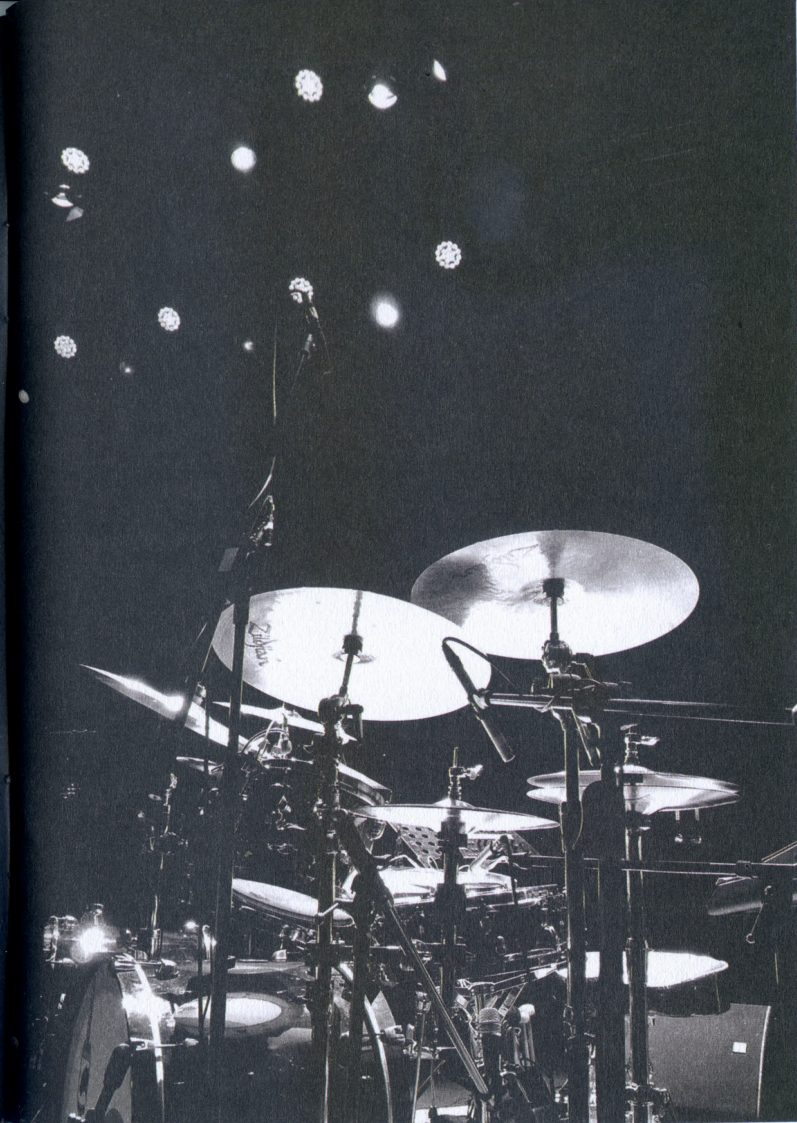
THE DESIGN LAB

A Comprehensive Lab Report For Drum Design



The Black Panther Design Lab
"The Lab Report"

Welcome to the "Lab Report"! The Black Panther Design Lab is excited to share years of experience and dedication to the art of drum design with you in this unique book. We hope this will inform and inspire you to be more familiar with the instrument we all love: the drums! The first installment of "The Lab Report" is about drums and how design components come to together to form a specific sound, response and feel from the instrument. Mapex has been innovating Drum Design for over thirty years and has deep appreciation for the history of the drums, as evident by past, present and soon to be future designs! They are committed to innovation. Many of these elements mentioned in the Lab Report are utilized in current instruments such as the innovative Design Lab Snare drums.

Our goal with "The Lab Report" was to help elevate your general knowledge about drums and drum design. Many of you may know me as an artist, but my two other passions are finish woodworking and mechanical drawing. This has led to my involvement for the past 20 years, in the design of over 40 instruments, with a vast array of highly acclaimed and notable companies. I am currently working directly with the new high-end "Design Lab" development team at Mapex, to leverage our years of experience. We are creating what is going to be truly unique and exceptional instruments. With help from our friends at Remo, Vic Firth and Shure, we've banded together to clarify many of the key elements of drums and their design components. We hope this information is useful in selecting your voice and finding what is right for you and your personal artistry.

To help continue your drumming journey, we have also included pages of personal lesson examples and manuscript paper in the back of the book. This is modeled after my personal study book that I have used for decades in my daily lessons and practice.

I hope you enjoy the first edition of "The Lab Report" and I hope to see you all out on the road!

Russ Miller

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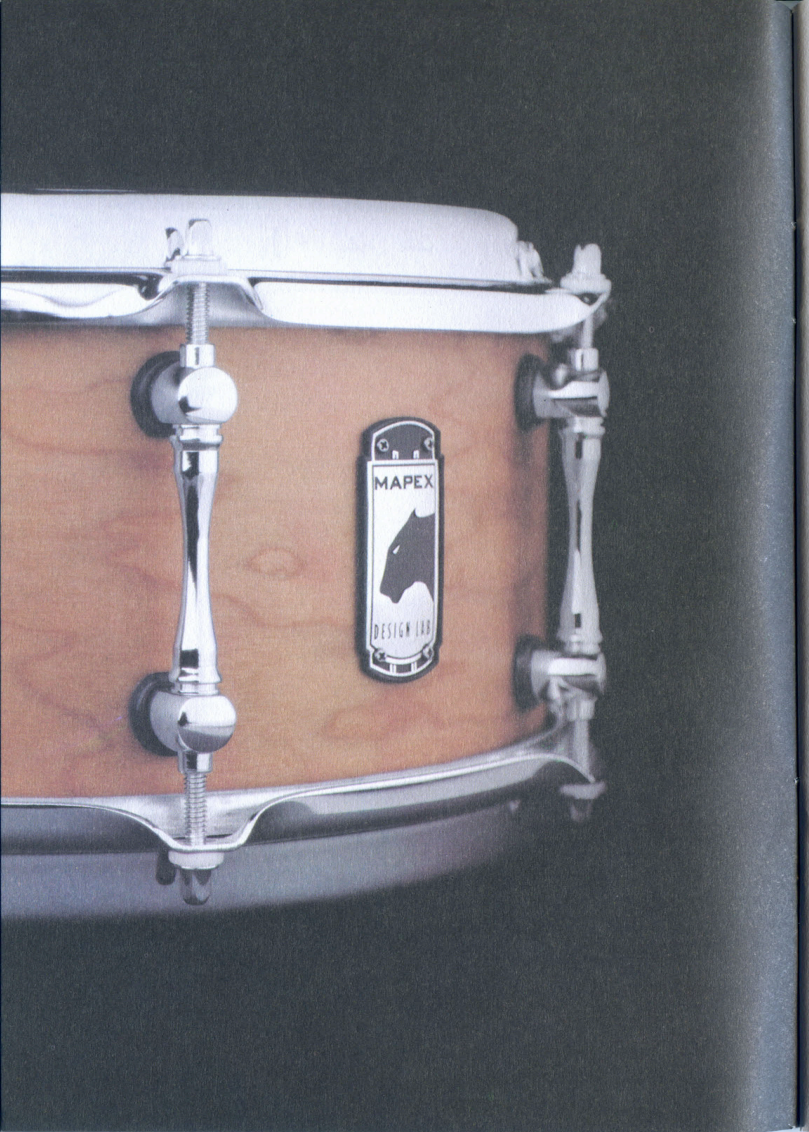


BLACK PANTHER DESIGN LAB

Unique professional instruments, conceived by a revolutionary "Concept Hybrid" and created with the modern science of drum design.

"CONCEPT HYBRID"

Definition: The process by which multiple sound concepts are combined into a single instrument, resulting in the creation of a new, unique voice.

The Concept Hybrid approach uses the specific blending of different woods, bearing edge profiles, hoop styles, reinforcement rings, lug casings, snare wires, drumheads and even shell finishes, to affect the performance and character of a drum.

The Bearing Edge

Resonance - The Bearing Edges are the apex points at the top and bottom of the shell on which the drumheads sit. The SONIClear™ Bearing Edge allows the head to properly "seat" on the shell. Seating means that the drum head sits flat on the top of the shell and can rotate freely around the full diameter of the shell. If the head does not freely rotate, rocks or gets stuck, it is not seating properly and will cause major issues in the tuning and sound of the drum.

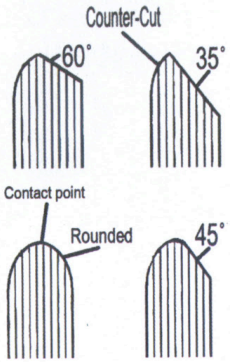
Why is it so important? First, the most important relationship in producing a good drum sound is between the drumhead and the shell. How these two components connect and react with each other determines the overall sound of the instrument.

Sonic Characteristics - the Bearing Edge determines how the shell is going to move when struck. If there is more wood contact with the head, the shell will vibrate more. This will produce a bigger, longer sound.

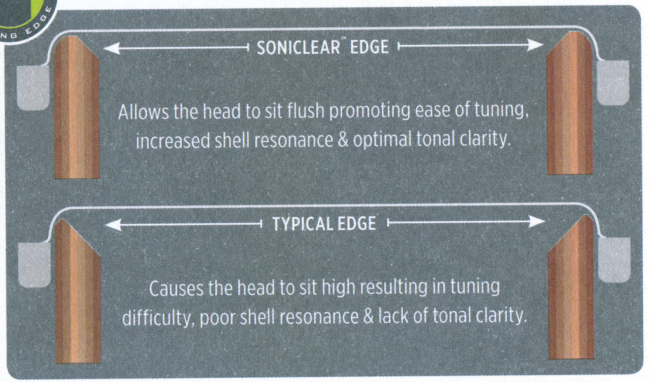
Tone - The edge shape will also change the sonic characteristics of the instrument. A sharper edge will produce more attack from the stick and higher frequencies in the drum's tone. It will also make a snare drum more "sensitive" and articulate. A rounder edge will make a fatter, warm sound from the drum.

Projection - The bearing-edge shape will dramatically affect the perceived projection and the character of the drum. For instance, the fat and short tone created by rounder edges, doesn't project as far. It is also very reminiscent of vintage drum sounds. The pronounced attack and longer sustain caused by sharper edges has much more projection and leans the instrument toward a "hi-fi" sound.

The ***angles and counter-cut*** of the bearing edge is what determines the aforementioned drum tones and characters. Here is an example of some of the angles on common bearing edges. Notice how the angles effect how much wood contacts with the head, this makes the major differences in tone. Also visible here, is how the counter cut (the radius cut on the outside of the shell) angles change. This affects the seating process.



"The SONIClear(tm) Bearing Edge"

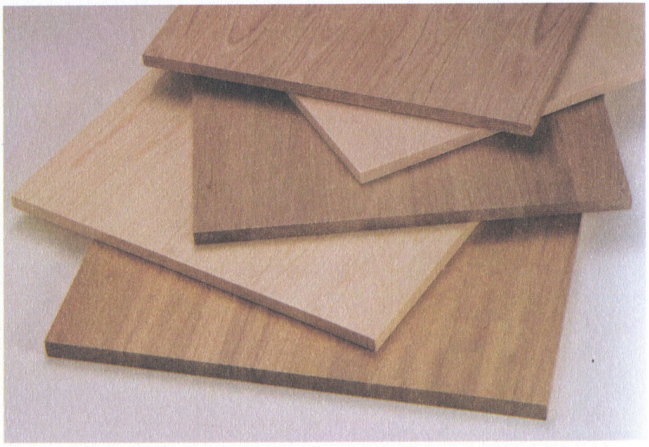


The Janka Scale and Effect of Wood Hardness

The Janka hardness test measures the resistance of a sample of wood to denting and wear. It measures the force required to embed an 11.28 mm steel ball into wood to half the ball's diameter.

Softer tonewoods (lower on the scale) produce a naturally lower fundamental pitch and a more focused sustain. Harder tonewoods produce a naturally higher fundamental pitch, which results in brighter overtones and increased sustain.

To the right is a list of the common woods used for drum design and their positions on the Janka scale. Each wood has a general description of its effect on the tone of a drum.



The Janka Wood Hardness Scale

Harder

LBF (pounds of force)

Softer

Brazilian Rosewood
3000 LBF - Difficult to use, mid and hi tones, projection

Purple Heart
2090 LBF - Specialty drums, high resonance, tough to work with

Gum
2025 LBF - Used in hybrid shells with Maple to add resonance, ambience

Bubinga (African)
1980 LBF - Strong tone, high resonance

Hickory
1820 LBF - Used in sticks more than drums, very good projection

Bamboo
1650 LBF - Used in snare drums, difficult to use, very clear and bright

Wenge
1630 LBF - Used in "hybrid" shells to add stability and sustain

Zebrawood
1575 LBF - Bright tone and increased projection

Maple (N. American)
1450 LBF - Classic tone, projects well, all-around sound

Oak (White)
1360 LBF - Increased projection and mid-frequency presence

Birch (Japanese)
1260 LBF - Has solid, dry, low frequencies

Walnut (Black)
1010 LBF - Great for hybrid shells, adds punch and dryness to the tone

Cherry (American)
950 LBF - Creates, dry "puffy" vintage tone

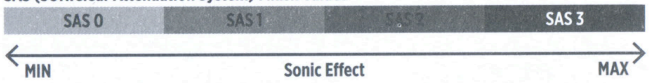
Mahogany
800 LBF - Adds a dry, low fundamental pitch

Drum Finishes and Their Effect on Sound

SAS (SONIClear™ Attenuation System) Finish

Mapex has developed a revolutionary systemwide design element called the "SONIClear™ Attenuation System". This design concept puts the most knowledge, choice and personal adjustments in the hands of the players. One of these "SAS" elements is the MAPEX Black Panther Design Lab's SAS Finish rating scale (shown below). This helps the player make an informed choice for the finishes on the instrument.

SAS (SONIClear Attenuation System) Finish Values



An SAS 0 Finish brings out the beautiful grain & color character of the woods used in the drums, but also allows the shell to vibrate fully due its extremely low-mass application. Thicker finishes like high-gloss veneers & wraps add mass to the shell and shorten sustain. Future Design Lab models may employ a thicker finish to create a more focused sound.

A little understood fact of drum design is taking into consideration what finish you are choosing for the instrument. Of course, players always want their instrument to look great. So, there is a balance between what look and presentation is desired for the drums and what effect that finish will have on the actual sound. Let's take a look at different types of finishes on drums and how they each affect the sonic freedom of the instrument. Here are the five finish options available within the "SAS" finish scale.

MAPEX SAS Finish Scale

1. Sealed Oil Finish - SAS 0

An "Oil Sealant" finish is a hand-rubbed wood sealant that is applied to the drums natural wood shell. This finish gives a slightly golden brown hue to whatever the shading of the outer layer of wood is. For instance, Oil Sealant on Cherry wood will produce a darker finish than an Oil Sealant on natural Maple. This sealant allows the drum to resonant to its fullest potential (so it is the SAS 0 finish) but offers no protection for the shell. It also has no additional color options.

2. Stained or Natural Satin Finish - SAS 0

A stained or natural satin lacquer finish gives you the option of applying wood stains to the outside of the drum's shell. This gives many more color options, again relevant to the natural color of the wood. A rubbed satin finish adds light lacquer and sealant, which creates some protection for the shell. The Satin finish on Design Lab is an SAS 0 and has little to no effect on the sound of the instrument.

▪ Mapex BP Design Lab Cherry Bomb Snare (SAS 0)

3. Stained or Natural Gloss Lacquer Finish - SAS 1

▪ Mapex Armory Transparent Walnut (SAS 1)

Stained, solid or natural gloss lacquer finishes offer the beautiful, classic look known for high-end instruments such as pianos, drums and guitars. Any color stain can be used, which opens up a world of solid or grain based finishes. The high-gloss lacquer is done by coating, buffing and re-coating gloss lacquer many times on the natural shell. This makes a deep, attractive finish. It does however inhibit the movement of the drum shell because of the thickness of the lacquer coating. Design Lab Gloss lacquers are SAS 1 because of the slight dampening of the drum's overall resonance.

4. Exotic Wood Veneers with Satin or Gloss Lacquer Finish - SAS 2

▪ Mapex Saturn V Cherry Mist Maple Burl(SAS 2)

A veneered lacquer finish is the most expensive looking (and costing!) of all of the instrument finishes. Any veneer can be used as an outer layer to the shell, creating an exotic wood appearance. With the addition of the high-gloss lacquer, this exotic presentation is stunning. Only the best instruments usually have high-gloss exotic wood finishes. Though the most attractive of all the finishes. The extra layer of glued wood, and many coats of high-gloss lacquer does inhibit the shell's resonance. Design Lab's Veneered finishes are SAS 2 because of this.

5. Wrapped Finish - SAS 3

Finally, the standard "drum wrap" or covering material. These plastic wraps have been used on drums since the inception of the drum set in the early 1900s. There are literally an unlimited amount of options for drum wraps these days, so drummers can get really creative with the look of their drums. However, the heavy glue, tightly wrapped plastic material and addition to the overall diameter of the drum drastically affects the drum's resonance. The wrapped finish denotes a SAS 3 rating.

A final note on the finish selection, a higher SAS rating doesn't necessarily mean that the drum will have an undesirable sound. Frequently, the muting effect of the veneer or wraps creates just enough dampening to help control extreme sustain or overtones. It is all a personal sound decision, balancing instrument presentation with the player's desired sonic voice of the drums.

▪ Mapex Saturn V Tour Edition White Marine (SAS 3)

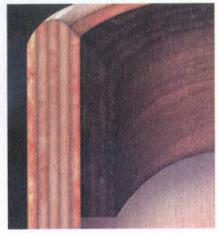
Drum Reinforcement Rings

Many vintage drum designs included thin-plied shells. Sometimes as few as three plies of wood were used. The addition of small "reinforcement rings" were used to help support the thin shells and keep them "in-round".

When a drum becomes "out-of-round" (or oval), it dramatically affects the sound. Odd overtones become prevalent and it is very hard to tune because the shell diameter is wider in one direction than it is in the other. The additional thickness produced by the rings at the top and bottom of the shells helped to keep the drum's shell round. These rings were commonly made of the same material as the shell (often Maple).

Reinforcement rings typically range from about 1" to 2" in height and are glued at the top and bottom edges of the shell prior to cutting the bearing edge. The bearing edge shape cuts were made through the reinforcement rings, as well as the drum shell's wall so that the reinforcement rings became an element of the overall bearing edge shape. This additional thickness at the edges of the drum would also add some low-end and projection to the drums' sound. Later in modern drum design, manufacturers began experimenting with wood materials for the rings that were different than the wood used in the actual drum shell. This created a "hybrid" tone that helped to specialize certain drums' voices.

The SAS Ring System



The Mapex Black Panther Design Lab uses a revolutionary process involving reinforcement rings. Rather than use rings solely for the purpose of keeping thin-shelled drums round, Mapex is concentrating on how the use of rings and their unique placement can affect the sonic character of the instrument.

The first example of this approach by Mapex came with the design of the Black Panther artist inspired "Versatus" snare drum. A batter-side-only ring was used to create a "vintage" style tone. By applying more wood at the top edge, the drum was given a thicker, or "fatter", sounding rimshot and back-beat compared to most shallow-depth snares. The absence of a ring on the bottom edge maintained the articulation and sensitivity necessary for lower-volume playing, whether that be ghost-notes or playing with brushes.

▪ Mapex Black Panther Versatus Snare Drum

Drum Shell Thickness: What Does It Mean to The Sound?

Drum shells have been made in virtually every thickness over the years, from 1 solid piece of wood to over 40-plies of wood! Most commonly, drum shells are created by layering ply-wood sheets. Some companies stagger the wood grains (2-plies vertical then 2-plies horizontal) for stability. The drum shell's overall thickness is crucial to the sound of the instrument. Because of the different sources of woods, drum shell thickness are often referred in the actual shell size (9mm rather than 9-plies). Some sources have 1mm plies and others 1.5 or 2mm space plies. Here are the various ranges of shell thicknesses and how they relate to the drum's sound.

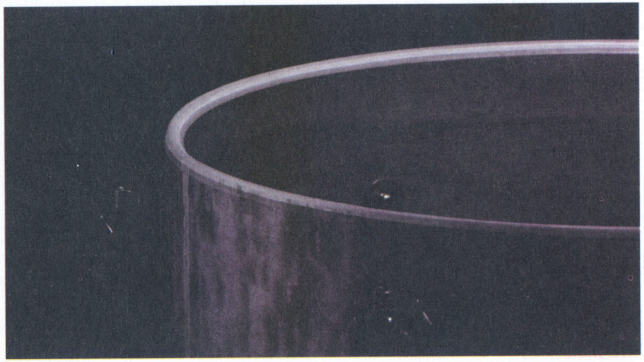
Very Thin Shell - This is most commonly done with synthetic materials such as Carbon Fiber or metals. A very thin wood shell will go out of round too easily. However, the stronger Carbon Fiber is very stable in thin shells. This allows the opportunity to get the most resonance from the chamber but sometimes these materials have darker, drier sounds. Metal materials have a lot of overtones and cut through high volumes easily.

Thin Shells (approximately 3-5 ply) - Shells with as little as 3 to 5 plies are considered thin shells. Most shells of this thickness will have reinforcement rings installed to help keep them in round. Thin shells produce a very resonant "puffy" sound depending on how much thickness are in the rings. The rings not only help with the stability of these shells but supply more wood at the top for shaping the bearing edge. Thinner drums don't project as much and usually have a higher fundamental pitch. Many vintage drums have very thin plied shells.

Medium Shells (6-8 ply) - Medium thick shells are the most common because they offer the best balance of resonance, tuning range, strength, and dimensional stability...meaning they maintain their roundness. Also, most manufacturers use 2-ply sheets when they make shells. So, using denominations of 2-ply (e.g. 3 sheets for 6-ply shells) is cost effective and easier to produce. They can have rings, or not use them. Most often this is to add wood at the bearing edge for the head seating angles. These thicknesses add projection and bottom-end fundamental to the sound. Medium shells also offer the widest range of tuning.

Thick Shells (9-11 ply) - Thick shells offer the most projection and the lowest fundamental pitches (depending on wood material). Usually, larger diameter drums have thicker shells for this reason. Drums will begin to lose sustain if they get too thick because it takes a lot of energy to "move" that much wood. Bass drums, and floor toms usually sound better with thicker shells.

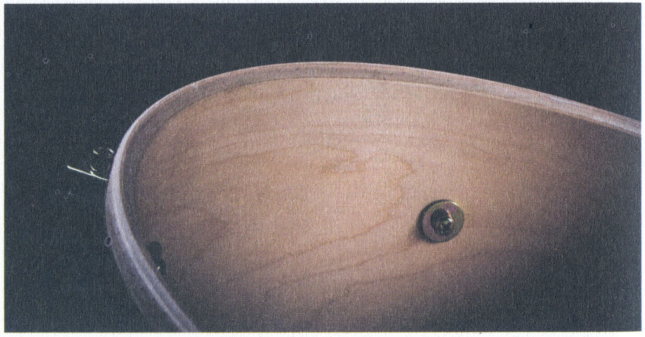
Very Thick Shells (approximately 12-40 ply) - Again, it takes a lot of energy to move a very thick plied shell. There are



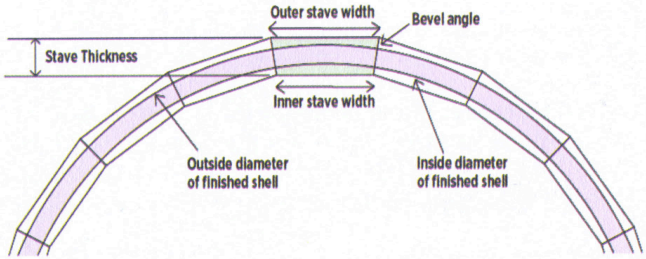
drums up to 40 plies on the market. This sound projects tremendously but doesn't resonate very well. This thickness can be a positive in bass drums since less added muffling is required to control resonance. Very thick shells are usually very dry and respond best when hit very hard. This can be counter-productive for smaller depth or diameter drums. It's just too much wood in a small area to resonate freely.

Solid Shell Drums - The true sound of the wood comes through the most when the drum shell is created from a single piece of wood. This is the best case scenario but comes with a few drawbacks. First, it's very expensive because the wood has to be "steam" bent. It is heated, bent into forms and then cured. This is very time consuming and it takes a long time to cure (thus expensive). Also, the wood will be seamed at a single point, which can lead to the drum bending out of round more easily. Conversely, the individual sheets of a multi-ply drum are cut on a diagonal and staggered, to eliminate the pressure of the shell pulling on a single point.

"Stave" Shells - Stave shells fix the issue of using solid wood



and having to steam bend and cure it. These are blocks of wood cut at specific angles and then glued together to make a round drum shape. They have to be cut down (tooled) into a round shape and it is a very difficult cutting job. The angles have to be perfect to fit together. So, they are usually more expensive and are very thick shells (1-1.5"). With shells this thick, you have to really move the wood to get the full character. They do have a lot of character though and great projection, especially at loud volumes. These can be made to be the most stunning of instruments visually, by using various woods in the shell compositions. This is similar to how conga drums are made. Usually it is boutique drum craftsman who provide these types of shells because of time and hands-on details.



Understanding Drum Sizes

There are a few basic rules to choosing the right sized drums for a musical application. Beyond selecting your favourite sizes, the following are some variables to consider that will affect the sound of each individual drum in your set-up:

Fundamental Pitch - The fundamental pitch is the basic "resolving" pitch of the instrument. Every drum produces more than one pitch. These are referred to as "Fundamental" and "Lug" pitches. The "Fundamental" pitch is the natural true pitch of the shell. The "Lug" pitches are overtones created by how the heads are tuned at each lug and are influenced by standing waves in the drum. This basically means that a drum cannot be tuned to a specific pitch but it can resolve to one. The "Fundamental" pitch is affected by:

- **The Composition of The Shell** (Maple has a higher pitch than Mahogany, etc.)

- **The Thickness of The Drum Shell** (thicker shells have lower fundamentals). Note: You can also achieve lower fundamentals by putting larger amounts of wood at the bearing edge (adding rings, etc.).

Projection - The projection of a shell is not its volume (a drum is not louder unless you hit it harder). Projection results from the combination of frequencies created by the drum. The attack of the primary strike combined with the additional frequencies created by the hoops, shell type, shell size, heads, etc. can all affect the projection of a drum. Most commonly, the depth of a drum has the largest effect on its projection. Other choices, such as harder woods and die-cast hoops, can add projection to the drum's sound.

- **Drum Depth in Relation to Diameter** (a 12x9 tom has more projection than a 12x7 tom).

- **The Opposite of The Depth Effect** has to do with the "Punch" or natural compression of a drum's sound. A shallow drum (depth to diameter ratio) will produce more natural compression (or "punch") from the instrument (a 12x7 tom has more punch than a 12x9).

Tone / Frequency Presence - The "tone" of a drum refers to what frequencies the drum's sound will contain. Drum diameter has a direct effect on tone. To make it simple, the larger the diameter, the easier it is to get lower tones from the drum due to the size of the chamber and the size of the drumhead. Shell thickness will have a perceived effect on pitch as well. Thicker shells will have a lower resolving fundamental pitch.

To sum up a drum size selection: If the player wants a "Deep-sounding, Punchy, Low-pitched drum", the choices would be:

1. Softer wood composition with thicker shell (lower fundamental)
2. Shallow depth (more punch than projection)
3. Larger Diameter shell (bigger diameter = lower pitch)

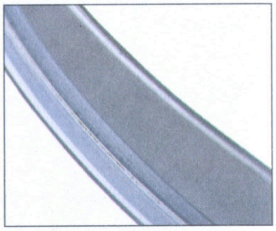
Again, all choices are personal and there are "compound" issues at work here. Each design element of a drum has a slight effect on the overall sound. Combinations of options are what allow the player to refine their sound. Understanding what the various components of the drum's design can do make the decisions wiser and much easier!

Drum Hoop Compositions and How They Affect The Drum's Sound

One of the elements of drum design that affects the sound of the instrument most is the choice of hoops. There are basically five kinds of hoops used in drum design. Each hoop type has a specific purpose and creates a different sound from the drum. Let's take a look at each and how to choose what creates your desired drum sound.

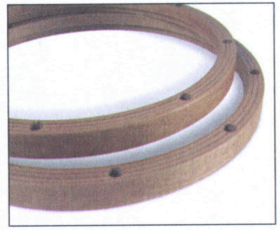
1. Triple-Flanged Hoops - This is the standard drum hoop. The "triple flange" refers to the amount of bends in the profile. The flanges provide stability and offer an outward bend at the top to help with rimshot sound and with prolonging the life of drumsticks. These hoops let the drum resonate well, as they are not heavy and vibrate naturally. An interesting test is to take a triple-flange hoop and a die-cast hoop. Suspend each one from one finger and tap them with a drumstick. The triple-flange hoop will ring. The die-cast hoop will produce a metallic "thunk" sound with no ring. The drawback is that the triple-flanged hoop's flexibility can cause it to go "out of round", or oval. If this happens, it makes tuning much more difficult. The snare drum is especially prone to this, because of rim-shots. A die-cast hoop does not have this flexibility. The image here is a comparison of the triple-flanged and the die-cast hoops.

2. "Die-Cast" Double-Flanged Hoops - These are single piece hoops that are much stiffer and heavier than triple-flanged. They will not bend and will keep in round permanently. This helps with tuning because the hoop will tension the head evenly across the drum. The cast metal adds quite a bit of attack to the drum's rimshot tones. The extra weight and rigidity, as well as the casting process, will reduce the resonance of the drum noticeably. They also project quite a bit more than triple-flanged, especially the crosstick sound.



3. Single-Flanged Hoops - The straight, "single-flanged" hoop has a very characteristic sound. These hoops open the drum up and create a very resonant tone from the instrument. They also have a metallic rimshot tone. Most often used with small claws for the mounting, they have a classic look and sound. They do cause the player to go through sticks a bit more quickly. Superb, open crosstick sounds are a benefit of single-flanged hoops.

4. Inward-Flanged, "Sonic Saver" Hoops - These classic hoops are triple-flanged but in the opposite direction on the top bend. This does a few things. First, it focuses the sound of the drum downward rather than sideways and out, like the triple flange. This can help control the sound of the drums, especially in larger diameters. Second, they create a very specific punchy, attack sound out of the rimshot tone. They are most often used to create a "vintage" style, drier tone. "Stick Savers", as they were called (Slingerland "Sound King" was the actual name), can be found on many vintage drums. First created by the Slingerland drum company in 1955, they have been revised by Mapex drums with the "Sonic Saver" hoops. These are 3.0 mm weighted, stick saver style hoops and are a new breed of stability and tone control for contemporary use.



5. Wood Hoops - Wood hoops have been around in their basic form (straight with claws) on bass drums, marching drums and drum kit snares, since the beginning of drum building. In the early 1990s Yamaha® drums released a new style of plied, round wood hoops with inset tension rod receiving holes (created by Takashi Hagiwara and Russ Miller). These also featured flats to position the drums closer together when set up in a kit configuration. Wood hoops expand the tuning range of the drum, they resonate with the drum shell to create a big, open sound, as well. They won't bend (similar to die-cast) and help with the tuning of the instrument. Of course, they will dent if hit hard and can be a bit expensive. Wood hoops have a superior, louder, bigger crosstick tone.

The "Nodal Point"

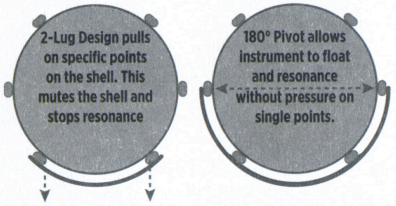
The "Nodal Point", in reference to drums, is a term coined by the Noble and Cooley drum company in the mid-1980s. A "node" is a point on a structure that does not move (the minimum amplitude point of a sound wave) while the rest of the structure is vibrating. Nodal points or Nodal rings happen in a few places on a drum. Here are the most common positions of "Nodal Points":

1. The point at which the drumhead is pressured against the bearing edge of the shell. This is an area is which the drumhead membrane doesn't vibrate, but does transfer energy into the shell.
2. The line at which the lugs are mounted to the shell. Depending on the lug designs, this can be one or two points where the bolts enter the shell and are tightened. Because the lugs are anchor points that receive the pressure from the tension rods, the pull on the lug-casings around the shell prevent the wood from vibrating along that line. This creates a "nodal ring or line" in the shell.
3. The point at which the weight of the drum is fixed to the mounting hardware.

Now that we understand what the Nodal Points are, let's talk about how they are used to our advantage in drum design.

Lugs - Establishing a Nodal Line for the lug mounting is important. The smaller the body of the lug, the more resonance from the shell. Fewer bolts through the shell and a smaller footprint touching the shell will produce a more open sound. Lug-casings that produce a large footprint against the shell will create bigger areas where the shell doesn't vibrate. Although this sounds like it would always be a negative, it can be used to help dry the sound a bit, such as on a metal drum. This being said, anything else that needs to be mounted to the drum (brackets, air holes, etc.) should be mounted in this "lug line" to avoid creating other nodes on the shell.

Mounting Hardware - The entire weight of the drum is applied to the point where the mount touches the shell. If you have tuned a drum holding it up in the air and it sounds great, only to put it on the mount and it sounds much worse, you have experienced the effects of the weight creating a Nodal Point. Obviously, the worst situation is to mount a bracket directly to the shell and attach the tom arm through the interior of the drum. This will have a huge effect on the sound of the instrument. This was the norm for many years until manufacturers figured out how to mount the drums better. The weight needs to be spread evenly and at 180° to help "suspend" the drum in the air, similar to holding it. If the mounts pull on single points or parallel points on one section of the shell, it will create a Nodal Point and mute the drum. The other "No-No" is to use the tension rods to suspend the weight of the drum. This pulling effect on the tension rods creates additional "nodes" and has a drastic effect on the sound of the instrument.



The suspension of the tom works best off of the lugs themselves. Remember, these lugs are already creating "nodes" where the wood is not moving. Thus, adding any weight to them will not make them move any less. This masks the mounting of the drum and has the least effect on the sustain of the instrument. This is especially effective done at 180° (opposite sides) of the shell.

Snare Drum "Snare Beds": Which Design and Why?

One of the least understood design factors of the snare drum is the snare bed. This is the portion of the resonant side of the drum where the snare straps/strings passes over the bearing edge or where the snare element itself passes over the bearing edge. There are two main forms of snare element execution on a snare drum:

1. Standard snare bed (Includes depth, pitch and width)
2. Extended or "Floating" snare beds

Let's take a look at each one and why a player would choose one over the other. Of course, the other main factor in how the snare element affects the sound is the composition of the snare element itself. These can be made of many kinds of materials and in many sizes.

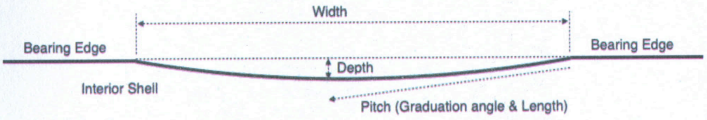
Standard Snare Beds - A standard snare bed is the area where the connection piece for the snare element passes over the bearing edge. But, it is much more important than providing a "path" for the snare string or strap. How this area of the snare resonant side is treated dramatically effects how the snare drum sounds. The **width** of the snare bed has a huge effect on sensitivity and sustain of the snares. The **pitch** of the snare bed has a big effect on how clean the snares respond (no extra buzz or flutter) and on how the bottom snare head can deal with the changes in angles on this portion of the drum. The pitch refers to how quickly the depth of the snare bed is reached from the level edge of the shell. When the pitch is too great (too much of an angle, too quick), the drum head will wrinkle at the snare bed. You can not only hear this plastic sound but it causes the snares to bow outward and rattle. The **depth** of the snare bed is what determines how articulate the snares will be. However, when cut too deep, it can also cause the snares to mute the bottom head too much and dry the sound of the snare drum. As with everything in instrument design, it is a choice of preference. Here is how to think about the snare bed choice:

- Deeper snare bed = more articulate and sensitive, but drier tone
- Wider Snare bed = bigger sound with longer snare sustain
- More gradual pitch = more snare element sound

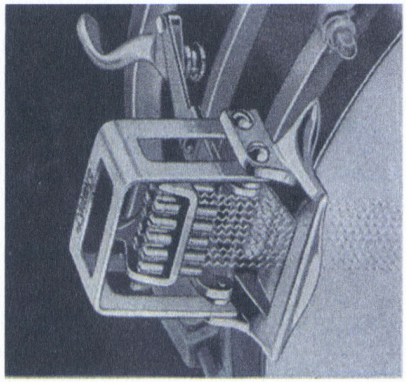
** A longer graduation in the snare bed pitch will also clean-up the snare element tone (less buzz/flutter). It will also stop wrinkles in the snare side head at the snare bed positions.

Again, there is a balance. When a snare is very articulate, it exposes every detail of the playing. The backbeat sound isn't as big and wide either. There is a sacrifice in the "fat tone" of a snare, to make it very sensitive and articulate.

Here is a diagram of how to recognize the various parts of the snare bed:



"Extended" or "Floating" Snare Beds - Another design method of mounting the snare element on the drum is what is called an "extended" (or sometimes "floating") snare. This is a snare element that is longer than the diameter of the drum. It extends past the sides of the snare bearing edge and connects to a mechanism on the outside of the snare drum. The Ludwig & Ludwig® "Super-Ludwig" was the first to do this in 1925-26. The idea is that the snare is not pulled upward via tension on either end by straps or cables, but is rather kept level and under tension between the two ends of the snare mechanism. It travels evenly up and down while under constant tension as it is turned on and off. Usually, the "Super-Sensitive" type throw offs have separate tensions adjustments for each snare wire. Often times, this is used on symphonic drums and allows for the changing out of snare wires individually. Many of these style throw-offs feature multiple compositions of snare wires (e.g. gut, stainless steel, brass, carbon, etc.). These drums feel a bit different because there is little tension of the snare element on the bottom heads. The drum can have more ambience this way (if desired).

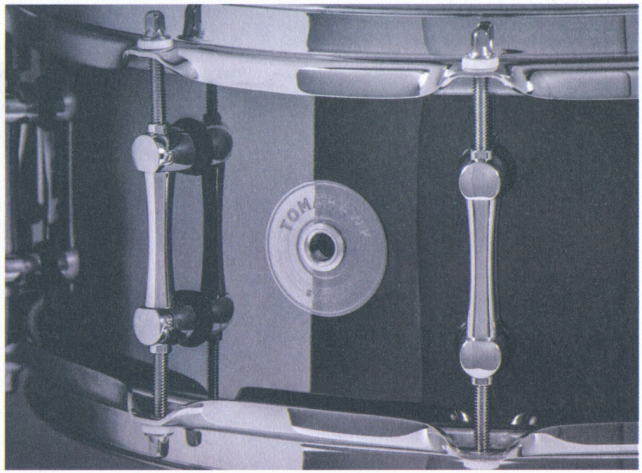


Metal Shell Compositions:

As with the "Janka" hardness scale for woods, there are scales that indicate the hardness (thus resonant qualities) of metal shells. One of these systems is called the "Mohs" hardness scale. When we know the hardness of the metal, we can choose the material that is correct for the sound we want. For instance, a softer and less stiff metal will help the shell to resonate more and usually affects the fundamental pitch and projection of the drum as well. I.e. Copper is a bit softer, so it will have a dry tone to it and a slightly lower fundamental pitch.

Cast vs. Seamed

A "Seamed" shell uses a piece of metal that is rolled into the desired diameter and then welded at the seam. A "Cast" shell is produced by spinning a disc of metal on a lathe and slowly pushing the metal into a cylindrical shape. As a result, these shells have no seam. The metal spinning process actually improves the hardness of the raw material metallurgically by realigning grain structures, creating a stronger shell. Combine that structural integrity and strength with the shells thinness and you have a shell that differs a lot from a seamed shell. A cast shell will be more resonant, since it has no seam to disrupt or choke the resonance (the seam is a small "Nodal Line"). Because there is also no density difference around the full shell that would come from having a seam, the result is a much more pure and defined tone.



The "Bead"

Metal shells (especially thinner walled, rolled shells) often have a "bead" running in the center of the drum shell. The bead is there for stability of the shell. This is why food cans have beads in them as well. A thinner shelled snare drum with no bead (or rolled bearing edges) would go out of round, especially under pressure from the drum heads. The bead strengthens the thinner shells.

The Bearing Edge

The rolled bearing edges also strengthen the shell, although they also provide proper "seating" of the drum heads. The angles of the rolled edges effect the sound of the snare. Cast metal shells often don't need to have rolled bearing edges. This is because they are stronger and the edge shape can be lathed (cut) directly from the shell wall. This allows the collar of the drum head to extend past the wall of the shell. Thus, no counter cut is need either. The "Bearing Edge" is then the wall of the shell resting on the flat of the drum head. So, there is no drum head collar to shell edge interaction.

Internal/External Beads

There are several kinds of beads, some are "external" and some "internal". There is really no difference in sound, this is for aesthetic purposes only.

Microphone Techniques for Drums

Courtesy of our friends at SHURE

General Rules

Microphone technique is largely a matter of personal taste — whatever method sounds right for the particular instrument, musician, and song is right. There is no one ideal microphone to use on any particular instrument. There is also no one ideal way to place a microphone. Place the microphone to get the sound you want. However, the desired sound can often be achieved more quickly and consistently by understanding basic microphone characteristics, sound-radiation properties of musical instruments, and acoustic fundamentals.

Here are some suggestions to follow when miking musical instruments for sound reinforcement.

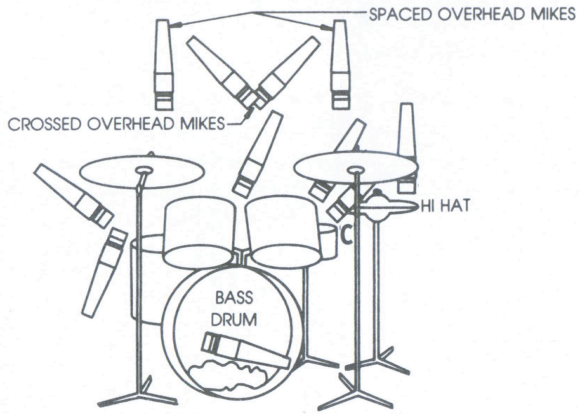
- Try to get the sound source (instrument, voice, or amplifier) to sound good acoustically ("live") before miking it.
- Use a microphone with a frequency response that is limited to the frequency range of the instrument, if possible, or filter out frequencies below the lowest fundamental frequency of the instrument.
- To determine a good starting microphone position, try closing one ear with your finger. Listen to the sound source with the other ear and move around until you find a spot that sounds good. Put the microphone there. However, this may not be practical (or healthy) for extremely close placement near loud sources.

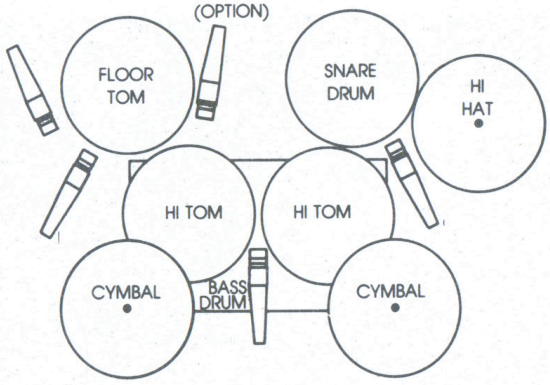
- The closer a microphone is to a sound source, the louder the sound source is compared to reverberation and ambient noise. Also, the **Potential Acoustic Gain** is increased — that is, the system can produce more level before feedback occurs. Each time the distance between the microphone and sound source is halved, the sound pressure level at the microphone (and hence the system) will increase by 6 dB. **(Inverse Square Law)**
- Place the microphone only as close as necessary. Too close a placement can color the sound source's tone quality (timbre), by picking up only one part of the instrument. Be aware of **Proximity Effect** with unidirectional microphones and use bass rolloff if necessary.
- Use as few microphones as are necessary to get a good sound. To do that, you can often pick up two or more sound sources with one microphone. Remember: every time the number of microphones doubles, the **Potential Acoustic Gain** of the sound system decreases by 3 dB. This means that the volume level of the system must be turned down for every extra mic added in order to prevent feedback. In addition, the amount of noise picked up increases as does the likelihood of interference effects such as comb-filtering.
- When multiple microphones are used, the distance between microphones should be at least three times the distance from each microphone to its intended sound source. This will help eliminate phase cancellation. For example, if two microphones are each placed one foot from their sound sources, the distance between the microphones should be at least three feet. **(3 to 1 Rule)**

- To reduce feedback and pickup of unwanted sounds:
  1. place microphone as close as practical to desired sound source
  2. place microphone as far as practical from unwanted sound sources such as loudspeakers and other instruments
  3. aim unidirectional microphone toward desired sound source (on-axis)
  4. aim unidirectional microphone away from undesired sound source (180 degrees off-axis for cardioid, 126 degrees off-axis for supercardioid)
  5. use minimum number of microphones
- If the sound from your loudspeakers is distorted even though you did not exceed a normal mixer level, the microphone signal may be overloading your mixer's input. To correct this situation, use an in-line attenuator (such as the Shure A15AS), or use the input attenuator on your mixer to reduce the signal level from the microphone.

Microphone Positions

In most sound reinforcement systems, the drum set is miked with each drum having its own mic. Using microphones with tight polar patterns on toms helps to isolate the sound from each drum. It is possible to share one mic with two toms, but then, a microphone with a wider polar pattern should be used. The snare requires a mic that can handle very high SPL, so a dynamic mic is usually chosen. To avoid picking up the hi-hat in the snare mic, aim the null of the snare mic towards the hi-hat. The brilliance and high frequencies of cymbals are picked up best by a flat response condenser mic.





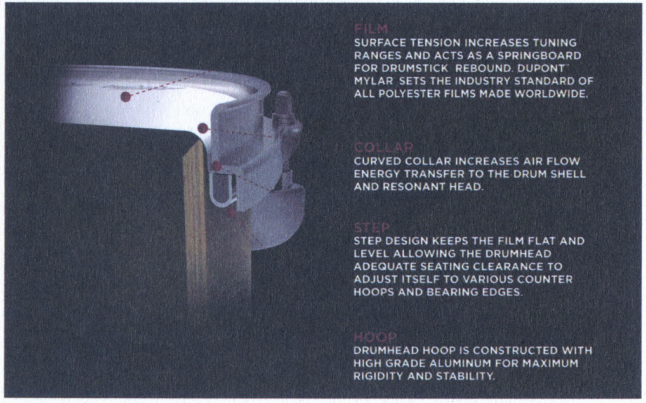
Drumhead Know-How

Courtesy of our friends at REMO

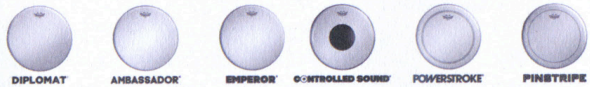
The best Drumhead combines the ideal amount of tone, sustain, sensitivity, stick response and durability. Each of these is determined by the three basic components of a drumhead – polyester film, aluminum flesh hoop, and polyurethane adhesive. Additional components may also include sound controlling features such as adhesive-backed reinforcement dots, underlay rings and internal / external dampeners.

Understanding the effect that each component has on the sound of your drums and the response of your drumsticks, brushes, mallets and hands will help you determine the best Drumhead for you, the music you play, and the environment in which you play.

Anatomy of A Drumhead



Choosing Your Drumheads



Film Thicknesses (weights)

Drumheads are measured in terms of the thickness of the polyester film as well as the number of plies, or sheets, of that film. The actual thickness of the film is measured in terms of one/one thousandth of an inch (1/1,000) or a "Mil". This is also commonly referred to as "weight".

The most common Drumheads for general purpose applications consist of a single ply of film that is 10-Mil in thickness (i.e. Ambassador® Coated and Clear, Powerstroke® P3). This is considered "medium weight".

The film type and construction (combination/thickness of films) has the greatest effect on the sound of the drum. The three most common construction types are 1-ply, 2-ply, and Laminated (multiple plies glued together such as Fiberskyn® and NuSkyn®).

Thinner Drumheads tend to be more sensitive and responsive, producing more overtones and a brighter stick response. Thin weight drumheads include: M5 Diplomat® (5-Mil), Diplomat® (7.5-Mil), Skyntone® (8-Mil), Diplomat® Snare Side (2-Mil), Ambassador® Snare Side (3-Mil).

Thicker (Heavy weight) Drumheads have a lower fundamental pitch and usually less sustain. They are usually more durable since they can better absorb the shock of the drumstick tip or bead. Heavy weight Drumheads include: Emperor® (2 plies of 7-Mil or 7.5-Mil film), Pinstripe® (2 plies of 7-Mil film), Powerstroke® P4 (2 plies of 7-Mil film) with or without a Controlled Sound® center dot.

Remo Pinstripe® and Emperor® Drumheads are made with two "free-floating" plies so that both plies have a certain slip to them as the two plies vibrate. This helps to regulate the distance between the two films and keep the sound consistent. 2-ply heads are unique in the fact that the two films reinforce each other to make a strong Drumhead and also to reduce high frequencies.

Construction Types

Tone control and dampening accessories such as Controlled Sound® dots and Powerstroke® underlay rings are utilized on certain drumheads for the specific function of controlling unwanted frequencies and/or increasing durability.

A dot in the center of the Drumhead provides three functions:

1. Increased durability
2. Control harmonic frequencies
3. Lower fundamental pitch

Controlled Sound® Black Dot™ tom and snare Drumheads, as well as Powerstroke® P3 with Black Dot™ bass Drumheads are the two most popular examples of utilizing center dots and underlay dampening rings.

A Mylar® underlay ring beneath the Drumhead collar provides control of unwanted harmonic frequencies while also shortening the amount of sustain. This is often desirable for close-miking applications as well as practice situations where volume and sustain are an issue.

Remo Felt Tone bass Drumheads feature a built-in felt dampening strip similar to those that were common from the 1950s-70s, but without covering the bearing edge of the drum. This allows the drumhead to sit perfectly on the drum while also controlling sustain.

Drumstick Anatomy

Courtesy of our friends at VIC FIRTH

The right drumstick for each player blends the perfect combination of balance, response, feel and sound properties. Each of these critical factors is a function of a stick's design—and knowing a little about each of these components will help you determine which stick might be best for you and your situation.

1. Thickness

The thickness of a drumstick's shaft affects its overall weight, projection, and strength. A thinner stick plays faster and creates a lighter sound on drums and cymbals. A thicker stick will offer power and projection.

A musical style, in and of itself, will not always determine the thickness of a stick that professionals prefer. There are heavy-hitting jazz players that prefer thick sticks and heavy metal drummers who prefer thin sticks for their playability.

2. Length

There are many determining factors in how a stick "feels" in the hand. The length of a stick affects its leverage and the reach. When comparing two sticks with the same diameter and taper, a longer stick will feel "front heavy," giving the player increased leverage and power. A short stick will feel like the weight is pushed back towards the hand.

3. Material

Stick material is the key to its response and durability. Material also has a unique effect on the sound, flexibility, and lifespan.

- **Maple** has a fine grain pattern, producing a light, fast playing stick with the greatest amount of flex. These sticks are perfect for the artist who is playing lighter types of music or prefers a larger diameter stick without as much weight.

- **Hickory** has a fibrous grain pattern and is denser and more rigid than maple. A hickory stick produces less flex and is capable of withstanding a great deal of shock and stress, making it more durable. American hickory has a wide variety of commercial uses - from hardwood flooring to furniture - and is by far the most popular type of wood for crafting drumsticks.

- **Persimmon** is known for its density, durability and resistance to high impact. Sticks made from persimmon produce a full-bodied and slightly darker sound than other wood. Persimmon is in the same genus as ebony and is sometimes referred to as "white ebony". Since it's grown more for its fruit than as a commercial lumber product, persimmon sticks are usually only found in smaller run product genres, such as concert snare sticks.

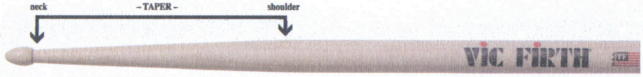
- **Oak** is a denser wood with a more rigid response than hickory. The natural hardness of oak produces clear,

defined cymbal articulation from the tip and an incredible cross-stick tone. The downside of oak's rigidity is the "shock" that is produced – and translated to the wrists and forearms – when playing rim shots. The most common oak used for producing drum sticks is Japanese Oak, found in Japan and eastern Asia.

4. Taper

Along with a stick's length, taper also affects its feel and balance. The amount of taper and location of the shoulder (where the taper begins) determines whether the stick feels "front heavy", "back heavy" or evenly balanced.

- A **Long** taper produces more flex and faster response. The downside to a long taper is the loss of power and durability if you are a heavy-hitter.



- A **Short** taper increases the size of the neck of the stick, providing more power and durability. A short taper feels "front-end heavy." Many heavy-hitting drummers like the extremely short taper because they can feel the front-end power without necessarily moving to a large diameter stick.

- A **Medium** taper provides the best balance between the butt and the tip. The weight of a medium taper stick feels like it's balanced between the hand and the tip.

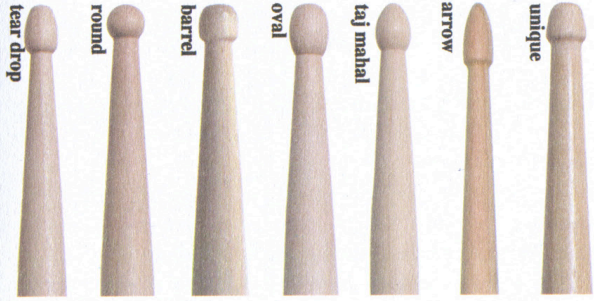
5. Tip Shape

The tip shape and tip material are critical to the overall sound produced on drums and cymbals (being more pronounced on cymbals). Each tip shape and size adds different characteristics to the sound, depending on the amount of contact surface area and mass.

When deciding on the type of sound that you want from your cymbals and drums, it's helpful to know that a large tip with a very large surface area will create a dark, rich sound, while a small tip with a very small surface area will produce a light sound with clear definition.

Of course, the weight and balance of the stick is also a contributing factor in the overall sound a stick produces. A long, front-heavy, large diameter stick with a small tip will most certainly produce a darker sound than a short stick with a long taper and large bead.

7 Common Types of Tip Shape

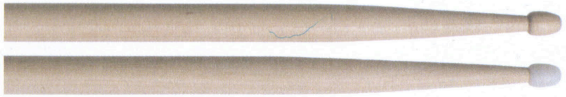


6. Tip Material

Each material produces a different sound color and varying degrees of articulation.

- **Wood** tips are the most common tip material, producing a balance between full sounds and great articulation on drums and cymbals. The density and hardness of a wood will also factor into the sound color produced by a stick. For instance, a soft wood such as maple will produce a darker tone when compared to a hard wood such as oak.

- **Nylon** tips produce a brighter sound and provide increased durability. Drummers who want the clearest possible articulation and brightest tone will often choose nylon tipped sticks over wood.



Summary

Once upon a time, manufacturers often classified sticks into musical categories. "A" model sticks were for orchestra, "B" stood for "band applications", "S" for "street" or marching band, plus others. Today, a stick with a letter designation has little to do with its size, design or application – and will vary widely from manufacturer to manufacturer.

There is no "perfect stick" for every drummer because we all have differing musical tastes and playing styles. The best way to select the perfect pair for YOU is to experiment until you find a great fit for you!

Personal Lesson Book

The Concept Hybrid and Standard lesson formats:

Similar to how the Design Lab combines multiple sonic ideas together to create a unique instrument voice, you can take this approach in your personal playing development. The following lesson pages are pre-formatted for you to take multiple playing concepts and combine them into a single practice idea. Also, there are standard lesson pages formatted for your personal use. Here are examples of Hybrid lessons.

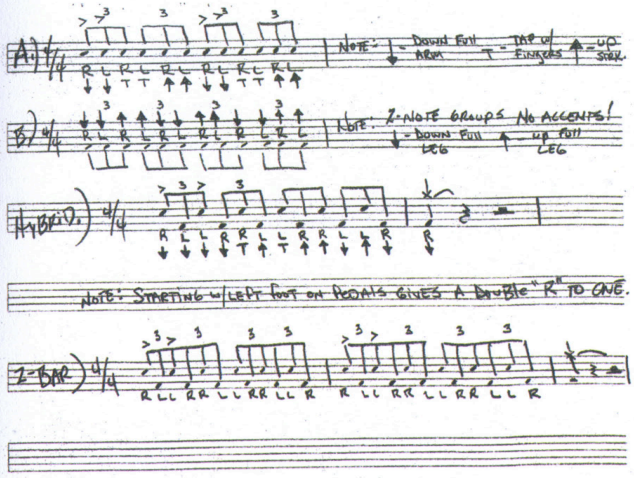
The "Concept Hybrid" Lesson Example

Title: Interplayed Hand and Foot Moeller Technique **Date: 5.8.17 B.P.M. 110**

Concept A in text: Interplayed Moeller Technique with Downbeat accents

Concept B in text: Interplayed Moeller Technique with pedals (no accents)

Reference: Steve Smith solo section "Nothing Personal" with Steps Ahead (France 2005)



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	20 min	20 min	30 min	40 min	20 min

Personal Lesson Book

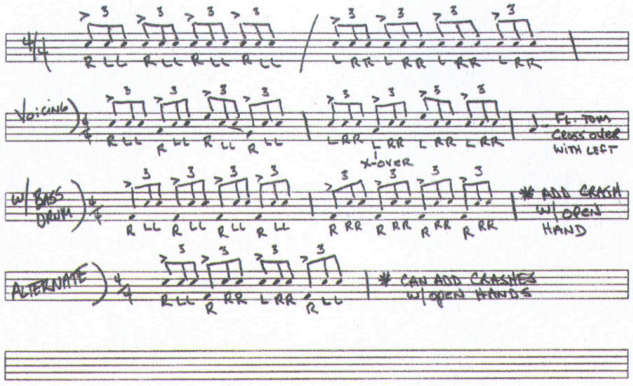
The Concept Hybrid and Standard lesson formats:

There are standard lesson pages formatted for your personal use.
Here is an example of a standard lesson.

Standard Lesson Example

Title: Buddy's "Solo" triplets **Date:**5.10.17 **B.P.M.:** Starting at 60 / 5.10.17 - 110

Reference: Buddy Rich "New Swinging Big Band" - 1966 "West Side Story" solo Section



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Standard lesson format

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Standard lesson format

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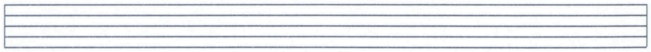

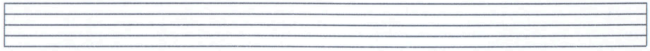

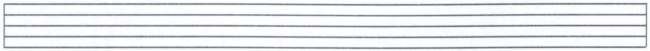

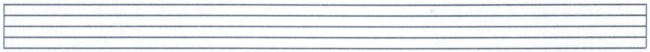

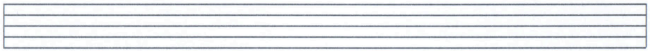

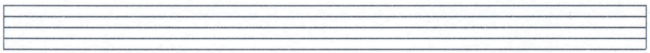

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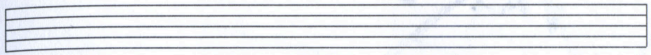

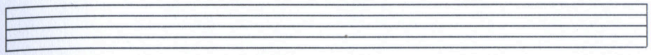

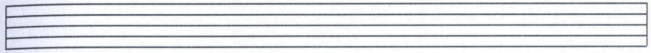

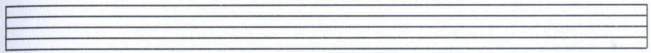

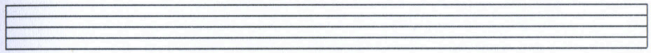

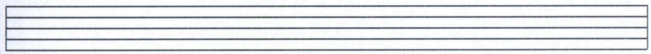

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Volume 1

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