

Investing In Quality – At What Cost?

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The following text was delivered as a technical keynote speech by mastering engineer Crispin Murray.

Audio Playback: Buddy Holly – True Love Ways

That was Buddy Holly, recorded in 1958. What I like about this is its simplicity; it's recorded in a nice-sounding room, with a good band with a good internal balance, and probably with only seven or maybe eight microphones – microphones that have been well placed with attention to phase, resulting in a clean recording, a recording that has survived well. There may well have been duplicate masters run at the session, and it is possible that one has remained in a Manager's archive and been relatively un-played and been used for this release.

When this came out originally on vinyl, at the time along with such artists Frank Sinatra, Dinah Washington, Ella Fitzgerald, and many classical recordings, they were released in extremely high quality on vinyl, even though 98% of the audience listened on nothing better than a Dansette – a straightforward all in one mono record player with a built in 3 W valve amp and speaker; this cost the equivalent of a few weeks wages for a parent, or a whole year on a paper round for a school kid and it sounded fairly dreadful, but every teenager wanted one. Hi-fi for the 2% that were audiophiles was considerably more expensive! The records were expensive then, the equivalent of about £50 or £60, including 100% purchase tax! A single was about £10! However, back to those records – If you can find any of these original pressings in good condition, they are amazingly good quality. Back in those days it was very expensive to make records to the highest standards; the equipment was largely hand-built, complex to use, idiosyncratic & limited operationally – requiring great skill, acoustics weren't the best, but the engineers learnt how to obtain the best results, and this attention to detail and quality was maintained right through to the end product.

Throughout the sixties the recording process became progressively more complex, bigger desks with more channels, and the introduction of multi-track. 8/16/24/32 tracks of additional noise, we added more busses, with yet more noise, and sometimes less attention to detail, more EQ built into every channel, together all producing less phase coherence... Remember the attention that was given in those earlier simple and clear recordings, simple details that were later followed obsessively by amongst others, Roger Nichols and Steely Dan, which gave such an

incredible sound to their output. The number of times people have asked, "Can you make this sound like Steely Dan?" – well, yes I can, but we'll have to start again...! Throughout the seventies we added more and more technology...

And then in late seventies early eighties we invented DIGITAL! Wow, the saviour of the modern world... As Akio Morita, head of Sony said, "perfect sound forever". It's fair to say that digital had been kicking around for a number of years, the BBC had been using a digital distribution system since the mid seventies, and Denon and EMI to name but two had designed and built prototype digital consoles, but nothing really concrete had really settled down. By and large we were waiting for processing speeds to be fast enough, storage capacity and costs to be feasible, and to be realistic, we were more than likely awaiting the next generation of chips for military radar to be available to facilitate all of this! However, in the early 80's digital had become a reality at 44.1, 48 and 50.1 kHz sampling rates at 16-bit resolution.

I won't bore you with all the issues of bottlenecks and compromising the quality too early in the production path particularly at these lower sample rates and resolutions, I hope you are all aware that as a rule of thumb, bigger numbers equal better quality, and it is best to maintain the highest quality right through to the end. However in those early days at these lower sample rates and resolutions the limitations occurred at the beginning of the chain, so all the detail was lost forever right at the start. Around that time, Sony gave a demonstration of digital recording at Abbey Road with a small jazz band in the studio, mixed live and recorded to stereo analogue and to stereo digital. They impressed everyone with how clean and noise free the digital recording was by comparison to the analogue, with no peak distortion or crushing; however a wily assistant asked if he could record the now empty studio and compare, the Sony chaps were amused with this but played along. When turned up loud, the feed from the studio sounded just like the studio, the analogue tape sounded just like the studio too but with added hiss, and the digital recording sounded just like a bag of gravel being shaken: the assistant suggested that they should perhaps work out how to record the silence before they try recording music – the Sony chaps were not amused. George Massenburg has publicly apologised for recording a Linda Rondstadt album onto digital multi-track in Nashville in the eighties; there is nothing to revisit – the detail is lost from the start. I guess we were all looking the wrong way in those days and perhaps deceiving ourselves.

So throughout the thirty odd years we've had practical digital recording and most importantly, 30 years of CD and a digital release format, we've had consumer investment, initially from early adopters, that has funded the development of better systems. Let's not ignore those early adopters, without them a format won't establish, and funding and more importantly development will cease. Music in the early 80's had to regain its place as number one in the home entertainment arena; it had just lost that position to VHS and Betamax home video recording! However, that early digital product is in many cases quite poor – the direct-to-digital classical recordings of 30 years ago are in the main, forgotten. The rock music of the early CDs has gone on to be re-mastered in ever better quality! More investment from those early adopters has paid for more development! Without them, look what happened to SACD, DVD-A, HD DVD and so on.

But what quality did we have through history, from 1983 to 1993? It was 44.1 kHz, occasionally 48 kHz, 16-bit, and then in 1993... 20-bit – Woo-Hoo! It did make a difference; it allowed digital processing to emerge – before that DSP would just reduce resolution and increase the noise... From there we went to 24-bit in 1995, and then to the heady heights of 96 kHz in 1997. Technology moved on, but digital recording was prone to its problems and DAWs were still expensive mainly because of storage. In 1950 Alan Turing predicted that at the turn of the millennium we would have computers with a storage of 109 bits, more or less a gigabit or about 125 MB, and he wasn't too far off. In the eighties, enough storage for a CD master could cost £30,000+, by 1993 2 GB cost £1200, and by the millennium it became not only affordable to have sufficient storage to make DAWs run as multi-track machines, but soon after it became cheap enough to use those hard drives as the permanent medium for recording a project.

So, in twenty years we have seen the development of Digital to a state where it became a viable, high quality and cheap recording vehicle, the costs of recording in high quality dropped immensely and it became much simpler, but let's spin back on the history lesson and see what else was going on...

Back in 1991-2 the Interweb Thingy was invented, and mindful that storage costs were still around £1000 for enough to hold one whole CD, a team of clever people came up with the idea of MP3 as a virtual format (other data reduced formats prior to this had been specifically created for physical release formats). These reductions in data in MP3 are through all manner of methods: masking, frequency and level conscious choices, and Huffman coding that depends on prediction to make storage economies. This was all optimised to work for the expected data rates of the early internet and with the then current actual volumes of recorded CDs, which were about +3 dBVU.

Some of the same team met up again in 2000-1 and defined MP4, with much advanced coding techniques, adapted to work with peak levels that were by now about +6-8 dBVU. Nowadays, both codecs are suffering badly with the volume of peak levels and are more lossy than they need to be. To put things in perspective, current peak digital levels are now up to +16-17 dBVU. With MP3 optimised for +3 dBVU, and MP4 for +6 dBVU, consider that mains electricity is only +50 dBVU, so only 33 dB 'louder' than today's music, and in the US it is of course only 27 dB 'louder'. So what happens when music is loud? Well, first of all the high-level clipped and limited signals produce a stream of data that is random and unpredictable, so the MP3/4 codecs rely more heavily on other more lossy forms of data reduction and they sound vastly inferior. Secondly, we get problems elsewhere with broadcasters; they use other forms of data reduced distribution which has similar problems, and added to this they use systems such as Optimod to enhance their presence on the waveband. This is a form of multiband compression that will make the quiet bits louder still and unfortunately this will result in the chorus getting quieter and smaller sounding, with the vocal sinking into the mix.... There's also R-128, but I shall leave it there for Thomas Lund to talk all about loudness...

So, let's go back to Buddy Holly for a moment. It's a high quality expensive recording, high quality release format that was reasonably expensive, and 98% of the audience had crap to play it on. Nowadays we have potentially high quality cheap recording, but a very low quality release format, but that 98% audience has potentially high quality playback – it is still about 98%, the other 2% are still the audiophiles... Those 2% of audiophiles will always search out the hi-res releases if they exist, such as Pure Audio Blu-ray (not the compromised Universal version!) and also HDTracks, Linn, Naim etc... Yet why shouldn't we release high quality for everyone including the 98% like we used to? We are throwing it all away, just at the point where we release it... At least the masters are ok now, not like in the 80's and 90's. There were excuses to keep MP3&4, portability and space, download speeds, battery life, but all of these reasons are by now invalid – the audience relies now on their smartphone with just the tracks they want today, rather than their whole collection on an iPod. Download speeds are irrelevant with fibre and 4G, and battery life... well have you ever switched on maps with GPS? We're all used to charging a smartphone whenever we can! Yes, we don't necessarily need all the quality all the time, but that wasn't the attitude in 1958 so why should it be now?

Another perspective of using MP3 is given by George Massenburg. He recounts playing a number of teenagers some 192 kHz material and then the same material converted to 44.1 kHz and then to MP3, and he asked which they preferred; two thirds preferred the MP3 version. When asked why, they said it sounded more like music to them and was more exciting. So he played sections of the files and compared them, showing them the detail that was lost and the elements that had just disappeared completely, and he educated them, briefly! He then repeated the listening test, and this time two thirds preferred the 192 kHz, so, concentrating on the one third he asked why they still preferred the sound of MP3; they answered that it still sounded more exciting! It is probably just a matter of time for people to get used to better sound.

So what do we have now that can make things sound better and improve the quality? There's Mastered For iTunes – Apple's attempts to improve the sound of MP4/AAC and pass the responsibility for poor sound over to the Mastering Engineer, meanwhile concealing their avowed intention to garner a 96 kHz library... So what does it do? It is a set of tools to assist the Mastering Engineer in avoiding clipping and in producing a 96 kHz file that will code better to MP4 at 44.1 kHz. But just hang on a minute, the SRC is buried within QuickTime running inside core audio in the Operating System – it can be changed at will by Apple, and has been in the past. The codecs for MP4/AAC are regularly changed and not always for the better, Variable Bit Rate encoding, indeed! So we are now producing a 96 kHz file that is optimised to go through a SRC that may change in the future, and then through a codec that almost certainly will change, so the delivered file itself has no validity at 96 kHz. Even if it did, can Apple really handle the jump from 256 Kbits/s to over 5 Mbits/s?? Sixteen times the data! What happens with iTunes Sync when an entire continent upgrades?? Also, will it cost more, and will the authors and artists ever see that revenue? The likely outcome is a data-reduced, but probably scalable file, with an annex file and a core file, with the annex to follow later. This is probably the solution, and will allow simple portable devices to just use the data reduced core

version, but still allow reconstruction of the original file at full 24/96 resolution; it will cover all bases, but we will need to have the codecs available in order to produce and master the best results for release. However, this means that the Mastering Engineer hasn't had the opportunity to try out the 96 kHz codec either. It is just ridiculous to collect a hi-res library like this; the Mastering Engineers must have access to all the codecs in their final form, we cannot keep changing defunct codecs because they cope 'less badly' with this year's tastes in music and pretend that they will therefore code previous music more advantageously. Mastering Engineers strive to deliver files that are 'bit for bit' accurate, and here is Apple changing the bitstream at random. But let's take a step back, what happened here... We are treating the symptoms, not the ailment. Apple will not allow the delivery of two files, one for hi-res 24/96 and one for 44.1 kHz, so we are torturing our music to make it fit into an inadequate medium, where in fact we should be perhaps changing the medium... But of course that will knock Apple off the air, they have nothing like the necessary capacity and most importantly nowhere near sufficient bandwidth. When Virgin Records couldn't get enough stock in their stores, or they had too many customers to get through the doors, they built a bigger store – the Virgin Megastore, with bigger doors. It cost money to do it, but it made the money that paid for it.

I take my hat off to Apple who have succeeded in turning a technological problem into a marketing opportunity. They've done a really good job of it, and they've succeeded in keeping all their money in the bank, whilst only modestly increasing the bandwidth and capacity of their data centres.

Of course there is also Amazon, persevering with MP3... er, why? So in summary, here it is – we can make records better than ever before, in higher quality for a lot less money, and whereas in the past we strived to attain the highest quality release format, we now release it in the lowest format available... It perhaps compares well with the cassette. The marketing chaps pretend that that is what the audience wants, but is it? Look at the ever-climbing figures for vinyl sales; the demographics show that the two centres of this market are the over 55's and the 14-28 year olds. The younger market perhaps started buying it as a novelty when they couldn't even play it, but they soon found a way and have realised that it is actually a high quality medium, and much better than a download, and they have stayed as a market force. I love vinyl, but I'm not saying that we should go back to it as the only way to get hold of a higher quality product. After all, this conference is entitled Innovation in Music, and I'm not just suggesting we go back to where we started, but we must not just accept poor quality because it is convenient and keeps just a few pockets full of cash.

Can we change, and can we change quickly? After all, when television took over from film in the 50's, the film world very quickly retaliated with Widescreen and 3D, it then took television about 50 years to become widescreen and 60 years to take on 3D, but on the other hand in 1927 the recording industry changed worldwide from acoustical recording to electrical recording and did it in the space of seven months. In 1964 Marshall McLuhan said, "the medium is the message"... but in our case that medium cannot contain the message by one hell of a long way, so instead we are bowdlerising the message to make it fit the medium. But now we are in the 21st

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century, surely it is time to produce a medium that is actually fit for the message. Let's try and release a record that is higher quality than what was achieved by Buddy Holly in 1958.

Let's hear that track by Buddy Holly again, and hope that we can have a release format that is worthy of the music we are creating, and if not, well let's just reminisce for a few minutes... After which, I'll try and answer any questions that you may have...

Biographical Notes

Crispin Murray started working with the BBC Transcription Recording Unit, mixing all types of music from classical, through jazz to rock and pop. There the engineers were still designing and building their own equipment as well using it for recording. Crispin went on to work at Townshouse Studios and ran the Manor Mobile Unit. Murray later became former Technical Manager at Metropolis Studios and is now Technical Manager of Guilde Productions keeping Neumann lathes alive for Mastering Studios across the globe.