What do you want to know?

When it comes to boat handling, we have probably all had an experience that tells us that, in a close quarters motoring operation, once things are going wrong it's often too late to do anything other than put out the fenders and hope for the best. So, in the absence of a crystal ball, what we want to get out of all of this is a mind's eye that can glimpse into the near future. Fortunately there are five key factors which directly affect the way a boat handles. Understand these and we'll have a better idea of how our boat is likely to behave in a manoeuvre long before we commence it. Take these into consideration and we may end up thinking of a completely different way to approach a manoeuvre that will save our pride and our topsides. We need to know which of these five key effects will be likely to most affect our contemplated manoeuvre.

Hamble School of Yachting's James Pearson takes us through the five key principles of handling under power that once fully understood will help us get closer to the holy grail of the right plan of action for any boat in any situation.

PHOTOS: Stewart Wheeler

THE BIG 5 of boat handling

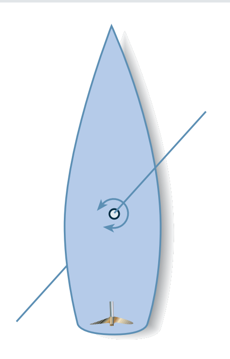
Boat handling instruction has sometimes been guilty of presenting answers to specific scenarios. 'We show you how to reverse your long keeler into a pontoon with 20kn of breeze blowing it off', or 'learn how to ferry glide into a pile mooring only a foot longer than your boat'. While this does work quite well for those few who need to do that specific task in those specific circumstances, the numerous variables of boat types, mooring types, wind and tide, mean that in order to be a competent handler of your boat, just in the scenarios you are likely to encounter coming in and out of your own berth, you will soon be trying to achieve the impossible task of remembering sequences of steering and throttle for literally hundreds of different situations. And then what happens if you want to visit a strange port? Or change boat? What all sailors need instead is a good grasp of the background mechanisms at work; the handful of key influences on a boat's handling under power. Many people have found that this approach provides them once and for all with a basic set of tools that they can eventually apply to any boat handling situation, in any boat.

The good news is that there are only five of these key principles:

The big 5 to have at your fingertips

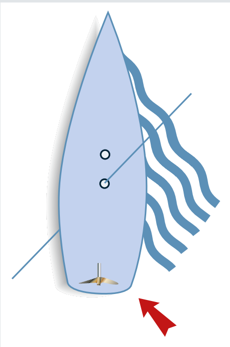
ST Tips

1. Pivot Point



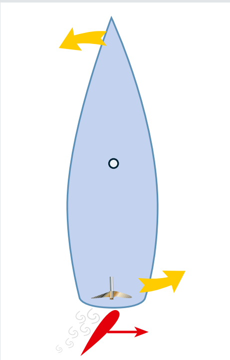
Our yacht when viewed from above turns around a point just aft of the mast.

2. Windage



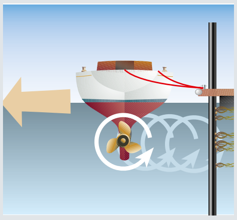
Most boats' centre of windage is somewhat forward of the pivot point.

3. Steerage



A good think about our arrangement of prop and rudder can explain a lot.

4. Prop Walk

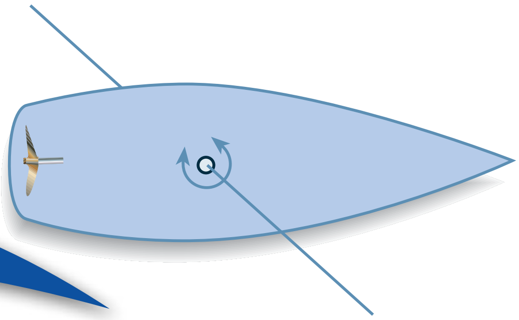


When propeller turns to paddle wheel and moves our stern laterally.

5. Slide

A yacht will slide out of a turn more like a shopping trolley than a car.

The bad news is that in most boat handling situations several of these factors are at work and, in some situations, all five of them are interplaying with each other. In this article we're going back to basics to define the terms and provide a few simple demonstrations of each effect acting as the prime mover, although we'll learn it's seldom possible to fully isolate an effect. »



1. Pivot Point

Our boat, if we were to push the bow or stern round while stationary in windless, tideless water when viewed from above, turns around a pivot point somewhere slightly aft of (abaft) her mast. The pivot point moves forward to around the leading edge of the keel (on a fin keeler) when we are moving forwards through the water and back to the aft edge when we are going backwards, but the basic truth that a boat always turns around a point roughly in her middle is enough information for most of us to begin with. It's the reason why, in no wind or tide, if we attempt to drive our boat ahead, along and out from a pontoon we are moored alongside by putting her into forward gear and steering our bows smartly out, we can expect our stern quarter to swing into and possibly clout the pontoon. Knowing that the pivot point moves towards the stern when we motor astern equally warns us to keep a particularly wary eye on what the bow is doing when we turn while motoring astern near to obstructions.

In the photo sequence on this page, in a tight turn using ahead and astern gears we can see how the boat turns around the axis roughly marked by the crewman standing on the coachroof, just abaft the mast. This is where we guessed the pivot point to be in this yacht, and we weren't far out.

Some boats will turn round this axis more easily than others. If we look at the underwater shapes of the two boats in the pictures below we can guess at how the lack of deep hull fore and aft of the pivot point to move sideways through the water while spinning the racing boat (right hand picture) means that she will spin on a sixpence compared with the long keeler on the left. Neither is better, as sometimes we want our boat to spin quickly and sometimes we want her to stay put, but it pays to know what you have under the water in your own boat.

2. Windage

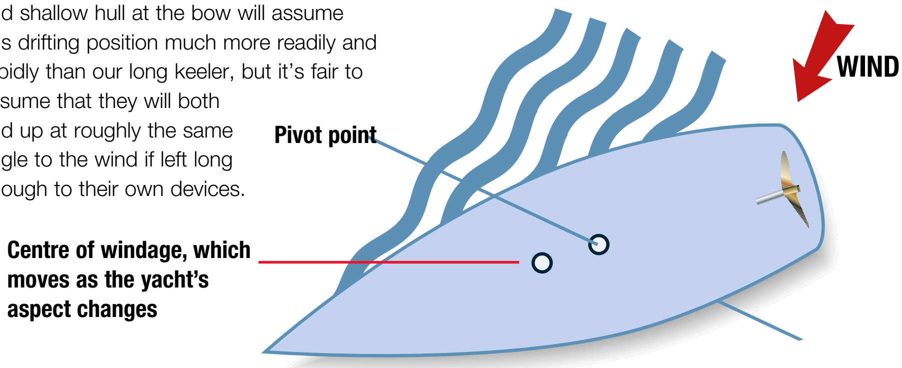
The amount of windage on your boat and where on the boat it has the biggest effect will determine how fast she will drift down wind, how much control you have over the bow and also how she will eventually lie when stalled in the water. How fast she drifts is determined by how much windage area there is above the waterline and its location, as well as what shape she has below the waterline. Typically, on a modern sloop with roller reefing headsail and a very shallow forefoot (depth of hull in the water between bow and keel), the bow will have a tendency to fall off the wind relatively quickly as steerage way is reduced.

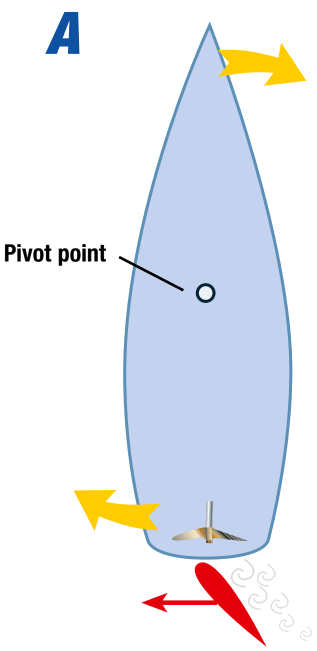
With this in mind, it's a useful exercise in any boat that we want to be able to predict the handling of, to stop the boat head to wind in open water with no sails on, engine running but in neutral and just drift for a few minutes until the boat stops turning and finds a consistent drifting angle to the wind. What we expect to happen, and what will happen assuming we have not erected the mother of all boom tents, is that the boat will assume a position with either quarter facing the wind and head off in a sideways drift at an angle downwind.

We tried it at slack water in 10kn of breeze in Hamble School of Yachting's Feeling 36. As can be seen in the photos, within about half a minute, even in these light winds, she had settled into a classic and expected stern quarter on to the wind, sideways drift.

Whether we remember this tendency of an un-powered or underpowered boat to find this position as 'the stern will always seek the wind' or the 'bow will always be blown off by the wind' is unimportant, as long as we don't forget that anything we do with our engine and rudder has to allow for our boat's inbuilt desire to assume this position.

Remembering our underwater shapes seen in the boatyard, it's worth a punt that the racer with her easily pivotable keel shape and shallow hull at the bow will assume this drifting position much more readily and rapidly than our long keeler, but it's fair to assume that they will both end up at roughly the same angle to the wind if left long enough to their own devices.





3. Steerage

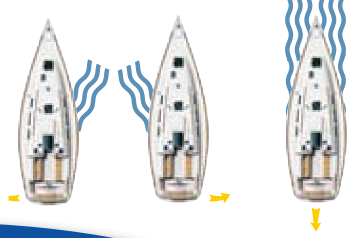
Encompassing rudders and propwash, HSY covers this effect straight after windage and the pivot point for a simple reason – there's not a lot we can do to change our windage or our pivot point beyond understanding and accepting them, but now we move into the effects that we, the skipper, can have more control over.

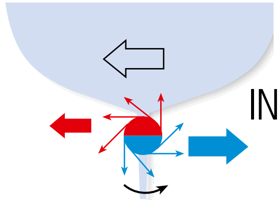
Steerage depends on a water flow over the rudder from the following sources: Movement of the boat forward and back through the water, tide moving over the rudder, prop wash from the propeller. The faster we get water flow over the rudder, the more effect that angling it to the water flow will have. If we are moving slowly ahead with our bows into a stiff breeze and we gradually pull back the throttle to go slower and slower, eventually the bows will be blown off the wind and nothing we can do with the rudder alone will be able to counter it, because the boat naturally turns round her pivot point seeking her stern-quarter-on rest position we covered earlier. This undesirable state of affairs is called loss of steerage and, so that everybody has time to think, prepare lines etc, the speed at which we want to do all our manoeuvres in confined spaces is the slowest speed we can possibly go without losing steerage. This is sometimes called the 'Minimum Operating Speed', or simply steerage way, and is a concept we will frequently be returning to.

If we wish to spin the boat in a very tight turn round her keel, we also usually have at our disposal an engine and propeller capable of thrusting a short blast of water over our turned rudder to give the boat additional steerage without having to accelerate the whole boat up to a higher speed. This is called prop wash and is achieved with a short burst (not usually more than 2 seconds) of the engine in ahead gear. Any more than that and we will start to move the boat ahead through the water, which we do not want if we wish our turn to be a tight one.

You can see in diagram A above and the photo below that the prop wash in this instance is being directed to starboard by the rudder angled to starboard, so moving the stern to port and, as we recall from our pivot point, the bow to starboard.

As we have already seen, not all boats are the same under water. Consider the distance that the propeller is from the rudder in the two boats in photos B and C above. We would expect any prop wash effects on the racer (B) to happen with a significant time delay from applying the engine power and to a diminished in degree due to the distance the rudder is from the source of the thrusted water. Then consider our long keeler again in pic D. We can see that although the prop is conveniently close to the rudder, to an extent it's too close as the area of rudder that this propeller has to thrust on is much less (roughly indicated by my hands) than that of the rudder in pic C. This suggests (along with the long keel reducing pivotability) that this is a boat that won't benefit as much as some from prop wash. You get no prop wash at all with twin rudder boats being devoid of prop wash to the point that some owners have been known to fit a small central third rudder. In a future issue of *ST* we'll be following a case study of an owner of a new twin rudder boat and seeing how he adapts to his new life without prop wash.





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4. Prop walk

1. We pop her into astern with no counter steer...

2. ...off goes our stern to starboard thanks to prop walk...

3. ...and we risk a tangle with the boats to starboard.

Not to be confused with prop wash, this is the propensity for a boat, if her engine is put into astern when stationary or nearly stationary, to push her stern, often quite smartly and sometimes for novices alarmingly, one way or the other. Like all these things it should be considered as yet another weapon to have at our disposal rather than a vice we need to try to eliminate. It's caused by the rotational or paddle wheel effect that a turning propeller has on stationary water, and it pushes the boat away from the direction in which the bottom of the propeller is turning when the engine is in reverse. In ahead gear we have the powerful weapon of prop wash and our rudder with which to immediately counter any prop walk as it tries to happen, so we only really need to think about prop walk when going into astern, especially while we still have some forward momentum on the boat.

So what have we got in our boat? The easiest and most commonly taught way to find out is to put our boat in gear astern while still firmly tied up to a pontoon. We will then get a pretty good idea of whether we will have much prop walk to deal with and in which direction. We tried this in HSY's Feeling 36 and saw a quite significant turbulence coming out on the port side of the hull, level with the forward end of the cockpit, while the water on the other side was still flat, and we saw the stern line strain as the prop walk clearly kicked the stern to starboard. On some boats, the telltale wash of turbulent water will exit the hull somewhere up by the bow; this will produce a fairly tame prop walk. On other boats it can be seen exiting under the quarter; this increased leverage will produce more pronounced prop walk. In the event that we have to turn our boat in a tight spot, all other variables like tide and wind being nonexistent (which they rarely are), then in this Feeling we'd best turn bow to port to use our prop walk to help us get round in a tighter fashion.

Similarly, the position of the prop in relation to the keel (our pivot point) will also affect leverage exerted by prop walk. This means a boat with a saildrive mounted forward near her keel (as in photo B – opposite page) will be able to exert less leverage and so usually show less prop walk than the boat in photo C with a shaft drive and propeller out aft further towards her rudder. But, as we learnt in the prop wash section, the shaft drive boat will have more prop wash available with her rudder close to her prop, so she has more leverage at her disposal in ahead gear to counter the increased prop walk she gets in astern, so it's swings and roundabouts. But, once again, it pays dividends to know what shapes lurk beneath our waterline.

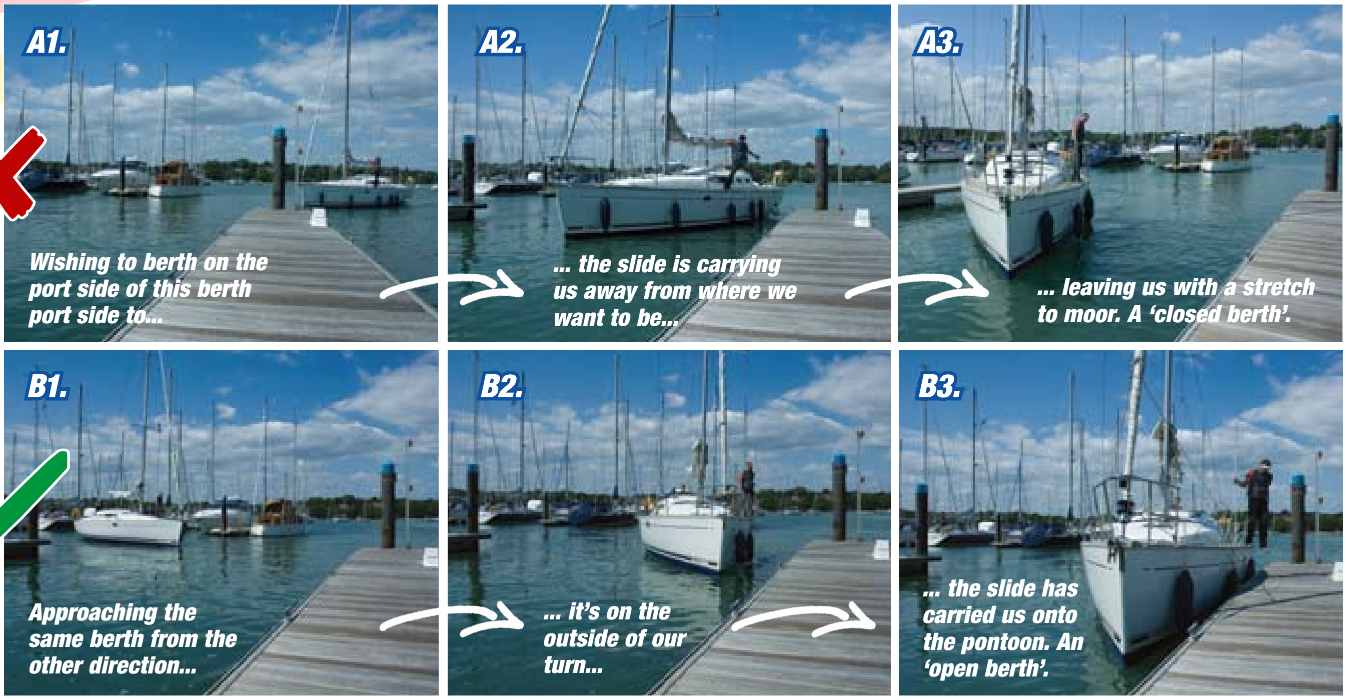
For an illustration of prop walk in action, in the photo sequence above, let's imagine we're heading up a narrow trot towards a marina berth we think is free at the inshore end by the wall. We suddenly realise our planned berth is occupied and we need to head back out again sharpish. Sensibly, not wanting to risk a seven point turn in such a tight spot, we decide to go out astern to the main channel to contemplate our next move.

In the top sequence we gently put the boat into neutral, then astern, but the prop walk shoves our stern to starboard and, aided by a slight wind on our starboard side too, we end up heading backwards onto the boats on our starboard side, despite our desperate efforts with the rudder to counter this in astern. To compound this we also have our pivot point (abaft the keel in astern) becoming a factor to lead our bows to swing even further into these starboard side moored boats when we get some rudder on in astern to try to get ourselves back over to the middle of the trots. We get away with it this time, because the wind is quite light and the channel quite wide, but it wasn't good helming. In the lower sequence we try it again with the simple addition of a flick of the bow about 30º to starboard just as the boat is put into neutral. We have allowed for the predicted prop walk we will get in this boat as we first go astern, so this time the boat has not lost any space to leeward before she gets decent steerage astern and we reverse safely back down the centre of the channel the way we came in.

1. We realise we need to reverse back out...

2. ...so we first give her 30° or so of counter steer...

3. ...to reverse straight back out the way we came in.



5. Slide

Our boat will react to helming inputs very differently from a car at slow speeds on a grippy surface. Her reactions are much more like a car on ice, or a shopping trolley. She has momentum from her considerable weight and the more weight (the bigger the boat) the more her momentum will be. In its simplest guise we can see this momentum by knocking our boat from motoring ahead in windless, tideless water into neutral and seeing how far she goes past a soft stationary object like a mooring buoy before she stops. Practicing this in various boats, we'll see it varies considerably. But this momentum (or 'way') isn't just a factor in a straight line. When turning, the stern with its heavy engine and rudder will tend to swing out of the turn, as we know from the pivot point, and when we add centrifugal force to this, which will want to make our boat continue the way she was originally going, regardless of the way she is heading, it's a considerable force that we can use or misuse.

This effect often comes to the fore when deciding which berth to go for when we have the luxury of a choice, and also when it comes to deciding on a direction of approach. Consider the berthing scenarios in sequences A and B above. Berth A is a berth located on the inside of a turn, what we call a closed berth, as the natural inclination for the boat to slide makes turning into it from the direction we have approached it an impossible stretch for our crewman, as the boat is carried out with her momentum away from the pontoon. Now consider the same berth but tackled from the opposite direction. It is now an open berth as momentum carries our boat into it and pushes her gently to rest on her fenders while our crewman steps ashore in a leisurely, unhurried manner.

And all this means?

In isolation, these effects don't mean much and none of them will get you very far unless you consider it in the light of all the others. But, as we'll see in future months when we start to apply these principles to more real life scenarios and regularly return to them, these five factors are all you really need to know to work out an effective plan of action for any berthing, unberthing or close quarters manoeuvring scenario.

About the Author

James Pearson is an RYA Yachtmaster Instructor and Chief Instructor at Hamble School of Yachting. He has been a keen sailor since the age of seven, sailing on a variety of craft ranging from racing dinghies to tall ships. He became a professional instructor at 18 and has sailed tens of thousands of miles since and taught hundreds of people at various levels through the RYA schemes.

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Hamble School of Yachting's friendly and experienced instructors have offered high standards of tuition for over 30 years. The school offers the full RYA training programme both ashore and afloat for all levels of experience as well as own boat tuition from one day covering sailors' own particular needs right through to a full RYA course. As demand has increased, the school has introduced many bespoke courses, such as yacht maintenance training, ISAF Offshore Safety Training and professional STCW qualifications. More recently, the School became the official training partner for the World Cruising Club, the organisers of the Annual Atlantic Rally for Cruisers (ARC).

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