

THE MUSICIAN'S GUIDE TO MUSIC PRODUCTION

**All about recording,
mixing and mastering.**

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Foreword

The most important date of my life was my dance with music and I am happy I didn't miss it. Truth be told, I'm unsure when the exact moment I fell for music was; I just know that it happened when I was still rather young. I had to sing in the school's choir right from the first day of school, and, being part of the school choir, it was mandatory to attend the Philharmonic's matinee shows every Sunday. So there was that. When I was ten, my parents forced me to learn classical guitar; they loved music, but, to be honest, the main reason for sending me to guitar lessons was to keep me busy, keep me off the streets and out of trouble. For the most part, they succeeded...

Hilariously enough, when I was about 17, I discovered the advantages of being a guitar player: it was like being a magnet for girls... right after the time I discovered rock. But, at a certain point in time I took studying music very seriously, as I did physics and philosophy. This led, eventually, to my first visit to a recording studio. Wow! I was fascinated by consoles, the process of recording... I knew, at that moment, what I wanted to do!

So, many years later and after a move to a new continent, I got to have and do what I wanted, and, during this journey, pick up some hard earned experience. This e-book comes from that experience of all these years, from what I learnt from great guys, and it is my gift to you. I hope it will help you better understand the process of music production: recording, mixing and mastering. The e-book is not meant as a technical guide. Rather, my goal is to try and present, in a simple way, the essence of the music production process, how to prepare for it and how to get the best possible results. I am confident that you will not be disappointed.

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1. HOW TO SELECT A RECORDING STUDIO

Finding and choosing a recording studio presents some challenges. First, in a large city there are too many studios; and in a small city there, most likely, aren't enough. So, how do you know which one is the right one for you? What criteria should you use?

The following are some thoughts that come from my experience - both as a guitar player and a sound engineer. When you finish reading, you will probably be picky when it comes to selecting a recording studio. But, in all fairness, I strongly believe that the more prepared you are for the recording session, the better the outcome, and, when you know what's involved, you contribute to a more relaxed, more productive atmosphere where everyone is happy and the product you walk out with is of a higher quality than could be achieved by feeling your way around a studio by chance.

So, you've decided to record an album or a demo. Well, it's best to think of the whole thing as a major project that you have to prepare for by understanding all its aspects. This is the most important thing. You want a good quality recording without spending too much money. Where do you start? While you can't avoid spending money (nobody records for free!), there are ways to maximize the results you're getting. Choosing the best studio for your project and planning your recording sessions properly are the keys to a good product. It takes quite some effort and patience, but it will pay off in the end. A good final product speaks not only for your talent, but also for the recording engineer's work and the studio.

Know exactly what the purpose of your final product is! It makes no sense spending a fortune in a major studio for a demo needed for promotion, for a CD you want to sell at your gigs or through the internet. Obviously, when you have a contract with a major label you'll be doing your job in major recording and mastering facilities - that's what major labels expect, and also fund.

As I said, for most of projects, a medium or small professional studio is your best bet. This is not to say that you can compromise when it comes to quality! Today, due to advances in technology, the quality you can get in a medium sized or small studio can be on par with one from a major studio. What medium and small studios lack are the large, great rooms - some of them being famous, like the Capitol recording room - and people working who are the top professionals in the business. But they also charge much more, most likely outside your budget, due to their overhead expenses.

Unless you are at the top of the charts or you have lots of money, a medium or small size studio is the answer. However, be aware that a small or medium professional studio doesn't mean a laptop in the kitchen!

Carefully establish your recording budget.

Always split your recording budget: from the total amount of money, always think that almost half is needed for mixing and mastering. The rest is for studio hours. It always takes longer to record than you expect, and watching the clock instead of focusing on your music may have disastrous results. Don't panic and don't rush the recording stage. Do redo some so and so tracks and delay the mixing if you have to. You'll be glad you did.

You have a budget, so automatically money will probably be the first criteria. This is not the most important criteria, but c'mon, let's be honest, this is the reality... at least until you're at the top... otherwise you wouldn't be reading this! So, look for a studio that fits your budget. Ask around: word of mouth is an excellent bet. The internet is a great source, but you need to use it intelligently; like with everything else when it comes to business, you have to be able to read between the lines.

I frequently see an extremely well designed, catchy website, talking about the latest technological wonder the studio has, as if that was the key to providing the holy grail of sound reproduction! Well, it definitely isn't, but many artists don't know that and when they find out it is too late... the train has already left the station! There is this human element of liking something or not when you see it for the first time.

Remember that a beautiful website is just a marketing tool meant to capture your attention and is not a guarantee of a better sound. So, pay attention to the samples (and, unless it's a well-known studio, stay away from the ones that are not putting samples on their site) and, right off the bat, you will have a pretty good idea about the recording quality the studio provides.

Be aware of the voice over beat samples- the beats sound fine, but they're done with synths (software and hardware) and they do not give you the real picture about the real sound capability. If the studio has samples of a band (jazz/rock/funk/...) or some music, where acoustic instruments were recorded, that speaks volume about the studio capability (both recording and mixing).

Check the photos (if available) – they give good indications about the recording space. Is it just a room or is it an acoustically treated room? The equipment list indicates the level of quality achievable if the engineer is good.

Be organized when you start gathering info about studios.

Take notes so you can compare them later. You can establish a couple of criteria (like price, distance, engineer, equipment, acoustics, sound, space, even your instincts). Notes are the best way to keep the track of what you found out. Otherwise, you'll forget details that may be important.

Make sure you know the quality you are looking for.

The days of a simple voice and guitar demo are long gone. Phil Ramone said in an interview with Howard Massey:

“The quality of a demo is so important these days- you can’t go anywhere with a piano/voice or a guitar/voice demo. You can’t do that anymore!”

The music business model has changed a lot over the last three decades. The way music is marketed and distributed has changed dramatically. How to promote yourself and your music has changed too. If you aspire to be signed by the major labels, you need to get to them somehow, or generate major buzz. I don’t think there are too many A&R people today that can envision, by themselves, how a song can be with a proper arrangement. And even if they can, they do not want to assume responsibilities that can cost them their job! They expect a product that, if it’s not ready for distribution, is very close to it. You may have a music business lawyer who has connections; do you really think he will give your demo to his connections if it doesn't sound right? Better think again.

If your target is to promote and sell your music and build your own brand (through sales, advertising, gigs, radio/TV) without getting signed with majors, the good news is that this is very possible today. Many musicians are doing it and internet plays a major role. I cannot stress this enough: ***the internet plays a major role in the promotion of your brand!*** Your music has to sound right in all the popular formats promoted on the internet. That poses challenges from a mastering point of view and it’s up to you to make sure the studio you select knows all about it.

Once you have a list of a couple of studios, arrange some appointments, head out and check the studios to get a direct feel and impression of what’s being offered.

Here are some very **useful tips when shopping around for a studio:**

- Try to find a studio not too far from your place- driving two hundred kilometers before recording doesn’t help your performance and definitely adds to your bottom line. Many times you have to come back for a re-mix or some post-production. Make appointments with a couple of studios that fit your budget criteria and go and take a look.
- Do you like what you see and hear? Does the studio have a pleasant and creative environment? This is way more important than you think. Feeling comfortable and confident is extremely important. Stay away from studios in the kitchen, hallways or rooms with cables laid out all over- do not expect a clean audio path, without hum! Basically, if it looks half-assed, your product will probably sound like that too.

- Check the acoustics for your style of music. If you're into large orchestral sessions, a large studio is what you're looking for. But for pop, rock, folk, jazz, R&B, a smaller live room will do the trick. Also, get a feeling for both the recording and control rooms - a good acoustic design goes a long way toward producing an excellent final product.
- Speaking of the recording space, think about the level of isolation you need if the act is a band. In some cases, microphone leakage is your friend (especially for jazz bands recording together); whereas in other cases isolation is required. For most projects like pop, rock, isolation is required, so check if the studio offers enough possibilities to achieve it (vocal booth, live rooms, space, etc).
- Have some familiar CD's with you. Ask the engineer to play them and listen from the mixing position. Do you hear every detail clearly, along with every instrument position? Ask the engineer to let you sit in his chair and switch the monitors from stereo to mono, and in that moment the sound should move right in front of your nose, like you can touch it. If it doesn't, the room has bad acoustics and there is no way to get a good mix! The studio acoustics / room response is extremely important for mixing and mastering! **And DO NOT LISTEN TO ANYTHING LOUD!** Volume merely masks imperfections. Everything should be audible at a reasonable level.
- It is a bonus if the studio has more than one pair of monitors, so the engineer can switch instantly to check the mixes. Aside from the main monitors, the other monitors should help give you an idea how a mix or master translates to the real world. A pair of small Auratones can give you a pretty good idea on how a song will sound on TV sets (they generally have nothing under 150 Hz or over 8000 Hz). Some computer speakers, a set of audiophile monitors and a boombox would definitely help when making decisions.
- Look for a studio that includes an engineer in the rate. The studio engineer knows the studio acoustics pretty well. Yes, you can hire an independent engineer, but generally it's not worth it. The studio engineer is familiar with the equipment and will solve problems as efficiently as possible, as he knows his way around the studio. Let him listen to the samples you have (samples in the same vein as your music style) and discuss with him how comfortable he feels about achieving that type of sound. There's no point in hiring a sound engineer that's never worked with a jazz band if you want to record jazz, for example.
- During the appointment, make sure you talk to the recording engineer. He is one of the key players for the session - the most impressive equipment will only sound as good as the engineer's ability to use it. You're paying for him, so make sure he is attentive, willing to help you when you hit roadblocks and does what you want. A personality fit goes a long way!
- You may or not have a producer. Producing a song is not easy, and having somebody who worked with many other acts means you get some objective ears

judging your project and making valid suggestions. It helps if the studio engineer is a producer too; the experience he's gained with other acts will only benefit your project. If you're on a tighter budget, finding a studio operated by a producer is a pretty good bet.

- If you've done some pre-production work at home (some tracks), you want to let the engineer know about it, and he will tell you how to have the tracks prepared when you come to record on top of them, so you won't lose time. Nothing worse than paying money for an engineer to hit the 'convert' button and charge you while you wait for something you could have done at home while eating wings and watching TV!
- Always look for a studio that can accommodate a set of drums in case you need it, so you won't have to record the drums into another studio. And, with more live rooms, it is easier to record more instruments (like drums and percussion at the same time) and get a better performance on tape.
- Speaking of instruments, check if the studio has a piano if needed. In small and medium studios, space is a problem, and you may not find a grand piano. However, the studio may offer some truly great alternatives, like Roland V-piano or Yamaha AvantGrand. They have a great action (of course, this is a matter of taste), and a very good sound. These pianos are a huge step above regular digital pianos and can indicate that a studio cares about the quality of the equipment it provides its guest.
- Make note of other instruments - guitars, basses, amps, effects- the studio has available. You may need to cut a track with a different color, or add an acoustic guitar, or double some guitar tracks, and you want to have some avenues available to explore. You're not going into a studio to write a song, but a little experimentation enabled by different sounding instruments than what you're used to can add an interesting flavor that really enhances your piece.
- The single most important thing that all famous producers like Ramone, Kramer, Visconti, Cherney, Brauer, Afanasieff, Johns, Parsons, etc, agree upon is getting **"THE PERFORMANCE"**. And a great performance can be generally only be achieved when everybody in the band plays together, feeding off each other's energy, even if some tracks will be overdubbed afterwards or only the drums and bass are recorded. A studio that can record at least 12 tracks simultaneously is a good bet in case you want to have everybody play at the same time.
- Pay attention to the monitoring system while recording!!! You want a multi-cue one, so each player can basically have his own mix and feel comfortable. Even better is a headphone monitoring system, which allows the player to control what they hear in their respective headphones. It's a funny human thing but each player wants to hear himself louder in the headphones! A multi-cue system enables this, allowing musicians to be more comfortable and churn out a better performance.

Once you've finished visiting the studios, it's time to narrow down the list. You may already have an answer, but sometimes it comes down to 2 or 3 options. All these options may do the job, but now is the time to connect the nature of your project with the technical possibilities of the studio. Some studios have only the latest technology, some have the prized vintage gear that ensures a certain color to your sound. A typical rock and roll has a different sound than R&B, and the tools used have a lot to do with it. So, let's dive a bit into the many aspects of the equipment used in a recording studio.

The studio equipment

Many studios post on their sites: "Beware of long lists of equipment!!" True, although, this would be more accurately worded as: "Beware of long list of crappy and cheap equipment!" What these studios don't tell you is how important the quality of the microphones, preamps and compressors is. It is OK to advertise that the engineer's experience counts for a lot, but if you ask for a certain high end microphone for vocal or acoustic guitar that you know is part of your sound and you're told that the studio has to rent one, it is only fair to assume that the engineer does not have the right experience to get the sound you're looking for because he doesn't work on regular basis with quality equipment, so he doesn't know what can be achieved with it!!!

A common answer when you ask if the studio has some high-end microphones and mic preamps is that the studio gets a fantastic sound with an unknown brand, as they know really well how to use it. While that may be true (extremely rarely, tough!), a good quality studio has to be able to offer you some options you can try and see which one provides the best results for you. And by options - especially for vocals- I mean tube large condensers with Neumann, AKG, Soundelux, Lawson, Brauner, Telefunken, Gefell, Blue or Manley logos!

Understand that the performance of a single microphone preamp worth double the price of a 16 channels Mackie mixer is beyond comparison with the aforementioned Mackie! Many engineers use a compressor when recording vocals, but no compressor comes close to the Tube Tech CL-1B or LA-2A for vocal work! The best engineer with the best equipment for the money you can afford - this is what you have to look for!

As I pointed out already, the performance is the most important element in the recording process. The sound quality comes mostly from the musician's ability to interpret his part. Equipment will never replace that. But good quality equipment captures the sound properly and gives the engineer the raw materials with which to do a proper mix and master! In other words, a poor performance or a poorly captured performance can only be masked to a certain extent in the mixing/mastering process. So you want to set yourself up for sonic success from the get-go rather than relying on post-performance trickery.

Always look for boutique quality and high-end/esoteric gear. The most important things are the microphones (look for names like Telefunken, Neumann, AKG, AEA, Lawson, Royer, Earthworks, Brauner, Blue, DPA, Schoepps, Gefell), mic preamps and

EQ's (like Martech, Neve, Millenia, Massenburg, Great River, Pendulum Audio, SSL, Chandler, Focusrite Red, API, Vintech, etc), and compressors (Thermionic, Elysia, Tube Tech CL-1B, LA-2A, Portico Neve MBP, Avalon, Urei 1176, Distressor, Cranesong, Manley, SSL, API, etc).

Do your homework and write down what the studio has to offer - microphones, preamps, EQs and compressors - and then take the initiative to do some research on the internet - there are many forums with a lot of info, like www.gearsllutz.com (where recording/mixing/mastering legends like George Massenburg and Bob Katz are moderators).

When it comes to microphones, for a solo act, a good quality microphone might be sufficient by itself. But for a band, you want to have access to different microphone flavors, because if you overdub everything, even with a premium microphone, the final product will sound flat. A good quality studio has to have a good collection of microphones, because each style of music and each instrument requires a certain sound and, there is no one type of microphone that fits them all.

If you want to record a piano a matched pair of omni Earthworks or DPA and a large premium condenser are the way to go, especially for classical music and jazz. Of course, two Rodes or AT will do the job, but you WILL HEAR THE DIFFERENCE!!! For reeds nothing beats a good ribbon mic!! And staples like Royer, Coles, AKG 414's and 112D, Shure SM7, SM 57, SM 58, Electro-Voice RE-20 and MD 421 Sennheiser are a good bet for drums, percussion, bass and guitars. While the most important thing for getting a top quality product is the artist performance, the studio has to be able to provide the right tools to capture that sound!

Regarding the preamps: make sure the studio has premium preamps, which are suitable for the style of music you are playing. If you're a classical musician, or for acoustic instruments, a transparent preamp like Millenia or Earthworks is desirable; for rock, jazz and R&B, then Neve, Focusrite Red, Martech, API, Pendulum Audio, Great River, SSL, Fearn, Vintech, Avalon are great options. There's a reason the Millennia preamp is used almost exclusively all over the world for classical/chamber/choir music.

Of course, great preamps are not cheap. They cost thousands of dollars! In your studio search you will be told how great Presonus, ART and Behringer preamps are. Here is the news: they're not! Sure, they'll get the job done, but you can't really compare a 1500 dollar one channel preamp with an 800 dollar eight channel preamp!

Look for a studio that has a couple of great different preamps, so you can take advantage and get the best in different recording situations! API, Focusrite Red, Neve or SSL are great for drums; on the other hand, when it comes to record or warm up a synth a tube preamp like Pendulum, Thermionic or Fearn is a great way to go.

Pay attention to the vocal chain- make sure there is a great vocal compressor like Tube Tech CL-1B or the LA-2A, or, eventually, a Cranesong Trakker. They do a

great job without compromising the voice quality and, when used properly, you can't tell that the voice was compressed – they've got a magic touch. Great vocal preamps are Martech MSS-10 (very deep, great for huge voices, many consider this the Ferrari of the mics world), Neve 1073 (especially good for pop/rock, raspy voices), Pacifica, Telefunken V72, Hardy, API. As far as the vocal microphone, you want to be able to choose from a selection of great microphones to see which one fits your voice best and make sure you are given to try at least one high-end tube large condenser.

Always ask about the quality of the A/D and D/A converters. If the studio uses tape, that's not relevant, but if the sound is recorded into a computer, the converters are the first thing you want to look at! There are audio cards with converters like Motu, Lexicon Omega, Digidesign Mbox-2 or Echo which provide a good sound; but when it comes to a great sound, with extremely reduced artifacts in the process of conversion from analog to digital for recording or digital to analog when listening, look for mastering grade converters- Prism, Mytek, Lynx, Lavry, Apogee.

When the track count is high, you'll hear clearly the difference! The aforementioned mastering grade converters are way more expensive compared with the rest, and, again, there's a reason why! These converters provide higher integrity to the sound and they employ very sophisticated jitter reduction technology. In plain English, they almost entirely preserve the quality of the sound during the conversion to digital or to analog.

Nowadays, almost all release-quality recordings include the use of hard disk recording and editing systems like ProTools, Nuendo/Cubase, or Sequoia. Few people know that in a tape-based studio (analog or digital) at least 20% of your time is spent waiting for the tapes to be rewound after every punch-in; this is not a problem in a random-access recording system like those mentioned above.

Certainly, tape recording has its own advantages; a lot of people swear by the warmth of the sound. In fact, they bring to the table some distortion that is pleasant to the human ear.

While digital recording at today's resolution is very accurate, the sound of premium consoles like Neve, SSL, API, Harrison is famous and you can hear it in all the major releases of pop/rock/jazz music. Unfortunately, they are extremely expensive, and you can find them only in the multimillion dollars large studios.

In the last couple of years the hybrid digital/analog mixing that gives a more personal and organic sound became possible due to analog summing boxes. Some of them have a unique and beautiful sound: Chandler (made by EMI/Abbey Road), Inward Connection Mix690 (made by Steve Firlotte with the famous 690 Jim Hall op-amps), Fat Bustard (made by Thermionic), Great River MM20, Shadow Hills, Neve 8816, X-rack SSL. While quite expensive, they are more affordable than the legendary consoles and there are medium and small studios that have started to use them; make note of studios

that are using this approach – these boxes again indicate a studio that has probably taken some pains to provide a really quality final product.

As some of the medium and small studios ventured in the hybrid analog/digital mixing, check to see what hardware are they using along with their plugins: names like Eventide, Bricasti, Lexicon, TC Electronics for space/reverb/delays; Elysia, Neve, Cranesong, Thermionic, 1176, SSL, API, Avalon, Empirical Lab, Pendulum, Manley, etc for compressors; and Neve, Massenburg, Chandler, Millenia, Avalon, Pendulum, API, Weiss and Manley as EQ's are quite desirable.

Another thing to look for are the plugins used. It makes a difference if you see the UAD, Powercore DSP or Duende cards with the top plugins in the business or native plugins like Sonnox Oxford, Algoritmix, DMG, Soundtoys, Waves, SSL, Lexicon, Altiverb, etc! Also, make sure the studio uses good software for voice editing - Melodyne, or Antares. Drums are usually a problem, and a tool for drum replacement like Drumagog (which can be also used to add actually another drum) can save the day!

Always ask to listen to some music (have some CD's with you) in the same vein with the one you're doing through the studio monitors. The monitors are used to judge the tracks, the mixing and the mastering. If they're low quality, there will probably be a problem! The studio engineer is used to them and he can do an excellent good job, but there are situations when you may be asked to make some decisions, to accept or redo some tracks, and you may not be able to have an objective opinion! It definitely helps if the studio has 2 or 3 sets of monitors of different makes and sizes, so you can check through all of them!

It helps even more if the monitors are made by ATC, Barefoot, Focal or Klein & Hummel, Yamaha NS10's powered by Bryston (a studio standard); other good monitors are Adams, Tannoy, Dynaudio, etc - just ask to listen to your CD's and you will notice the difference!. They reveal easy any problems and allow an engineer to achieve great balance and imaging.

Ask about the studio policy when it comes to mixing. If the same engineer that does the recording will do the mix, ask him how soon that will happen after recording. Normally, in cases like this, you want the engineer to work a different project after your recording sessions, then come back and do the mixing, so he can be more objective.

For hip-hop, R&B and rap, or for any situation when you need pre-production, always look for high-end synths and sound modules made by Moog, Kurzweil, Korg, Waldorf, Oberheim, Nord, Access, Dave Smith, Roland, Ensoniq, etc. Lately, a lot of very good software synths have come out as well. I personally prefer the hardware - that's not to say I do not enjoy creating sounds with Omnisphere, or use libraries from 8dio, LASS, Soundiron, VSL and many of the libraries from Kontakt, EMUx3 and Yellow Tools.

You can skip this paragraph, it's going to be little technical, but it gives you a better understanding of why a microphone preamp does a good job. Most everyone knows that we have to avoid clipping during recording; what is not widely known is that, long before clipping, many preamps exhibit an extreme distortion increase, as they change from Class A to Class AB operation. Therefore, it is very important to have at least 6 dB between the peak level of the music and the clipping point to avoid a harsh sound. The difference between the average level of the sound and the clipping point is known as headroom. The bigger the headroom, the better the sound! The high-end preamps have clipping points as high as 37 dBu (+55 Volts), while the semi-pro and consumer equipment have 20 to 24. In plain English, in order to get a good sound, the preamps have to have very high output devices and high-voltage power supply, which is very expensive; you won't get that with 100 dollars per channel preamp. These cheap preamps are good for the hobbyist recording engineer, but they are to be avoided if you are looking for quality! The good preamps or EQ include very high quality circuits and excellent transformers, and when have to mic many tracks, you'll understand it!

There are many small and medium studios and there is nothing wrong with them, especially if they pass the lower overhead costs to you (unlike big studios who can't afford to do so, as they have a large overhead due to rent and maintenance). Just make sure they provide comfort, good acoustics and monitors and good equipment.

Beware though: many people are recording with a computer, a cheap console or preamp and cheap microphones. My suggestion is to think twice before you pick the most inexpensive studio as your product will definitely reflect that. A \$200 mic or preamp can't provide the same quality you get from a \$4000 microphone or preamp (cheap mics made in China working exactly like Neumann is just plain marketing BS, you know they have to make money too! Not that they're terribly bad, they can be useful, but they're very inconsistent). When you're putting a lot of effort into making a recording, saving one or two hundred dollars at the cost of low quality is definitely a mistake.

In conclusion, always choose the studio that makes you more comfortable and meets your recording needs. What really make the difference are the engineer's ears and experience, your musicianship, the space you record in and the equipment that captures your performance.

2. RECORDING EXPLAINED

2.1 Recording in a studio

This article outlines the basics of the recording process. The time you spend recording should be used properly, so a basic understanding of the recording process is imperative, especially if you're going into a recording studio for the first time.

If you have some tracks (pre-production or tracks recorded in another studio), they are to be taken care of first and loaded into the workstation. Make sure that the tracks are exported from the same starting point, so no time will be wasted aligning them. If you are doing these tracks yourself with software instruments, their peak level should be somewhere around -6 dB (at least under "0" to avoid clipping when exporting them!). I would recommend recording them in mono and exporting them as mono files. Have 24 bit/44.1KHz or higher (88.2 or 96KHz) as a target when you record them, and export them at the same resolution.

There are two approaches when recording a band. The first is to have everybody play together, and try to get a great performance - which is the most important thing you have to have in mind when recording. The studio in this case has to have the capacity to do this with enough isolation between instruments (even though leakage is not necessarily bad). Later, other instruments can be added (overdubs) or some parts need to be re-recorded (punch ins).

From the sound point of view, recording each instrument separately is desirable because it provides easier control of leakage into the microphones. This doesn't mean that a band will not play together - let's not forget that the most important thing is to capture a great performance. Recording will be done in stages whenever necessary; the drums and the bass first (with all people playing together if that's what they want), then other instruments and voices done as overdubs.

While for rock, alternative, and pop this is a typical way of recording, in jazz, all the players are generally recorded at the same time, the way they play is interactive and capturing the feel of how they're interacting is very important. It helps a lot if each musician has their own mix (or personal mixer), so they feel comfortable.

As far as getting the sound right, once you have your instrument set up and ready for recording, the engineer will try to determine the best position of the microphone. This process takes some time; while there are some general rules for capturing the sound, let's not forget that every instrument and microphone has their own acoustic characteristics. The engineer will help you with some tips (like gels and rings for drums, or a different amp or cabinet for recording guitars). However, remember that the sound lies in the musician hands, ears and his playing ability!

The microphone's set up takes time and you don't want to take shortcuts here! Having some music samples in the vein of the sound you're looking for is important - the engineer will have a much better idea of the sound you're aiming for. Microphone placement is essential; let the engineer do it, and, if you already recorded some tracks into another studio and you got your sound with a certain placement, let the engineer know about it. Fine tune the placement until you get the sound you're looking for; record a bit and listen in the control room through the monitors and adjust more if necessary.

As a principle for recording vocals, the engineer will usually try with a couple of microphones to see which one is the best fit for the voice. While generally large condensers like Neumann, AKG, Telefunken, Lawson, Sony, Brauner, Gefell, Soundelux, etc are the norm, sometimes a dynamic or a cheaper microphone can prove to be the right tool. In deciding which microphone suits the voice better, use your ears only. Don't fall for the mistake of picking up the Neumann no matter what because of its logo! Experimentation is a major factor in getting a great sound; it takes more time but it can bring something unique to your project.

The microphone preamp/compressor chain is an important part of vocal recording. The microphone preamp has to fit the voice and the compressor has to be transparent. There are a couple of microphone preamps used quite often (like Neve, Martech, Pacifica, A-Design P1, Great River, etc) but when it comes to compressors, there are basically two that are used all the time because of their high-quality and transparent sound: the legendary Tube Tech CL-1B or the venerable LA-2A.

Always listen to what you have recorded; you don't want to discover there are problems when the engineer does the mixing and come back for more recording. On a later recording session the sound will be probably different; it is almost impossible to match the previous set up; the air (humidity) and so on will be different. So, listen after every 2-3 takes and one more time at the end of the recording session. Sometimes people are tired, but this is an effort that always pays off. Yes, it is costly, listening is in real time, but is completely worth it. Break it down like this: you can either budget for an extra hour or two for listening throughout your project or you can budget for doing two or more setup/recording sessions after you decide you want to re-record something because you're not happy with the original recording. Which one's better for your bottom line? The answer is obvious.

2.2 Recording on location

There are instances when it makes more sense to record on location, as there are some advantages to it:

- a. It can get very expensive for a large orchestra, chamber music assembly or choir, to record in a studio with a very large room with good acoustics. Space is always a challenge, but you know there are some very nice halls and churches out there with great acoustics.
- b. The sound of the room (hall, church) helps the type of music. On the recording, it becomes part of it. Choir and chamber music definitely benefits from the natural reverb of the room. Proper microphone technique provides more or less of the room reverb.
- c. Recording a concert/show in a club or a different location, with a crowd present. The recording may not be as polished as a studio release, but this is not the objective; the scope of recording is to capture the performance, the band's ability to entertain, improvise and move the crowd. I personally like live recording a lot as it is all about performance and, being a musician myself, I really empathize with that.
- d. Recording jazz is definitely about performance. Jazz is extremely interactive, it has so much improvisation and a lot of the spirit of the music lives in the dialog between the instruments. Jazz aficionados love the live albums because it gets very close to the essence of human nature: freedom and creativity.
- e. Recording on location can also save the day, in some cases, for safety reasons: I've recorded several excellent children's choirs at schools - they produced a CD, then the school sold the CD for fundraising. Many parents won't agree to have their children go to locations they don't know anything about; children need to be supervised and it is way easier to do it in a school setting.

Recording on location requires a great deal of experience: each scenario is different. Recording a chamber music group, a choir, a philharmonic orchestra or something similar requires certain techniques to provide both a good balance between the room atmosphere without muddying the vocals/instruments and their clarity (techniques like Decca Tree, Telarc, ORTF, M&S, the use of Soundfield mics, the Holophone, the Schoeps KFM 360 designed by Jerry Bruck). The microphone and preamp quality and transparency is essential; think Schoeps, Earthworks (both mics and preamps), DPA, Millennia. A live stereo recording is OK for a simple demo; but for a CD release a stereo recording is just not good enough, and that is the reason the aforementioned techniques are employed.

Recording jazz/rock/alternative requires capturing both the atmosphere and each instrument separately so it leaves a lot of open options when it comes to mixing. The major challenge to recording on location is getting the best sound of the space,

maintaining clarity and capturing the small details. While the acoustic space is well known to the engineer in the studio, a different acoustic space requires new solutions, different than those used in the studio.

An important aspect of recording on location is the careful planning needed - for both the studio and the artist/artists. A good engineer first studies the space and, based on it, develops the best recording strategy. As a client, you can do many things to help the process, which in the end influences both the quality of performance and recording. An example: try to schedule to record the songs where you have brass and reeds at the beginning of the session rather than nearer the end; unless the artists are pros with a lot of experience, there is a fatigue that occurs, which can be quite annoying.

2.3 Do it yourself recording

DIY recording is a reality, and more and more people are doing it! It is amazing how technology touches our lives, raises challenges and also makes things which were impossible just a few years ago become reality! More and more musicians are starting to record themselves, lured by marketing campaigns like "Studio in a box!" and by the low price of the technology. So they buy a multi-track workstation like a Korg, a Boss or a Roland, they buy a microphone, they read the manuals, they do the recording and then the mixing (these boxes are amazing, aren't they? tons of virtual tracks, they have all the effects and EQ's) and then they are surprised to discover that their product is very far from an acceptably commercial one! Sound familiar?

Trying to save money makes sense, and everybody does it, but you have to do it wisely. I am giving these tips away because I had many clients who were recording themselves and then coming and asking me to do the mixing for them. Many of them believed that you can fix all the problems at mixing, but that is simply not true. "Do it yourself" can be a viable option, provided you do it properly and you are willing to learn a bit about recording. Also, there are limitations to this process - you can get a decent product that you can sell at gigs or showcase on the internet, but it can't properly compete with a major commercial release.

Right off the bat, everybody should understand that recording and mixing require a completely different set of skills. Mixing is a very complex process, and there is no way you can do it right on a \$1000 box and a set of cheap headphones. A single high-end EQ plugin could be well over 500 dollars, and a high-end hardware EQ around \$5000, so you can understand why these boxes are limited. The listening environment is much more important than you may think, and it starts with good monitors and an acoustically controlled space, like we've already talked about. So if you decide that you want to go down this avenue, I would advise doing the recording yourself and having the mixing and mastering done in a professional studio.

First rule: **record at 24 bits**, period! Get a multitrack that records at 24 bits (you can either buy one or rent one). Another solution, though more expensive, is a computer where you need to buy a good audio interface and along with a sequencer. This path can be very rewarding, as you can use samples and virtual instruments and end up with quite complex arrangements on your own time.

A nice all around solution is a MacBook Pro loaded with Logic and with an Apogee Duet interface. Logic is a pretty good all around program, and it comes with a very decent library and virtual instruments. Use a good pair of headphones when recording. One major advantage here is that Macs are easier to handle than Windows computers, and if you're not a computer geek, you'll be up and running with a MAC in no time. For the purpose of simple high quality recording, this is a very elegant solution.

Do not buy a cheap microphone, rather go and rent one or a matched pair. Go for a good condenser, like AKG 414, which has three patterns and is a great all around microphone (for vocals, acoustic guitar and others), and a dynamic like MD 421 Senheiser for guitar amps/percussion or an SM57. The AKG 414 is a standard studio microphone, you can't go wrong with it. Also, rent one or two mic preamps (Neve, Chandler, Focusrite Red, Avalon, dbx Blue) or a channel strip - try a Pendulum Quartet, a Focusrite Red, a Millenia STT1 or an Avalon.

Run everything through the preamps and make sure you don't go into clipping. I repeat, avoid clipping!!! Keep the peaks at max -6dB! When you record at 24 bit, it is definitely OK to record at a lower level than risk to get close to "0" and running into problems. **ALWAYS LISTEN AFTER RECORDING !!!**

Do some research (internet will suffice at this point) about recording techniques, how are the mics working and how to use them, their patterns and how to position them when recording. Try and experiment first, don't settle for the first take. Play the same thing, use different placement scenarios, compare. You will hear the differences!

Many people use drum machines; sync it with the DAW and run the drums separately (kick, snare, toms) one by one through the preamps and record them in separate mono tracks. If you take your project to a studio to mix it, it is a good idea to have the drums in separate tracks (kick, snare, mic room) and eventually the overheads can be in a stereo track. If you are doing the drum tracks with samples, using something like Addictive Drums, Superior Drummer, BFD or the sequencer drum program, export them separately too – mono tracks. These software packages have also usually EQ, compression and reverb, but I would advise to export the tracks without using the effects.

Pay attention to the meters on the workstation box, they don't show you the whole story, especially when it comes to percussion, and it is very easy to go over without even knowing it. Pay special attention to shakers, cymbals, and similar instruments. Make sure you're not peaking over -10 db for these types of percussion instruments.

To record vocal and acoustic instruments, try to find a quiet place in your house, and try to choose the largest room. When recording vocals make sure the reverberation is rather low. Throw some blankets/duvets around to reduce the early reflections and if you need to dampen the sound.

Avoid recording vocal in the bathroom (I suggest trying an electric guitar amp there for fun!). Natural reverbs are desirable if they are excellent; otherwise, if not that great, once printed to tape you can't take them out. Use blankets hung around the walls of the room to control the reverberation. And even if the reverb is great - you may live in a huge mansion - it should fit the style of music you're doing, so give that some consideration as well.

Recording yourself for some small projects could be very rewarding. Feel free to try and experiment. But, as a rule of thumb, when it comes to instrument sound, try to capture the signal as clean as you can. There are two schools of thought: one (the American one) is to record clean and the other (the British/European) is to print with effects. Because of the lack of experience at mixing, if you want to print with effects, hopefully you know exactly what you're doing, because once recorded you can't undo it, so it is safer to print it clean. If the effects are part of your sound- especially for electric guitars - use them all but the reverb. Do not be afraid to experiment, it doesn't cost you, it is fun, and you can get some spectacular results. And in the end, you can do multiple takes, and choose later at mixing; it doesn't cost you studio time!

Once you have the song recorded, listen carefully to each track separately (solo), and then listen to them together. Is there clipping? Are there any distortion problems? Is there any excessive noise? Are the vocals clean? Can you understand the words easily? Listen to some music in the vein of the music you're doing. Don't be afraid to compare.

Some people record everything themselves except the vocals, and they go into a studio and overdub the vocals. This is a very smart idea, nothing beats a high-end combo mic/preamp/compressor and an acoustically controlled space. And that's aside from the fact that you can listen to your voice through some relevant monitors and get advice from the engineer whether or not you have to redo some parts, do some more punch ins, or what can be edited and corrected at mixing and what can't. Also, you do not have to worry about start/stop tape, finding places for punch in, which helps maintain your focus on singing and the performance itself.

3. GETTING PREPARED FOR RECORDING

The following are some guidelines that can take you a long way toward getting a great recording...

If you plan a good schedule you don't have to do multiple set ups, and that saves time and makes it easier to redo parts in case you find out next day that something went wrong. It is always better to leave your gear overnight and continue the next day, instead of doing very long recording hours, where everybody gets tired.

Discuss with the engineer and schedule the recording sessions in consecutive days, in order to cut the set up time. Consider recording the drums and bass first for all the songs, and then proceed with overdubs.

Make sure the band has rehearsed a lot!!! I cannot stress enough the importance of this statement. The quality of the sound comes mainly from the musician's fingers, and everybody has to feel confident when playing, and this comes from proper rehearsals. The studio is not really a stage, so try to move less during the last rehearsals before recording.

Record yourself during the rehearsals, even with a simple recorder. Listening to the recorded material is a reality check for both the performance and the sound. It is a good idea to show the engineer these recordings. These recordings will help you identify problems with rhythm, pitch, even arrangements issues.

Have all the song arrangements finalized before you go into the studio. There is no point to argue over a bridge or a solo in the studio. Prepare the arrangements in writing for every musician.

Be rested and show up on time; do not bring friends, this is about hard work; they will distract you in a way or another. If you do however, then bring the ones that are positive and cheerful (but tell them to be quiet when recording!). Have a good night sleep before recording. The vocalists should wake up early enough so the voice gets "in shape" by the time the recording starts.

Use comfortable and quiet clothes; the microphones are very sensitive, so avoid unwanted noises. Leave the jewelry aside, you don't really need them. If you know you will try to use a guitar or bass that the studio has, make sure you have comfortable pants that work well without a belt; no studio engineer will allow you to play the studio instruments if they know there is a chance you can scratch it. If you're a guitar player, and plan to use a classical guitar that the studio has, and if the guitar has French polish on top, make sure you wear long sleeves, as the French polish gets affected by the skin.

When you schedule the sessions, arrange with the studio so the evening before recording you can set up the drums and the engineer sets up the microphone. Make sure you tune the drums before the engineer places the microphones. You can do a preliminary sound check and then leave the drums overnight in the studio. The studio atmosphere is different and that can affect the drum tuning, so, first thing next day is to check the drums again, do final tuning and microphone placement adjustments. If you do all this in the first day of recording, you'll get most likely tired and maybe frustrated and the smart way is to avoid it. Double check for squeaks, noises, so you have time in case you have to do some fixes.

It always takes time to do the set up for the session. Be patient, recording takes longer than just playing the song. The microphone's placement and level set up are essential for the recording quality. Try to help having your gear prepared properly - see below specific preparations.

Once the instrument setup is done, try not to move the microphones. They are generally strong enough, that's not the problem; the problem is that their position affects the sound. If they are moved accidentally, let the engineer know so he can reposition them.

Make sure you have all setup tempos for your songs (know the BPM, it is useful to know it when you do not use a click track), and it is definitely a good idea to get used to play along a click track. If you have never used the click track, then do not try right in the middle of recording session, it's not going to produce results.

If you sing and play an instrument at the same time, try to get used to only play or sing; it will be easier to get a better sound recording the instrument and the voice separately, It is better to concentrate at one thing at the time, however, I have to say it, the technical aspects are less important than getting a great performance on the tape. Experiment!

Recording is hard work, it makes no sense to argue whether it should be a solo over one or two verses; studio time is expensive, rehearsal time is not, there will be enough pressure anyway, so have all the song arrangements figured out and have fun with the tunes. Do not forget the old saying: "less is more".

It is widely accepted by the greatest recording engineers that, when it comes to the sound quality, the player/band/artists ability to master their instruments account for 60-70%, the rest being the room (recording space), the microphone placement and the type of microphones and preamps!

Consider laying the drum tracks for all the song you want to record in the first sessions as the drum set up is laborious and it can take time. On the next session, the band can go into overdubs and save time. Make a written plan of what and how you plan to record, what does it needs to be recorded first, as it also helps what's coming next.

Be careful when recording with effects; it may be better to record clean. Once the effects are printed, there is no way to take them out. If a distorted guitar or bass is what you want, it shouldn't be a problem. But the delay or the reverb can create havoc at mixing. Leave the addition of reverbs/ chorus/ delay for the mixing stage unless they are definitely part of your sound.

In jazz, things are a bit different, usually the jazz people know exactly what they want, and they have a better understanding of the sound. When it comes to rock, pop, etc, where there are overdubs, and a song may get to have many tracks, it is better to leave the options open, so there are more possibilities to create the space.

Always listen carefully at what you just recorded!! The engineer may not be able to know that something is wrong in the performance; and sometimes you can point to sound problems! Wasting money by not listening to the recorded material is a huge mistake! Listen to low volumes and ask the engineers to play the dry tracks (no reverb or any other effect whatsoever). Does it sound good? If it does, all is fine. If it doesn't, then analyze if you have to redo some tracks.

Do not rush decisions! Better think twice, try to be as objective as possible.

Always remember that, if you want to get a very personal sound, you need time to experiment; without experimentation, there would be no "Sgt. Pepper's..." – Beatles, or "Time" - Pink Floyd, or Phil Collins's gated drums.

Write down the title of each song; provide as many details as you can, including the key of the songs (or the key for each part of the song), the chord charts, the general arrangement sequence, the words. This is really helpful at the editing stage - for voice correction and for instruments like acoustic bass, strings, etc.

Bring a hard drive with you and have the engineer copy the recorded material into it. A new one if preferable, as usually the recording engineer will either want to use a new one, or format an old one. The reason is simple: the workstations used in studios do not have antivirus programs, as the antivirus software creates major problems with the audio sequencers. So, don't get upset if the engineer won't use an old hard drive unless he formats it. Reloading from scratch a workstation and test it can take easy two to three weeks, so nobody takes this risk.

Do not hesitate to ask for the engineer's opinion when you hit a roadblock. Most of the engineers are/were musicians, and they have a lot of experience, as they both recorded many acts and played.

Shut off the phones when you get to the studio; ask what is the policy regarding food and drinks – most likely they are prohibited in the control room. Be well fed, you need energy. Try to keep the chit-chat to low levels, and avoid discussions or comments especially during the vocal recording. Give space to the vocalist, vocals are the most important part of the song.

Finally, bring a notebook and a pen and write down things you should remember lately. Have your Facebook and so on passwords with you, so in case you want to post some snippets of what you recorded, you can ask the studio to do it right away. That helps keeping the fans excited.

Specific recording preparations:

Drums

The key of a good sound lies in a good sounding drum set and the drummer himself. Do not forget that in some of Led Zeppelin's songs, John Bonham was recorded with three microphones. And what a sound! It doesn't matter how good the studio equipment is, if the drums sound like crap, there is not much that can be done to improve it.

Make sure you have a new set of heads, both top and bottoms. Tune them a day before the recording session; once you're in the studio they'll probably sound different, but it will take you less time to retune them. The truth is that so many drummers don't know how to properly tune their drums! Tune, and listen, and then you'll get it right! Pay attention to the seating of the heads! The type of music influences also the tuning: for jazz, the kick is rather tuned high, not muffled or just a little. For hip-hop a low tune is advisable, so you get the "boom"! Check out on the net where you can find many advices and tips for drum tuning.

Check for squeaks and rattles and fix any unwanted noise. The engineer will help you control the sound with gel pads and rings if necessary, until the desired sound is achieved. If you like to hit hard the cymbals, consider rehearsing before you go into the studio and try to hit them softly; this helps a lot in getting an overall good sound through overheads. Consistency on hitting the drums and where you're hitting them goes a long way toward a good sound. Do not forget to bring spare sticks.

Based on experience, more often than not the drummer is a great musician, but many times he doesn't sound great and that happens when he usually listens to somebody else perform and he doesn't listen to his inner clock. If the drummer is pushing and pulling it's not necessarily a big deal, as much time as the natural groove is there. I recommend rehearsing with a click track and use it while recording.

Bass

So many basses hum!!! Try to solve this problem before entering the studio, otherwise it can take a lot of time to fix it and time costs money. Check for the action and reduce the fret buzz. Hum and buzz is a major problem; once they're recorded there isn't too much you can do about it. Check the pots and electronics and, if you use some effects, make sure you know the presets.

In medium and smaller studios the most common way of recording the bass is through DI boxes- look for Avalon and Aguilar, but there are some others, cheaper, still with a good sound. It's not unusual to re-amp a bass sound at mixing, so getting the sound free of hum and buzzing is paramount.

Bass and drums should be tight as they are the foundation of the tunes; bass has a major role both in rhythm and as main support for vocals/melody. It is a good idea for both drummer and bass player to practice with a metronome. In fact, all class players have in common one thing: the sense of timing. Timing is a shared responsibility between the drummer and bass player.

Guitars

Have new strings and break them in; also, always have a spare set (as a tip, have some pine matches and clean the strings with them; another solution is to buy a Fast Fret brush and use it after playing, then wipe the strings and the neck with 100% cotton cloth. Check all your pots and electronics. Know your amp settings.

If your amp needs to have the volume at 10, consider a THD hot plate or a Marshall Power Breaker (they allow you to reduce the volume while the output tubes are run at full speed). I strongly recommend the use of these devices, they also allow you to have a very good tone running the amp at lower levels, which can be a huge advantage at gigs. I can tell you that the house engineers will love it and help you get a good sound.

One secret less known is this: a small amp- like a 5 to 7 Watts amp- will sound huge in a small room. Interesting enough, a cranked up wall of Marshalls in a small space sounds bad; however, a small amp cranked up in a small space sounds like a wall of Marshalls. Many of Eric Clapton recordings were done with some 5 Watts Fender amp in small recording booths and the sound is great!

On the other hand you and your band mates are very much used with your guitar sound, and it can be difficult to accept other sounds. If you're a perfectionist, try and record a guitar line a few times, using different amps and cabinets, and then compare them. Listen through the studio monitors and as a rule of thumb do not push the distortion. Too much and it will sound weak. Don't go overboard and use everything from the studio just because you can, use only what makes sense.

Have the sound set up before, store the presets in your effects, but also look what the studio has to offer, you may find some better alternatives. Use good cables and check your effect boxes for noise; check the action and adjust to avoid fret buzz. Always install new batteries in your stomp boxes before the session or in your guitar preamps if they have active hardware or piezo preamp for acoustic guitars (acoustic guitars sound best when miked, but recording their piezo/sensors doesn't hurt).

Check the tuning if possible after each take. The guitar can go out of tune after one take. Also don't forget to relax; over gripping the chords can lead to sharp some chords.

Keyboards

Save all the settings so they can be easily recalled. As a general rule, make sure you bring all the accessories, including the manuals. Sometimes you may need to turn off an effect (like reverb) as that may create problems at mixing, and this is when the manual becomes very useful.

Sound wise, nothing is carved in stones; while you have to have the sounds prepared, experimentation can lead to a very particular and beautiful sound. Putting the keyboard through a different amp may lead to something that really fits the song, and you don't want to miss this opportunity.

Do not rush when recording; better later than early, later gives groove, early sounds like out of time.

In some projects pre-production is mandatory. Regardless of the sequencer used during pre-production, the files can be dumped into the computer and then you can use either yours or the studio sound modules. It's a good idea to have the midi files with you and try some of the hardware the studio has to offer, especially if your sound modules are not the best. If the studio has units like Kurzweil, Moog, Korg, Oberheim, Waldorf, Access, Nord Lead, Yamaha, it may be worth it to experiment.

Add live instruments to a sequenced track - percussion, cymbals, tom fills, live bass tracks or live guitar tracks. The best solution is to hire a session musician to lay down these tracks. That goes a long way toward getting a track that doesn't feel like made on computers or drum machines.

Singers

Do not listen loud when singing, as this can affect the pitch. Always listen to the takes to see if you went flat or sharp. Ask the engineer to give you some reverb in the headphones if that makes you more comfortable, but do not exaggerate, as it can affect the pitch and intonation.

Take breaks when recording. Recording 6 songs and 8 takes for each one is a hard thing to do. You need to have that in mind when you're making the recording schedule.

Start each take like it is "The Great One", but, if something goes wrong, slow down and relax; otherwise you'll run out of steam. Even if you will comp from different takes, is better to do it from a smaller number of takes, so take it easy.

In the end, I suggest you bring your video camera and use it. You're going to like it later when you see it, it is going to be the proof of your hard work. Take pictures; you can post them in your Facebook or MySpace pages and keep your fans updated and excited with the progress of your work. Who knows, 20 years later the footage and pictures may be part of music history.

4. MIXING

Mixing is the process of putting everything together to get great balance, frequency range, panorama, dimension, dynamics and interest.

Mixing is the most complex part of the music production chain and I would say the most important. It takes years for a mixing engineer to get good at it; that is the reason the mixing engineers are the highest paid in the industry.

Why is it mixing so important? For starters, hearing is way less objective than sight and much more open to interpretation, and the way songs are resonating in people when they listen is different in each individual. We don't know too much about how music reacts with our brain and how the emotional mechanism really works. However, a lot of research was done in the last three-four decades, and the results of these studies help us understand better how to put a mixing together.

Interesting enough, with all the subjectivity, almost all of us know when a mixing is bad or good. The marks of a bad mix are easy to recognize: vocals are hard to understand, sometimes are too low or too loud or out of tune; some instruments, even if they are there seem to disappear at times; some lead parts are too buried within the instruments, sometimes it seems that the instruments/vocals are not together, like they perform in different spaces; at times, the combination of instruments doesn't fit, you know something is wrong.

The marks of a good mix are even less complicated: everything flows, nothing seems to be unusual, you feel emotion, the groove is there, you feel moved and comfortable, and you feel like you want the song to keep on going: it is that simple!

The mixing engineer takes a song and, through experience and creative decisions helps the story of the song. The song is the single most important thing, no matter if the idea is to showcase a song, voice or a band. The mixing engineer puts all of the instruments and vocal together, like a painter puts colors in a painting. He needs to support the song message, and each song is unique, so there are no rules and standards.

Arguably, the most important factor that influences the quality of a mix is the song arrangement. The musician/composer/band will have more success if he is good at song arrangement, understands the sound of the instruments and how they are complementing each other, to underline the melody and the song message.

A good arrangement pays attention to tempo, rhythm, pitch, consonance and dissonance. You do not need to listen to a whole song to know which one is it, when people hear some chords in a certain order in an Eagle concert (B-minor, F-sharp major/A-major...) they start singing "Hotel California", or when the bass line starts people recognize right away "Beat it" of Michael Jackson.

Through arrangement you can capture the attention of the listener, put him in a certain mood, create tension, bring or not a finalization of the tension, suggest control and then take him out abruptly and move him into unknown. Most of the commercial music operates in patterns that induce good mood, rhythm, without any major change, if you look carefully at the main commercial hits you'll discover they have the same structure.

When listening to the progressive rock bands (like Yes, Pink Floyd, Procol Harum, ELP) the forms are different, the way the attention is captured is different, there is a different level of richness – both harmonically and rhythmically; there is definitely a deeper sense of how to use and group sounds. Jazz overall is rich in harmony, rhythm and improvisations, and the natural side of the sound is very important.

Mixing is the next step after recording. Don't proceed with the mixing right away after recording, give it some time. Doing the mix the next day won't help when it comes to objectivity. As a precaution, allow for some last minute changes if needed, or maybe something that has to be added to the recording.

All the instruments have to be heard properly, and there has to be a fit in between them. There should a feeling that they *are together*, not that they are playing in different spaces. The song gets to be round, polished, with a good sense of tridimensional space. In theory, this sounds simple; in reality it's much more complicated.

Every instrument carries different amount of energy in the frequency bands and they have to be worked out so they don't cancel each other and sound naturally together. They have to be placed in space – both stereo and depth. The voices or leads have to stand out. For every type of music there is a certain idea of sound that is a starting point for the mixing engineer.

Getting in details, every instrument vibrates at different frequencies at once. Each sound has a fundamental and overtones- the frequencies above the fundamental. Each instrument has its own overtone profile, its own timbre, so we can make the difference between them. These overtones put a different amount of energy in each harmonics, as an example, trumpets have a pretty even distribution of energy, while clarinets have high energy in the odd harmonics (like multiples of 3, 5, 7 of the fundamental).

Peter Schaeffer did a very interesting experiment, he basically cut the very beginning of each tone, and at that moment it was almost impossible to distinguish the instrument. He proved that the **attack** of the sound is essential to its definition. Another researcher – Petr Janata – proved through experimentation that, when removing the fundamental of a sound, it will be restored at early stages of auditory processing (we listen to some stereo systems or in the car and we have the feeling that the bass is strong, but in reality, there is no bass there, as the speakers do not go under 125 Hz; what we hear are only the overtones of the bass).

All these are taken in consideration when doing a mix, as there is a limited area where all the vocals/instruments are occupying the space. In isolation, some instruments may sound thin, but together they must gel. As an example, when strumming an acoustic guitar in a rock typical song, the body of the guitar is less pronounced, but the higher harmonics are brought out. In isolation, it may sound harsh, but it fits in the mix.

Each song is different, and each mixing engineer has his personal approach when doing the mixing. The engineer needs to understand what the song is all about, what is the story and what is the best way to tell it.

The engineer has to understand the arrangement and identify the starting point (like in disco the kick is everything, or in jazz the melody and the musical dialog between musicians), and then, using panorama, EQ, dimension (effects), dynamics (compression, gating, limiting) he starts to build from the bottom up, he has to figure out the direction of the song, making sure it has the groove and captures the interest.

In modern music, for some of the engineers the mixing approach is to build the foundation, creating the triangle drums- bass – vocals and getting the main balance of the mix. The drums may need editing and enhancing, sometimes drum sounds have to be replaced or reinforced. The bass and the kick have to be together, complement and work extremely well with the vocal and the snare. If this triangle is right, the mix will be good. Other engineers start with the driving element of the song and then build the foundation with it.

The vocals are undergoing editing, breathing reduction, noise removal from the tracks and subtractive EQ. The voice editing (pitch correction and intonation if needed) requires experience and specialized tools, like Melodyne or Antares.

In classical music things are a bit different, even though the final objective is the same. The editing and compression have a very limited role, you can say it's somehow easier. Attention has to be paid to dynamics and their preservation as they are definitely a major form of expression; also, the idea of space is different than in the modern music, and the most important word here is "natural". High end realistic and credible reverbs are required (as famous as Lexicon or TC Electronics are, for natural acoustics Bricasti is unbeatable).

The mixing is different also because the way of capturing classical music is different. The proper way to record a choir as an example is to use a Decca tree, or maybe XY, with the purpose of capturing the choir as a single instrument; I did see some recording a choir putting acoustic panels between the sections of the choir, which is definitely not the way to go. The performance and space is already there, normally only fine tuning is required during the mixing if the recording was done properly.

In general terms, the fundamental music mixing process consists of: 1. Establish levels and panning. 2. Editing and pitch correction. 3 Equalization - subtractive and shaping. 4. Compression 5. Effect processing 6. Automate levels 7. Print the mix.

There are variations to this process (like sometimes the need for EQ is covered with using some effects (like a chorus) which change the tone enough and make the track sits well in the mix.

The engineer comes with a rough mix which will be presented to the artist/producer, so they can decide which way to go. A good mix has strong and controlled lows, the mids evenly distributed across among instruments and strong but smooth highs. The mids are extremely important: a great mix still has to sound good if you filter everything bellow 100 Hz and over 6KHz (remember the old recordings from Blue Note label, most of them done in Rudy Van der Gelden studio: there are no strong lows or highs, they were mono and they sound great in any speakers!). While the engineer has a certain view and tries to do his best, what really counts is the customer opinion and the mixing tries to get as close as possible to what the artist/producer has in mind.

Typically there are a couple of versions of the mix:

1. the master mix, the one everybody likes;
2. vocal up 1-2 dB;
3. vocal down 1-2 dB;
4. the TV mix, with no lead vocal, often called trax, used for TV/karaoke
5. the instrumental mix.

It is a regular practice to prepare multiple versions of certain songs. First is *the album cut* which usually stands out for artistic integrity, then the *AM version* which is the radio mix, with a length of 3 minutes or close, and *the dance mix* for use in dance clubs, generally longer, around 5-6 min.

When you're budgeting for a project, always consider the time for mixing; this is very important. It is common to spend between 6 to 10 hours in the 16 plus tracks world and 2-3 hours for a voice over. You may ask for compromises if your project is a demo for club promotion, but it would be a mistake to do so for important projects.

Aside of the engineer experience, there are a couple of important elements that have a major influence over the mix: the room acoustics, the monitors and the quality of the equipment - hardware and software. I can't stress enough the importance of the monitors & room acoustics in the mixing equation.

A good mix starts with an acoustically tuned room and a good set of monitors that allows the engineer to *hear everything!* It also allows the musician/producer to hear properly, as ultimately they are the one asking for changes or making certain decision. It is a bonus if the studio has a couple of sets of monitors, so you can check and see how it sounds in the real world.

Lately, there is a major dispute, with arguments in both side concerning mixing ITB vs OTB (ITB = mixing in the box, inside the computer, OTB= mixing out the box, with a console/summing box and outboard gear). I think that too much energy went into this subject, and to me both ways can produce great mixes. There are famous engineers using only software, others working hybrid (both software and hardware), while the rest are swearing by the pure analog consoles.

Mixing in digital vs analog has the same basic principles, but some things are different. Too many mixes done ITB (in the box – computer) are sounding weak, which suggests the idea that mixing in analog produces better results. The reality is that digital mixing is more affordable than ever, and too many people are doing it, but not too many know how to really do it. Like with analog, it takes many years to develop the craft. In digital there are some steps a mixing engineer should go through, like gain staging, in order to avoid clipping. This is especially important where the hybrid approach is used, to take advantages of both worlds (and my favorite way of approaching the mixing process).

Regardless of the way the mixing is done, all these top engineers work in an acoustically tuned environment, and this is something you should be looking first when you are shopping for a mixing facility. Digital or analog, it doesn't matter if the sound is not properly heard, and the acoustics of the room are messing with some frequencies, creating peak and valleys in the room response. The mix will not be good period.

Headphones are OK for checking a track, detect problems that otherwise is hard to spot them. But the bass can't be felt in your stomach, the sense of close/far and panorama are compromised, and let's not forget that most of the time people listen to music through a sound system in an open environment – home stereo, boombox, in the car, in clubs.

The digital systems reached full maturity: the quality they provide is outstanding. Platforms like Avid/ProTools and Steinberg/Cubase-Nuendo are used in the most professional facilities. For years ProTools was the professional choice, but in the last decade Steinberg (which is now part of the Yamaha Group) audio engine took over in my opinion quality wise. Their open VST platform stimulated third parties to produce a plethora of plugins software. Nuendo became the main force behind the sound in the film industry (Nuendo and Cubase share the exact same audio engine). While in North America Pro Tools still dominates, in Europe Steinberg platform is the professional choice and trend.

This tendency will only continue because Apple is dropping slowly the bar in hardware, as they shifted the attention from audio-film industry to creating a hub for entertainment. There are other platforms- like Sequoia, Logic, etc which are good too. The plugins industry brings to table some excellent software processors, I would mention here the Universal Audio - UAD cards, Sonnox, Waves, Lexicon, TC Electronics, Sountoys, Altiverb, Paul Frindle DSM, Algoritmix, Brainworks.

The digital systems offer some excellent advantages: fast and accurate editing, total recall capability, clarity and (at least in theory) a large dynamic range (at 24 bit recording it is 144 dB). Unfortunately, just because so many things are possible when working digital, there is a tendency of going back and do all kind of adjustments and corrections, which usually prove to be detrimental to mixing. There are so many famous songs where there are pitch problems, or noises; they would not be so famous if they would have been done perfect technically.

Lately, with the evolution of DAW software and audio interfaces - AD/DA convertors – and analog summing boxes, the hardware processors can be easily integrated in the mixing process. The hardware processors have their own sonic signature. A plugin is basically a mathematical representation, and in many cases they are emulating the real hardware with a pretty impressive accuracy. However, the sound of the hardware incorporates so many other things, like transformers, op-amps, etc. A hybrid system brings together the analog and digital world. You can spot right away the sound of a Neve or Harrison console, a Chandler EQ, and many others. They are in fact part of the sound of rock music history.

There is definitely a sonic signature to both digital and analog, and I personally like to take advantage of both of them. I feel that the clarity of digital fits better classical and jazz music (in many cases anyway) while other styles- rock (hard, heavy, alternative, punk, etc), latin, country, progressive jazz, funk, soul, R&B – benefits from the character brought in by the analog gear like Neve, Chandler, API, Neve, Thermionic, etc. Of course it is a matter of taste and vision, and a good engineer will do a good job regardless, but it is good to have tools handy and be able to select the best ones for the job and have an expanded palette of sound options. The essential thing is to end up with a balanced mix, which brings up the unique musical characteristics of the band/singer/etc.

5. MASTERING

Mastering is the last creative process that brings a musical project to its final sonic dimension. Mastering is the process of taking the source - the final mix to a data storage device- the master, from which all the copies will be produced. Mastering takes care of the final assembly of an album, ensuring that a collection of songs will flow from start to finish, like they belong together, in the desired order and with the right amount of space in between songs.

Mastering brings forward the best in the mixes; expect mastering to enhance the sound, add more depth and make the songs shine. The better the songs sound, the more records will be sold. Mastering is equally important for the new formats that gained so much popularity as a result of the internet explosion as is for CD mastering. The music need to be polished and sound good on the new generation of listening devices that are using the internet, like ipods, iphones, ipads, mp3 players, computers.

Many projects are made on project or home recording studios, where the monitoring system and the room are less than accurate. I definitely recommend having the mastering of these projects done somewhere else, with an experienced engineer familiar with different styles of music, working in an acoustically treated room using a high-end speaker monitoring system, with mastering grade A/D/A converters and audio cables and high-end analog and digital equipment.

The list of the most important issues the mastering takes care includes:

- noise, glitches and hiss removal, de-humming (cause by the 50/60 Hz of the power supplies), de-clicking, de-scratching and de-crackling for re-mastering from vinyl.
- clean up the beginning and the end of each song and smooth out or create fades through editing, dynamic or harmonic enhancement of the song or just make up for inconsistencies through EQ, compression and multiband compression.
- optimize average and peak volume levels for proper loudness.
- achieve the right sonic balance for the type of song (country is different than jazz or R&B).
- add warmth and depth to your mixes.
- correct and adjust stereo image if needed.
- place songs in proper order and adjust the gaps between them.
- create a sonic signature for all tracks.
- sample and bit rate conversion.
- adjust the song levels and make them match so the listener won't have to turn the volume up and down between songs.
- place everything into the format required for distribution and create the master from which all the copies will be created. That could be the master CD, the DDP, but also other formats used for distribution over the internet.

A good final mix speaks for itself, but is definitely not enough anymore. The competition in the music business is tough and you shouldn't make any compromise when it comes to the quality of your song. Even a demo for promotion that has three songs needs mastering. There is always a tendency to save money, but in this case it can be too costly and can compromise your chances. A/R people, agents and producers who are doing the screening of hundreds of tapes are getting tired too and you don't want them to concentrate to hear your music instead of listening to it; they simply won't do it. So, unless your demo is for promotion in clubs, we advise you to go for mastering and have that in mind when you plan your budget.

The mp3 files are very popular; their problem is the inherent sonic compromise and loss in audio quality. More and more acts are paying attention now to the quality of mp3 and understand that these files can be improved sonically through mastering the same way the regular songs are mastered. Mp3's are a fantastic marketing tool: you don't want to compromise the sales because others have better sounding mp3's.

Apple came with a new concept, in their effort to control the sales of music for different platforms. Their last format- HD ACC - basically allows the customer to play the music at the highest resolution that his player can do it (iPod, iPhone, iPad, etc). In some cases, it will be a lossless format, in some not. It would be useful to know how your song will sound on each one of them, and yes, the mastering is definitely a good idea, and, if you plan to sell your songs through iTunes, make sure you tell that to the mastering studio, and the mastering engineer knows what you're talking about.

The vinyl LP is coming back, sales are up in the last couple of years. When you plan to do it so you release a vinyl, the mastering should be done accordingly, the preparation and the guiding rules are a bit different than for the digital format. Yes, you can send your master CD to the printing house for making the lacquer vinyl, but that's not the best idea. The rules of the process when cutting the "lacquer" with the sapphire tip are imposing some special requirements.

There are some things you should know about mastering. Mastering will clean a mix, but there are flaws that can not be removed. There are things you didn't notice in the mix, but you'll notice them at mastering: most of them can be corrected. The mixes can be made brighter or heavier, the stereo width can be changed and the mix can be made to sound tighter and together. If a mix needs to be redone, it should be redone; no mastering can take care of that. It is recommended to send a preliminary mix to the mastering studio and ask the mastering engineer opinion; he can point to some problems that can be fixed in the mix.

The following is a guideline you can use to estimate how much mastering time a CD project will take:

1. Roll-on time - assuming your mixes are in a different format than a .wav or .aiff files – digital or analog tape – the loading of the workstation is done in real time. Having your

mixes burnt on CD as .wav or .aiff files saves a lot of time, the loading is much faster. If mixes are on tapes, it takes longer.

2. Mastering – this step is quite hard to predict; it depends a lot on the quality of the mixdown and the processing required. This step includes the process of testing/listening in various speaker systems and doing the necessary corrections.

3. Roll-off time – the final edited and mastered project gets burnt onto a CD-R master or finalized for the new formats. The burning is done "Disk at once" - to eliminate all possible errors, so you won't have a problem at the CD manufacturing facility.

At the end of the process, a mandatory second quality control with headphones will be performed, to catch problems that can not be heard on speakers and make sure no abnormal sounds exist. Regardless of the package, we are listening to the master in a couple of music systems (in the studio, a regular house music system, boombox, car, hi-fi and low end speakers) to make sure the final product offers an enjoyable experience to the listener in all the systems.

When looking for a mastering studio, there are a couple of things you have to pay attention. The loudspeakers and an acoustically balanced room are the most influential elements after the mastering engineer's ears and experience.

The mastering speakers should have a flat frequency response, provide a very detailed stereo image, meaning excellent accurate phase response, and controlled dynamics. Good mastering speakers are very expensive, between the most used are ATC's, Duntech Sovereign, Barefoot MicroMain27, B&W Nautilus, Tannoy, Lipinski, Paradigm, etc. They have an almost perfect impulse response, a fantastic phase coherency and a stunning accuracy: you can hear a half dB when added or subtracted! They are meant to reveal all the details, and are very clinical.

The room acoustic response is essential for a good mastering, because it is so important to have a proper representation of the sound coming from the monitors. Bruel&Kjaer determined that the ideal room response should increase linear by 6 dB when sweeping from 20Hz to 20 KHz. The measurements are to be performed by using a sweeping tone through monitors, record it and analyze it. Usually these measurements are done with software like Room EQ Wizzard and FuzzMeasure. The results show the problems in regards to frequency response, decay, phase coherency, impulse response. The range between 20 to 300 Hz is extremely important and affects the mix to the highest degree; due to the room modes and energy of the lower spectrum, the normal variation on this frequency range is between +/- 25dB to +/- 40dB. What you hear is definitely different than what's in the song in reality!

When going to a mastering facility, usually the rooms are acoustically treated and the people working there know what they're doing. However, it is quite interesting to note that almost none of the mastering studios are posting in their websites the room frequency response! The reality is that, in order to improve the room frequency response, you have to invest tons of money, and go through a long trial and error process, until the frequency response gets to be within +/- 3 dB versus the ideal graph

at 1/48 smoothing octave resolution (be it the Bruel& Kjaer profile, or a perfect flat one-some are still debating this aspect). The room response is essential for a proper mastering and here you really do not want to cut corners; improper monitors and bad room acoustic are a lethal combination for mastering!

The equipment used, both hardware and software, dedicated to mastering is very expensive, but this is the only way to achieve a proper sound dimension. Mastering was perceived lately by many as just a means of doing the music sound louder; but this the wrong approach. The mastering engineer is, if you want, yours and your customer best friend. He needs to ensure the listener loves the sound, and, in return, the listener will appreciate the artist. There is a loudness war out there on the radio, but listening to overly compressed music is tiresome.

Let's talk about the mastering steps that are involved. In the beginning (around 1900) and up until the analog tape machine, the audio was captured directly to the so called "lacquer"- a form of vinyl, which was used to create the "metal stamper", which pressed the melted vinyl into the discs played on turntables. In 50's, all that changed, with the introduction of the analog tape machines, allowing a dramatic improvement in sound quality. As the final product at that time was still vinyl, the process of preparing the audio became critical, having a major influence in the delivery of the songs and accordingly, in their commercial success.

The technology advances in the sound delivery to the customer brought in a series of new formats for the audio product: CD's, SACD's, mini discs, and the new generation of files used to deliver music over internet. The mastering ensures that the sonic signature helps the delivery and the integrity of the artistic message in any system, while providing to the listener an enjoyable experience no matter where he listens.

Despite the evolution of the music delivery, there are a couple of basic steps in the mastering process:

- a. **Master Mixes preparation:** have every possible information handed to the mastering engineer, like sample rate, bit depth, file format, etc
- b. **Tape/files transfer**
- c. **Create song order / editing / spacing:** The song order is extremely important, not only for the mastering process, but from the listener point of view. Think the song order having the flow of the album in mind.
- d. **Processing / levels:** this is the stage where the mastering engineer, through the use of EQ's and compressors polishes the songs, adding clarity, punch, removing the mud, adjusting the imaging.
- e. **PQ coding + ID tagging process:** at this stage ISRC codes, UPC/EAN, CD text and copy protection data are created.
- f. **Dithering:** always the last step in the audio mastering process. It basically adds random noise when converting from a high resolution format to a lower one – like from 24 bit to 16 when creating a master CD.

- g. Final master:** creating and checking the master, be it PMCD (pre-master CD) or DDP file (Disc Description Protocol).

Preparing for mastering

Knowing how to prepare the mixes for mastering goes a long way toward a final better quality product. The following are some useful guidelines you should be aware of:

- book the session at least a week in advance, so you have time to decide about any last minute question. Make a list of the songs in the order you want on the final CD. If you ask for certain editing, please write it down; also write down any other thing, like raising the lows into a song, etc. Make sure you provide a list of the phone numbers you, your producer and your band players can be reached.
- bring the highest resolution mixes you can. Do not buss compress when mixing (except when the type of music is asking for, quite rare anyway), just make sure the mixes sound good.
- if you would like to remove noise, please include examples of the floor noise you want to be removed- a few seconds would be just great.
- have a list with the tempo of each song; this is needed because, in order to maintain the flow of the album, the very last beat of the first song has to stay in tempo with the downbeat of the next one. This is called spread and is used in most of the cases.
- include all ISRC codes with the songs in case you want them written, we have to have them before we burn the master disc. The codes are written on the CD - in the sub code- Q channel, as every recording has its own code. Each ISRC is a unique and permanent identifier for a specific recording which can be permanently encoded as its digital fingerprint. They make possible to automatically identify recordings for royalty payments. Each ISRC is 12 characters long: first two for country, next three for first owner- allocated by RIAA), next two for year of recording and last five designation code, which is assigned by the first owner. Type ISRC on google and you will get all the info in details.
- bring with you some recordings that you feel are in the same vein with your music; they will help the mastering engineer to get a sense of what type of sound you're looking for. This is not about trying to copy somebody, but rather to better understand the relation between your music and the sound.
- make a couple of mixes of the same song, make a "vocal up", a "vocal down", a "solo up" and a "solo down"; you may be happy you did that. The compression tends to change the balance of the leads to the track bed, so you give the mastering engineer some room to breathe and definitely get a better final product. It is better to have the vocal too hot than too soft. Use de-esser at mixing for vocal, it gives clarity and keeps

the sound from becoming too harsh. Also, use an auto-tuner at mixing, we can not bring the voice in tune at mastering. Pay attention to cymbals, they are usually too hot.

- bring safety copies of your mixes! And if you id some rough pre-master, it would be a great idea to bring the original premixes. So, always make an uncompressed mix along with the compressed mix you have prepared during mixdown..

- check your mixes before you submit them to us: listen to them on good speakers and at different volume levels. Make sure the mix isn't clipping. Always mix in 24 or 32 bit even if the source tracks are 16 bit! Do not sample rate convert!!! Always leave some room at the beginning and the end of the song (at least 10 sec) and don't perform any editing or fading.

- Never ever compress the stereo output buss unless this is really what you want!

- export the mixes as .wav or .aiff files at 24 or 32 bit, the higher the resolution, the better, and burn the files on CD/DVD. If it's a tape make sure it is properly labeled and marked.

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If you had the patience to go through this booklet, you probably understood that recording is a complex process. Don't get overwhelmed by it; common sense is your weapon of choice, because no matter what the business is, common sense is the most valuable (and most of the time neglected) approach. Hang in there, and at the end of the road you'll have the chance to hope again... because this is what music is, a pathway to hope!

And going along this path you'll meet interesting people, most of them passionate and consumed... and spending time with them you'll have a chance to understand the essence of them all: it is all about doing what you love doing the most. You may not get to be rich – in fact there are almost zero chances for that, but you'll have a good shot at discovering yourself going through this entire crazy thing called music business.