B Taylor - 2007

Concepts of UWH stick design

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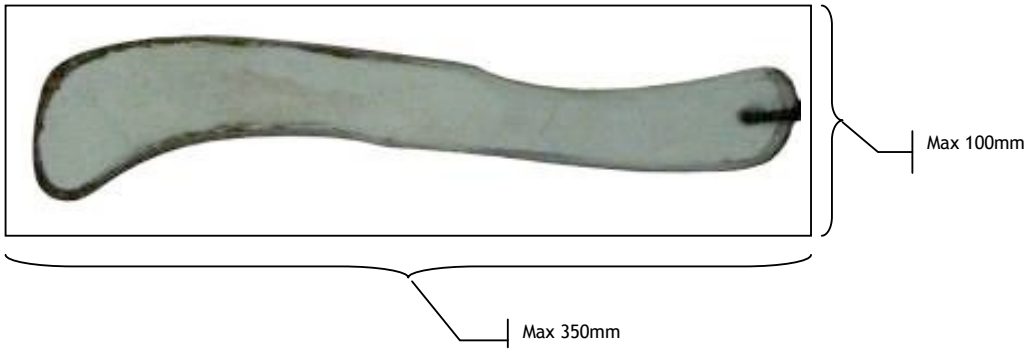
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Chapter 1: Introduction

Underwater hockey sticks are a wonderful exercise in diversity with a remarkable variety being available for view at pretty much every hockey club in the world. One of the reasons for this is the dynamic range of playing styles and abilities found in our sport, allowing proponents to customise their weapons to enhance specific attributes. Every player has a specific body, skill set, style and ambition that will unlock or destroy the potential of any particular stick. Some enormously talented players can pick up pretty much any hunk of wood, leap in the water and carve up the opposition. I am not one of those players, so my sticks have always been constructed in an attempt to draw every available advantage from my play. I started off with massive clubs made to hurt people, slowly evolved down to sticks smaller than my middle finger and back up to the more standard example I use today (although people still tell me it's tiny). Along the way I've figured out a lot about stick design. Most of it's probably wrong, but I figured I'd throw it down on paper anyway and maybe I could help somebody avoid some of the pitfalls I encountered in trying to design an effective stick for my skills, style, puck and opposition. I've tried to include both simple precepts for the first timer and some of the more complicated physics for the seasoned pro.

Chapter 2: The Rules

The rules around stick design have evolved over the years to become increasingly simple. Essentially, the stick must fit into a box 100mm x 350mm x 50mm and not have any sharp bits.



Additionally, any hooks, bumps or protrusions must have a minimum radius of 10mm, and no part of the stick may encapsulate more than 50% of the puck. The handle must not protrude more than 25mm out of the heel of the hand, and it is illegal to play the puck with this (sorry, no Darth Maul styles).

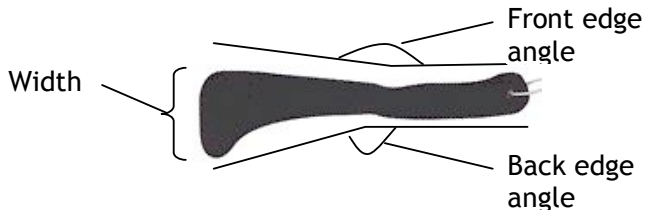
Or if you want the technical version:

11.3.7.1	The stick shall be made of wood, plywood, or a homogeneous material that floats horizontally in the water.
11.3.7.2	The stick must fit wholly in a box with the interior dimensions of 100mm x 350mm x 50mm.
11.3.7.3	Minimum corner radius around the perimeter edge of the entire stick is 10mm.
11.3.7.4	Edges where surfaces intersect must be rounded.
11.3.7.5	The stick must be uniformly black or white. However, it may have a discreet and simple symbol or initial(s) in a contrasting colour for identification purposes. If the Chief Referee or Water Referee determines that the symbol or initial(s) creates confusion as to the colour of the stick, the stick may be removed from play for that match.
11.3.7.6	The stick may not protrude from the heel of the protected hand by more than 25mm.
11.3.7.7	The puck may not be played with the portion of the stick that may protrude from the heel of the protected hand.
11.3.7.8	The “playing area” of the stick is that area not covered by the protected hand and forward of the thumb.
11.3.7.9	A wrist lanyard may attach the stick to the playing hand.
11.3.7.10	A player may tape the stick to the playing hand.
11.3.7.11	The stick may be of any shape or design within the minimum and maximum dimensions given. The illustration is only a guide (Figure 11A). Knob(s) on the stick is/are allowed.
11.3.7.12	The stick must not be capable of surrounding the puck or any part of the hand. The stick may not encapsulate the puck by more than 50% or lock the puck to the stick.

Right, back to the interesting stuff then.

Chapter 3: Basic Structure

The basic hockey stick we all know and love constitutes a front edge, a back edge with a hook and a well designed, comfortable handle. The edges will likely be bevelled to varying degrees to aid in flicking the puck.
When a player grips the handle, the front and back edges will protrude from the hand at specific angles, depending on what the player wants from their stick. More forward angle on the front edge results in a better flick, more backwards angle on the back edge results in a more secure hook, and the interplay between these two parameters will define the width, mass and balance of the stick in general.



Playing Style & Skill Set

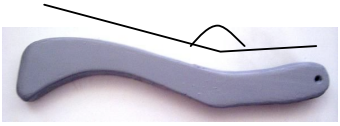
How you want to play the game greatly affects what kind of stick you should be using. As a back you might want consistency of control, a good tackle and a dependable flick. As a forward you might be more interested in speed and manoeuvrability. Thus the same player may use two completely different sticks for two different positions. By designing your stick around the skill set you want to use as a player, you can help force yourself into using that skill set. Once you get to the end of this article you should be able to decide which attributes are the most important to you, and accentuate them in your stick design.

Angles – Front Edge

The angles of the front and back edges have probably the most direct affect on how a stick can be used. This is the angle of the edge to the handle, not the angle of the bevel.

A forward angled front edge will flick better, faster and more consistently (to a point, then it just gets stupid), but will have control issues when using the stick vertically, preventing an entire skill set from being utilised effectively. This also tends to reduce the angle of the back edge, lowering tackling effectiveness. Stick designers will often attempt to counter this affect by having grossly oversized hooks. 30 degrees is about the maximum forward angle you'll ever need.

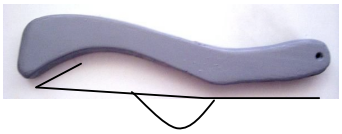
A backward angled front edge will have more difficulty flicking, requiring a longer (slower) motion with more wrist activity (resulting in a higher risk of wrist injury due to impact during the flick). In return, control with the stick vertical is greatly increased when the puck is held close to the body and it becomes easier to flick the puck with the stick vertical and the puck coming off the bottom of the stick. With a backwards angled front edge it's relatively easy to get the puck up off the bottom and travelling a significant distance with this pass. However it is more difficult to extend the arm and it can also be more difficult to invert the hand whilst in possession.

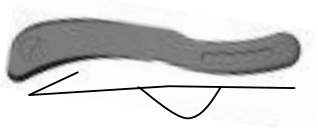




Angles – Back Edge

The angle of the back edge defines how well the stick will tackle. A stick with a steep back angle and a small hook will tackle as well as a stick with no back angle and a massive hook.

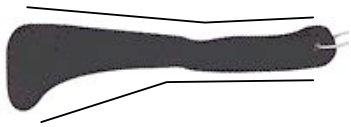




A deeper back angle makes it much harder to dispossess you of the puck when using this surface. A stick with a large back angle and a deep hook can end with the puck almost completely shielded – by the stick on one side and the wrist/forearm on the other. Unfortunately, whilst this is good for swimming in circles, once you run out of air the game is pretty much over.

Width

The width of the stick is defined by the angles of the front and back edges. If you have a sharply angled front edge for a good flick and a deep back angle for a good hook, you're going to have a very wide, unwieldy stick. This might be good for slapping down passes or filling in when your favourite cricket bat breaks, but it isn't going to control the puck swiftly in an intense melee.





Greater width provides

- More mass, meaning more impact when you hit people and less damage when you get hit.
- A fin effect which helps keep the stick flat and improves aim and pass control.
- More surface area for catching the puck.
- The centre of gravity (balance point) is closer to the end of the stick, increasing flick power.

Less width provides

- Less mass, meaning more speed.
- The ability to use the stick on its side with speed and control.
- The ability to flick off the top and bottom faces.

So, the width argument is one of stability, power and flick (wide) vs. speed and control (narrow). Decide how important each attribute is to your style of play (or the style you want to play) and design your stick accordingly.

Cautions - If you're going for a very thin stick then:

1. Design it no narrower than the depth of the puck or you're going to run into serious control problems with a vertical stick. It will move the puck around great while you're practising on your own, but once you're in a melee with another player it'll be impossible to control.

2. If you want to slap down passes then design it no narrower than the radius of the puck or your catching skills will become a joke.

Straight vs. Curved Front Edge

A lot of sticks have a curved front edge. The main advantage of this is you get to increase the angle of part of the front edge, for a good flick, before tapering away to reduce the overall width. A rounded end also helps with puck control manoeuvring the puck from the front edge to the back.
The disadvantage is that the flicking characteristic is not consistent over the length of the front edge. I.e. if you flick the puck from near your hand you will get a different result to if you flick it from half way down the stick. A straight front edge tends to be more consistent. The matter is pretty much down to personal preference, try them both and see which one suits your playing style. The following two sticks have the same angles on the back and front edges, but the curved sabre has a lot less width at the end.



The best thing about a curved front edge is that it puts a lot more of the stick close to the bottom when using the stick vertically. This improves your control with a vertical stick, and alleviates some of the negatives of having an extreme front angle when playing this way.



Depth - Thickness

The thickness of your stick will have an effect on your playing style. Slimmer sticks move faster, thicker sticks hit harder. Generally, if the depth of your stick is less than half the depth of the puck you play with, then you're going to run into control issues during a game, the puck will tend to bobble a lot. Choose a thickness dependant on your playing style, if you like smashing stuff you might go as thick as 20mm, if you consider your stick to be a fine and delicate instrument you might go down as far as 14mm. Generally most people are happy in the 16-18mm range. The difference between 20mm and 14mm is 30%. That's 30% less mass (weight) and 30% less water resistance. You can either get your timber merchant to tool your wood to the correct thickness at the time of purchase, or if you're making your sticks out of mom's old breadboard you can just suck it up and take what you're given.

Chapter 4: Intermediate Structure

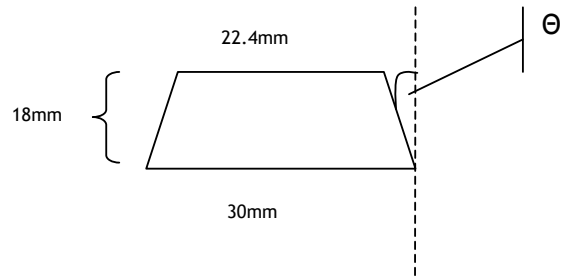
Bevels

Most people these days bevel the front and back edges to enable easier passing off each edge. A lot of people use far too much. Remember, the idea of a bevel is to incite the puck to come up off the bottom. Wonderful if you're trying to pass it to your mate – a complete prick if you're trying to dummy the opposition. Every degree of angle on your bevel makes it harder to control the puck and requires a greater skill level to play well with (I define playing well as using stick skills to beat your opponents – sue me), so experiment and use the least bevel that gives you a consistent flick that you're happy with. Make sure your bevels are smooth and consistent the whole way along the face, with no bumps or perturbations. A consistent edge will result in a consistent flick (well, it will if you practise enough). Bevel angles generally range from about 8-12 degrees on good sticks.

When you add a bevel to any edge, obviously you're removing mass, and altering the width of at least one face of your stick. If your stick is only 30mm wide, and you add a large bevel to the front and back, then the width of the top face is going to be considerably less than 30mm. You need to take this into account when designing your stick on your 2 dimensional piece of paper.

For example: Let's say John has 18mm thick wood, and want's a bevel of 12 degrees. That means the front and back edges will remove 3.8mm each from the width of the top of the stick. So if John originally wanted a 30mm wide stick, it's now only 22.4mm across the top (although still 30mm across the bottom). That's a considerable difference.

So, find the angle you want your Bevel to be (Θ), and the thickness of your wood (d). The loss of width caused by the bevel is equal to tan(Θ) * d.



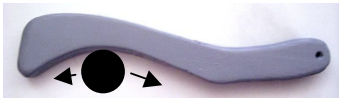
The Hook

The hook is used for tackling and curling the puck away. Some players like it fairly straight, for easier inside flicks and more manoeuvrability going forwards, some like it massively curved for better tackling and possession. There are all sorts of shapes to the curve of the hook out there for all sorts of different reasons. When designing yours remember that control comes from the amount of surface area of the stick in contact with the puck. The more pronounced the curve, the more control you have over what the puck is doing (but this will restrict the list of things you can do with the puck) until the curvature exceeds that of the puck, at which point it's just stupid. The puck will always tend to gravitate towards the point of greatest curvature along the back edge, and when you're moving the puck around this is likely where it will be sitting. If you have a smooth even curve the whole way along the back edge, the puck will roll all over the place and be difficult to control. If the end of your hook is quite straight (for a better inside pass) the puck might sit close to your thumb (and risk breaking it in three places when Jason Miezies tackles you). I like to control the puck with the end of my stick, so my point of greatest curvature is as close to the end of the stick as possible. This also means that the part of the hook you tackle with has the most contact and the most control. To make a stick like this the back edge should be shaped in an elliptical pattern. The height of the ellipse will define the depth of the hook.



In the following diagrams the length and direction of the arrows relates to the amount of motion you can expect from the puck under normal movement.







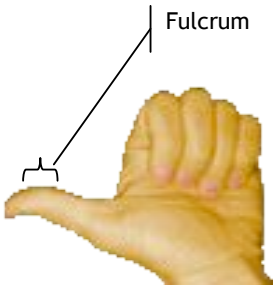


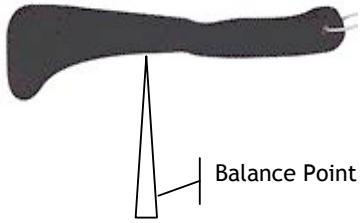
Chapter 5: Advanced Structure

Length and Balance

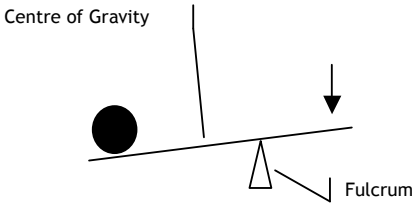
The balance of a stick is a highly malleable attribute, and an important one to get right. Most people do this by trial and error, with some sticks 'just feeling right'. Every stick will have a point where it balances; try balancing your stick on your finger to figure out exactly where this balance point is. This is the centre of gravity of the stick, and the point about which the stick moves whenever you alter direction. If the balance point is biased too far towards the playing end the stick will feel clumsy and unwieldy (although the greater reach might be beneficial). If it's biased towards the handle it will feel light and fluffy with a poor feel on the puck and no power in the flick. As you'll soon notice, altering the mass/length of the handle or the stick will alter where this balance point lies.

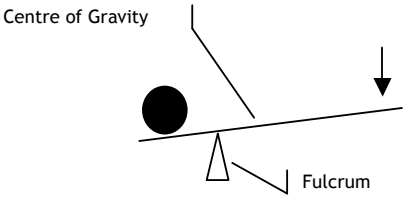
The pad of your thumb (from the knuckle till about halfway to the end) is the fulcrum about which you apply force to the stick in order to do nifty cool stuff. The closer the balance point is to this fulcrum, the more mobile your stick will feel and your skills will come off faster, cleaner and easier. Most people have the balance point a couple of centimetres off the thumb, as this adds more leverage to flicks and smashes.





When you throw the puck your stick acts as a lever around the fulcrum of your thumb. This is why you can throw the puck further with your stick than with your hand. As the centre of gravity of your stick moves further towards the playing area your leverage increases, resulting in your flicks going further. If the centre of gravity is beneath your fingers, then the puck isn't going far no matter how much power you put into it.

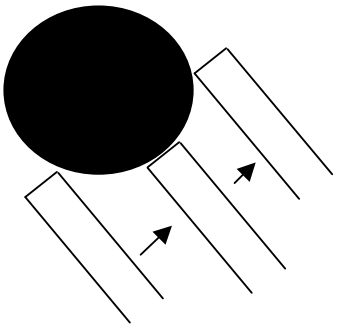


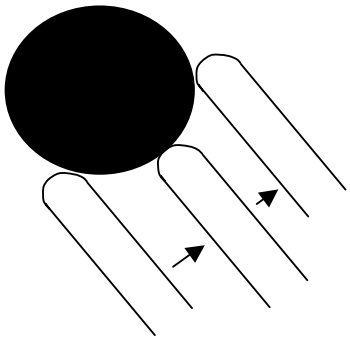


So, a really wide stick with a small handle will behave poorly, as will a really thin stick with a huge long handle (yes, I'm talking about the britbat here). A ratio of about 1:1.6 between handle length (end of the stick to the start of the front edge – not the end of the thumb) and front edge length will usually see you right, unless the shape of your stick is grossly deformed (again, the britbat). If you design your handles well (more on that in a second), then you can alter where your thumb is sitting on the stick with a subtle shift of the fingers. This can have a range of effects including altering the angle of the front edge, and extending the balance point further out beyond the thumb – both increasing the quality of your flicks.

Rounding

In my humble, ok you're right, in my arrogant opinion, good puck skills come from having good contact between the stick and the puck **all the time**. If you lose contact, you no longer have control. To this end I round the end of all my sticks in the X and Z planes. A sharp corner means that when you move your stick around around the puck it has to slip off one edge and be re-gathered by another. Better to have the stick in an even curve that retains the same level of contact (and therefore control) the whole way around. But then, I think I might be the only person that believes in this, so maybe it's just a waste of time.





Chapter 6: Handle Design

God I am sick of seeing sticks where someone has poured love and attention into a beautiful playing area, then hacked the handle into a rough rectangle and called it a day. The handle is the part of the stick that turns it from a club into an extension of your body. Personally, I think the design of the handle is more difficult and more important than the design of the playing area – but then, I'm a freak and if you listen carefully I'm sure you can hear the weight of thousands of hockey players drowning me out.

Standard Grips

The first consideration when designing your handle is the grip you use when you hold it. Grip ranges along a spectrum that I refer to as power vs. control. It's not entirely accurate, but it's my article so sod off.
A more powerful grip has the thumb reaching down the stick providing a platform for balance and power. Players using this tend to have consistent flicks, solid tackles and are very hard on the puck.
A more controlling grip has the thumb directly opposite the forefinger. Players using this grip tend to use the stick vertically a lot more with fine dextrous movements. They also tend to have poor flicks.



Power Grip



Control Grip

A well designed handle will allow you considerable range of motion along this spectrum, allowing you to use either power or finesse dependant on the situation – e.g. if your beautiful little jink didn't work, just slide your thumb out a bit and pound the crap out of the bad guy instead. :D A poorly designed handle will lock your hand into one grip or the other and probably get you hurt. You'll note that with the power grip the thumb is at right angles to the forearm. If you use this grip and the handle isn't designed to transmit force into the butt of your thumb (the thickly muscled bit joining your thumb to your wrist) then you will suffer thumb and wrist injuries. A small handle is not for you. With the control grip the thumb is almost parallel to the wrist and pressure is directed back into the forearm, so it's not such an issue.

Alternate Grips

Altering your grip is a useful way to expand the range of your stick, and there are a variety of small permutations you can use.

Hammer Grip



The lesser used 'hammer grip' is commonly used by beginners as they struggle to come to terms with the concept of using a stick underwater. Most coaches beat their students out of this as soon as possible, unless the student seems particularly well suited to thuggery. This grip allows you to smash with less risk of damage to yourself. That's it. If you're currently using it, um, stop.

Monkey Grip



The monkey grip is where you place your thumb over the stick in much the same way as the rest of your fingers. You don't want to use it going forwards, but when the puck is on the back edge it gives your stick a greater range of motion – allowing you to more effectively use your wrist to deepen the hook of the stick.

Thumb Back



This is an obscure grip used by very very few people. It involves releasing the stick with all but the index finger and the thumb, and rotating the thumb back along the handle, causing the stick to lie in a completely different configuration. It has very little strength, but allows puck motion and skills in positions where they would be impossible with a conventional grip.

Front Edge

The angle of the front edge of your handle defines the angle of the front edge of your playing area, and can be straight, concave, convex or complex.

Straight



Straight handles are dead easy and hard to screw up. They don't tend to offer much, but they don't destroy your stick either.

Concave



Concave handles are tend to be controlled by the index and little fingers – which is good, as accentuating the role these fingers play in controlling the stick will improve your skills. Too much concavity however will end in wrist injuries. Clench your fist. Now keep the 3rd and 4th fingers clenched while opening the 2nd and 5th fingers slightly. That strange sensation you feel in your wrist is an injury waiting to happen.

Convex



Comfortable, but tends to lock your fingers in to one configuration.

Complex



Most people who make their own sticks end up with a complex handle at some time in their lives. They can be great, or they can destroy a stick. Cutting a finger notch into the handle will accentuate the forward angle of your front edge, as will increasing the concavity towards the little finger.

Set Back



Setting back of the entire handle from the playing edge is a strangely popular handle design. It's also stupid. Don't do it. Unless you really really want to. It sets your fingers back from the playing edge, reducing the effect of having the puck resting against your index finger, and forces you to kink your thumb on the back edge of the handle. It improves your control with the stick vertically, but I don't think I've ever seen a player with this kind of handle use their stick vertically, so it's a bit of a moot point. It puts a lot of the impact into the base of the thumb, which is good, but eventually you're going to get hit hard enough that your already kinked thumb is going to be bend backwards and have a very unfortunate (and painful) meeting with your wrist – and that's career ending.

Finger Notches

They set your fingers back into the stick, and lock them in place. Why, why, why? Having a small raised knob between the second and third fingers however, can completely change the dynamic of a stick, without the negative of setting the finger back into the handle.

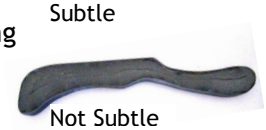
Back Edge

What is one without the other?
There are very, very few concave handle back edges out there (so few I couldn't even find a photo of one). Mostly because nobody likes breaking their thumb more than once. Enough said. There are a few straight handles around, mostly for the same reasons as above, easy and predictable, but most rear edges are some form of convex design. Find a nice smooth curve that's comfortable and fits your hand. Be careful, the more pronounced the curve is, the more it locks your hand into place, preventing some of the more subtle skills (yes, again the britbat).

The placement of the thumb on the handle is one of the defining aspects of any stick and will make or break it, no matter what your playing area is like. Thus, there's a myriad of different approaches:

Thumb Groove
One of the most common is a groove for the thumb to sit, usually centred under the fulcrum as referenced earlier. This locks the thumb into place, giving consistency and aiding in the transmission of power during flicks, but if it's too deep there's no escape when you get hit and you will get injured.


Subtle


Not Subtle

The Kink
Highly popular in France and Holland is to have the stick kink forward at an extreme angle as it comes out of the fingers. The thumb faces a much more forward angle meaning you can pretty much smash as much as you want and never have to worry about getting hurt. However, it locks your hand permanently into one grip, throwing several skill sets straight out the window. Your tackling, passing and impact will be consistent – just don't expect to be showing off your sublime puck skills anytime soon.



The Knob
Some people use a knob or raised section of the stick against which the end of the thumb presses. It helps with the flick a little as it gives you something to brace against. It's also an injury saver if you get hit a lot with the puck on the back edge (the puck doesn't get smashed into the end of your thumb), and injury causer if you get hit a lot with the puck on the front edge (the knob gets smashed into the end of your thumb). Your call.



Nothing



A nice smooth curve (or straight line) seamlessly connecting the handle and the playing edge. If you alter your grip a lot or use fine finger motions to control the playing surfaces of the stick, this is the way to go. Nothing to prevent movement, nothing to get in the way. Yummy.

Width

The width of your handle hugely influences your playing style.
A wider handle gives better grip on the stick, better power transmission, a better pass and more surety in melees. It usually has better contact through the base of the thumb, helping prevent damage when you get smashed. A thinner handle allows you to rotate the stick easily with small movements of your fingers allowing you more precision in your puck control and a greater range of motion, but you suffer the impacts more. Experiment through the range and see what works for you (that's what works in a game, not what works playing around with the puck by yourself).

The second major aspect of the width of your handle is its effect on the angles of the front and back playing edges. The wider your handle is, the more these angles are reduced. So with a thin handle, you can get better angles out of a narrower playing area.



Many sticks have handles of uneven width, which can have a range of effects. Having a thick handle which narrows around the thumb and forefinger can increase those angles, but alters all sorts of other dynamics. Having the width increase suddenly around the little finger increases the angle of the front edge and gives you a lever to pull against for more powerful flicks. Small permutations have large effects. Experiment away, just don't experiment on your favourite stick.

Permutations

The rest of the weird stuff people do to their handles.

Undercuts



Cutting a few mm off the bottom of your handle to get the playing area closer to the ground. It also reduces the general size of your handle increasing that control thing I keep going on about. To be recommended.

Raised Handles



This is a way of getting the playing area closer to the bottom without sacrificing handle thickness. Effective, but it makes using the stick inverted much more difficult, as it moves the playing area further away from the bottom in this configuration.

Angled Handles



This manages to be quite useful in both the normal and inverted hand positions, but makes life crazy if you want to use your stick vertically. Could be worth some application.

Attachments – connecting the hand to the stick

Once you have a beautifully crafted handle grafting the stick to the end of your arm, you need to make sure it stays there. If you don't have something to maintain that connection then sooner or later you will lose your stick, no matter how big and bad you think you might be. Most likely, it'll be in front of your own goal bin with 4 seconds on the clock.

String

Ol' Faithful, far and away the most popular choice of attachment, mostly because it's the easiest. Drill a hole in the stick, tie on a loop of string large enough to fit your hand through and away you go. Shoelace seems to be particularly prevalent, especially in emergencies.

Elastic

Some people swear by it, some people (me), hate it. Loop a piece of elastic over your hand and into the stick. I find it resists movement and tries to pull the stick back into the same configuration in your hand all the time, but like I said, some people swear by it. As a positive it means you can relax your hand a lot more when holding the stick – which will make your hand skills faster, stronger and smoother.

Tape/Rubber Finger Loop

Growing in popularity, use a small loop of rubber or tape. Slip the loop over the third and fourth (or second and third) fingers and slip the handle of the stick through the loop under the fingers. To make one wrap a couple of loops of tape around the four fingers of your hand (without glove) sticky side up, then repeat sticky side down. Voila – quick and easy on the side of the pool.

Glove Loop

I've seen a couple of people punch two holes in the palm of their glove and tie a loop that they feed the handle of the glove into. I find it restricts the movement of your grip a little, but it's not a bad option.

Chapter 7: Materials

Most sticks are still made out of wood, mostly because most sticks are still made at home, but the balance is shifting towards mass produced sticks for, ho ho, the masses. As it does more and more plastic sticks are turning up at pools all over the world. Don't be afraid to experiment and make your stick out of whatever you think might work for you. Some people will tell you that plastic sticks are much better – they're wrong. Some people will tell you that wood is much better – they're wrong too. Some people will tell you there's no difference – these people have either poor skills or they're trying to sell you something. Every material (that's every species of wood, every type of plastic) has its own properties – density, flexibility, compaction, texture – and they're all different. If you make the same shape in soft wood, hard wood and polyurethane, you will have three different sticks that behave and control the puck in different ways. If you close your eyes and do some skills you'll find the feel of the puck very different between all three. If you leave the sticks wet for a couple of weeks to get waterlogged this difference will accentuate even more. In the end you have to try everything and see what you like.

Density

Density is defined as the amount of mass contained within a specific volume. In our terms it means that a stick made out of a denser material will weigh more, with all the pros and cons that greater mass brings. The rules state that the greatest material density of any stick is equal to that of water. I.e. it must float.

A denser material yields more mass, resulting in a better flick, more impact, better resistance to impact and often a better edge. It also tends to be slower, with less compaction and flexibility.

Flexibility

This is the tendency of a material to flex along its length under force. It is a particular issue with soft plastics. More flexible sticks tend to spill the puck in serious melees, although they make up for this by adding a little bit of spring to flicks.

Compaction

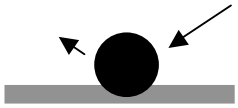
The compaction rating of a material describes its ability to accept localised impact. Materials with low compaction, such as metals and hard plastics feel very 'tinny' when the puck hits them. The puck tends to bounce off very easily. Softer woods and plastics have a higher compaction rating, and under impact the puck indents the material – absorbing the force and improving contact and control under adverse conditions. Think of it as the

difference between bouncing a tennis ball off concrete, and bouncing one off grass.

One of the greatest benefits of wood is that the process of becoming waterlogged causes the xylem cells forming the wood to swell slightly, increasing compaction. This is why experienced players claim they have a better feel on the puck from waterlogged sticks. The water also replaces various gases within the cellular structure of the wood, creating a denser material.



Low Compaction



High Compaction

Texture

Texture relates directly to the control exerted over the puck by a movement of the stick. It is the 'grip' of the stick. Glassy smooth surfaces slide along the puck, making it difficult to induce fine motion. Chopping hunks out of the edge or deep cross-hatching with a hacksaw destroys the consistency of the edge. All materials will accept and hold a texture to differing degrees. Soft woods lose texture quickly, hard plastic holds it for a very long time. Many people today enhance the texture of their edges through one of the following methods:

Rasp Grind
Hold a rasp against the edge and twist it.
Sand Paper Grind – Hold a sheet of coarse sandpaper against the edge, run something hard (such as another stick) over the sandpaper to embed the grains in the edge.

Textured Paint
Mix some fine sand or sawdust with paint and apply to the edge.

Unfinished
If you're using hardwoods and an angled bandsaw to create the edge then the simple act of cutting the stick out will leave it with a nice texture. Requires very accurate cutting technique.

Material Pros and Cons

Material	Pros	Cons
Soft plastic	Usually very nice feel on the puck. No need to paint.	Highly flexible, tends to bend at the thinnest point of the stick.
Hard Plastic	Doesn't break. No paint required.	No compaction, so the puck tends to bounce off the stick easily – hard to control.
Soft wood	Once waterlogged the feel on the puck is awesome. Very light. The wood compacts when hit and grips the puck even better.	Breaks easily. Low mass reduces flicks and smash effectiveness. Tends not to hold a good edge.
Hard wood	Doesn't break. Good feel on the puck.	Puck bounces a little. Heavy.

Keep in mind that these are the extremes of two spectrums, with a range of properties in between. Most top players still use a medium/high density wood.

Chapter 8: Cavalcade

The following are a bunch of real sticks that real people play with. I've tried to make some commentary on the positives and negatives of each and what kind of player they're suited to. I'll try not to annoy proponents of each and every design, but I doubt I'll manage it.

Typical Dutch/French:



Massive forward angle and kinked thumb lock the hand in position. Long thick playing end results in poor balance, but lots of leverage. Good for flicking. Tackling could be better but the reaper of a hook most likely makes up for that. You're not going to pull off anything flash with this, but you're not going to make a lot of mistakes either. Good for simple, uninventive, straightforward play.

The Tom stick:



One of the best proponents of skilful hockey in France, Tom's been selling his sticks for years. The latest versions are pretty good, and much more versatile than standard French sticks. Relatively even angles on the forward and back edges, although it keeps the monster hook – all that mass right at the end of the stick will unbalance it a little. Nice simple, effective handle design although it looks like part of the rear edge is shaved down. Not sure what that'd do to it, probably lift the angle of the front edge slightly. A solid choice.

The Britbat:



Backward sloping front edge. Forward sloping back edge. Massively overlong handle which pulls the balance far too far back. Massively concave front edge on the handle will run you into wrist problems. Massively convex shape on the back edge of the handle locks your hand in place so you can't escape the damage. Overly kinked hook has smaller arc radius than the puck, resulting in poor contact/control and it also makes inside edge flicking much more difficult. Hard plastic (I've never heard of one breaking) that the puck bounces off like its spring loaded – good contact on the puck it does not have. Apparently you can move it quite fast, although with poor balance and poor puck contact, this isn't really going to make a difference. In its defence, you never have to paint it. An acceptable choice for firewood.

Standard Canadian:



For some reason whenever you pick up a Canadian stick it always feels like you should be playing ice hockey with it. ;) Typically a strong forward angle, narrow and not much hook. Straightforward handles, sometimes with a bit of a thumb kink, sometimes not. Fast sticks with a nice flick and good performance with the stick vertical, although the length of the playing area unbalances them a little and can reduce puck control in this area. Not the best tackling stick in the world. Good for forwards who like to carry the puck through the middle of the pool at pace.

The Slick Flicker & Atom Ant:





Two of the most popular sticks in the world and with good reason. Even front and back edges, the elliptical hook places the point of best contact right at the tackling point, handles come in slim or thick depending on your preference. The thumb depression is a nice guide to where your thumb should be for passing, but small enough to allow the stick to be mobile in your hand. A solid performer, easy for anybody to use. This jack of all trades is a great choice for youngsters who don't really know what they want yet. The Atom Ant has a bit more mass in the playing area for backs who want more impact on the puck and slightly improved flick distance.

The Sabre:



The Atom Ant with a curved front edge. Better control with the stick vertically, but there's a bit too much mass for it to be effective at it. Other than that, the same positives as the Slick Flicker.

The Dorsal:



A recent arrival on the scene from NZ, it has rubber mixed in with the plastic and has a great feel on the puck. It's reasonably small and fast, playable off all surfaces. Flicks can be massive if you get the action right, but whether you think this is a good thing or not is up to you - the flicking action is quite long with the puck travelling quite slowly. The hook is not designed to tackle well but has a good inside edge for flicking instead. The wide, raised handle is somewhat restrictive, limiting inverted hand movement and locking the hand in place a bit.

Sven Special:



I've never played with this one in particular so can't comment on the plastic construction, but I used to run a very similar design back in the mid-90s. Good tackling and flicking, but it's not going to transfer the puck from the front to rear edges very quickly. This stick is designed for staying flat and making strong, controlled movements with the puck. It's also one of the few sticks being made these days that will spike the puck well.

The Scalpel:



I guess I'll get flack whether I comment on my own sticks or not, so I might as well throw it in. Extremely small and fast, very well balanced with the centre of gravity located precisely on the ball of the thumb. Relatively even front and back angles. Not enough mass to have a good flick. Exceptional control when vertical. Good for show-offs who never want to pass the puck to anybody and just do flashy puck skills all day instead.

Liam's Gladius:



One of the best sticks around and sought after by any back that's tried one. Extremely consistent surfaces, well balanced with a lot of weight behind it. It doesn't take too well to controlling the puck vertically, but it will tackle, pass, catch, dummy and smash all day and never let you down or take you by surprise.

The Ski:



Polyurethane design out of the States, where the stick scoops up at the end like a ski. Very much a one trick horse. The curve can enhance a flick (but it's inconsistent), and you can scoop the puck off an opponents stick nicely when vertical – albeit only in one direction. Trying to use the stick inverted is horrific. In my opinion it detracts from too wide a range of skills without significant enhancement to the narrow range it supports. Of course, if that narrow range is where all your strengths lie, it might be just the thing for you.

Old Faithful:



Sticks like this used to be a dime a dozen. Now they're not. Good. Uneven front edge must have a hideously inconsistent flick. It probably tackles well but would be nearly impossible to inside flick with. Hmm, it would spike the puck well though. Simple, basic, not very effective.

The Unnameable:



Here's an interesting puppy. Interestingly moulded handle, very nice front edge. Looks like flicks off both edges would be good and consistent. The two square angles at the end would make controlling the puck around your stick interesting, but I'm betting it would behave exceptionally well when held vertically. Nicely balanced with the holes in the playing area offsetting the length. I wouldn't ever want to have to tackle someone with it though, nor would I ever want to have to pull the puck backwards. Looks like fun. Definitely forwards only.

The Hideously Unbalanced One:



The balance on this stick is so far up the playing area that it must be like using a cricket bat. The overall angles and shape aren't that bad but I wouldn't want to have to control a club that big with a handle that small (and I like small handles). If used by a player with a powerful grip and forearms of steel it'd probably be quite effective. A classic example of a player wanting to play a faster and more skilful game, but still trying to conform to the general stick shapes around them.

The Thing:



Hmm, back sloping front angle, back set handle. This must be a nightmare to flick with, probably why there's such a massive thumb indentation to try and transfer power through the stick. The hook is quite nice, as is the rest of the handle. Actually, now that I think about it, the playing area is good, the handle is good - they just shouldn't be attached to each other.

So Near:



This stick looks like an experiment in raised handles. I really hope that's what it was. Please tell me nobody actually represents their country with this…

The Majorca Shocka:



This stick exists to make you feel better about whatever you're using.

Chapter 9: Afterword

Well, there you have it. Hopefully I just made stick design a much more complicated, but much more rewarding process for you. If you buy your sticks, you should now be armed with the necessary information to make an intelligent, reasoned decision about what styles of stick will suit your skills and ambitions. If you want to make your own, I suggest you ignore every stick at your club, focus on the basic principles you want to emphasise and design your stick from the ground up. Pay careful attention to mass, length, balance and your handle and everything will be fine.

Ok, choose the weapon that's right for you, sally forth and get down to the pool for a game. I'll see you there.

Benson - 2007