000). *The Beatles Anthology.* London: Cassell / Weidenfeld & Nicolson.
- Ryan, K. and Kehew, B. (2006). *Recording the Beatles.* Curvebender Publishing.
- Ryle, G. (2000). *The Concept of Mind.* 1 edition. Chicago: University Of Chicago Press.
- Savage, J. (2015). *1966: The Year the Decade Exploded.* London: Faber & Faber.
- Savona, A. (2005). *Console Confessions: The Great Music Producers in their Own Words: Insights and Opinions from the Great Music Producers.* San Francisco : Berkeley, CA : Milwaukee, WI: BackBeat Books.
- Schmidt Horning, S. (2013). *Chasing sound: technology, culture, and the art of studio recording from Edison to the LP.* Baltimore: Johns Hopkins University Press.
- Schroeder, J. (2009). *Sex and Violins: My Affair with Life Love and Music.* Brighton: Pen Press.
- Scott, A. J. (1999). The US Recorded Music Industry: On the Relations between Organization, Location, and Creativity in the Cultural Economy. *Environment and Planning A*, 31 (11), p.1965–1984. [Online]. Available at: doi:10.1068/a311965.
- Scott, D. B. (ed.). (2009). *The Ashgate Research Companion to Popular Musicology.* Farnham, Surrey ; Burlington, VT: Routledge.
- Scott, K. and Owsinski, B. (2012). *Abbey Road to Ziggy Stardust: Off the Record with the Beatles, Bowie, Elton & So Much More.* Van Nuys, CA: Alfred Publishing Co., Inc.
- Simpson, Da. (2014). The Byrds: how we made Eight Miles High | Music | The Guardian. *the Guardian*. [Online]. Available at: <https://www.theguardian.com/music/2014/sep/16/how-we-made-eight-miles-high-the-byrds> [Accessed: 27 June 2016].

- Southall, B. (1982). *Abbey Road: The Story of the World's Most Famous Recording Studios*. Cambridge: Patrick Stephens.
- Stanley, B. (2014). *Yeah Yeah Yeah: The Story of Modern Pop*. London: Faber & Faber.
- Stevenson, P. (2001). Bob Ohlsson: Look at Digital Recording. *Tape Op*, (30).
- Sundazed. (2011). *45cat - The Byrds - Eight Miles High / Why - Sundazed - USA - S 238*. [Online]. Available at: <http://www.45cat.com/record/s238> [Accessed: 23 March 2017].
- Tagg, P. (2013). *Music's Meanings*. New York: Mass Media Music Scholar's Press.
- Tamarkin, J. and Kantner, P. (2005). *Got a Revolution!: The Turbulent Flight of Jefferson Airplane*. New York: Atria.
- Tedesco, D. (2015). *The Wrecking Crew*. Wienerworld.
- Teehan, M. (2010). The Byrds, 'Eight Miles High', the Gavin Report, and Media Censorship of Alleged 'Drug Songs' in 1966: An Assessment. *Popular Musicology Online*. [Online]. Available at: <http://www.popular-musicology-online.com/issues/04/teehan.html>.
- Theberge, P. (1997). *Any Sound You Can Imagine: Making Music/Consuming Technology*. Wesleyan University Press.
- Thompson, G. (2008). *Please Please Me: Sixties British Pop, Inside Out*. New York: Oxford University Press, U.S.A.
- Tobler, J. and Grundy, S. (1983). *The Record Producers*. St Martins Pr.
- Townshend, P. (2012). *Pete Townshend: Who I Am*. London: HarperCollins.
- Toynbee, J. (2000). *Making Popular Music: Musicians, Creativity and Institutions: Musician, Aesthetics and the Manufacture of Popular Music*. London : New York: Bloomsbury Academic.
- Unterberger, R. (2003). *Eight Miles High: Folk-Rock's Flight from Haight-Ashbury to Woodstock*. San Francisco : Berkeley, CA : Milwaukee, WI: Backbeat Books.
- Vinitzky-Seroussi, V. and Levy, D. (2011). *The Collective Memory Reader*. Olick, J. K. (ed.). New York: Oxford University Press, U.S.A.
- Wald, E. (2009). *How the Beatles Destroyed Rock n Roll: An Alternative History of American Popular Music*. Oxford ; New York: OUP USA.
- Waterman. (1969). Columbia Broadcasting System, Inc., Plaintiff-appellee, v. American Recording and Broadcasting Association, Defendant-appellant, Andradio & Television Broadcast Engineers Union, Local 1212, International

Brotherhood of Electrical Workers, Defendant, 414 F.2d 1326 (2d Cir. 1969). *Justia Law*. [Online]. Available at: <http://law.justia.com/cases/federal/appellate-courts/F2/414/1326/84539/> [Accessed: 25 March 2016].

Weber, E. T. (2016). *The Beatles and the Historians: An Analysis of Writings About the Fab Four*. Jefferson, North Carolina: McFarland & Co.

Weinreich, D. (2015). Conversation with author, 20 November.

Weinreich, D. (2015). *JAMES Dennis Weinreich*. [Online]. Available at: <http://www.jamesonline.org.uk/about/dennisw/> [Accessed: 1 April 2017].

Weisbard, E. (2007). *Listen again: a momentary history of pop music*. Duke University Press.

Wenner, J. (ed.). (1971). *Lennon Remembers*. Harmondsworth: Penguin Books

Whalen, J. (1998). The Trip. *LA Weekly*. [Online]. Available at: <http://www.laweekly.com/1998-07-09/news/the-trip/> [Accessed: 20 August 2014].

White, T. (1995). *The Nearest Faraway Place: Brian Wilson, the Beach Boys, and the Southern California Experience*. New York: Henry Holt & Co.

Whiteley, S. (1992). *The Space Between the Notes: Rock and the Counter-Culture*. Routledge.

Williams, P. (1967). *Paul Rothschild Speaks, March 1967*. [Online]. Available at: <https://www.pastemagazine.com/articles/2015/06/crawdaddy-classics-rothschild-speaks-interview-wit.html>

Williams, P. (2002). *Brian Wilson and The Beach Boys: How Deep is the Ocean? Essays and Conversations exploring the mysteries of their incomparable musical accomplishments*. London: Omnibus Press.

Wilson, M. (2002). *Six views of embodied cognition*. *Psychonomic Bulletin & Review* (9), p.625–636.

Wykowska, A. and Schubo, A. (2012). Action intentions modulate allocation of visual attention: electrophysiological evidence. *Frontiers in Psychology*, 3. [Online]. Available at: http://www.psy.lmu.de/exp/people/ma/wykowska/publications1/wykowska_schuboe_2012.pdf.

Zagorski-Thomas, S. (2014). *The Musicology of Record Production*. Cambridge University Press.

Zagorski-Thomas, S. (2017). Conversation with author, 13 April.

Zak, A. J. (1997). *The Velvet Underground Companion: Four Decades of Commentary*. London: Omnibus Press.

Zak, A. J. (2001). *The Poetics of Rock: Cutting Tracks, Making Records*. University of California Press.

Zak, A. J. (2012). *I Don't Sound Like Nobody: Remaking Music in 1950s America*. Reprint edition. Ann Arbor, Mich.: University of Michigan Press.

Zak, A. J. (2012). *I Don't Sound Like Nobody: Remaking Music in 1950s America*. Reprint edition. Ann Arbor, Mich.: University of Michigan Press.

Discography

Animals, The (1964) *House Of The Rising Son* [Vinyl] UK EMI Columbia DB7301

Beach Boys, The (1964) *Don't Worry Baby* [Vinyl] UK Capitol CL15350

Beach Boys, The (1965) *California Girls* [Vinyl] UK Capitol CL15409

Beach Boys, The (1966) *Wouldn't It Be Nice* [Vinyl] US Capitol 5706

Beach Boys, The (1966) *Pet Sounds* [Vinyl] UK Capitol T2548

Beatles, The (1966) *Rain* [Vinyl] UK Parlophone R5452

Beatles, The (1964) *A Hard Days Night* [Vinyl] UK Parlophone R5160

Beatles, The (1963) 'All My Loving' *With The Beatles* [Vinyl] UK Parlophone PMC1206

Beatles, The (1965) *Day Tripper* [Vinyl] UK Parlophone R5389

Beatles, The (1964) 'Eight Days A Week' *Beatles For Sale* [Vinyl] UK Parlophone PMC1240

Beatles, The (1965) 'Girl' *Rubber Soul* [Vinyl] UK Parlophone PMC1267

Beatles, The (1966) 'Got To Get You Into My Life' *Revolver* [Vinyl] UK Parlophone PMC7009

Beatles, The (1967) *I Am The Walrus* [Vinyl] UK Parlophone R5655

Beatles, The (1964) 'I Should Have Known Better' *A Hard Days Night* [Vinyl] UK Parlophone PMC1230

Beatles, The (1963) *I Wanna Hold Your Hand* [Vinyl] UK Parlophone R5084

Beatles, The (1965) 'If I Needed Someone' *Rubber Soul* [Vinyl] UK Parlophone PMC1267

Beatles, The (1965) 'In My Life' *Rubber Soul* [Vinyl] UK Parlophone PMC1267

Beatles, The (1969) 'It's All Too Much' *Yellow Submarine* [Vinyl] UK Parlophone PCS7070

Beatles, The (1962) *Love Me Do* [Vinyl] UK Parlophone R4949

Beatles, The (1966) 'Love To You' *Revolver* [Vinyl] UK Parlophone PMC7009

Beatles, The (1967) 'Lucy In The Sky With Diamonds' *Sgt. Pepper's Lonely Hearts Club Band* [Vinyl] UK Parlophone PMC7027

Beatles, The (1969) 'Maxwell's Silver Hammer' *Abbey Road* [Vinyl] UK Apple PCS7088

Beatles, The (1965) 'Nowhere Man' *Rubber Soul* [Vinyl] UK Parlophone PMC1267

Beatles, The (1966) *Paperback Writer* [Vinyl] UK Parlophone R5452

Beatles, The (1967) *Penny Lane* [Vinyl] UK Parlophone R5570

Beatles, The (1966) 'She Said She Said' *Revolver* [Vinyl] UK Parlophone PMC7009

Beatles, The (1967) *Strawberry Fields Forever* [Vinyl] UK Parlophone R5570

Beatles, The (1966) 'Taxman' *Revolver* [Vinyl] UK Parlophone PMC7009

Beatles, The (1964) 'Things We Said Today' *A Hard Days Night* [Vinyl] UK Parlophone PMC1230

Beatles, The (1965) *Ticket to Ride* [Vinyl] UK Parlophone R5265

Beatles, The (1966) 'Tomorrow Never Knows' *Revolver* [Vinyl] UK Parlophone PMC7009

Beatles, The (1965) *We Can Work It Out* [Vinyl] UK Parlophone R5389

Beatles, The (1966) 'Yellow Submarine' *Revolver* [Vinyl] UK Parlophone PMC7009

Beatles, The (1965) 'Yesterday' *Help!* [Vinyl] UK Parlophone PMC1255

Beatles, The (1964) *Beatles For Sale* [Vinyl] UK Parlophone PMC1240

Beatles, The (1970) *Hey Jude (The Beatles Again)* [Vinyl] US Apple SO 385

Beatles, The (1963) *Please, Please Me* [Vinyl] UK Parlophone PMC1202

Beatles, The (1966) *Revolver* [Vinyl] UK Parlophone PMC7009

Beatles, The (1965) *Rubber Soul* [Vinyl] UK Parlophone PMC1267

Beatles, The (1967) *Sgt. Pepper's Lonely Hearts Club Band* [Vinyl] UK Parlophone PMC7027

Beatles, The (1968) *The Beatles White Album* [Vinyl] US Apple PCS 7067/S

Beatles, The (1963) *With The Beatles* [Vinyl] UK Parlophone PMC1206

Berlin Philharmonic Orchestra / Arthur Nikisch (1913) *'Beethoven Symphony No. 5 in C minor, Op. 67* [Vinyl] UK HMV

Bernard Cribbins. (1963) *Right Said Fred* [Vinyl] UK Parlophone R4923

Bernard Cribbins. (1962) *The Hole In The Ground* [Vinyl] UK Parlophone R4869

Billy J Kramer & The Dakotas (1965) *Trains and Boats and Planes* [Vinyl] UK Parlophone R5285

Bob Dylan (1965) *Like a Rolling Stone* [Vinyl] UK CBS 201811

Bob Dylan (1966) *Blonde on Blonde* [Vinyl] UK CBS SDDP 66012

Buffalo Springfield (1967) *Neighbor Don't You Worry Box Set* [CD] US Rhino R274324

Byrds, The (1965) *All I Really Want To Do* [Vinyl] UK CBS 201796

Byrds, The (1965) 'Bells of Rhymney' *Mr. Tambourine Man* [Vinyl] UK CBS SBPG 62571

Byrds, The (1965) 'Chimes of Freedom' *Mr. Tambourine Man* [Vinyl] UK CBS SBPG 62

Byrds, The (1966) *Eight Miles High* [Vinyl] UK CBS 202067

Byrds, The (1965) *I Feel A Whole Lot Better* [Vinyl] UK CBS 201796

Byrds, The (1965) *I Knew I'd Want You* [Vinyl] UK CBS 201765

Byrds, The (1987) 'It's All Over Now Baby Blue' *Never Before* [Vinyl] US Re-Flyte MH 70318

Byrds, The (1965) *Mr. Tambourine Man* [Vinyl] UK CBS 201765

Byrds, The (1966) *Set You Free This Time* [Vinyl] US Columbia 4-43501

Byrds, The (1967) 'So You Want To Be A Rock 'N' Roll Star' *Younger Than Yesterday* [Vinyl] UK CBS SBPG 62988

Byrds, The (1965) *Turn! Turn! Turn!* [Vinyl] UK CBS 202008

Byrds, The (1965) 'Wait and See' *Turn! Turn! Turn!* [Vinyl] UK CBS SBPG 62652

Byrds, The (1966) *Why* [Vinyl] UK CBS 202067

Byrds, The (1994) *Journals* [CD] US Cedrem CD 81-89

Byrds, The (1971) *Byrdsmaniax* [Vinyl] UK CBS 64389

Byrds, The (1999) *Fifth Dimension* [Vinyl] US Sundazed 5059

Byrds, The (1987) *Never Before* [Vinyl] US Re-Flyte MH 70318

Del Shannon (1966) *The Big Hurt* [Vinyl] UK Liberty LIB55866

Doors, The (1971) *Riders On The Storm* [Vinyl] UK Electra

Doris Day (1963) *Move Over Darling* [Vinyl] UK CBS AAG 183

Jefferson Airplane (1967) *White Rabbit* [Vinyl] UK RCA RCA 1631

Jimi Hendrix (1970) *Voodoo Child (Slight Return)* [Vinyl] UK Track 2095

Joan Sims (1963) *Hurry Up Gran* [Vinyl] UK Parlophone R5021

John Coltrane Quartet, The (1962) 'Africa' *Africa / Brass* [Vinyl] UK His Masters Voice CLP 1548

Manfred Mann (1966) *Pretty Flamingo* [Vinyl] UK His Masters Voice POP 1523

Max Matthews (1962) 'Daisy Bell (Bicycle Built For Two)' *Music From Mathematics* [Vinyl] UK Brunswick STA8523

Moody Blues (1964) *Go Now* [Vinyl] UK Decca F.12022

Napoleon XIV (1966) *They're Coming To Take Me Away Ha Ha!!* [Vinyl] UK Warner Bros. Records WB 5831

Paul Revere & The Raiders (1966) *Kicks* [Vinyl] UK CBS 202205

Peter Sellers & Sophia Loren (1960) *Bangers and Mash* [Vinyl] UK Parlophone R4724

Peter Sellers & Sophia Loren (1960) *Goodness, Gracious Me* [Vinyl] UK Parlophone R4702

Pink Floyd, The (1967) 'Interstellar Overdrive' *The Piper At The Gates Of Dawn* [Vinyl] UK EMI Columbia SX 6157

Pink Floyd, The (1967) *See Emily Play* [Vinyl] UK EMI Columbia DB 8214

Pretenders, The (1983) *2000 Miles* [Vinyl] UK Real Records ARE 20

R.E.M (1985) 'Green Grow The Rushes' *Fables Of The Reconstruction* [Vinyl] UK I.R.S 26525

Ray Cathode (1962) *Time Beat/'Waltz In Orbit'* [Vinyl] UK Parlophone R4901

Rembrandts, The (1995) *I'll Be There For You* [Vinyl] UK EastWest A 4390 LC

Rip Chords, The (1963) *Hey Little Cobra* [Vinyl] US Columbia 42921

Rolling Stones, The (1965) *(I Can't Get No) Satisfaction* [Vinyl] UK Decca F.12220

Rolling Stones, The (1966) *Mothers Little Helper* [Vinyl] UK Decca F.12397

Rolling Stones, The (1965) *The Singer Not The Song* [Vinyl] UK Decca F.12263

Rolling Stones, The (1966) *Aftermath* [Vinyl] UK Decca SKL. 4786

Scott McKenzie (1967) *San Francisco (Be Sure To Wear Some Flowers In Your Hair)* [Vinyl] UK CBS 2816

Searchers. The (1964) *Needles & Pins* [Vinyl] UK Pye Records 7N.15594

Small Faces, The (1967) 'Green Circles' *Small Faces* [Vinyl] UK Immediate IMLP 008

Small Faces, The (1967) *Small Faces* [Vinyl] UK Immediate IMLP 008 lp

Small Faces, The (1967) *Itchycoo Park* [Vinyl] UK Immediate IM 057

Smiths, The (1983) *This Charming Man* [Vinyl] UK Rough Trade RT 136

Spencer Davis Group, The (1965) *Keep On Running* [Vinyl] UK Fontana TF 632

Status Quo, The (1968) *Pictures of Matchstick Men* [Vinyl] UK Pye Records 7N 17449

Strawberry Alarm Clock (1967) *Incense and Peppermints* [Vinyl] UK Pye International 7N25436

Toni Fisher (1959) *The Big Hurt* [Vinyl] UK Top Rank 45-JAR-261

Tornados, The (1962) *Telstar* [Vinyl] Decca 34F 11494

Who, The (1965) *My Generation* [Vinyl] UK Brunswick 5944

Yardbirds, The (1966) *Shape Of Things* [Vinyl] UK EMI Columbia DB 7848

Filmography

Going Underground (2013) Directed by O'Dell T [DVD] London: Pride

Muscle Shoals (2014) Directed by Camalier G [DVD] London: Dogwoof

Pink Floyd London 1966/1967 (2005) Directed by Whitehead P [DVD]
London: Highnote

Tom Dowd & The Language of Music (2005) Directed by Moormann M [DVD]
Fort Lauderdale, Fl: ILC

The Beatles Anthology (1995) Directed by Godley K, Smeaton B, Wonfor G
[DVD] London: Apple Corps

The Wrecking Crew (2015) Directed by Tedesco D [DVD] Los Angeles, Calif.:
Wienerworld