David Dellenbaugh's
# SPEED&Smarts™
*The newsletter of how-to tips for racing sailors* July/Aug 2012

JH Peterson photo

## Find the best pressure!

The wind velocity is never constant around the race course. On many days it's easy to see puffs and lulls moving across the water surface, but even when it seems like the breeze is fairly steady there is always at least a subtle variation in pressure. This might be just an extra knot of wind on either side of the course, but more often than not this increased pressure will play a role in sorting out the race results.

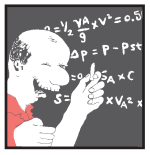
Sailing in more wind is almost always faster than sailing in less wind, so one of your primary strategic goals should be to find the areas of better pressure. This is easy on a puffy day when the presence (or absence) of wind is very distinct, but harder when pressure changes are slight.

Recognizing puffs and lulls is a first step to success on puffy days. Once you find the best pressure, you still have to get your boat there. And you have to figure out how to connect from one area of good pressure to another, and how to keep doing this all around the course.

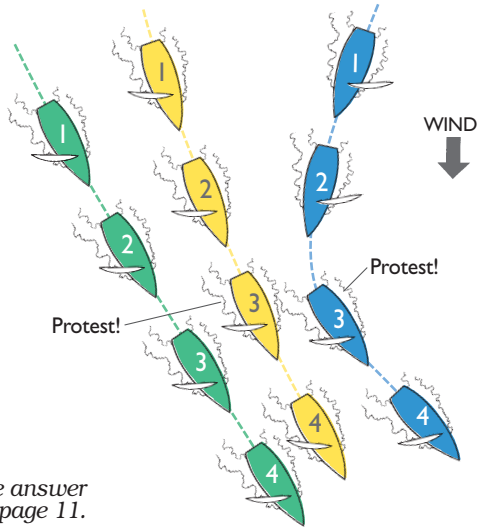
One thing for certain is that every race you sail will be filled with changes in wind velocity. As you search for the best breeze, you will constantly get small puffs, lulls, big puffs and (hopefully just once in a while) big lulls. To keep sailing fast through these transitions, you have to set up your boat and sails for the wind pressure you have at any moment. When that pressure changes, you need to shift gears, both upwind and downwind. All of these topics are covered throughout this issue!

**BRAIN TEASER**

## 'Sandwich' on the run



Three boats with asymmetrical chutes are running downwind toward the leeward mark. Two of them (Green and Yellow) are overlapped on port tack and converging with the third boat (Blue) on starboard. Yellow knows she must keep clear of Blue, but she cannot bear off behind Green so she hails Green for room to jibe. Green replies that there is no such rule. Blue has to jibe to avoid contact, and she protests Yellow. Yellow protests Green. As a jury member, how would you decide this?




*See answer on page 11.*

**ISSUE #122**

**Puffs and Lulls**

## IN THEORY

# Understanding puffs and lulls

When you're trying to find (and guide your boat into) the best pressure on a beat or run, it helps to know as much as possible about the nature of puffs and lulls. Here are some things to think about.

**What causes puffs and lulls?**
Every sailor knows that the wind doesn't blow at a constant velocity all the time. Why not?

***Obstructions*** – Obviously, there is less wind behind a building than in the street next to that building. Lulls exist in the lee of objects that block the wind, while puffs blow through the openings between those objects. Nowhere is this more clear than when you are racing close to a windward shore that is filled with trees or buildings (*see photo*). This effect is also created by the sails of a fleet – wind shadows are lulls and areas of clear air (which may even accelerate between boats) are puffs.

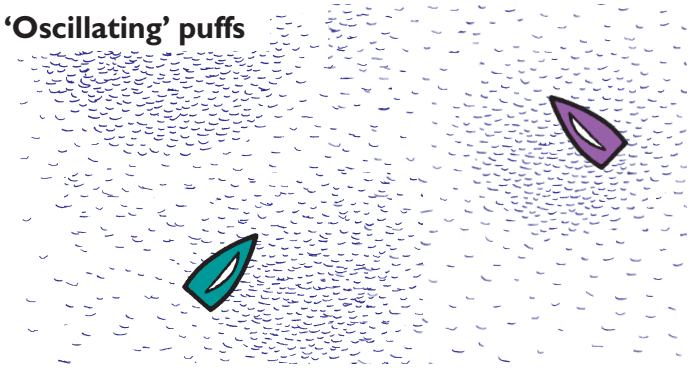
***Vertical mixing*** – According to Doug Charko, US Sailing Team meteorologist, puffs are also commonly created when, "The sun heats the ground and creates pockets of rising air called thermals. As the thermals rise, adjacent air comes down to replace them. This descending air mixes down wind from aloft which is usually stronger than the surface wind, and this creates a puff. The speed of the descending air itself adds to the puff so you can actually have puffs that are greater than the wind speed aloft."

***Clouds and weather*** – Wind pressure is also affected by local and regional weather effects. There is often more pressure near the leading edge of a large cloud, for example, and the approach of a storm or front can easily bring more (or less) wind to part of your course.

**Movement and shape of puffs**
Puffs come in several different flavors, and it's helpful to know these in order to play them effectively. ☛

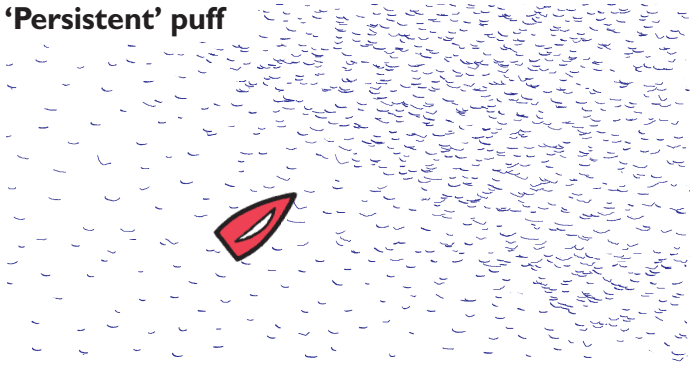

**The most common cause of variation in wind pressure across a race course is the presence of obstructions on a nearby weather shore. These could be anything that blocks the wind such as trees, buildings or mountains. Look for consistently better pressure near low spots on the windward shore (e.g. the gap in the buildings above). Also, expect to find less variation in pressure the farther you get from the obstructions to windward.** Photo by Ken Legler

### 'Oscillating' puffs



We don't usually think of puffs and lulls as oscillating or persistent, but changes in wind velocity are similar to changes in wind direction. The typical puffy day, for example, has a lot of relatively small puffs spread across the course. Sometimes the velocity is better on the left, but other times it is stronger on the right or in the middle. Boats can make gains (or losses) on either side depending on how they play the pressure. These puffs and lulls behave much like an oscillating breeze.

### 'Persistent' puff



Sometimes puffs or lulls are much bigger and exist only in a particular part of the racing area. This often happens when a new breeze fills in from upwind or on one side of the course. This extra pressure might be temporary (e.g. it may be slowly filling over the entire course), or it could be longer term if, for example, it is the result of a geographic effect (e.g. more wind on the left because of fewer trees there). In either case, this type of puff can be handled like a persistent shift in direction.

Most puffs move in the direction the wind is blowing, but this is not always the case. A 'linear' or 'directional' puff moves generally in one direction, usually downwind. But a 'fanning' puff comes down to the water from above, fanning out in a circular pattern.

The speed of puffs is often, but not always, related to the wind velocity in that puff. Some puffs move a lot slower than you think. When you're racing in this kind of breeze, make sure you sail far enough into the puff before tacking. A few puffs don't move much at all – these include 'geographic puffs' which form (and stay) near certain features like a low spot on a windward shore.

**How to see pressure changes**

The first step in any puff strategy must be to identify pressure coming down the course as far in advance as possible.

***Look upwind*** – This may seem obvious, but what percentage of every race do you sail with no one looking for the wind that is coming to you? Watch for darker patches among the wind ripples, and try to factor out deceptive influences like sunlight and current.

***Sail the course*** – For finding subtle differences in pressure, there is nothing better than sailing in and around your course area before the race. Sail with another boat (and carefully watch for slight performance differences between the two) to learn even more.

***Watch other boats*** – One great thing about fleet racing is that other boats are like a bunch of wind vanes spread across the course, and you can use them to recognize subtle differences in pressure. Often you will notice crews hiking slightly more (or less) than others. Or you will see boats sailing at different angles on the same tack; this might indicate a shift in wind direction, but it is caused by pressure differences more often than most sailors think.

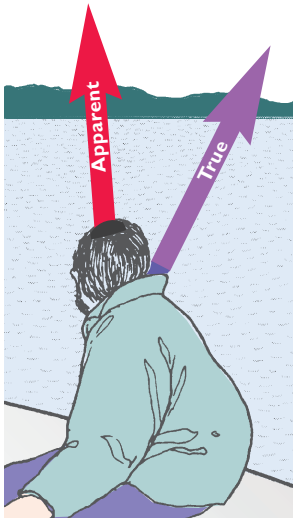
***Stand up!*** – When you are looking for wind, the higher you are the better. Gaining height allows you to see farther and gives you a more accurate picture of the water surface to windward. An easy way to get a better view of the wind is simply to stand up on a high part of your deck or cabintop. This is easy to do before or even during a race, and the extra few feet of height will give you a much improved view of the wind. •

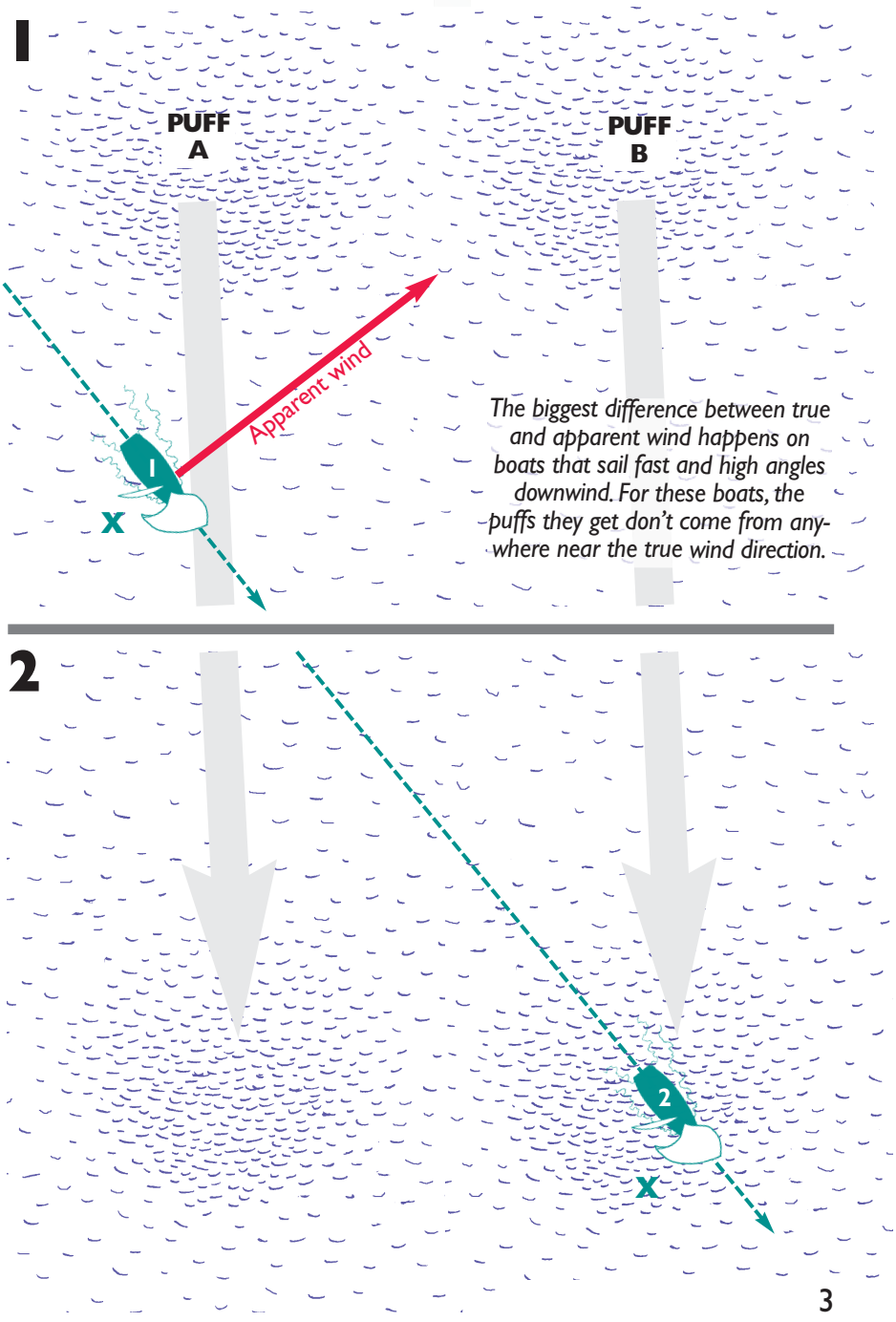
## Puffs come from your *apparent* wind direction.

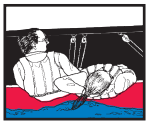
If you want to know where your next puff (or lull) will come from, look in the direction of your apparent wind (right). This is the direction of the wind you feel on your body and the place where your masthead fly and shroud telltales point.

Many sailors trying to find the next puff look straight upwind (toward the true wind), but this is too far aft. The puffs that are directly to windward will hit you only if you stay in one place. When you are moving forward, the puffs that are directly to windward will pass behind you. By looking in the direction of your apparent wind, you compensate for the forward motion of your boat.

**Below:** This diagram shows how it works. At position 1, Boat X is directly to leeward of Puff A, but her apparent wind is coming from the direction of Puff B. By the time X gets to position 2, she meets Puff B and Puff A is well behind her.





GOOD ADVICE

# Tips for racing in variable pressure

When your racing area is full of puffs and lulls you can't just put your brain on automatic and hope for the best. Even small changes in wind velocity will have an impact on almost every part of your race, so you need an extra degree of cleverness to be successful. That's why I love these conditions.

Here are some things to keep in mind when sailing in puffy conditions, and other things that will change depending on whether you are in a puff or lull:

## Tactics

The puffier the conditions, the less you should focus on tactics (boat-on-boat maneuvers) and the more you need to think about strategy (doing the right thing for the wind). You can't really cover other boats when there are big puffs and lulls, so you have to sail your own race in the wind you have at each moment, and be patient when your competitors temporarily have more breeze. In the big picture, it probably won't work to make a tactical move against nearby boats if this means you have to do the wrong thing strategically.

– *Wind shadows*: The bad air from other boats extends quite a bit farther in lulls than it does in puffs. Wind shadows are also more crippling in light air, so make sure your breeze is clear, especially when you have to sail through light spots.

– *Sailing on a 'windward hip':* When racing upwind, you can often sail fairly close to windward of another boat and 'survive' for quite a while. But you cannot hang in nearly so close when you're in a lull.

## Strategy

Strategy is all-important when the velocity is up and down. Try to stay in the best pressure for as much time as possible. When it is light overall, avoid the middle because there is often better pressure on either side, especially in a big fleet. But don't get to the lay-lines too early – with variable pressure these change constantly (*see right*) and it's easy to overstand.

– *Puffs or shifts*: One of the biggest strategic questions is whether you should sail toward better pressure or stay on the lifted tack. Of course, it's ideal if you can do both at the same time, but often you have to make a choice (*see pages 12-13 for much more on this).*

## Boathandling

A good rule of thumb is that you should never make a maneuver in a lull unless you have a very good reason. Whenever possible, perform your tacks and jibes in puffs. If you make turns without much wind you'll lose a lot in each maneuver.

– *Turning the boat:* You should always use crew weight and sail trim to help turn your boat (to minimize rudder drag), but this is especially important whenever you have to turn in a lull.

– *Tacking technique:* Adjust your roll-tacking technique for the wind velocity that you will have as you exit the tack. If you are tacking in a lull, give the boat a hard roll and come out of the tack powered up (as you would in a normal light-air tack). But if you will be in a puff, switch to medium- or heavy-air tacking style.

## Boatspeed

When the wind velocity is changing all the time, you must 'shift gears' constantly to keep your boat going fast. Obviously the set-up that is fast in a lull will not work so well in a puff (*see pages 6-7 and 10-11*).

– *Kinetics:* Sometimes you have enough wind to plane or surf in the puffs, but not in the lulls. This affects when you can (and cannot) pump your sails.


JH Peterson photo

**When the wind is light and spotty, look for small increases in pressure and try to stay in these veins. But be careful about tacking too much. If you're in a heavy keelboat like these Tartan Tens, a light-air tack will probably cost you two boatlengths. Therefore, try to tack only when you are in a puff (don't maneuver in lulls), and minimize the number of tacks you make. Before tacking, consider whether the potential gain will offset the distance you know you will lose.**

## Watch the waves, too.

When the wind velocity is up and down, this will have an impact on waves around the course and may affect how you set up your boat for speed.

Imagine that you are racing upwind in a puffy northerly, and the range of wind velocity is 6 knots in the lulls and 12 knots in the puffs. This makes the average wind velocity around 9 knots and means the waves will be about as big as you would expect for a steady 9-knot breeze.

Normal waves for a **9-knot** breeze

Since puffs and lulls come and go fairly quickly, they don't affect the water surface very much. In a 6-knot lull, therefore, you still have waves that are typical for a 9-knot breeze. And the same is true in a 12-knot puff.

When the wind is blowing 6 knots, you normally expect the water to be smoother than when it is blowing 9 knots.

Normal waves for **6-knot** breeze

However, when you're in a lull on a puffy day you will experience waves that are bigger than normal for that wind velocity. This means you have to power up your boat more to get through the chop.

Conversely, in a 12 knot breeze you expect the waves to be bigger than in a 9-knot breeze.

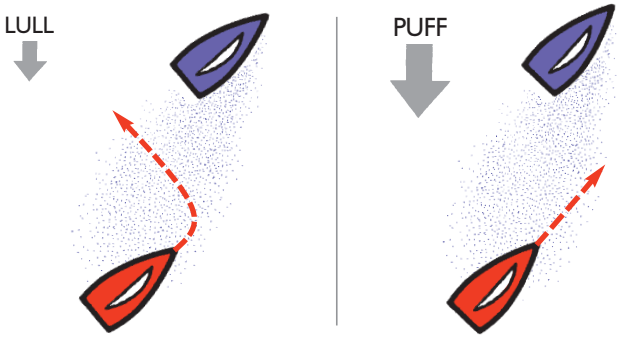
Normal waves for **12-knot** breeze

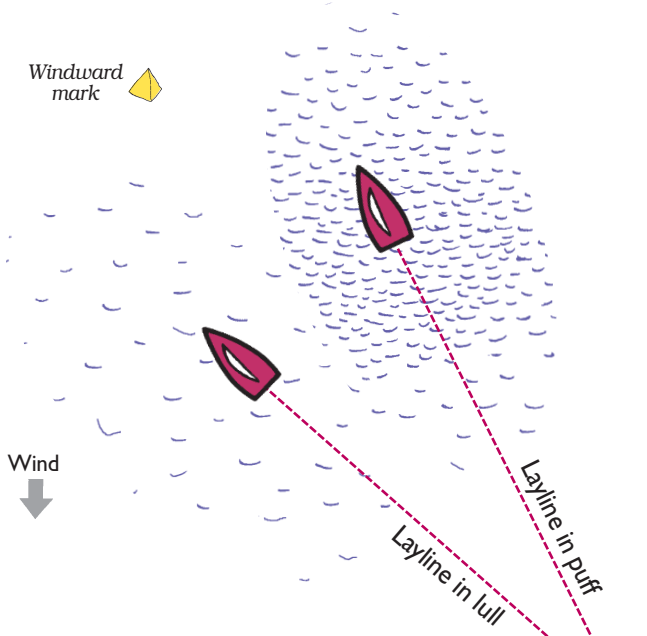
However, in a temporary 12-knot puff the waves will never build up that big. Therefore, in puffs you will always have flatter water than you expect, and this means you can trim your sails harder and point the boat higher.

Also, if puffs and lulls are coming off a windward shore, remember waves get progressively bigger as you go farther offshore, and this affects your speed set-up.

## How bad is bad air?

Wind shadows do not have the same effect in puffs and lulls. In light air you need every bit of pressure possible, so sailing in bad air is very slow. If a competitor tacks on you in a lull, you should almost always tack away for clear air (*below left*). In strong breeze, however, a little more or less pressure won't make as much difference. Therefore, in a puff it may be an option to continue sailing in bad air (*below right*).



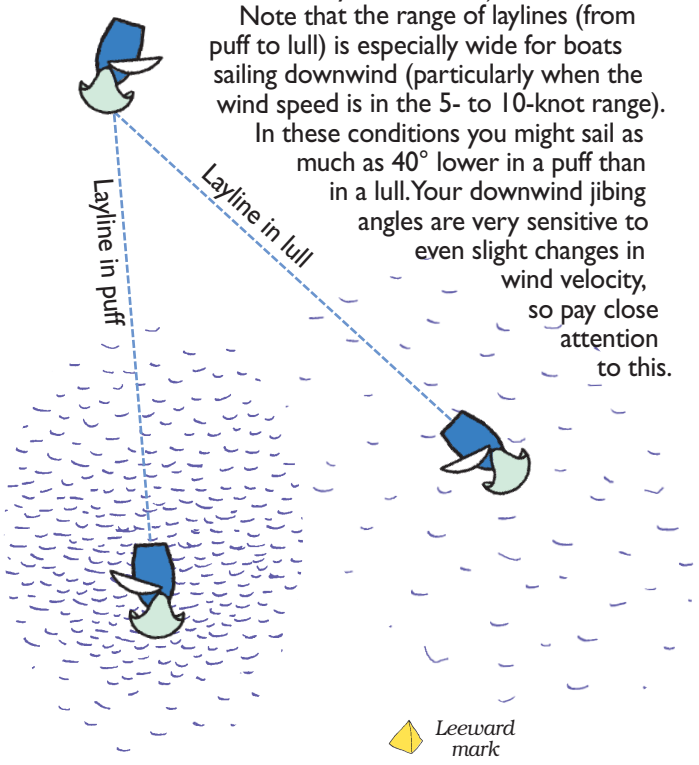




## Beware changing laylines!

When the wind velocity is constant, it's relatively easy to make layline calls because your tacking and jibing angles are always the same. But when you race in puffs and lulls, the laylines are always changing. If you call a layline in a puff, you may not fetch the mark if you sail into a lull. And if you call the layline in a lull, you will be overstanding if you get a puff before the mark.

In these conditions, the best strategy is usually to avoid getting to the layline too soon (just as you would do when the wind direction is oscillating). Instead, play the middle of the beat or run until you are pretty close to the mark. If you do have to make a layline call from farther away, take a good look at all the wind you expect to get before you reach the mark, and tack or jibe in the appropriate spot. In other words, don't base your layline call only on the puff or lull you have at the moment you tack or jibe (unless you expect that pressure to hold all the way to the mark).

Note that the range of laylines (from puff to lull) is especially wide for boats sailing downwind (particularly when the wind speed is in the 5- to 10-knot range). In these conditions you might sail as much as 40° lower in a puff than in a lull. Your downwind jibing angles are very sensitive to even slight changes in wind velocity, so pay close attention to this.



**BOATSPEED**

# Change gears upwind

The concept of 'changing gears' in a sailboat usually means making adjustments in the trim of your boat or sails to match changes in the wind or water conditions. For example, when you sail into a lull, you typically ease your mainsheet and bear off slightly. When the wind increases, you trim in and head up.

We usually think of changing gears as something that happens quickly and easily, and is fairly temporary. When you get a lull, for example, you don't put a softer batten in the top pocket of your mainsail or change your mast rake. You might do these things at the beginning of a day when you expect light air, but they are not normally considered when changing gears.

In sailing it's relatively easy to set your boat up so it will go fast in one particular condition. The problem is that conditions almost never stay constant. You may get your boat going fast in the lighter spots, but then you get a puff and you have to change your trim.

It is difficult to be in the perfect gear for an entire race. However, the best sailors might be in the right gear for most of every race. This means they have their boats sailing at optimum speed almost all the time. In contrast, the sailors at the other end of the fleet might be in the right gear only half the time.

In puffy conditions, often what looks like a speed problem is really a problem of shifting gears. You may be as fast as other boats when you are set up properly for the conditions – but you just aren't in the right gear often enough. So how do you know when to shift gears?

## Advice from the 'Wizard'

*Buddy Melges, America's Cup winner and Olympic gold medalist, grew up on inland lakes where 'puffy and shifty' is a way of life. His secret to success? "You have to present your boat for Mother Nature," says Buddy, known to many as the 'Wizard of Zenda'. In other words, look ahead to see the wind that is coming and have your boat ready for that wind by the time it reaches you.*

• ***Trust your sense of feel.*** Indicators like pressure in the helm and angle of heel will tell you a lot about whether the boat needs more or less power. Tune into the rate of change of these indicators.

• ***Watch the nearby boats.*** If your performance relative to the nearby competition is not great, there's a good chance you're in the wrong gear, so change something.

• ***Look ahead for visual clues.*** Many changes that require a gear shift are things you can see before they reach you (e.g. puffs, lulls, waves). Anticipate what's coming.

In the ideal world, you should change gears just *before* you get a change in wind or wave conditions. Try to avoid shifting gears in reaction to changes that have already happened. If a puff hits and your boat heels way over with a big increase in windward helm, you are already losing speed. Shift gears before this happens to keep your boat in balance through the puff.

Many racing sailors are fairly good at "shifting up" when they get an increase in wind pressure. Puffs

**When the wind velocity is up and down, you have to 'change gears' to keep your boat going as fast as possible. But you can't change every speed control each time you get a change in pressure. For example, you don't normally adjust things like outhaul, rake, rig tension or choice of sails for every puff and lull.**

**For controls and settings that can't be changed easily (or legally while racing), a good rule of thumb is to optimize your set-up for the lulls (not the puffs). In a puff you have plenty of power and it is relatively easy for everyone to make their boat go fast. But in lulls there will be much greater variation among boatspeeds. That's where you want to gain the most (or lose the least).**

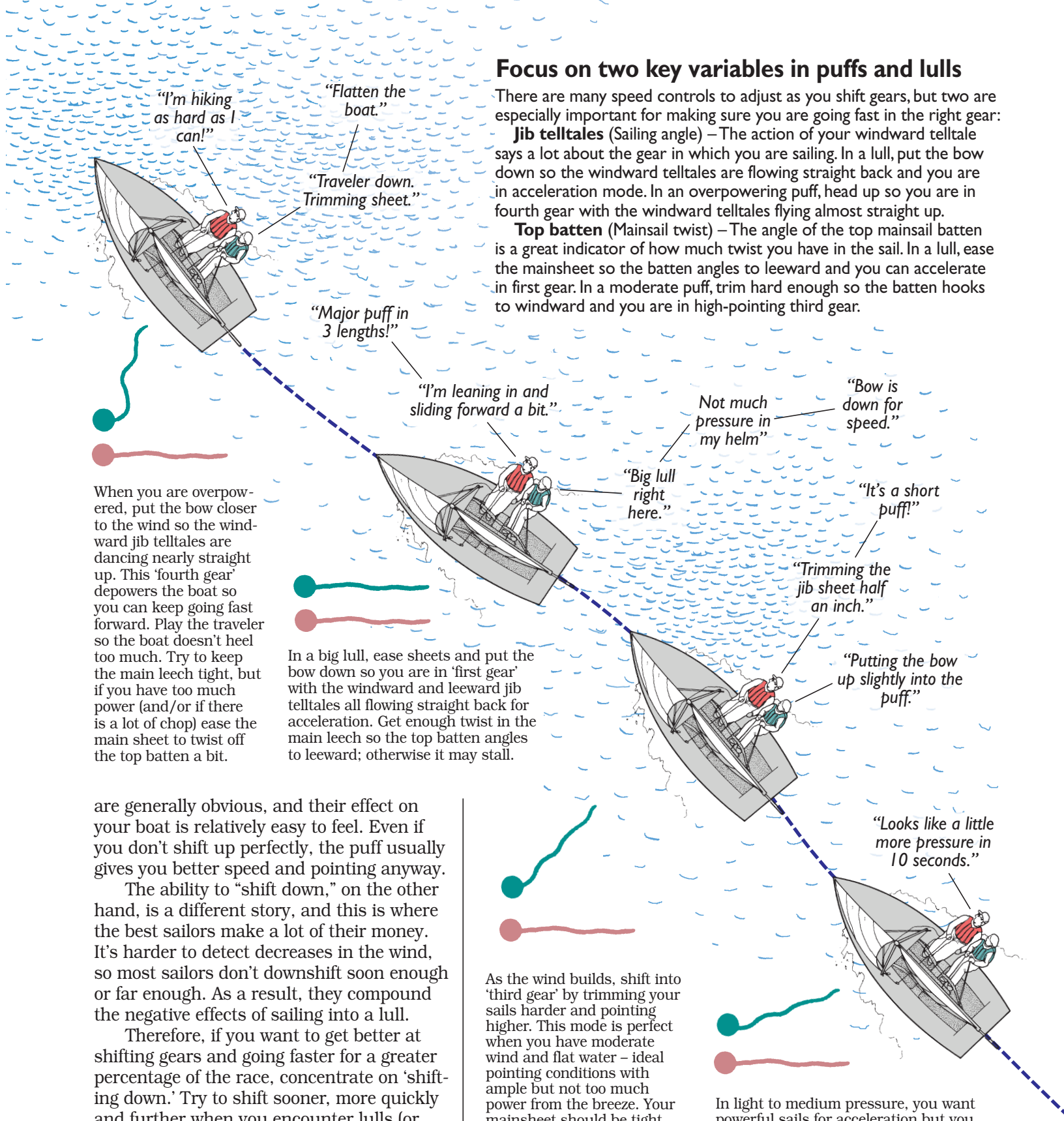
JH Peterson photo

## Focus on two key variables in puffs and lulls

There are many speed controls to adjust as you shift gears, but two are especially important for making sure you are going fast in the right gear:

**Jib telltales** (Sailing angle) – The action of your windward telltale says a lot about the gear in which you are sailing. In a lull, put the bow down so the windward telltales are flowing straight back and you are in acceleration mode. In an overpowering puff, head up so you are in fourth gear with the windward telltales flying almost straight up.

**Top batten** (Mainsail twist) – The angle of the top mainsail batten is a great indicator of how much twist you have in the sail. In a lull, ease the mainsheet so the batten angles to leeward and you can accelerate in first gear. In a moderate puff, trim hard enough so the batten hooks to windward and you are in high-pointing third gear.




When you are overpowered, put the bow closer to the wind so the windward jib telltales are dancing nearly straight up. This 'fourth gear' depowers the boat so you can keep going fast forward. Play the traveler so the boat doesn't heel too much. Try to keep the main leech tight, but if you have too much power (and/or if there is a lot of chop) ease the main sheet to twist off the top batten a bit.

In a big lull, ease sheets and put the bow down so you are in 'first gear' with the windward and leeward jib telltales all flowing straight back for acceleration. Get enough twist in the main leech so the top batten angles to leeward; otherwise it may stall.

are generally obvious, and their effect on your boat is relatively easy to feel. Even if you don't shift up perfectly, the puff usually gives you better speed and pointing anyway.

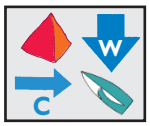
The ability to "shift down," on the other hand, is a different story, and this is where the best sailors make a lot of their money. It's harder to detect decreases in the wind, so most sailors don't downshift soon enough or far enough. As a result, they compound the negative effects of sailing into a lull.

Therefore, if you want to get better at shifting gears and going faster for a greater percentage of the race, concentrate on 'shifting down.' Try to shift sooner, more quickly and further when you encounter lulls (or any other situation where you might slow down such as bad air or waves).

◀ *In most cases, a lack of wind ripples on the water surface means a lull, but this is not always true. Once in a while the wind doesn't show up on the water. For gear-shifting, be ready for what you see up ahead, but use your sense of feel as your ultimate guide.*

As the wind builds, shift into 'third gear' by trimming your sails harder and pointing higher. This mode is perfect when you have moderate wind and flat water – ideal pointing conditions with ample but not too much power from the breeze. Your mainsheet should be tight enough so the top batten is hooking to windward and the telltale attached to its outboard end at the leech is stalling almost all the time. Aim the boat so the windward jib telltales are lifting up about 45° on average – this will give you optimal height without losing power.

In light to medium pressure, you want powerful sails for acceleration but you can also start thinking about height. This is when you want to be in 'second gear.' Trim the mainsheet so the top batten is roughly parallel to the boom to get a good balance between power and pointing. Steer the boat so the windward jib telltales are just starting to lift – in flatter water they can lift almost all the time but be careful of sailing this high if it's choppy.




**STRATEGY**

# Game plan for puffs and lulls

When the wind velocity varies across the course, a good strategic plan becomes very important. Here are some factors specific to sailing in puffs and lulls.

***'Where is the best wind velocity?'*** On a puffy day, any strategic plan must include your best guess about where and how you will find the most pressure. Try to spend as much time as possible sailing around the course area before your race. Keep watching the boats, water surface and other telltales to windward while you are practicing, sailing around during the starting sequence and racing.

Your game plan should answer questions about wind pressure on that specific day: Are the puffs random? Is there better pressure on either side of the course? Are the differences in wind velocity constant (e.g. due to geography) or are they changing (e.g. because of a weather system)? Do puffs come with any pattern of wind shift?

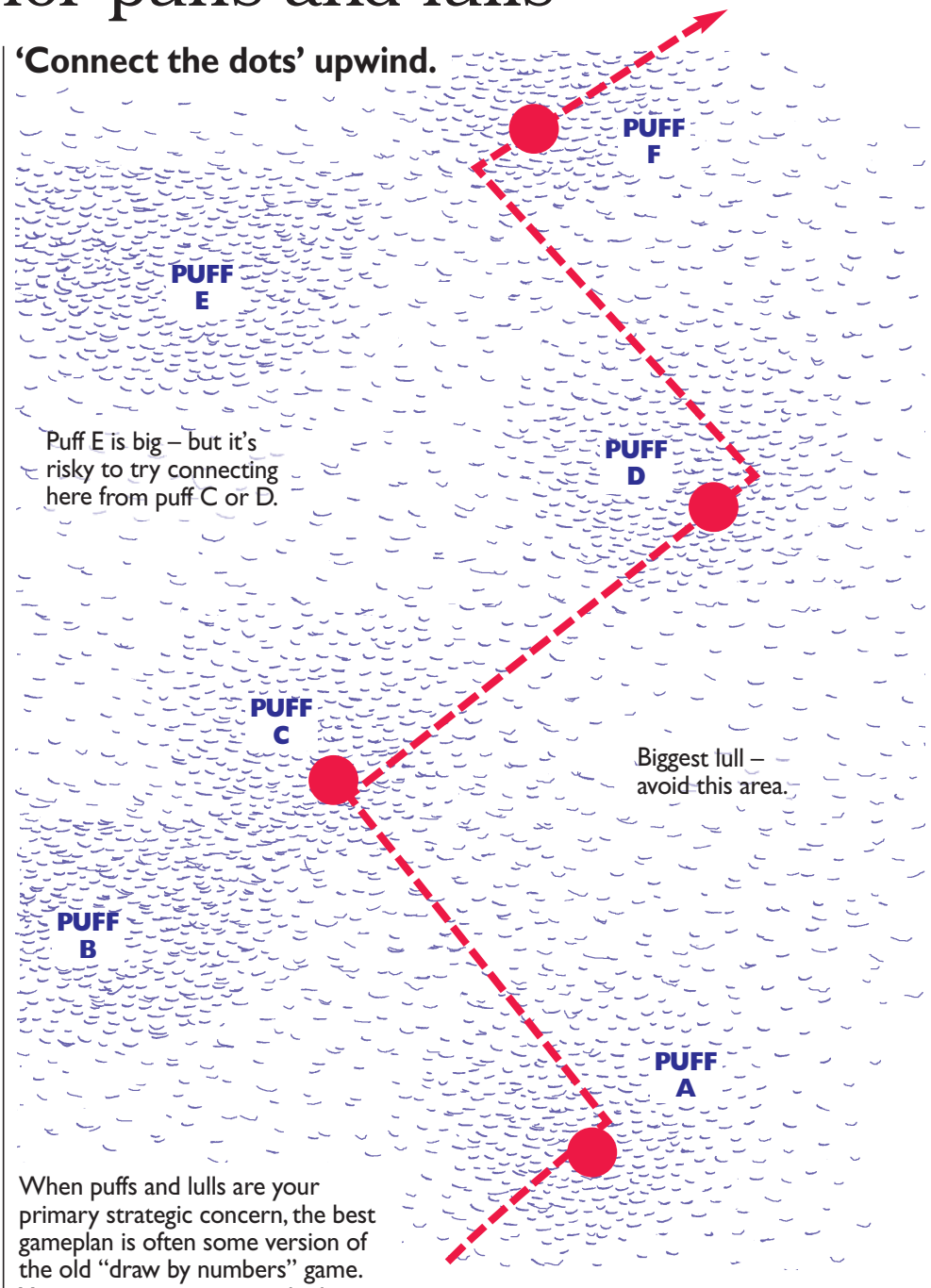
***Sail the longer tack or jibe first.*** This rule of thumb works well whenever you are not too sure about what the wind will do next. If you know there is better pressure on the left side of the course, for example, then you should go that way even if it means you have to sail on the 'shorter tack' (toward the edge of the course).

But when the wind velocity is a bit random (as it often is with puffs and lulls), your surest bet is usually to sail the tack or jibe where your bow is pointing closer to the next mark. This will maximize your progress toward that mark, help you avoid overstanding in a puff and give you more strategic (and tactical) options as you sail the final part of the leg.

***To chase or not to chase puffs?*** If you see a boat that has better wind, should you head toward them and try to get the same puff? When the wind direction is shifting a lot, it usually does not work to chase after lifts. In order to get to a lift, you'll probably have to sail through a header, and that is the wrong strategy. Plus it is likely the lift will be gone (or short-lived) by the time you get there.

When there are puffs and lulls without big shifts, however, that's a different story. In that case your game plan should be to stay in the best pressure, so heading for a nearby puff might be a perfect strategy. ☛

**'Connect the dots' upwind.**




When puffs and lulls are your primary strategic concern, the best gameplan is often some version of the old "draw by numbers" game. Your priority is to stay in the best pressure on the course, so spend a lot of time looking up the beat at the wind that is coming to you. Then try to "connect the dots" between puffs in the most efficient way. This is especially important on windward legs because you can't just find one big puff and stay with it for much of the leg as you can on a run (see *next page*). On windward legs the puffs come and go more quickly, so you have to keep looking for the next one.

"Connecting the dots" works best when the wind direction is not changing very much. In a shifty breeze, things are trickier. Obviously it's still good to stay in the best pressure, but you can't go blindly chasing puffs. If you sail a header to get to a puff, the amount you gain from the increased pressure may not make up for what you lost by missing the shift. In this case you still want to connect the dots between puffs, but only when doing so is at least reasonably consistent with playing the lifts and headers.

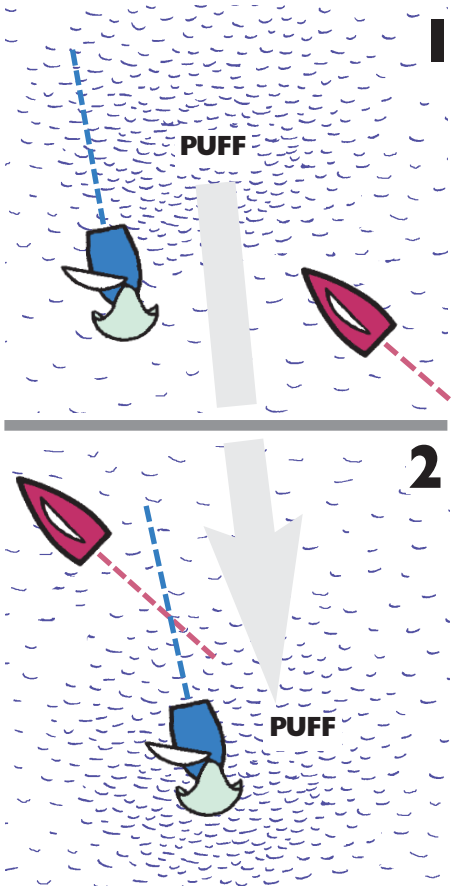

JH Peterson photo

**Many boats, especially heavier ones with symmetrical kites like these IODs, sail almost directly downwind (except in light air). These boats can sail by the lee and have narrow jibing angles, so they stay close to the rhumbline and don't get far apart. Therefore, they have fewer chances to catch puffs that pass on the sides of the course. Most of the fleet tends to see the same puffs and lulls; boats behind get these puffs first and often close the gap on boats ahead. With a compressed fleet, wind shadows are a problem for boats ahead, so treat areas of clear and bad air a lot like you would puffs and lulls.**

*Play smaller puffs downwind.* When you have at least enough pressure to sail a fairly deep angle downwind, jibes will normally be less costly than tacks. Therefore, you have more options to play the puffs on runs than on beats. When you're sailing upwind, tacking to get into a small puff may cost you more than you gain by reaching that puff. Downwind, however, it's often worth jibing to find even an extra knot or two of velocity because 1) jibes don't cost much; and 2) a small increase in pressure will usually help you much more on a run than a beat.

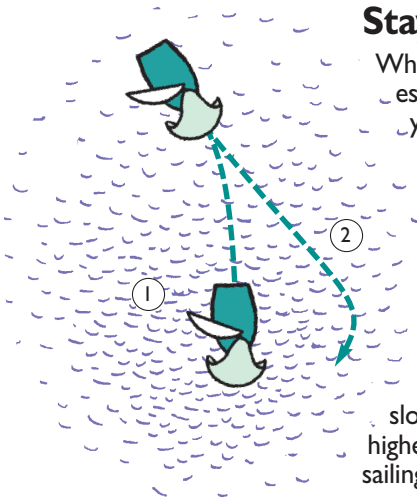
*Sail your own race!* The bigger the puffs and lulls, the more you can gain by doing the right thing. Therefore, it's very important to have (and to follow) a strategic plan. Use the rest of the fleet to help you understand what the wind is doing, but try to sail your own race with minimal inter-

## Puffs upwind vs. downwind




Puffs and lulls do not affect boats equally on beats and runs. When a boat is sailing upwind, she is moving in the direction that is opposite to the puffs. Therefore, she will pass through each puff relatively quickly. On a downwind leg, however, boats move in the same direction as the puffs so they stay with each puff much longer (see *below*). As a result, on a puffy day you may see a lot of puffs as you sail up the beat but only half that many on the run. Strategically, this means that catching and staying with a couple of the best puffs is critical downwind, while upwind you have to constantly look for, and set yourself up to get, the next puff.

## Stay in each puff longer!



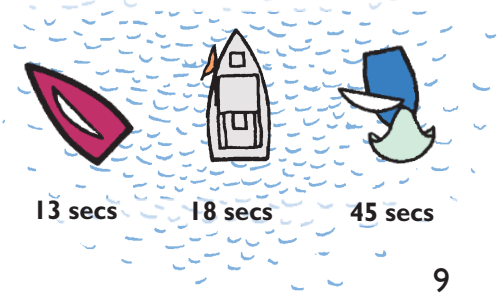

When the wind velocity is up and down, even the smallest increase in breeze can make a huge difference in your performance (and therefore your race results!). So keep sailing aggressively toward better pressure. Once you get to a puff (or the puff gets to you), your goal should be to stay in that pressure as long as possible. There are two ways to do this:

1) Bear off with the puff so you are sailing more nearly dead downwind. If you can aim your boat in the same direction that the puff is travelling, you will stay with it longer.

2) If bearing off to sail with the puff is too slow (i.e. slow enough that your VMG decreases), keep sailing the higher angle that maximizes VMG. Then, when you start sailing out of the puff, jibe so you sail back through it!

**For Example**: Let's say you have a moderate puff that is 100 yards square and moving to leeward at 10 knots. How long will each boat experience this puff?

- A boat sailing upwind (VMG 4 knts)
- An RC boat that is anchored
- A boat going downwind (VMG 6 knts)



# Change gears downwind

To have good speed, you must set up your boat and sails for the wind velocity in which you are sailing at any moment. And whenever that pressure changes, you need to adjust your trim accordingly. This applies both upwind (*see pages 6-7*) and downwind.

Shifting gears on a run is a bit different than on a beat. Here is a list of boat and sail controls that are priorities for most boats when sailing downwind in puffs and lulls.

***Sailing angle*** – This is a very critical variable for speed on a run. When racing upwind, you sail a fairly constant angle to the breeze and adjust your sheet tension to keep the boat moving as the wind velocity changes. On a run, it works the other way. Normally your sheets are always eased as far as possible, and you change the angle you are steering to compensate for changes in pressure. In simple terms, you head up in light spots and bear off when you have good pressure (*see below*). On any boat, this should be your primary way of changing gears in puffs and lulls downwind.

***Spinnaker pole position*** – Of course, if you sail a boat with a fixed bowsprit pole, you can't use this to change gears. But on all boats with symmetrical chutes, the height and fore-and-aft position of the pole are vital for keeping the chute going fast when conditions change. In general, move the pole forward and down in lulls – then up and aft in puffs. Try to make this a seamless process by having good communication between your wind spotter, spinnaker trimmer and helmsperson.

***Heel angle*** – For most boats, the ideal heel angle when running ranges from moderate leeward heel in light air to slight windward heel (when sailing dead downwind) in good pressure. Move your weight from side-to-side to maintain the proper heel while conditions change.

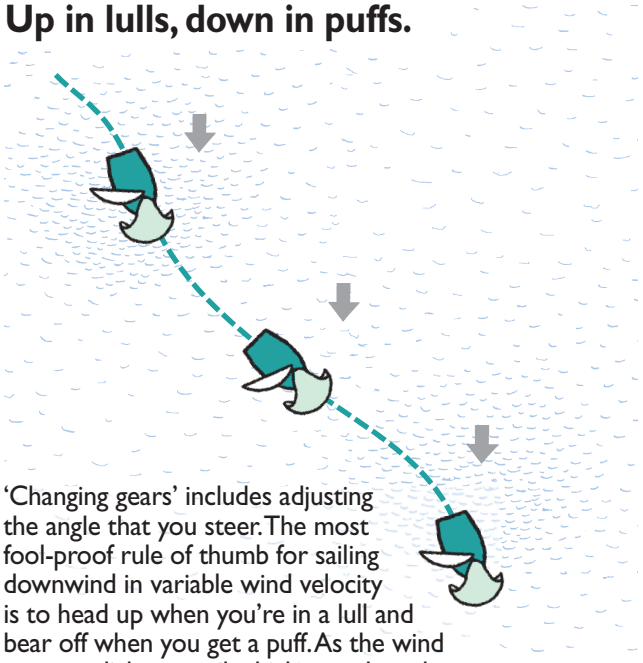
Another reason why heel angle is so important is because on a run filled with puffs and lulls you are always changing your sailing angle. In other words, you are constantly steering up or down. The fastest way to do this is by using heel angle to help turn the boat – heel to leeward when you are heading up in a lull; heel to windward when bearing off in a puff.

***Fore-and-aft weight position*** – The position of your weight is very important not only in the sideways dimension but fore-and-aft as well. On runs your weight might be as far forward as possible in very light

JH Peterson photo

**Fast, light boats that sail high angles downwind (such as these E Scows) are very sensitive to small changes in wind velocity. Even a tiny puff or lull will have a big effect on sailing angle, heel, fore-and-aft weight placement, ability to plane or surf and so on. That's what makes these boats a ton of fun to sail, but it also means that you must be a) very tuned in to the feel of the boat and wind in order to realize optimum performance; and b) willing to work hard at constantly shifting gears.**

## Up in lulls, down in puffs.



'Changing gears' includes adjusting the angle that you steer. The most fool-proof rule of thumb for sailing downwind in variable wind velocity is to head up when you're in a lull and bear off when you get a puff. As the wind pressure lightens, sail a higher angle to keep pressure in your sails and maintain speed. This will also help you sail through the lull and get to the next puff more quickly.

When you get a puff, bear off to maximize your VMG to leeward. This also allows you to sail more in the direction the puff is traveling, so you will stay in the puff longer. By making a roller-coaster path down a puffy reach or run, you'll go faster than sailing a straight line.

lulls, or all the way back when you are planing in a puff. Most sailors do not move their bodies nearly enough in this dimension as they sail through pressure changes.

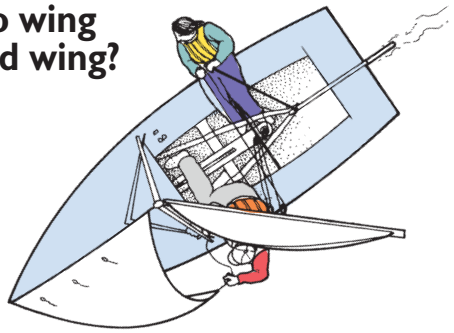
***Vang tension*** – The vang is quite a critical control downwind, and optimal tension varies almost directly with wind pressure. In lulls, too much vang will close down the mainsail leech and make it much harder for the sail to breathe, so ease the vang until the top batten is roughly parallel to the boom.

In puffs, too little vang will open up the mainsail leech excessively. This spills wind (and power) and, in a big puff, makes the boat hard to control. As the wind builds, pull on vang so the top batten stays more or less parallel to the boom.

***Kinetics*** – When you have enough wind and waves to plane or surf, pumping your sails can be a huge part of going fast. In puffy conditions, it's not so unusual to be able to surf or plane in the puffs, but not in the lulls. In these cases, make sure you change gears by going into 'kinetics mode' as soon as you have enough wind to make it legal (and, of course, stop kinetic actions as soon as you don't).

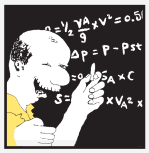
***Other stuff*** – There are not a lot of other things you should worry about when you get a puff or lull downwind. In dinghies, you might adjust the centerboard a little – put it down some in lulls when you are sailing high; pull it up more in puffs when you are sailing dead downwind. In boats with asymmetrical chutes, you should lower the tack height in lulls when reaching and ease the tack line (to let the tack go up and to windward) when you are

## Go wing and wing?



On small boats without spinnakers, such as Vanguard 15s or collegiate dinghies, there is a critical point for changing gears downwind at about six or seven knots of wind. In strong breeze, it's clear that you will maximize VMG to leeward by sailing wing and wing. In light air, you will go fastest by sailing a broad reach with the jib to leeward. Somewhere in between is a point at which the two are almost equal; that's when you have to be very alert because even a half-knot puff or lull may mean you have to shift gears.

## TEASER ANSWER (From page 1)



Here are some observations to help us understand and answer the Brain Teaser situation:

• Blue has the right of way over Green and Yellow, so Blue is an obstruction to both of them.

• Green and Yellow are approaching an obstruction, so rule 19 (*Room to Pass an Obstruction*) will apply to them.

• Green is a leeward boat and has the right of way over Yellow; therefore, according to rule 19.2(a), Green may choose to pass the obstruction (Blue) on either side.

• In this case, Green chooses to pass Blue on Green's port side. Yellow also chooses to pass on that side; since Green and Yellow are overlapped, Yellow is the inside boat and Green is the outside boat.

• According to rule 19.2(b), Green must give Yellow room to pass between her (Green) and the obstruction (Blue).

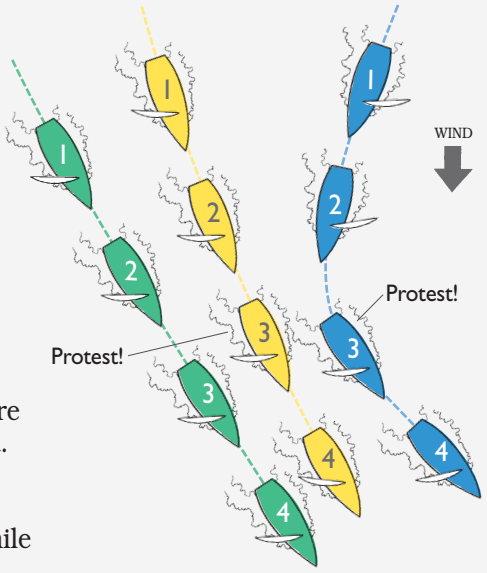
• 'Room' is "The space a boat needs in the existing conditions while maneuvering promptly in a seamanlike way."

So, here's how it works: Green and Yellow, two overlapped boats, approach a right-of-way boat (Blue) that is an obstruction. Green has right of way over Yellow so she can choose to pass Blue on either side. Yellow must keep clear of Green, but if she has an inside overlap when the boats are at the obstruction then Green must give her room to pass the obstruction. Room includes enough space and time for Yellow to keep clear of Blue – in this case Green must give Yellow enough room to jibe.

Even though Green holds the right of way (over Yellow), she has to bear off and probably even jibe to comply with rule 19. Note that rule 20 (Room to tack at an obstruction) doesn't apply here because neither boat is sailing 'closehauled or above.' Also, rule 20 does not cover jibing.

A similar situation was discussed in Issue 119 – see page 13 of that issue for a slightly different explanation of the applicable rules.

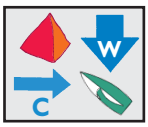
For more Q&A about the rules, check out our FB page: www.Facebook.com/SpeedandSmarts




### RULE 19 – Room to Pass an Obstruction

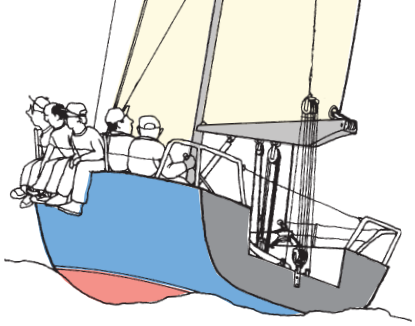
**19.1 When Rule 19 Applies**
Rule 19 applies between boats at an *obstruction* except when it is also a *mark* the boats are required to leave on the same side …

**19.2 Giving Room at an Obstruction**
(a) A right-of-way boat may choose to pass an *obstruction* on either side.
(b) When boats are *overlapped*, the outside boat shall give the inside boat *room* between her and the *obstruction*, unless she has been unable to do so from the time the *overlap* began …



STRATEGY

# Sail for puffs or shifts?



Imagine you are racing upwind on port tack in about seven knots of breeze. You start to get headed, so you consider tacking to stay in phase with the shifts. But you can also see that staying on port tack is the fastest way to get to a puff up ahead. Should you play the shift or go for the puff?

This is a tricky situation; the best way to handle it depends on a number of factors that are often changing. Here are some things to consider before making a decision:

**Light air or heavy air?**

In many puff-or-shift situations, the best strategy depends on how much wind there is. In heavy air, it is likely that you already have plenty of power and are sailing almost as fast as the boat will go. In this case, another couple knots of wind will not improve your speed or height very much. But sailing the lifted tack upwind (or the headed jibe downwind) will be very helpful in getting to the next mark. Therefore, when it's breezy, a good rule of thumb is to play the shifts first and not worry so much about the puffs.

In light air, however, the opposite is true. When you are sailing slowly, even a tiny increase in pressure can have a substantial impact on your speed (*see Chart 1 on page 13*). If the average wind speed is seven knots, a two-knot puff represents a huge increase in power!

In addition to giving you better speed through the water, a puff is like a shift because it allows you to point higher upwind (and lower downwind). Since a puff gives you better speed and pointing in light air, going for extra velocity should be your top priority.

Shifts can also be very valuable in light air, but a lift (or a header on a run) without pressure is not too valuable. Once it gets windy enough that more wind won't increase your speed or height very much, then shifts are especially critical.

**Upwind or downwind?**

Puffs and lulls on runs often have a different strategic value than the same puffs and lulls on beats. That is because when you are sailing downwind a puff not only gives you better speed through the water but also usually allows you to sail quite a bit lower.

An increase in wind velocity will affect your sailing angle much more on a run than on a beat. In moderate air, for example, a two-knot puff might allow you to point 2° or 3° higher upwind. But the same puff could let you sail 10° lower on a run (*see Chart 2 on page 13*)!

On runs, puffs are a lot like headers because they permit you to sail lower and closer to the leeward mark. In addition, puffs have extra value because downwind you sail *with* the puffs (instead of *against* them as you do upwind), so you


Photo by Ken Legler

**Should these dinghies be sailing for better velocity (puffs) or favorable changes in direction (shifts)? There is a fairly strong breeze here, so extra pressure won't help them as much as if it were light. Also, there doesn't appear to be a big disparity between puffs and lulls (so it's not urgent to get to the puffs), the boats are sailing upwind (where puffs don't have as big an impact as downwind) and these dinghies are relatively heavy (so they won't be helped as much by a little extra pressure). Therefore, it's probably safe for them to play the windshifts as their primary strategy.**

stay in the extra breeze longer.

These are all good reasons why you might choose to sail toward a puff downwind, even if it's a small one and even if you must sail a lift to get there. Of course, puffs are also helpful upwind, but generally you need a bigger puff to offset the cost of missing a shift.

### Size of puffs and lulls

When it comes to choosing a puff or shift, it's obviously more tempting to go for the puff if it's a big one. Unless you're already overpowered, there is a direct correlation between more wind and better performance.

If you are racing in a condition where the puffs create whitecaps and the lulls have less than five knots of wind, you should almost always head for the next puff. But if the pressure differences are subtle and there is only a one- or two-knot variation between the high and low wind speeds, you should place a higher priority on playing shifts.

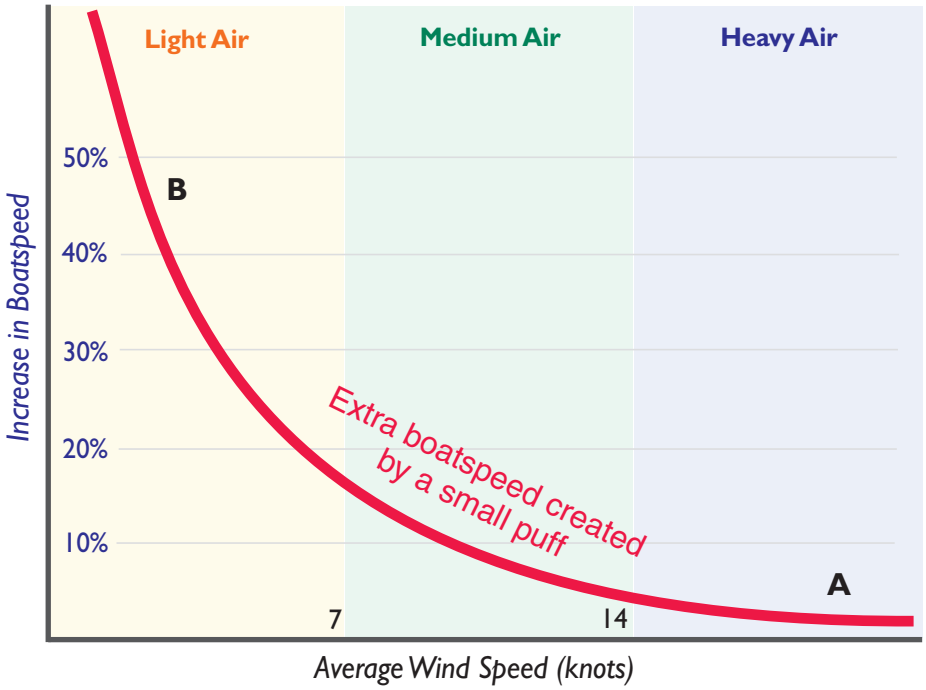
The same can be said about the geographic size (area) of the puffs. If the increase in pressure will be short-lived, you have less incentive to go out of your way to get it, even if it brings a lot more wind velocity. On the other hand, if the puff will affect you for a relatively long time, then it's a no-brainer to head for it.

### Performance of your boat

The choice between puff and shift also depends somewhat on the type of boat you are sailing. Lightweight boats with a lot of sail area will accelerate more quickly than heavier boats, and therefore they will benefit more from puffs that are smaller in velocity or area. Heavy keelboats need more wind and more time to get going, so they often choose to play a shift over a puff, unless that puff is substantial.

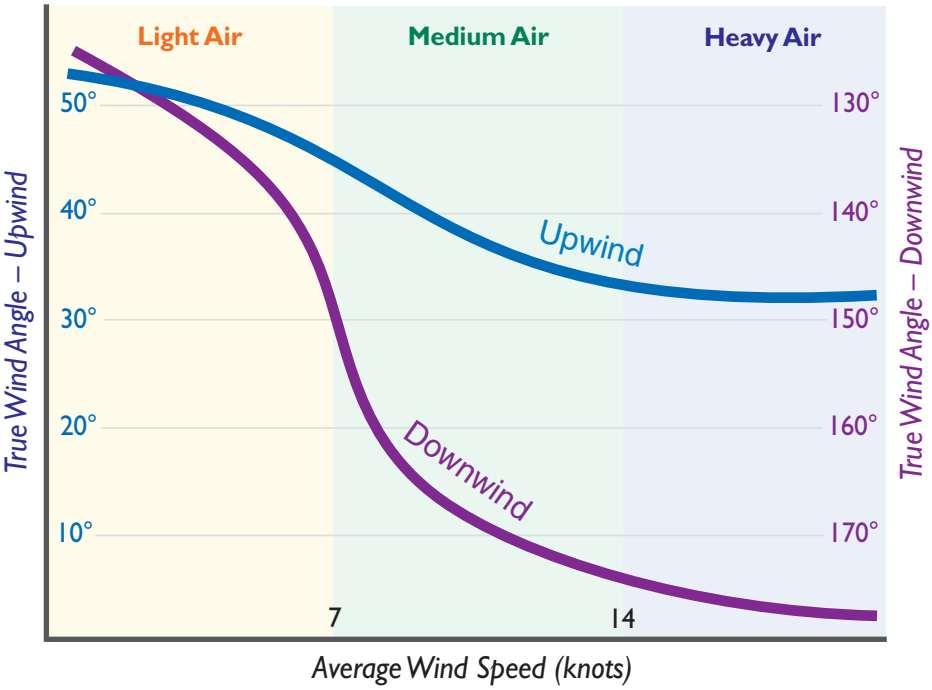
From a strategic point of view, it's always good to get a favorable puff or shift. And often it works out that you can play both at the same time. But when you can't, use the factors above to make the choice that will help you the most in each particular situation. •

**1. Sail for puffs in light air:** ***Effect of a small puff on boatspeed***




A small puff of wind will help you much more in light air than it will in heavy air. When you already have enough wind to be fully powered up (A), more pressure will increase your boatspeed only slightly (if it's windy enough more breeze may actually slow you down). On the other hand, in light air even a little more velocity can have a huge impact on your speed (B). In three knots of wind, for example, a one-knot puff might increase your speed by 50%! That's why puffs are so valuable in light air.

**2. Sail for puffs downwind:** ***Comparing wind speed and sailing angle***




A puff of wind almost always makes you go faster, but it also improves the angle at which you can sail. Most boats sail upwind at a true wind angle between roughly 35° (in strong breeze) and 50° (in very light air). That's a difference of 15° due to wind velocity. Downwind, boats sail true wind angles between roughly 180° (dead downwind in breeze) to 130° (in very light air). That's a change of 50° all because of pressure! This is why puffs usually have a much bigger impact on runs than beats.

## IN THEORY

# Watch for 'velocity shifts'!

If you want to be consistently at the front of sailboat races, you must know how to take advantage of changes in wind direction. The wind is shifting all the time, and these shifts are worth many boat lengths if you put yourself in the right places.

But not everything that looks like a windshift is actually a change in wind direction. When you are sailing through puffs and lulls, you often get what many sailors call 'velocity shifts.' These are lifts and headers created temporarily by changes in wind pressure (while the actual wind direction remains exactly the same).

In simple terms, here is how a velocity shift works: Imagine you are sailing a heavy keelboat at 6 knots of boatspeed in 10 knots of wind. All of a sudden you sail into a lull and the wind speed instantly drops to 2 knots. At that moment you still have 6 knots of speed, but since the real wind speed is so low the wind you feel will be coming from almost straight ahead. This is what we call a 'velocity header.'

A velocity shift occurs whenever the speed of your boat is different from what is normal for the existing wind velocity. So if you are sailing slowly in a lull and suddenly you get a puff, that creates a velocity lift until your boatspeed increases to match the new wind speed.

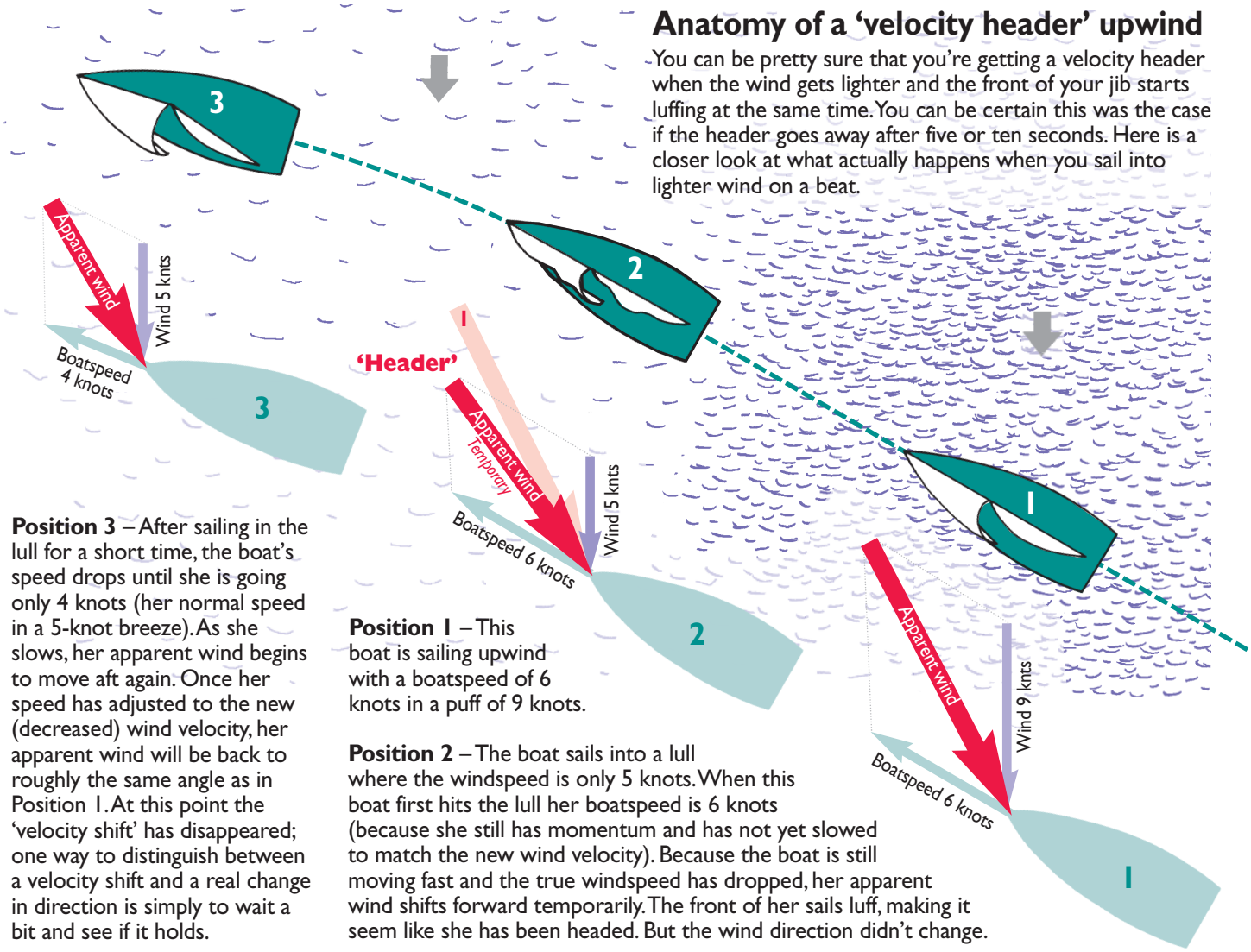
### How to recognize velocity shifts

Velocity shifts happen both upwind and downwind whenever the wind velocity changes quickly. The key thing is that these shifts are temporary. As your boat speed adjusts to match the speed that is appropriate for the new wind pressure, your apparent wind will return to roughly the same angle it was before the puff or lull. That process could take a few seconds for a light boat that changes speed quickly, or longer for a heavy boat carrying momentum.

A velocity shift happens only when the wind velocity changes quickly. If the wind drops (you get a lull), expect a velocity header. If the wind increases (you get a puff), expect a velocity lift. If you are not sure whether you have a real shift or the velocity kind, wait for a few seconds and see what happens.

## Anatomy of a 'velocity header' upwind

You can be pretty sure that you're getting a velocity header when the wind gets lighter and the front of your jib starts luffing at the same time. You can be certain this was the case if the header goes away after five or ten seconds. Here is a closer look at what actually happens when you sail into lighter wind on a beat.




**Position 3** – After sailing in the lull for a short time, the boat's speed drops until she is going only 4 knots (her normal speed in a 5-knot breeze). As she slows, her apparent wind begins to move aft again. Once her speed has adjusted to the new (decreased) wind velocity, her apparent wind will be back to roughly the same angle as in Position 1. At this point the 'velocity shift' has disappeared; one way to distinguish between a velocity shift and a real change in direction is simply to wait a bit and see if it holds.

**Position 1** – This boat is sailing upwind with a boatspeed of 6 knots in a puff of 9 knots.

**Position 2** – The boat sails into a lull where the windspeed is only 5 knots. When this boat first hits the lull her boatspeed is 6 knots (because she still has momentum and has not yet slowed to match the new wind velocity). Because the boat is still moving fast and the true windspeed has dropped, her apparent wind shifts forward temporarily. The front of her sails luff, making it seem like she has been headed. But the wind direction didn't change.

### How to handle velocity shifts

It's clear that you should generally not deal with velocity shifts in the same way that you would treat real changes in wind direction. Tacking on a header, for example, is a good strategic rule of thumb for actual shifts, but not for temporary headers caused by velocity. Also, you wouldn't want to tack when you get a velocity header because maneuvering in a lull can be very slow.

In most cases, the best way to handle a velocity shift is to stay on the same tack (or jibe), at least until your speed and the wind pressure match up. When you get a velocity lift (puff), ease sheets to keep flow attached to the sails (i.e. ease sails so the leeward telltales don't stall, then trim as the boat accelerates).

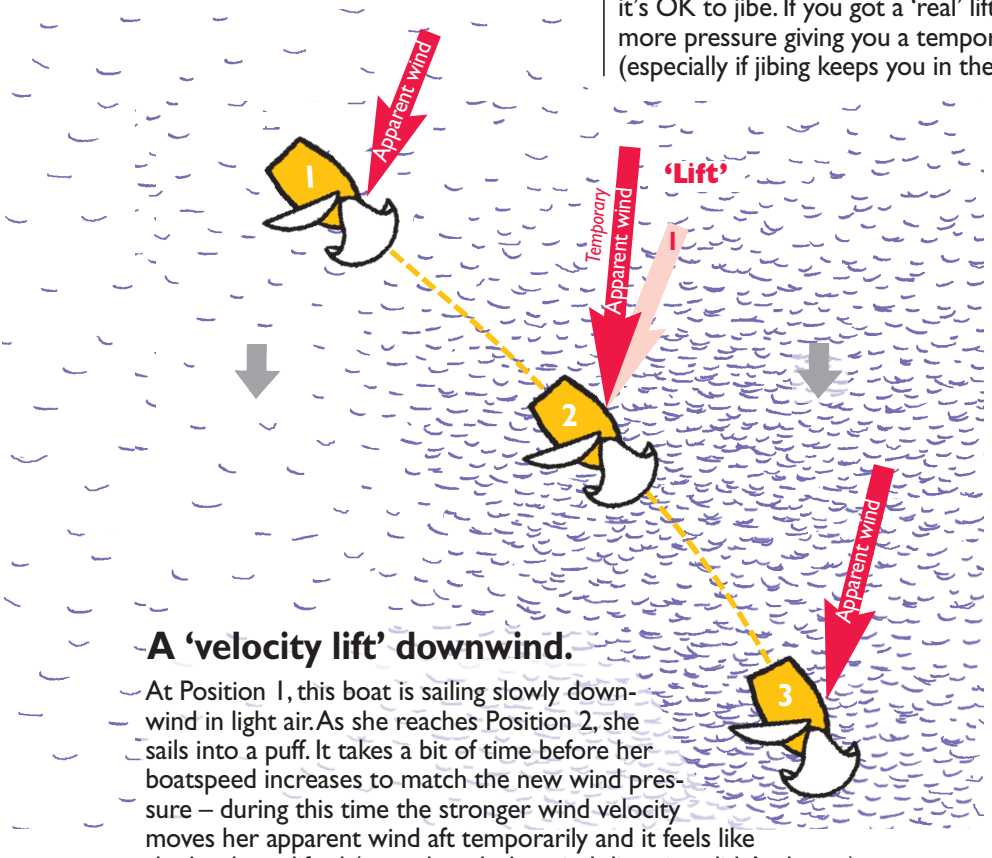
For a velocity header, bear off right away to keep your sails filled if you are in a light dinghy. In a heavier boat, bear off just a bit and let your momentum carry you until the wind comes aft again. •


J-H Peterson photo

### Should you tack or jibe in a velocity shift?

***Upwind***: When the breeze is oscillating, a good rule of thumb is to tack on the headers. But what looks like a header may not really be a shift in wind direction at all. When you sail into a lull, your apparent wind moves forward temporarily and you see a 'velocity header.' This is not a good time to tack because you haven't really been headed and, more importantly, maneuvering in a lull is costly. If you're not sure what's causing a header, wait a few seconds and see what happens (since a velocity header will mostly disappear when your speed adjusts to the new wind velocity).

***Downwind***: When sailing in shifty breeze, a good strategy is to jibe on the lifts. But sometimes it's hard to know whether a change in your apparent wind is due simply to an increase in wind velocity or to an actual shift in direction. In either case, it's OK to jibe. If you got a 'real' lift you'll be jibing onto the headed tack. If it was just more pressure giving you a temporary 'velocity lift,' it's OK to maneuver in that puff (especially if jibing keeps you in the pressure longer).




### A 'velocity lift' downwind.

At Position 1, this boat is sailing slowly downwind in light air. As she reaches Position 2, she sails into a puff. It takes a bit of time before her boatspeed increases to match the new wind pressure – during this time the stronger wind velocity moves her apparent wind aft temporarily and it feels like she has been lifted (even though the wind direction didn't change).

As the boat's speed increases in the puff, her apparent wind begins moving forward again. By the time the boat reaches Position 3, her speed is normal for the new increased wind velocity and her apparent wind is close to where it was in Position 1. The 'velocity lift' has disappeared.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**TEAMWORK**

# Talk about changes in wind velocity

There are many variables in sailboat racing, so getting around the race course fast is a challenge even in the best conditions. But when the wind velocity is all over the place, you need lots of help from everyone on your boat.

My opinion is that most racing boats seldom have too much information available. It's more likely that certain details about the wind are missing, so I always encourage my crews to talk a lot. Even if something seems obvious, say it. Your teammates can always let it go in one ear and out the other, and this way you avoid the more costly error – that what you were going to say wasn't obvious to everyone else!

When you are sailing in puffs and lulls, good communication is essential for changing gears, planning your strategy, carrying out good boathandling and keeping everyone involved and psyched. It is impossible for the trimmers, helmsperson and tactician to do a good job without getting an accurate picture of what's happening on the race course.

In static wind conditions you can get by without so much talking among your team, but that won't work when things are changing. •

## Things you might say about puffs and lulls

When you're sailing in conditions where the wind velocity is variable, it's important to talk about information like how soon a puff or lull will hit, how strong it will be (relative to the existing wind) and how long it might last. Here are some examples of what the crew of this A Scow (or any other boat) might say:

– *"We're about to get the biggest puff we've seen all day!"*
– *"The pressure looks equal across the course right now."*
– *"Looks like we will be in this lull for at least another minute."*
– *"The pressure will be much better if we tack before this puff dies."*
– *"Another couple of knots coming in 10 seconds . . . 5 . . . Here it is!"*
– *"The boats on the left side have the best pressure in the fleet."*
– *"We will get the next puff sooner if we pinch up into it."*
– *"The next puff is passing behind us – the best way to get it is to jibe."*

JH Peterson photo