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A PLAYER'S BEST FRIEND
examining the essential role of the bow stick

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FREE POSTER **Giovanni Paolo Maggini violin, c.1630**

Sticking point

A bow is traditionally represented in the pages of instrument catalogues by the head and the frog, allowing us to appreciate the bow's style and ornamentation but disguising its mechanical function. The function comes from the shaft; and shafts are under-appreciated.

A fine stick is a delight to the eye – a sensual sculpture evoking Brancusi's Bird in Space – but a technically complex shape. The bow is so important to musicians that in France they have developed their own vocabulary, to use alongside the makers' terms; for instance, they say *pointe*, a fencing term, when the maker would say *tête*, or head.

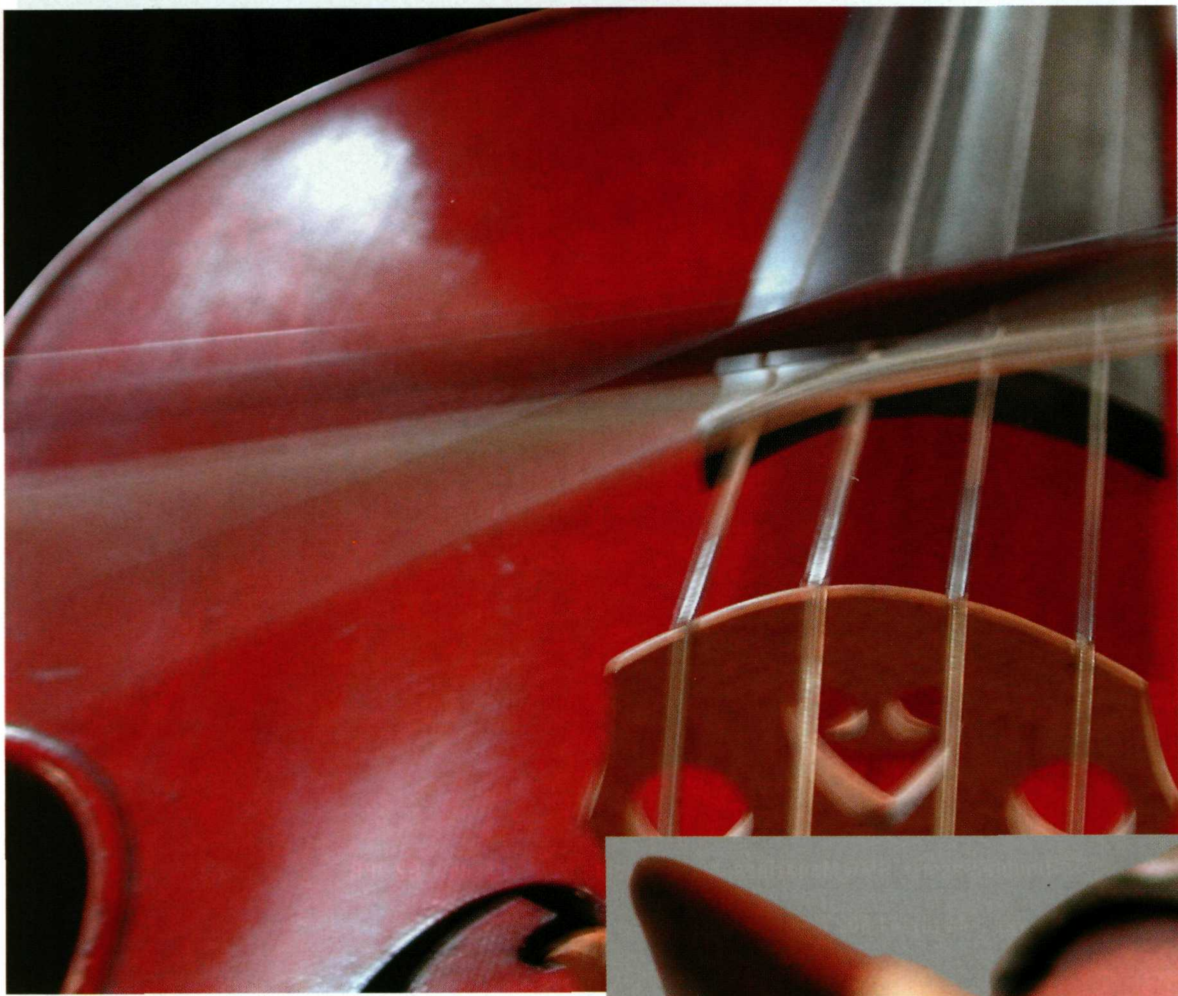
The basic properties of the stick are common to violin, viola, cello and double bass bows. When making a bow, I visualise a playing stick, and here the emphasis is on the term 'playing'. The stick is incomplete without the musician's grip, because the balance of a bow takes into account the mechanics of the bow hold: the player's body absorbs much of the vibration, while the player simultaneously analyses it to give the proper muscular response. Good players will always find a path to their musical goals, whatever bow they have in their hands; but the choice of bow could lead to struggle or freedom, open or closed doors. A bow should instantly convey the intention of the player.

A bow can be defined by six criteria: length; mass; balance; playability, whether the bow is firm or flexible, inert or responsive; potential for power and tone; and aesthetics. As a result of the bow's evolution, the length and mass have now been optimised to within a few millimetres or grams. The bow length is established from the longest useful hair ribbon available when the bowing arm is straight and outstretched. The minimum mass is determined by the lightest bow that can make the strings vibrate under its own weight, without applying any pressure: this has been shown to be between 57 and 62 grams for a violin bow. The heavier the bow, the more likely it is to tire the performer's muscles. Experiments with synthetic materials, which allow the maker to reproduce identical sets of data, show that most violin strings misbehave if a 54g bow is used. Musicians are sensitive to differences of less than two grams. Putting a bow on a scale, however, to detect the extra gram would be pointless; it is the location of this extra gram that really matters. Any mass added or removed between the heel and the tip will obviously modify the playing balance and be felt in the head area.

More important than the mass of the bow is the balance. Violin dealers often assess a bow's balance by looking for its centre of gravity, balancing the stick upside-down on a pen. However, the centre of gravity of a bow not held by a player is not really related to its playability. The balance in the working bow is dynamic and brings together two concepts: equilibrium, a result of the tapering and felt in the musician's arm as soon as the bow is grasped; and stability, which is related to the camber. The tapering of the bow and the curvature are dependent on one another, and artificial additions of mass along the bow are never satisfactory. If the bow is well tapered and well cambered, a centre of stability appears halfway between the forefinger and the head of the stick, when held in the playing position.

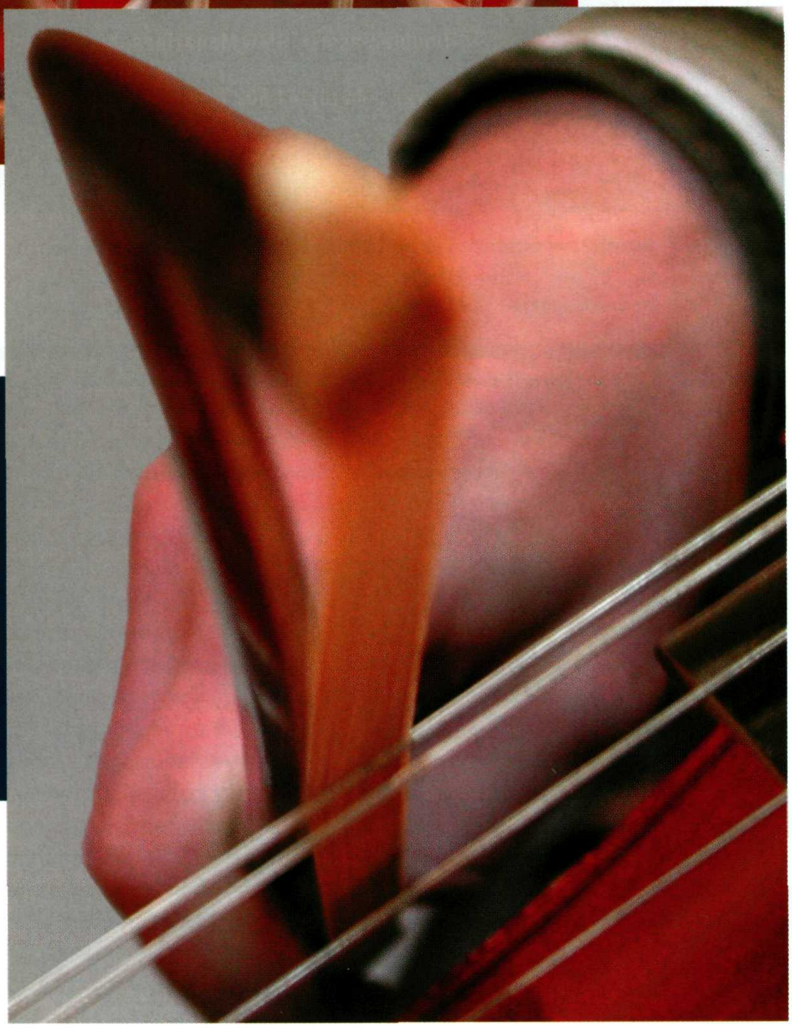
At the same place lies the sautillé point. Here the bow, held between two fingers, naturally bounces on the strings and the player feels no fatigue. The precise location of this point varies slightly from bow to bow, although some musicians who have changed bows attempt to produce this effect at exactly the same place on the new bow, even if it is uncomfortable. Sautillé represents about ten per cent of bowing in the Classical repertoire, yet performers see it as a priority. The bow must also be quick-moving, acrobatic and allow easy articulation; this is particularly true of modern performance styles as well as contemporary music.

There are no set rules for determining playability; it is simply a prerequisite of the quality and volume of ▸



OPPOSITE fine bows are evocative of Brancusi's Bird in Space

Benoît Rolland looks at the bow stick in use and finds it is inseparable from the musician's body



All photos: Benoît Rolland

the sound production. Fine French sticks have a reputation for combining an impression of suppleness with genuine power. A stiffer bow often displays a straightforward, competitive character, with a quick response to sautillé and spiccato; it generates a brighter timbre that can lighten the tone of a dark instrument. A more flexible bow draws warmer sounds from the instrument, often allowing a greater range of expression, but requires more skill from the performer. Musicians generally prefer one of these types to the other, depending on their style and technique.

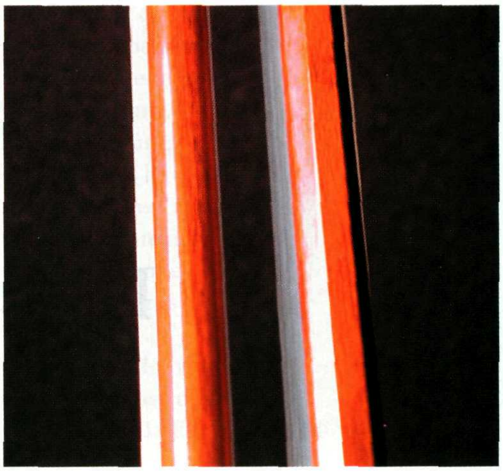
The stick itself is not an acoustical device, but its properties influence the sound volume and colour of the instrument by stimulating different parts of the spectrum. It both generates and picks up vibrations. The information circulates between the bow, the body of the player, the string and the body of the instrument in many different ways, and the clarity and conviction of the maker's concept determines the overall effect.

The bow maker works with three variables: the wood, the shape and the camber. The wooden boards from which the bow is cut are all different and making techniques exhibit much variation from maker to maker. Concentrating on a few magnificent sticks, bow makers have been searching for scientific equations and rules as eagerly as violin makers have sought the perfect varnish recipe. But their calculations provide no better guidelines for crafting a reasonably good bow than a template does. A fine bow achieves a more complex equilibrium than a set of fixed data. The bow is to the violin what breath is to the vocal cords.

Pernambuco, an extremely tough and dense wood, is ideal for bow making as it has very low damping, allowing the vibrations to decay slowly. This is particularly important because the damping increases as soon as a person grasps a bow. In theory, carbon fibre should make better bows, as the vibrations run along it more quickly. Yet it produces greater acidity and brightness in the sound because of the hardness of the material. This demonstrates that low damping is not all-important and that the sound and tone colour of the material must be taken into consideration.

The wood transmits vibrations according to the arrangement of its fibres and its cellulose and resin content, rather than as a simple function of its density. If bow makers have time to select and prepare the wood carefully, they only sculpt pieces displaying a certain, uniform arrangement of the fibres. Likewise, density does not necessarily lead to a stiff bow, it simply gives the maker more freedom. Compared with a lighter wood, a dense, hard wood allows for a thin bow at the same weight or, alternatively, a heavier bow at the conventional diameter. Denser woods can make exquisite octagonal sticks, slim but powerful, with pleasing sharp edges. Musicians often think that octagonal sticks are stronger than round ones because the edges of the facets act like ribs. They are right about the strength, but the explanation is a little more complicated. Octagonal bows are usually stronger because they have to be chiselled from non-porous wood, and because of an optical illusion they can be left fatter, and therefore stiffer, than they appear.

Bows stretch our senses to the limits. We have noted musicians' sensitivity to mass and to vibrations. As for the profile, the human eye can normally detect variations of as little as half a millimetre in diameter along the stick. In the way that performers relate to them, bows have a lot to do with fencing. One overall ▸



ABOVE the bow maker heats the wood over the flame, then bends it on the edge of the bench

BELOW octagonal bows can be left fatter than round ones because of an optical illusion aspect of the bow has remained unchanged for years – that the functional necessities are optimised within a pleasing design. This prerequisite imposes structural rules on the shaping of the stick and the bow maker's challenge lies in their interpretation. The aesthetic requirements are much more than mere ornamentation.

The quality of the vibration in a bow as well as its playability are not exclusive features of the wood; they also derive from the profile and the camber. Tapering and cambering the stick may even override the initial character of a piece of wood. After the Baroque period, the demand for a longer hair ribbon increased so the elongated bows gradually became more slender towards the head to compensate for this. The more the arm is stretched away from the strings, the more demanding is the effort to maintain a consistent sound – a constant pressure at the tip of the bow. So the stick must be lighter and more flexible at this point, to aid the player. As the wood becomes narrower, the bow maker must compromise between the lightness and the rigidity of the shaft.

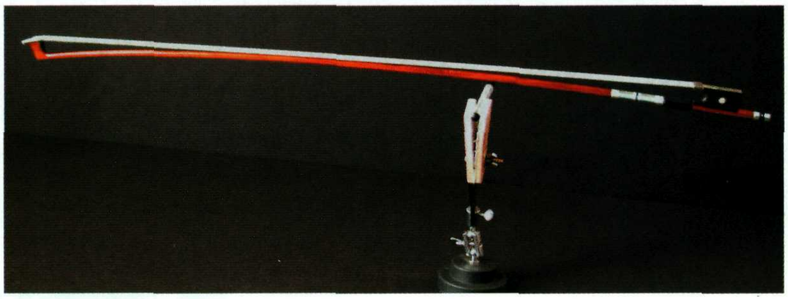
The hair exciting the string is an intrinsic part of the stick concept. The whole stick tenses the hair via the button mechanism. When stretched by a stiff stick,

There are three advantages to cambering a stick: the convex shape increases the tension of the hair; the wood of the curve remains as close as possible to the hair; and the stick turns from a pole into a spring. The theory of camber is simple, to imprint a memory of the shape in the wood, but its realisation always proves to be difficult. Over the years makers developed different approaches, cutting the stick out of the wooden board either straight along the grain or in a curve. It is essential to maintain the relationship between the tapering and

THE CAMBER OF THE BOW INCREASES THE TENSION OF THE HAIR AND TRANSFORMS THE STICK FROM A POLE INTO A SPRING

the hair touches the string in a straight, tangential line that quickly springs back off the string: a desirable characteristic of fast and sharp bowing. Yet in this situation the hair rapidly abandons the string and has less chance to produce harmonics, whereas the hair of a flexible bow 'wraps' the string and pulls on it, further developing the harmonics. Fine bows, both flexible and responsive, combine the two qualities. At the moment there is no substitute for horsehair, despite numerous experiments with replacements. Its properties combine perfectly to produce the bow–string interaction: it returns to its original length after being stretched, but its breaking point prevents excessive elongation; the porous fibres retain rosin; and the bearded surface multiplies the contact points.

We have talked about the balance of the bow and the centre of gravity when looking at the bow from the side. But it also important to consider this when looking along the bow from the frog, as bow makers often do, checking the profile of the stick and its distance from the hair. The further the centre of gravity is from the hair, the less stable the bow. Yet at one time bows were just sticks and hair without curvature. The Baroque bow was unstable because the hair was stretched too far from the stick: the tension device tightens the hair but also pulls it away from the stick.



the camber, and also the uniformity of the curve. This is complicated by the irregular structure of the wood fibres and by our traditional method of bending the stick. The bow maker heats the wood over embers or a flame, then pushes it one section at a time, on the edge of the bench, without creating any angles.

Through the centuries, historical bows have been frequently subjected to re-bending to correct weaknesses or discomforts. Some of these old bows are now like palimpsests, medieval manuscripts with one story on top of another, retaining only subtle hints of their original line.

Ultimately, a great stick is the essential link between a musician's emotion and the stringed instrument, one that keeps evolving with the latest playing styles and music. ■

TOP it is vital to imprint a memory of the bow's shape in the wood

ABOVE measuring the balance point of a bow in this way ignores the effect of the player's arm and body