



Milwaukee Community Sailing Center
Advanced Sail Trim Theory - Spinnakers and Speeds
March 2015

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Sail trim 101 was about foils, lift, angles and mains and jibs



Source: Viper Productions

Here, we'll move on to spinnaker trim

Course Agenda

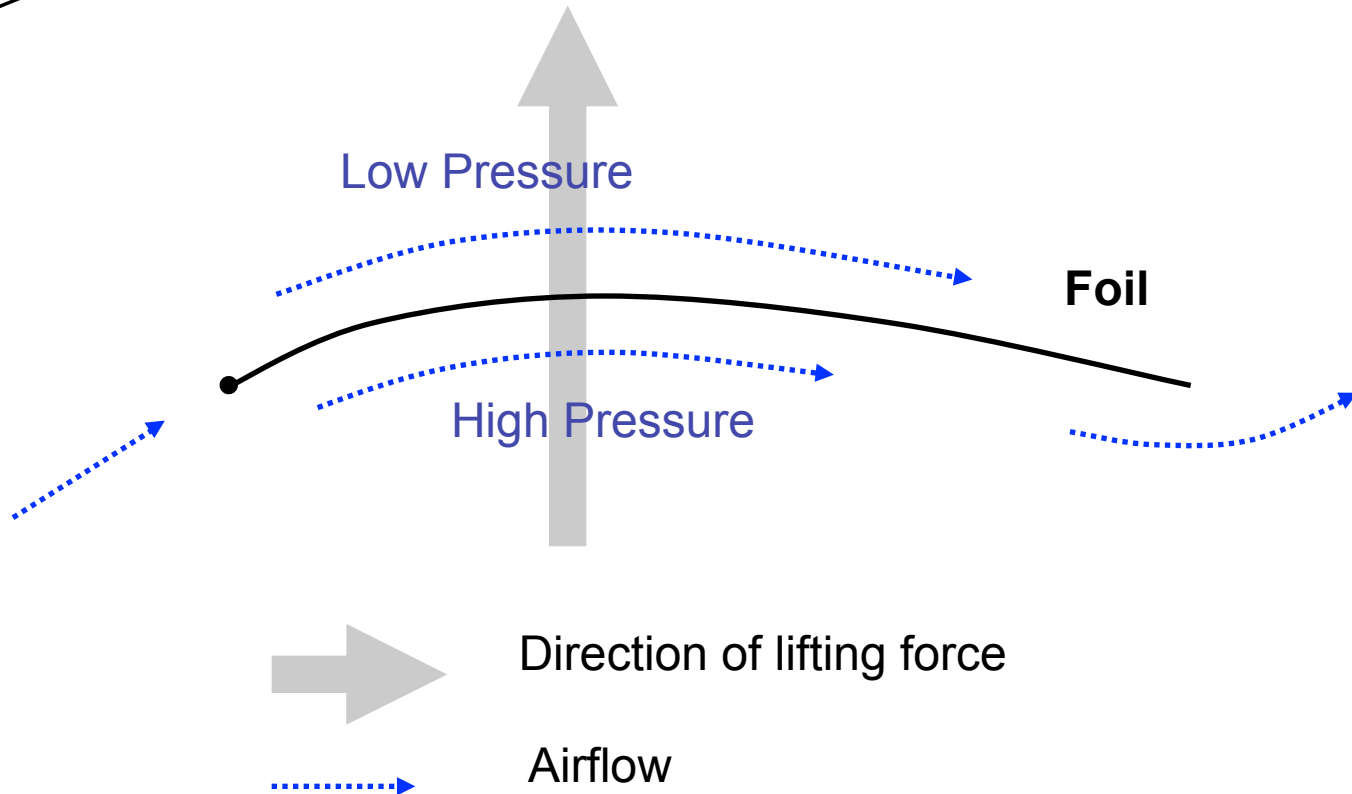
- Review foils, lift and basic trimming objectives
- Polars – target speeds and angles
- Basic spinnaker controls
- Shape and how to get it
- Speed and how to get it
- Shape review
- Q&A



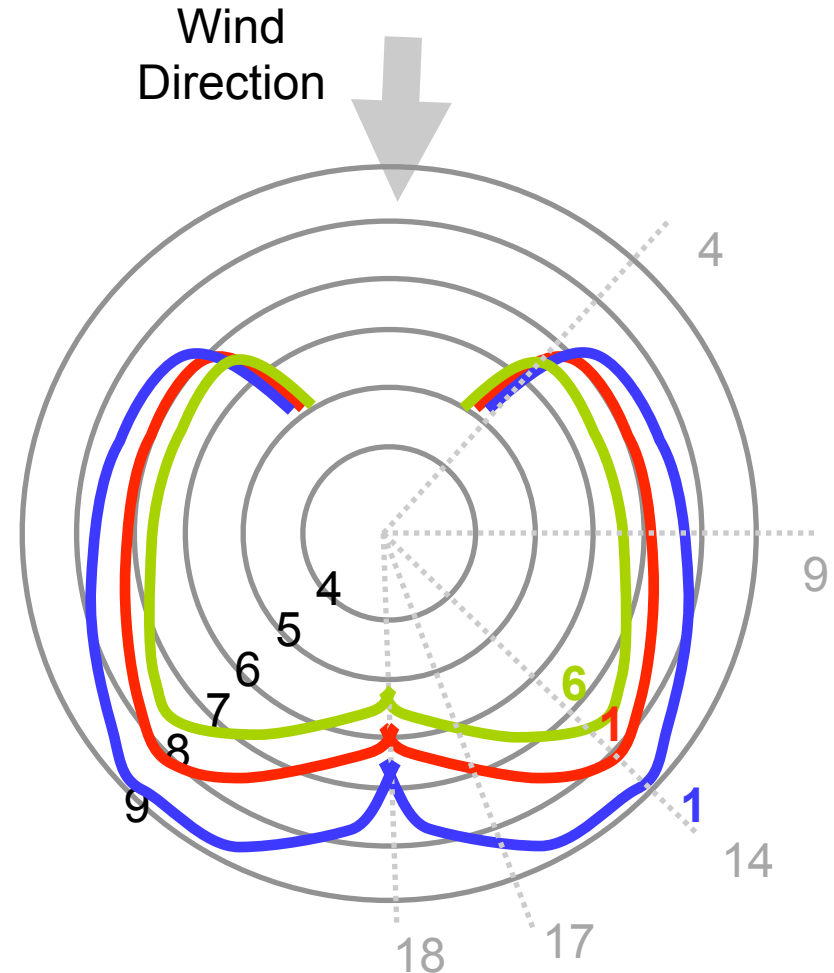
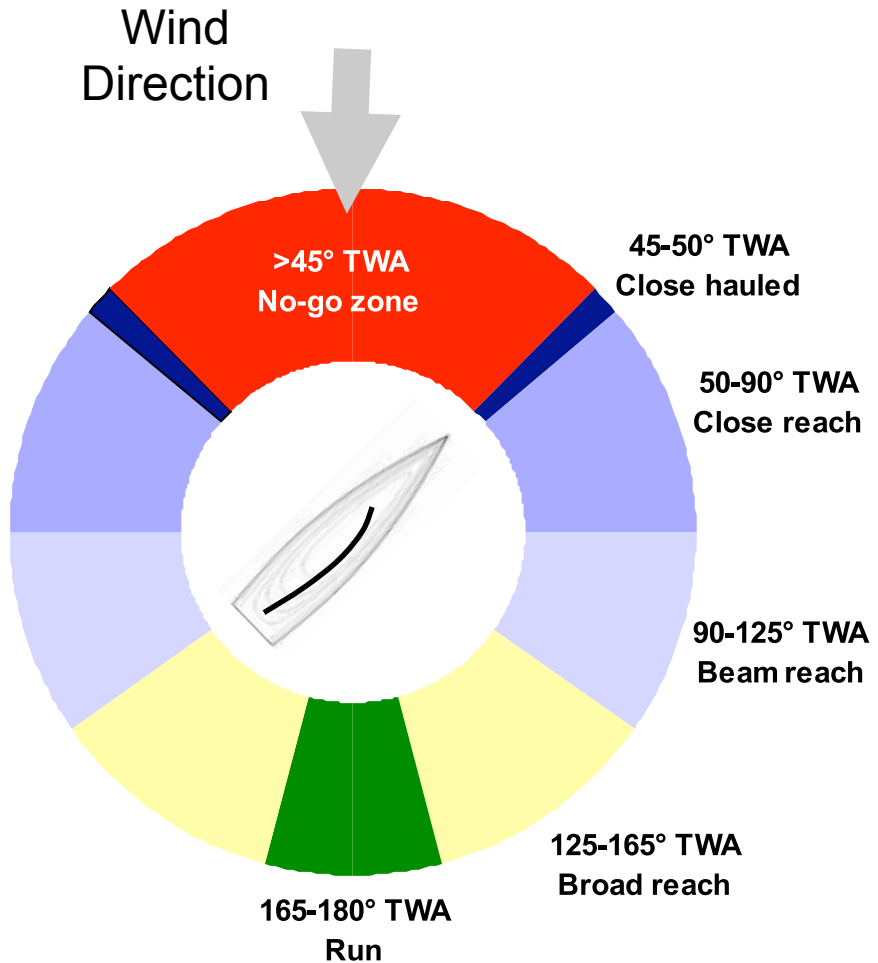
Source: Viper Productions

A foil (sail) creates lift by altering the flow of air, creating a difference in pressure between one side and the other

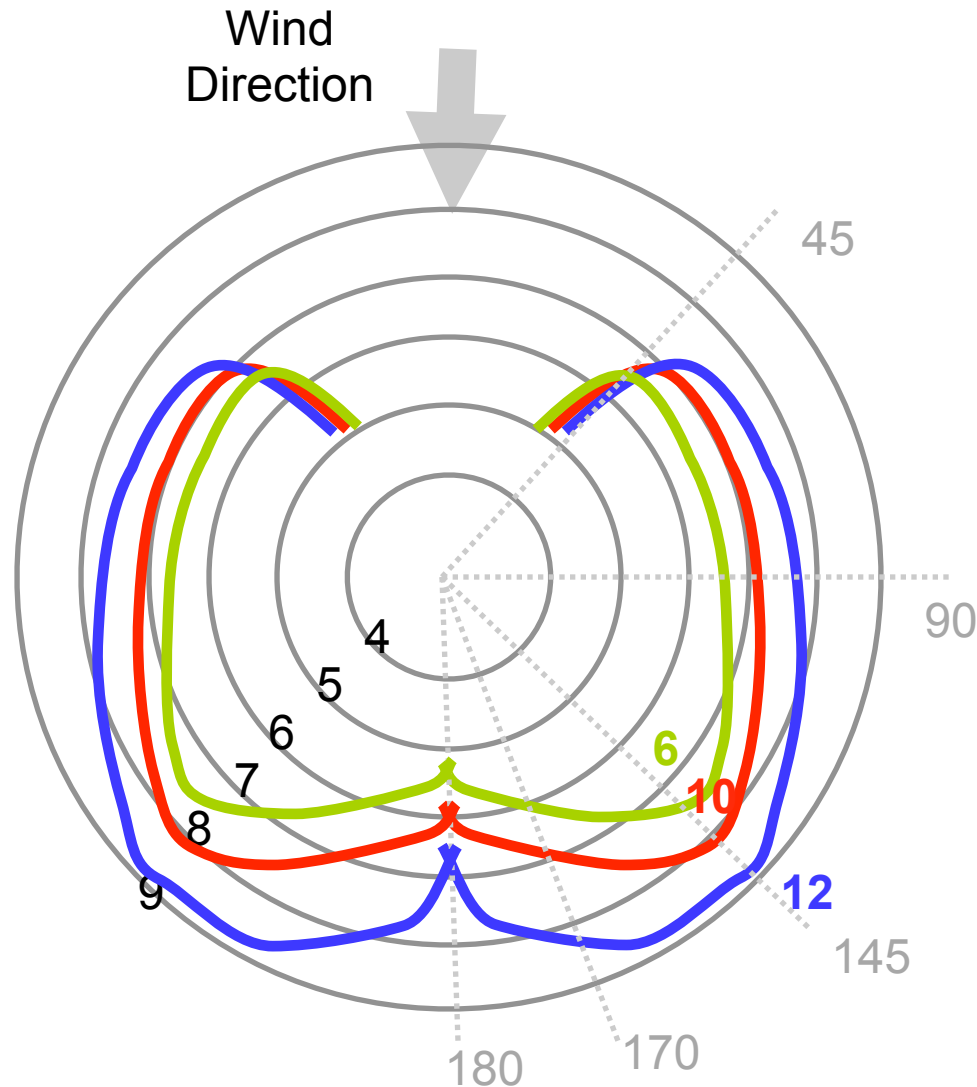
Sailtrim 101 Review



The classic sailing angles chart has a deeper dimension: called the Polar Diagram



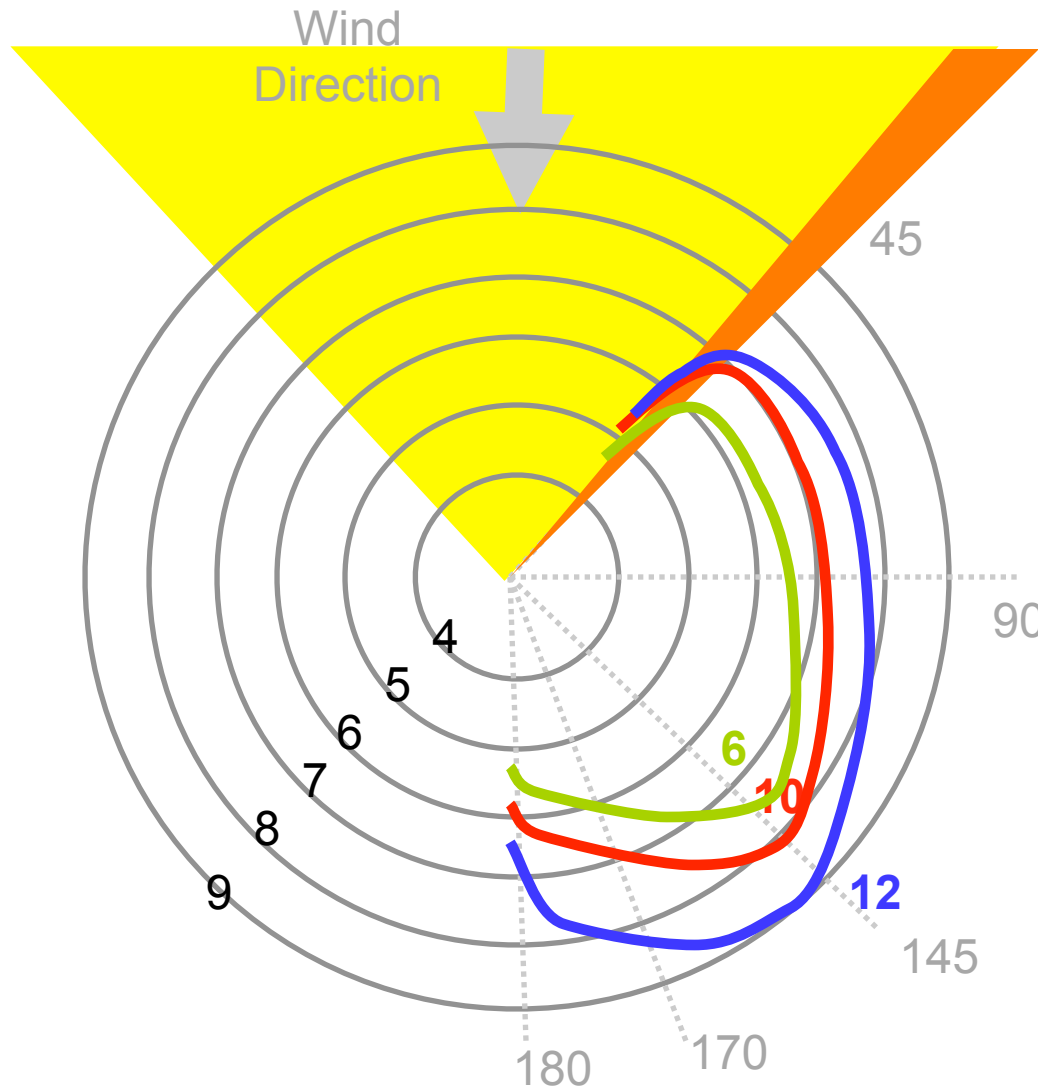
Every sailboat has a theoretical ideal speed, given wind angle and velocity



Sail Trim Theory

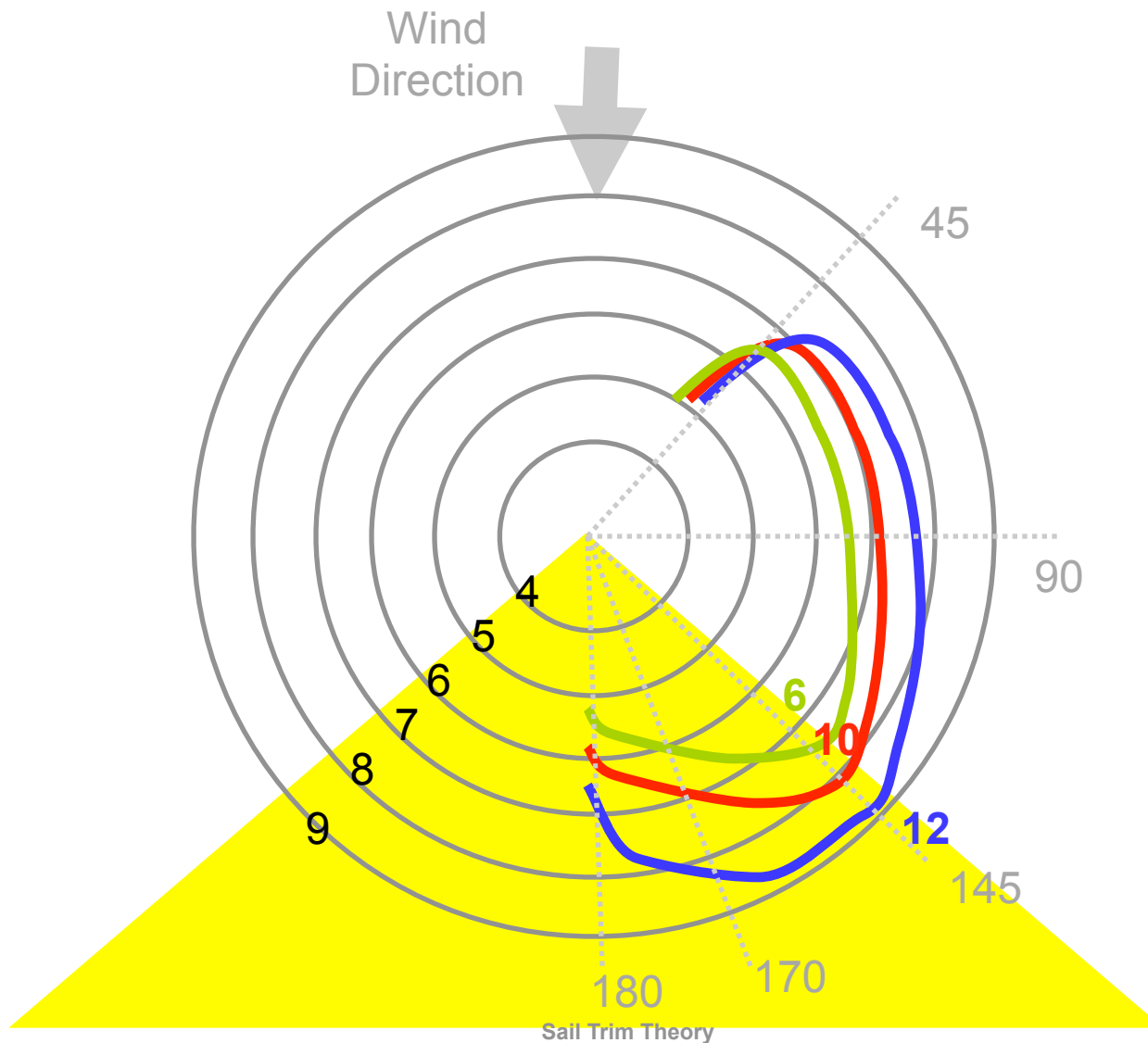
Created for MCSC by Nicholas Hayes, Team Syrena, US 46409

In a typical windward, leeward racing scenario, the idea is to maximize “velocity made good”, both upwind....



Note the slight difference in angle between too high and too low – this is the groove

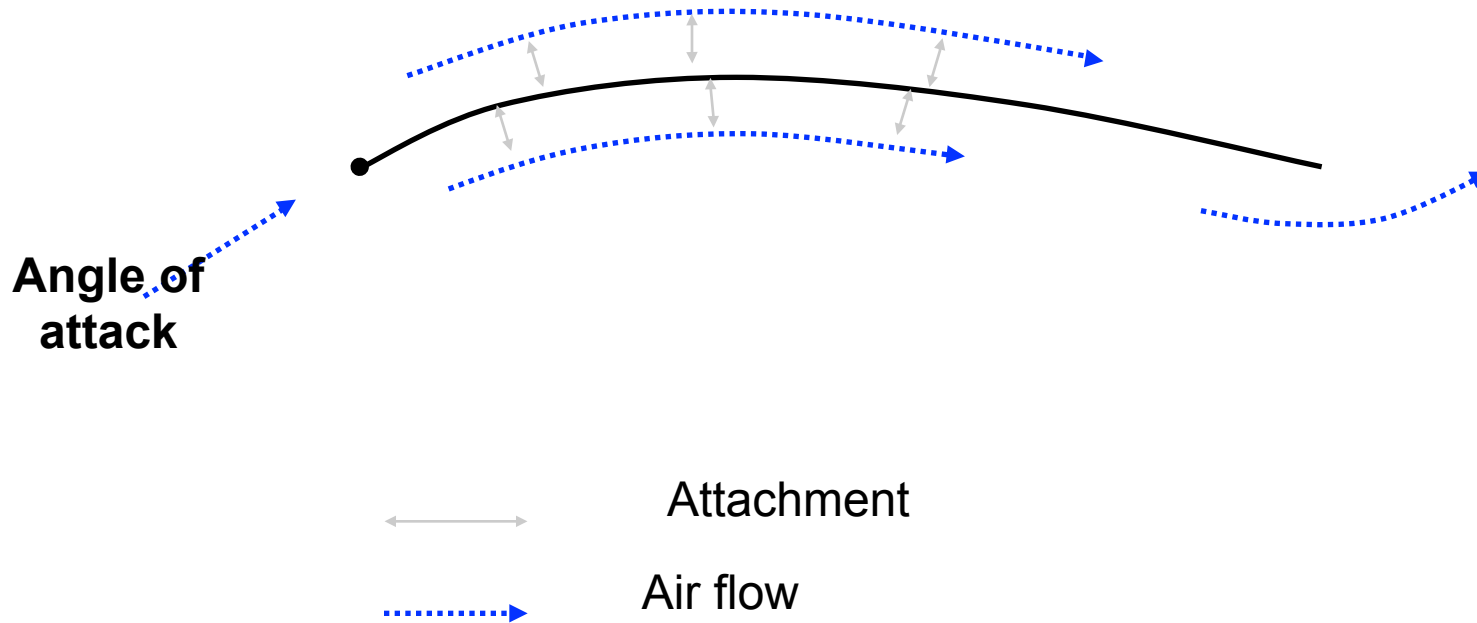
... and downwind



Sail Trim Theory

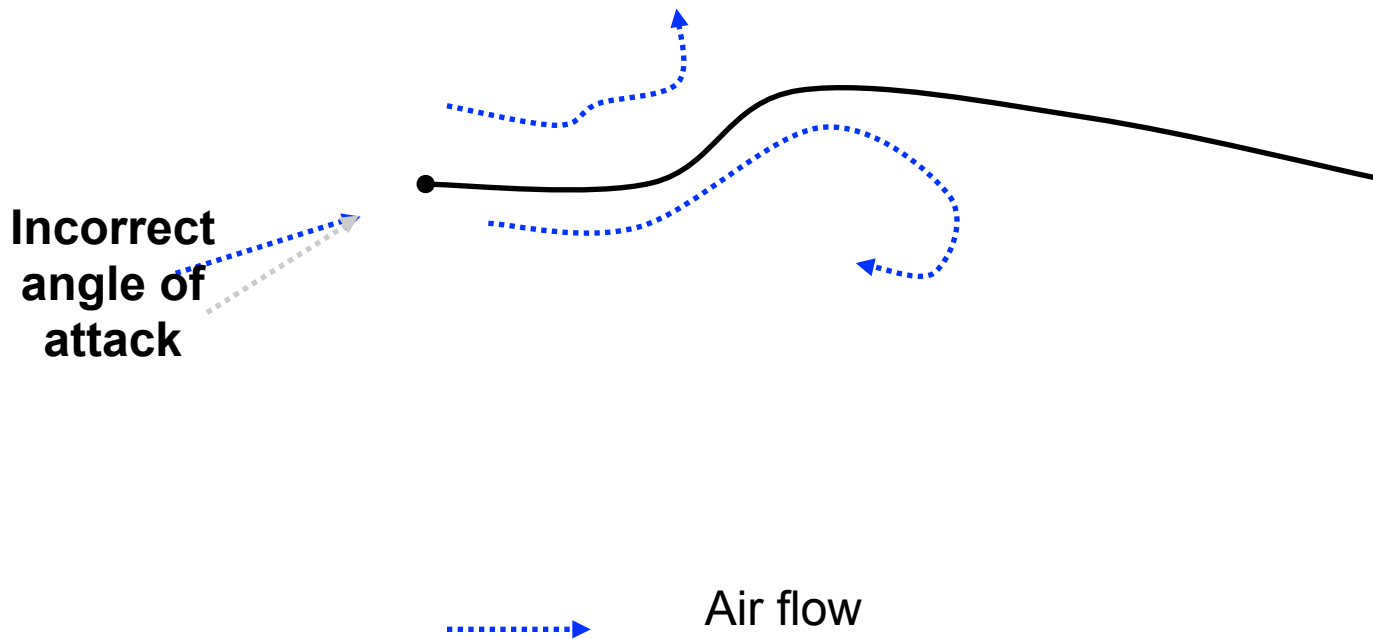
A sail “in trim” is in an the efficient state where air flow is undisrupted and remains attached to the foil

Sailtrim 101 Review



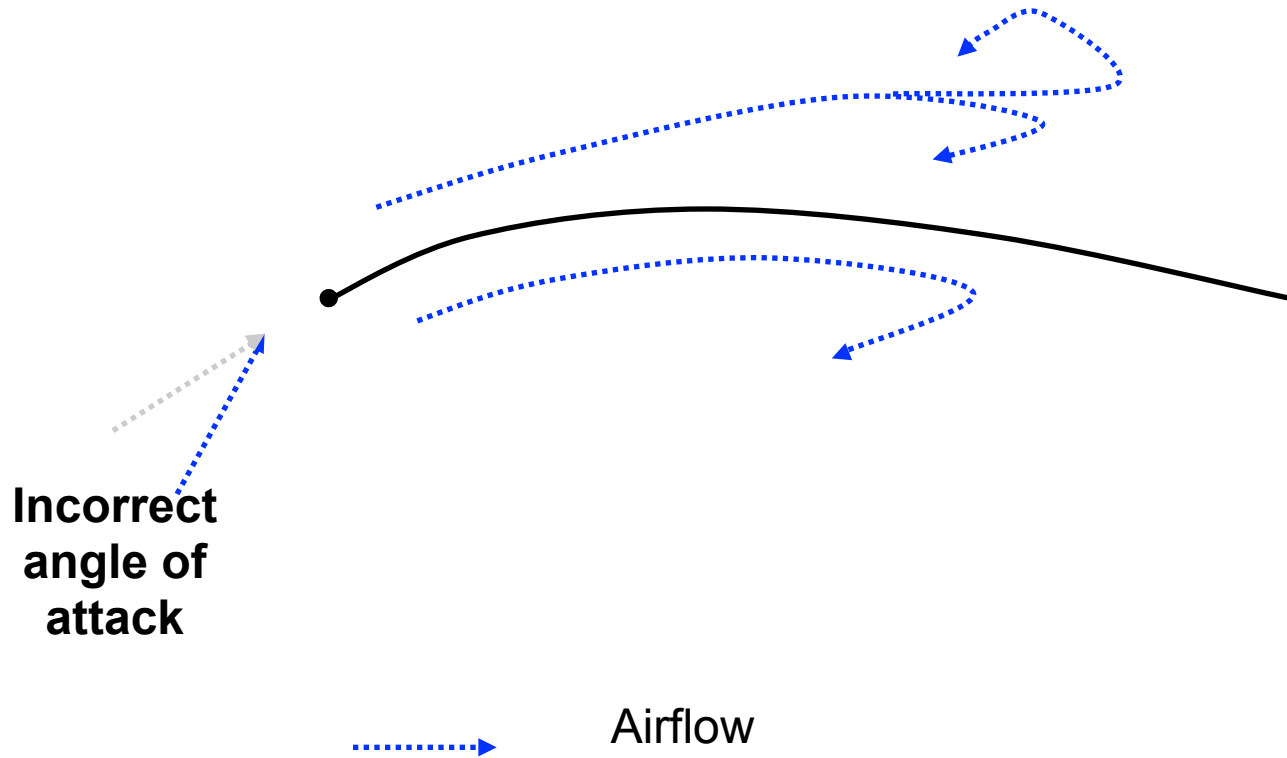
If the angle of attack is too tight, flow is disrupted and the sail will “luff”, resulting in less lifting force and a slow boat

Sailtrim 101 Review



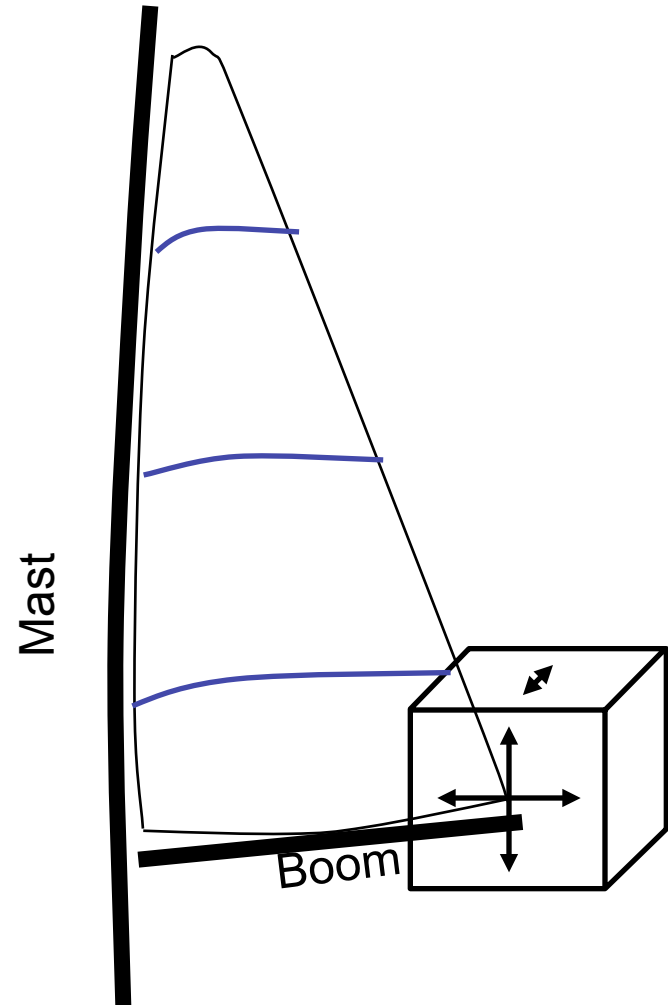
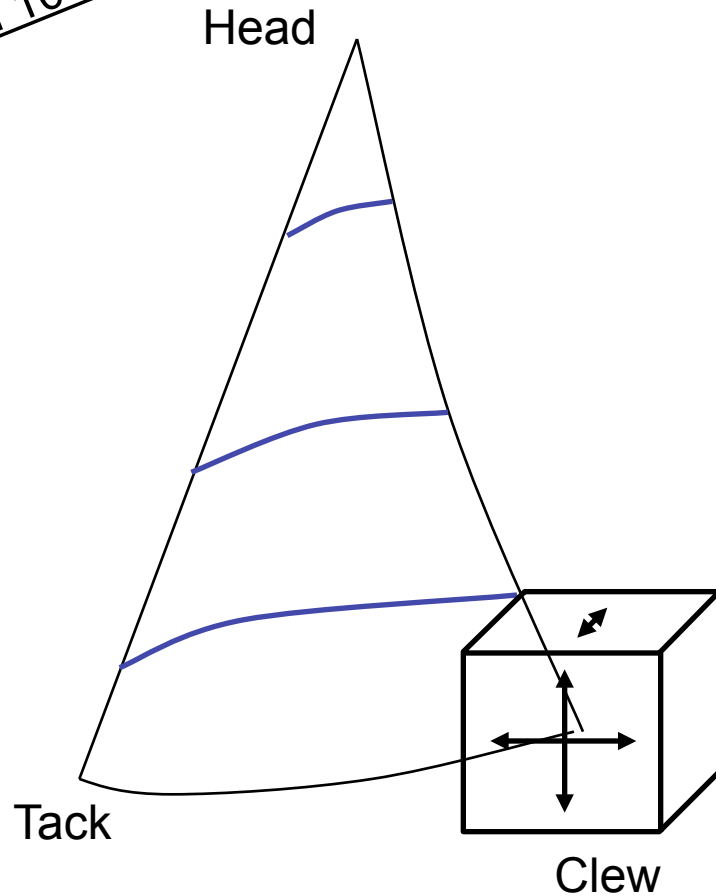
If the angle of attack is too great, (the sail is trimmed to tightly) airflow is disturbed, stalling the foil

Sailtrim 101 Review



The vast majority of sail trim is accomplished by moving the position of the clew in a 3 dimensional space

Sailtrim 101 Review



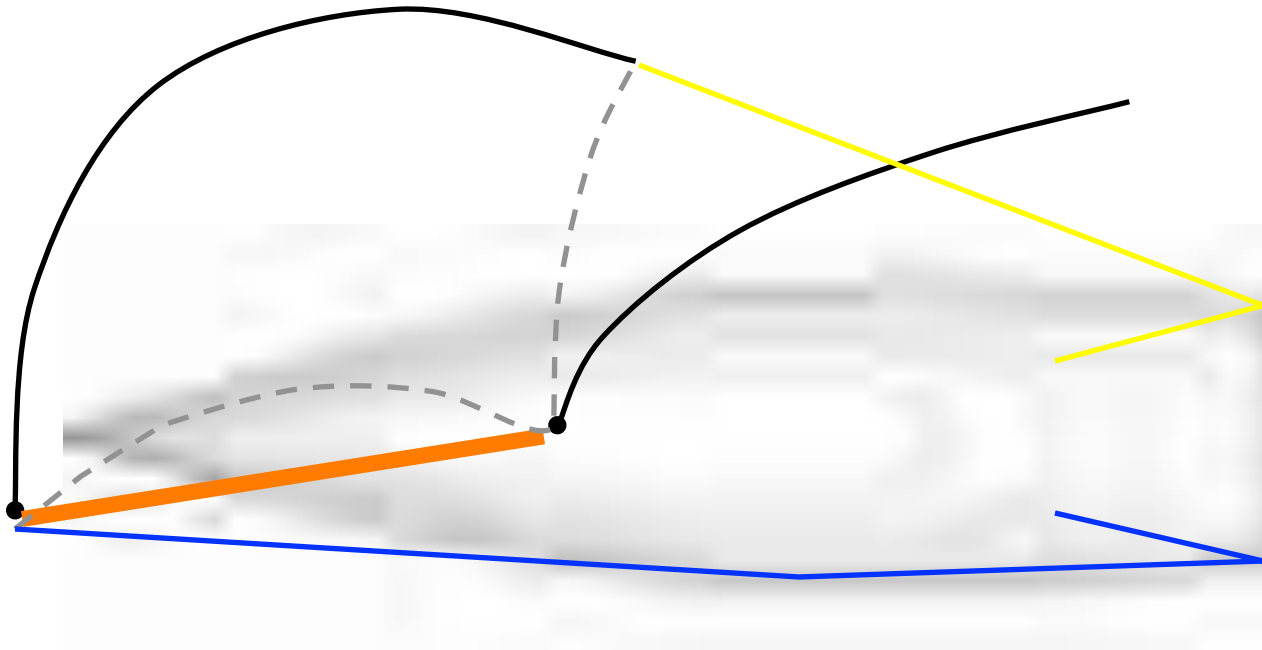
... the same principles apply to downwind sail trim, the topic of this course

- What makes it exceptional?
 - Both the clew and the tack are adjustable in the 3D box
 - The luff is free floating also!

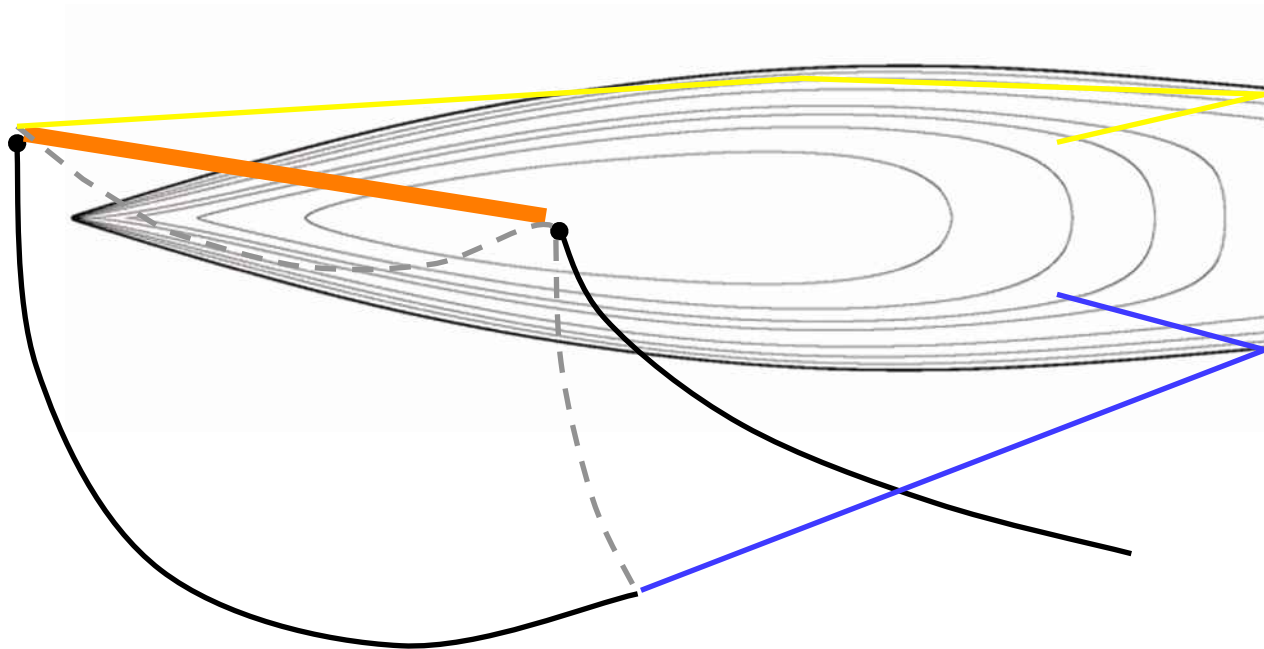


Source: Viper Productions

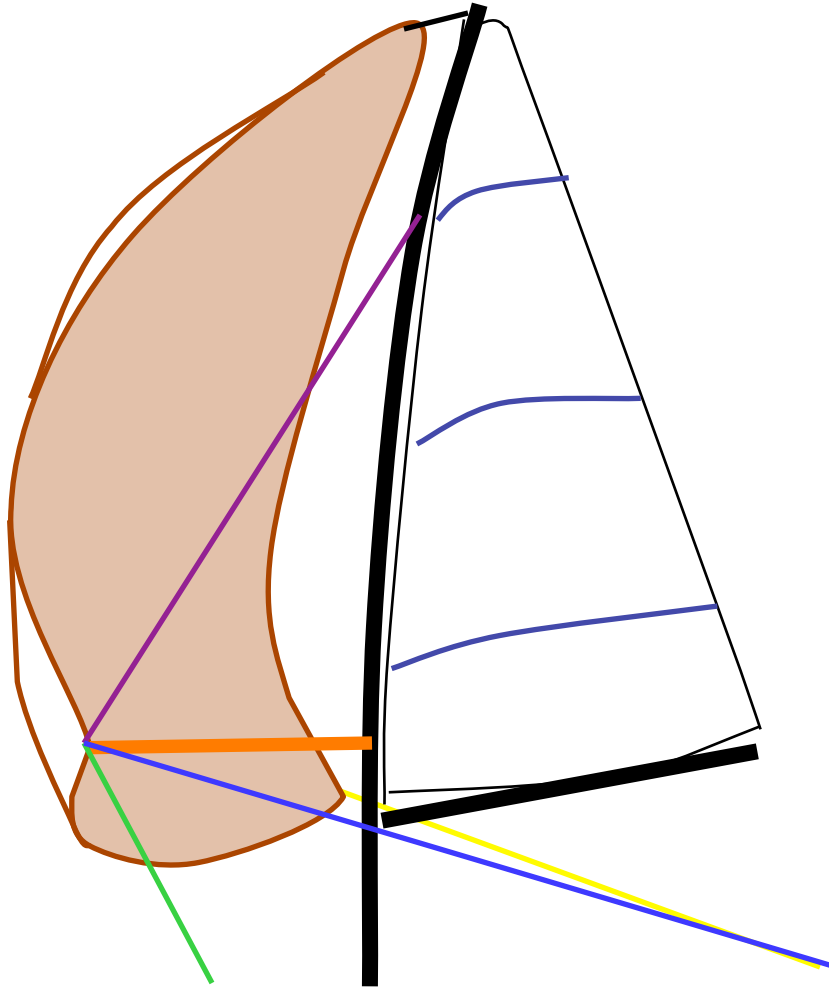
Spinnakers introduce a new controls, starting with the **guy**



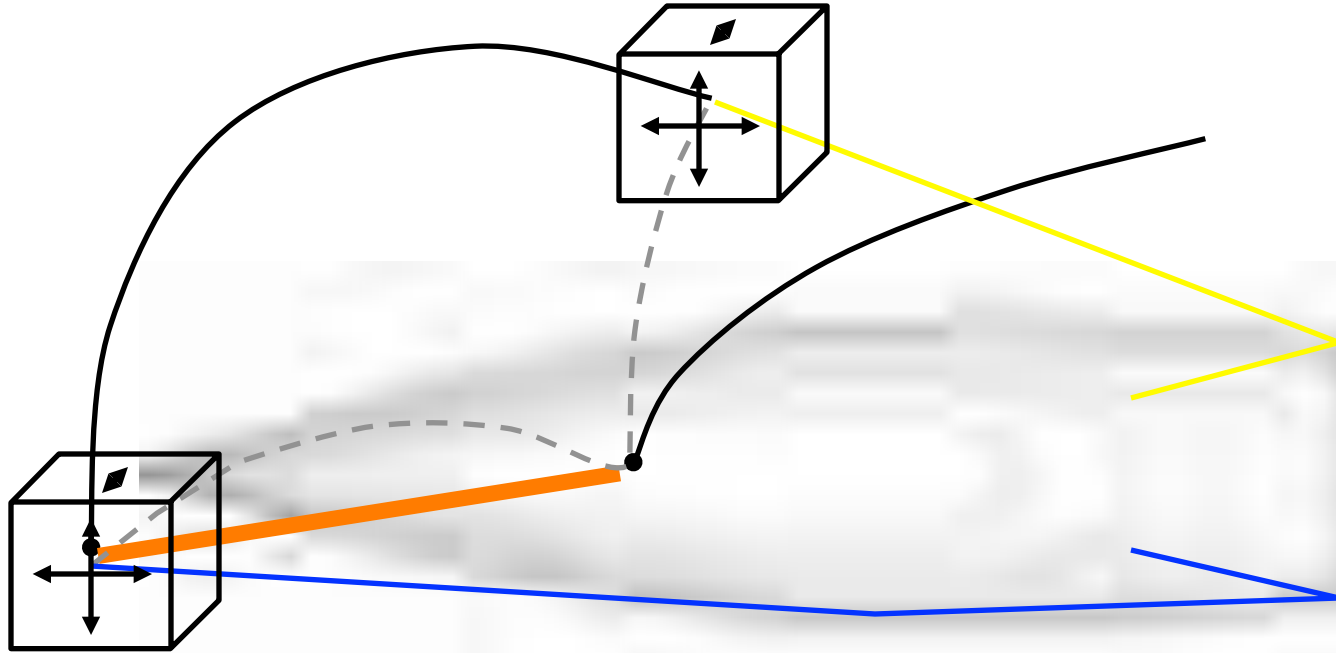
... which becomes the sheet on the opposite jibe



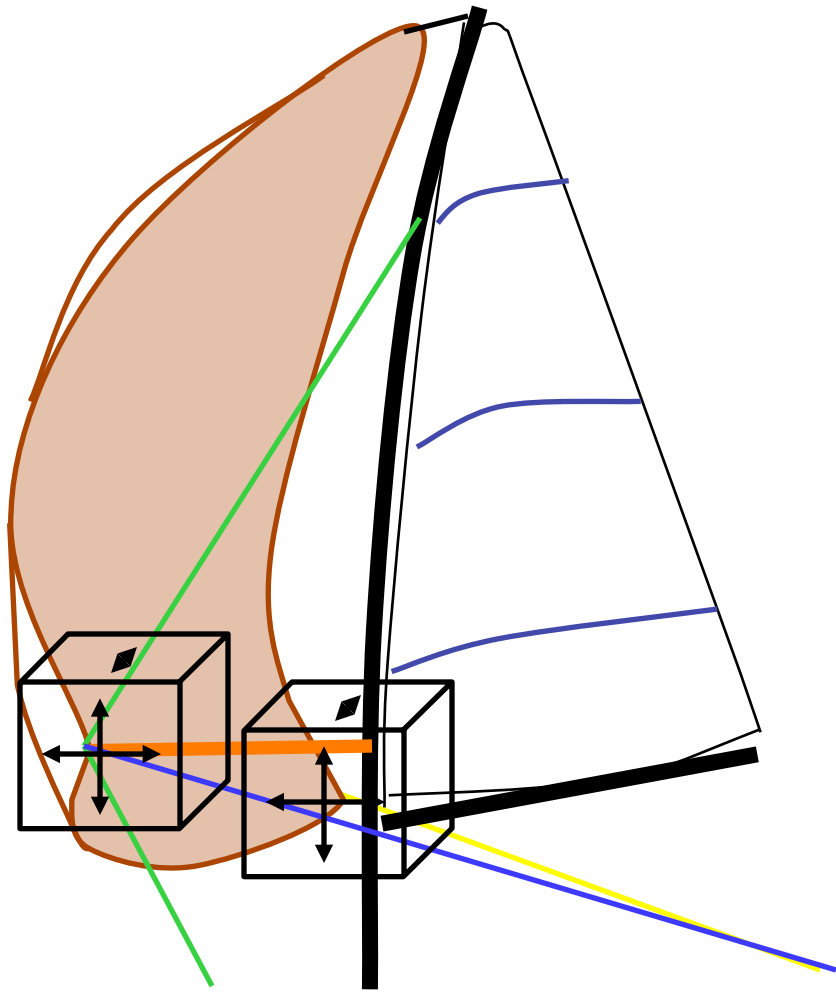
And the **topping lift** and **down-haul**, which, together with the **guy**, control the pole



These controls determine the tack position in space

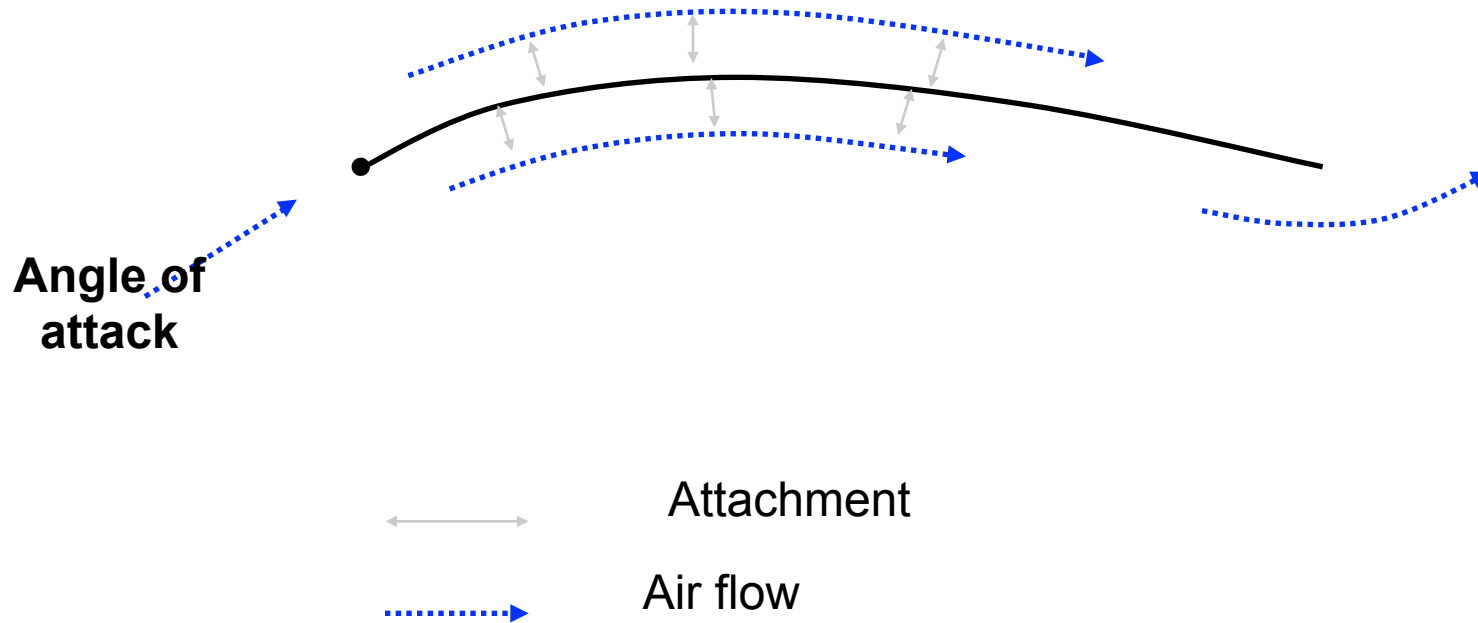


Vertical position is controlled with the topping lift and guy for the tack, and the sheet (and sheet angle) for the tack

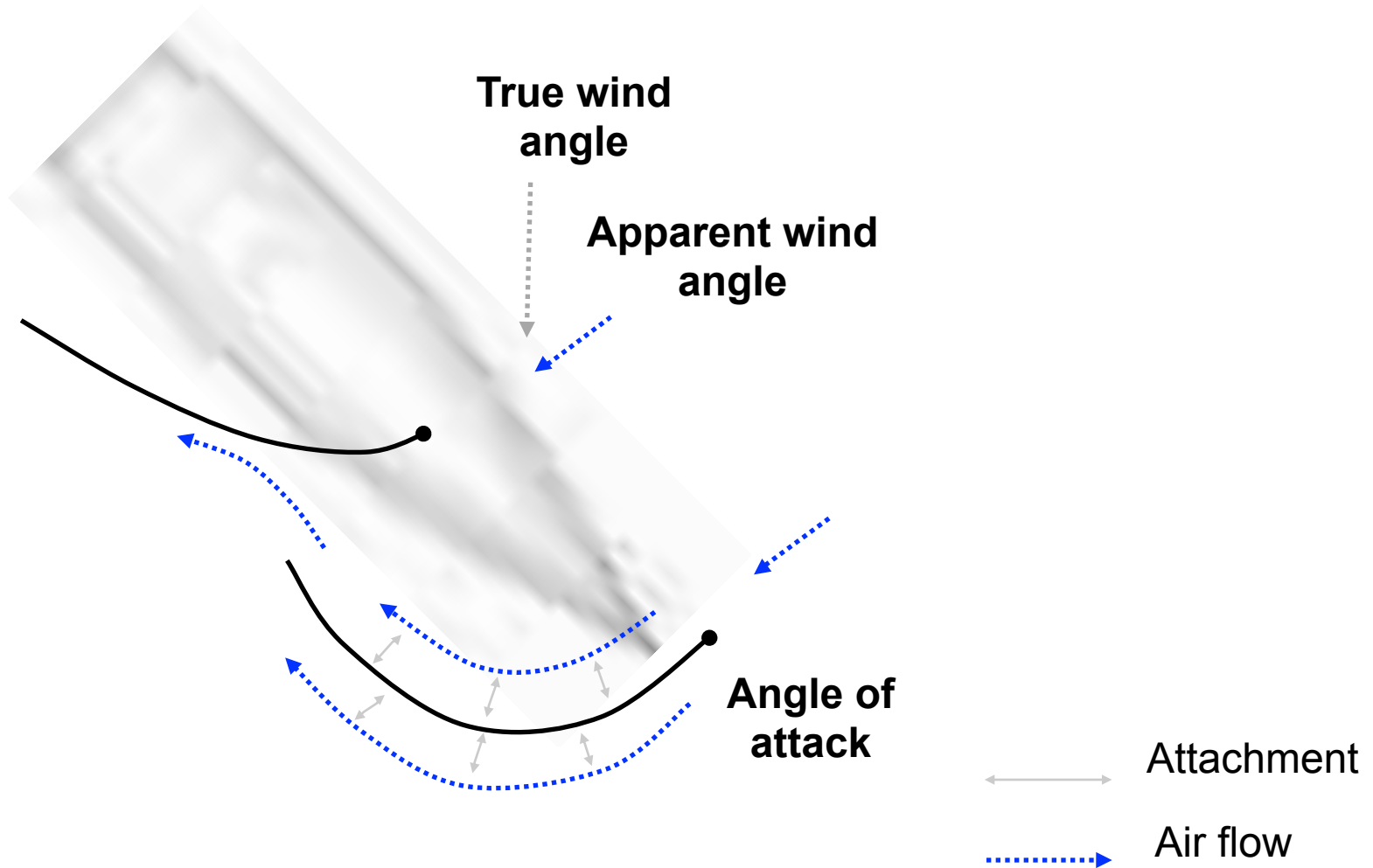


Remember, a trimmers job is to keep a sail “in trim”...

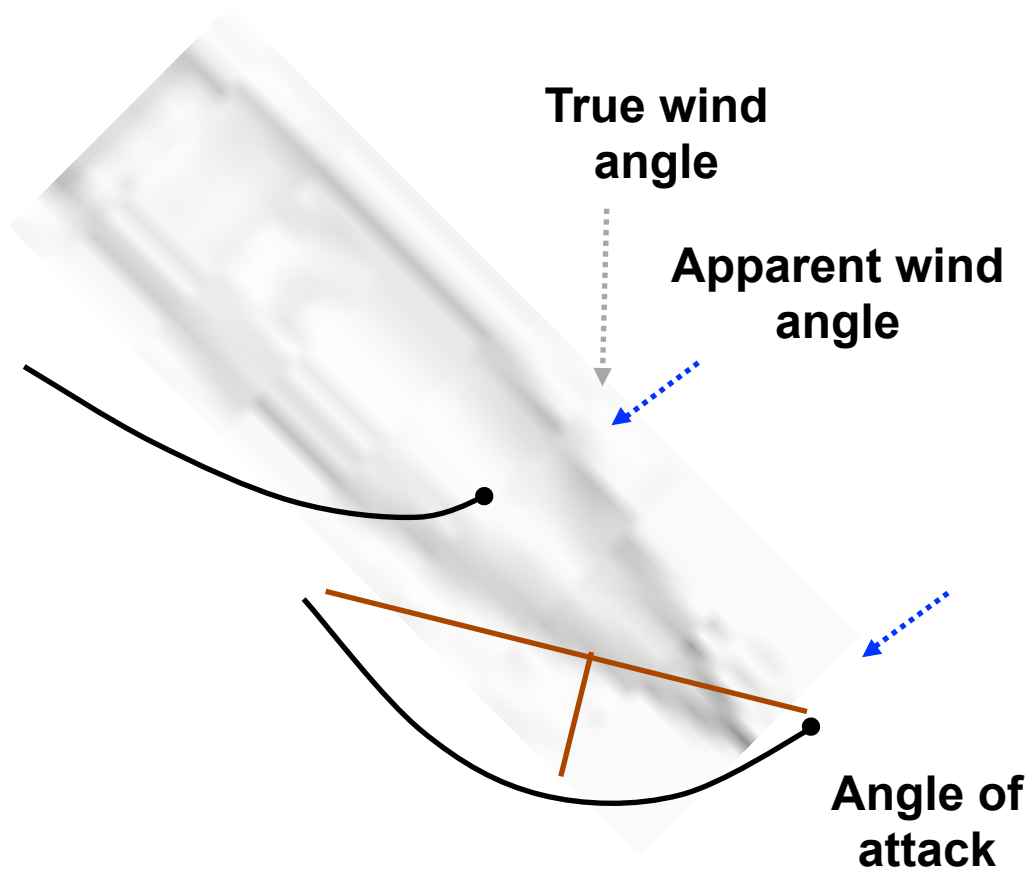
“In trim”: the efficient state where air flow is undisrupted and remains attached to the foil



... so downwind sail trim is *still* about maintaining “lift” through interacting sails (foils) in “trim”



Starting with fast feeling reaching trim, where the trimmer still focuses on angle of attack, **draft and shape (camber)**

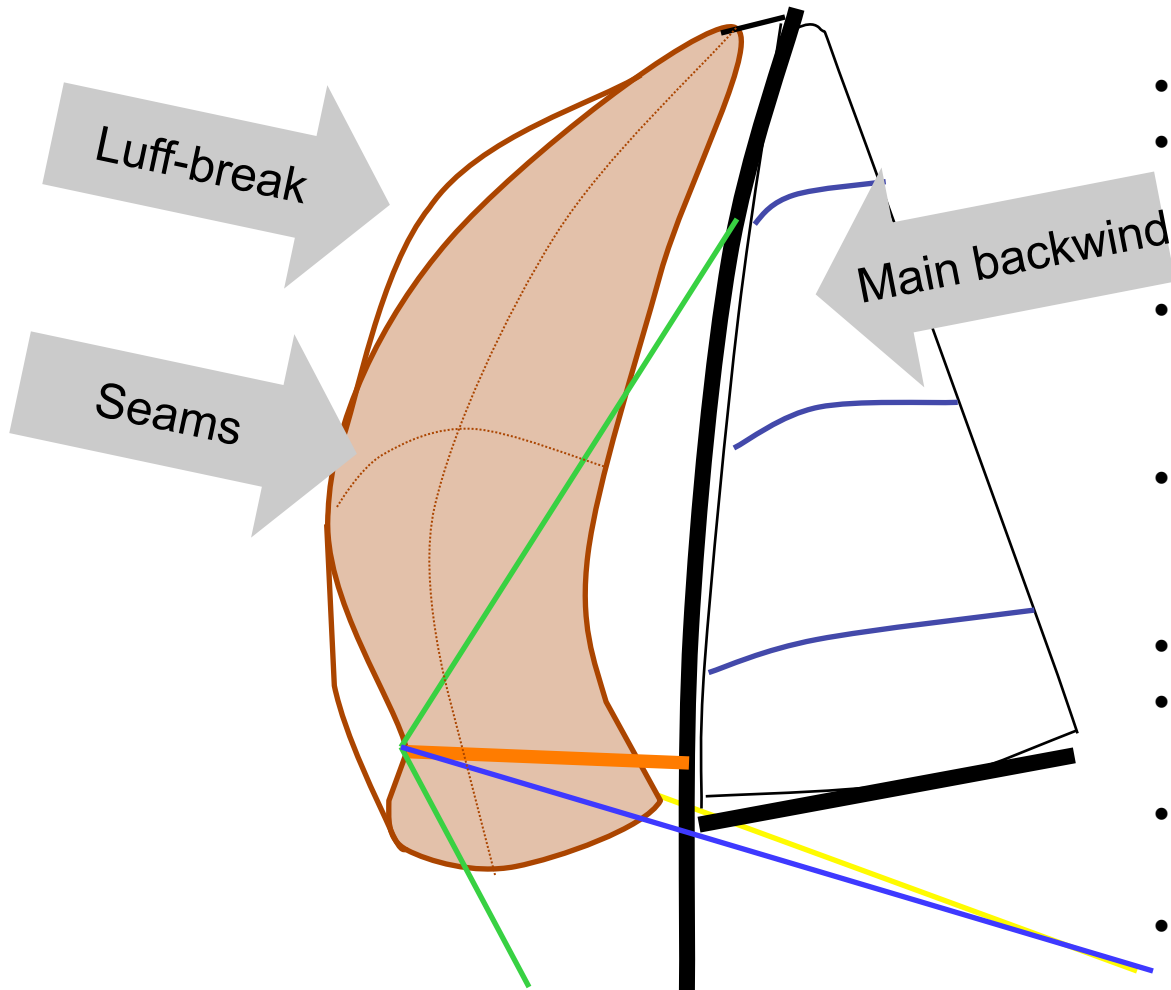




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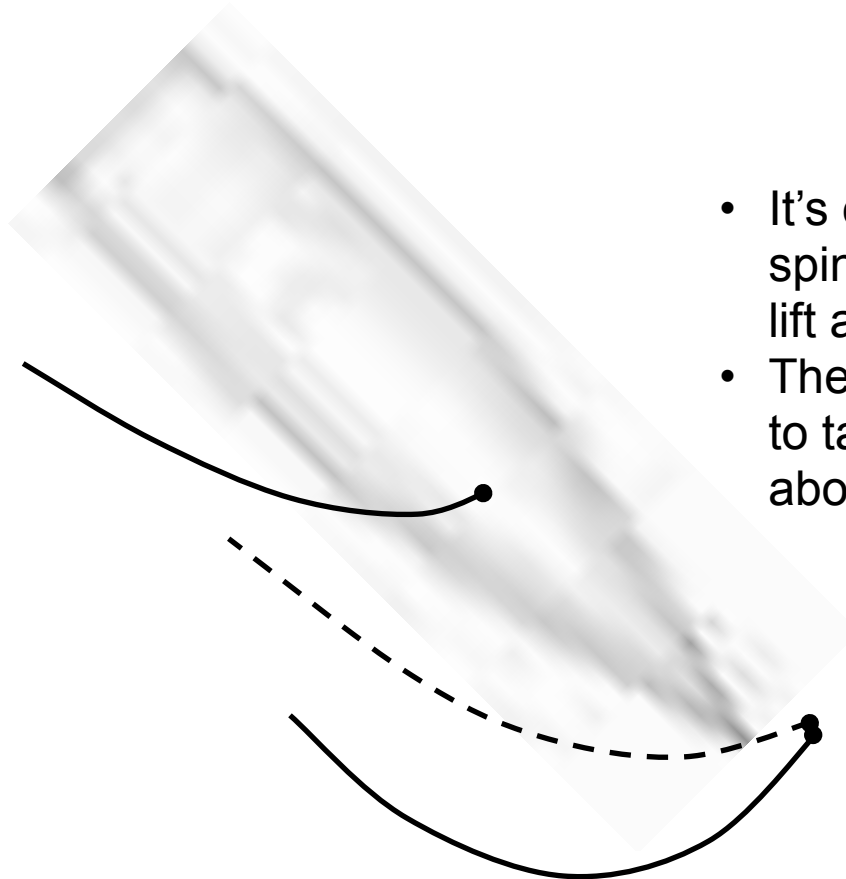


Spinnakers don't have tell-tales, but they still provide signals, and trimming follow basic rules



- Clews even...but:
- Look for draft to be towards the luff side of center
- *A high pole brings draft aft, low pole brings draft forward*
- Even luff break. High break, raise pole, low break, lower pole.
- Halyard at max hoist
- Center seam even with rig (from trimmer station)
- Pole straight (exposes the most sail area)
- Trim the main too

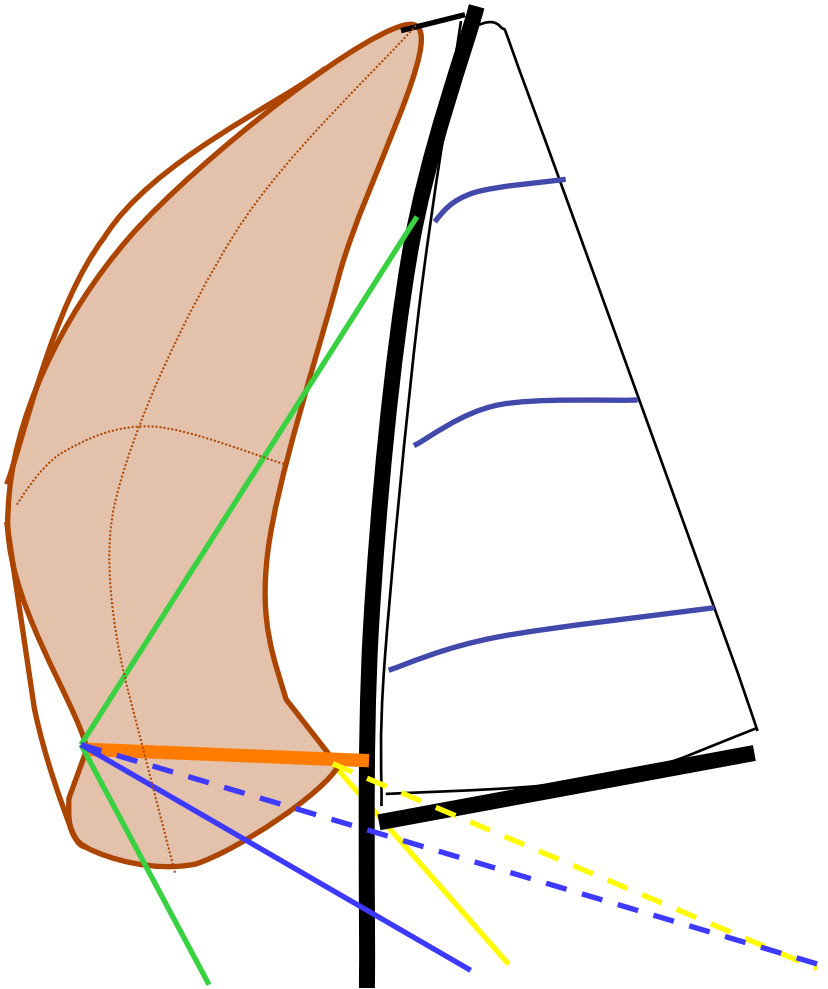
Most important, let it breath.



- It's easy to over strap a spinnaker, and by doing so, loose lift and power.
- The trimmer's main challenge is to take it to the edge – where it is about to break, but doesn't

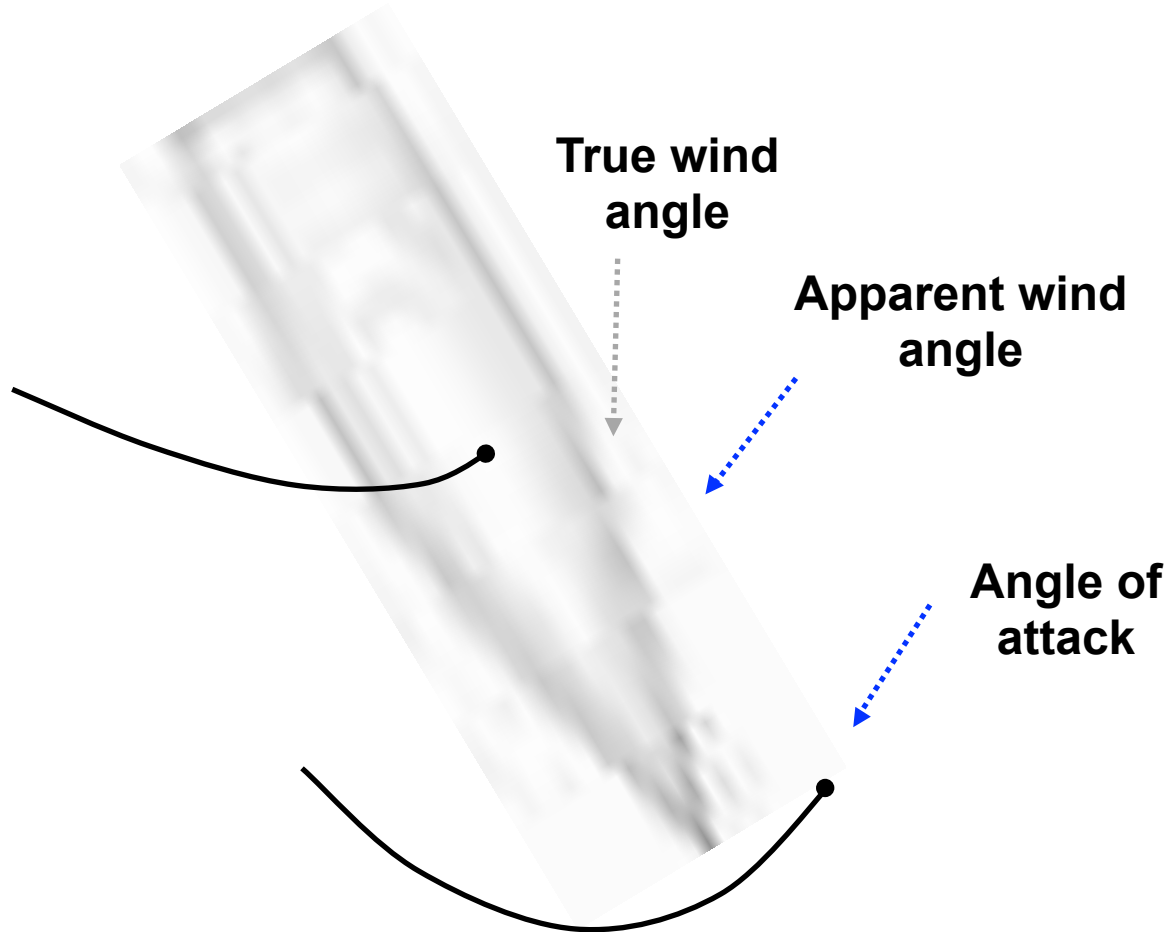


Take control in heavy air

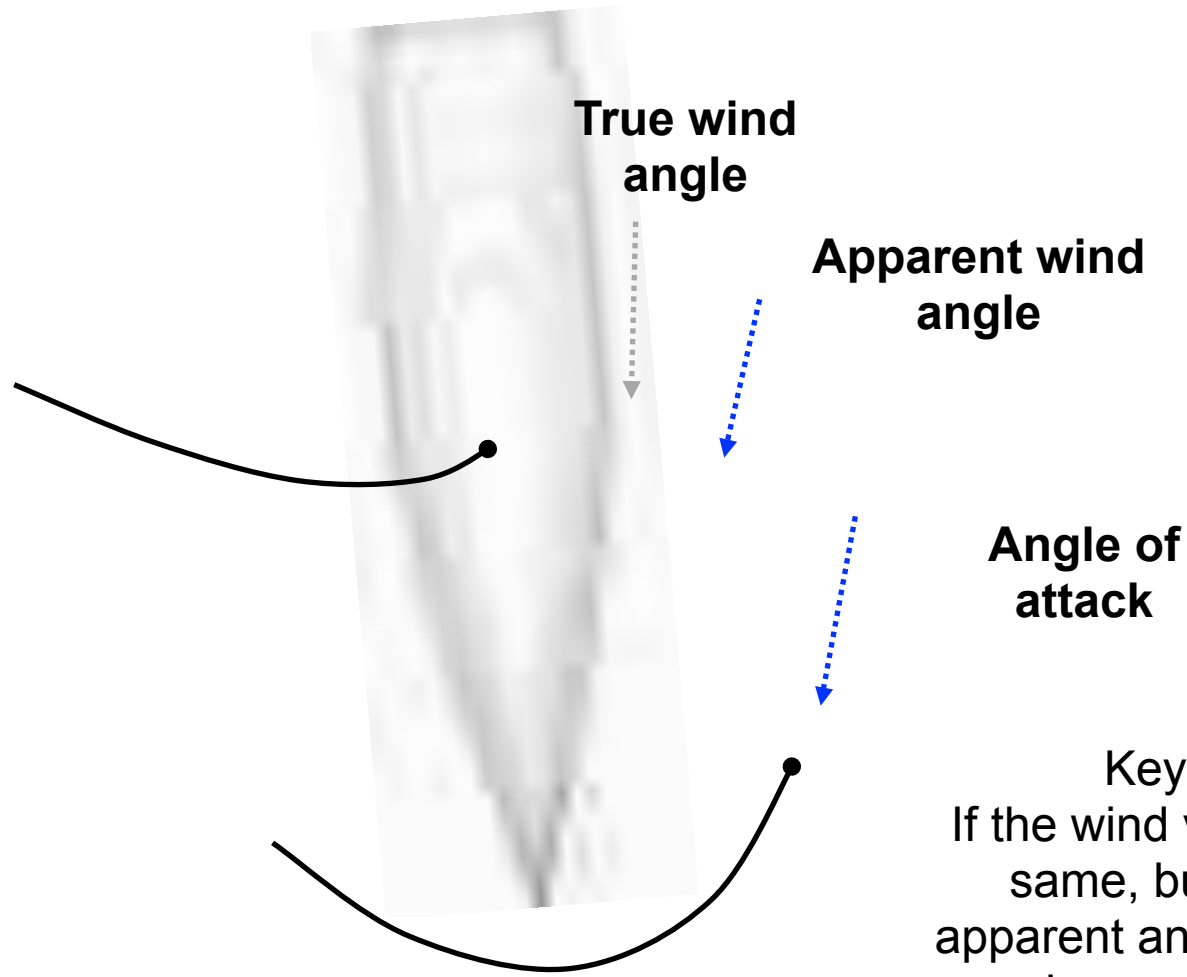


- Strap it down, by moving guy and sheet forward
- Over trim slightly
- Deeper downwind angles

By adjusting angle of attack and draft, the boat frees into deeper angles – by tightening the guy and easing the sheet

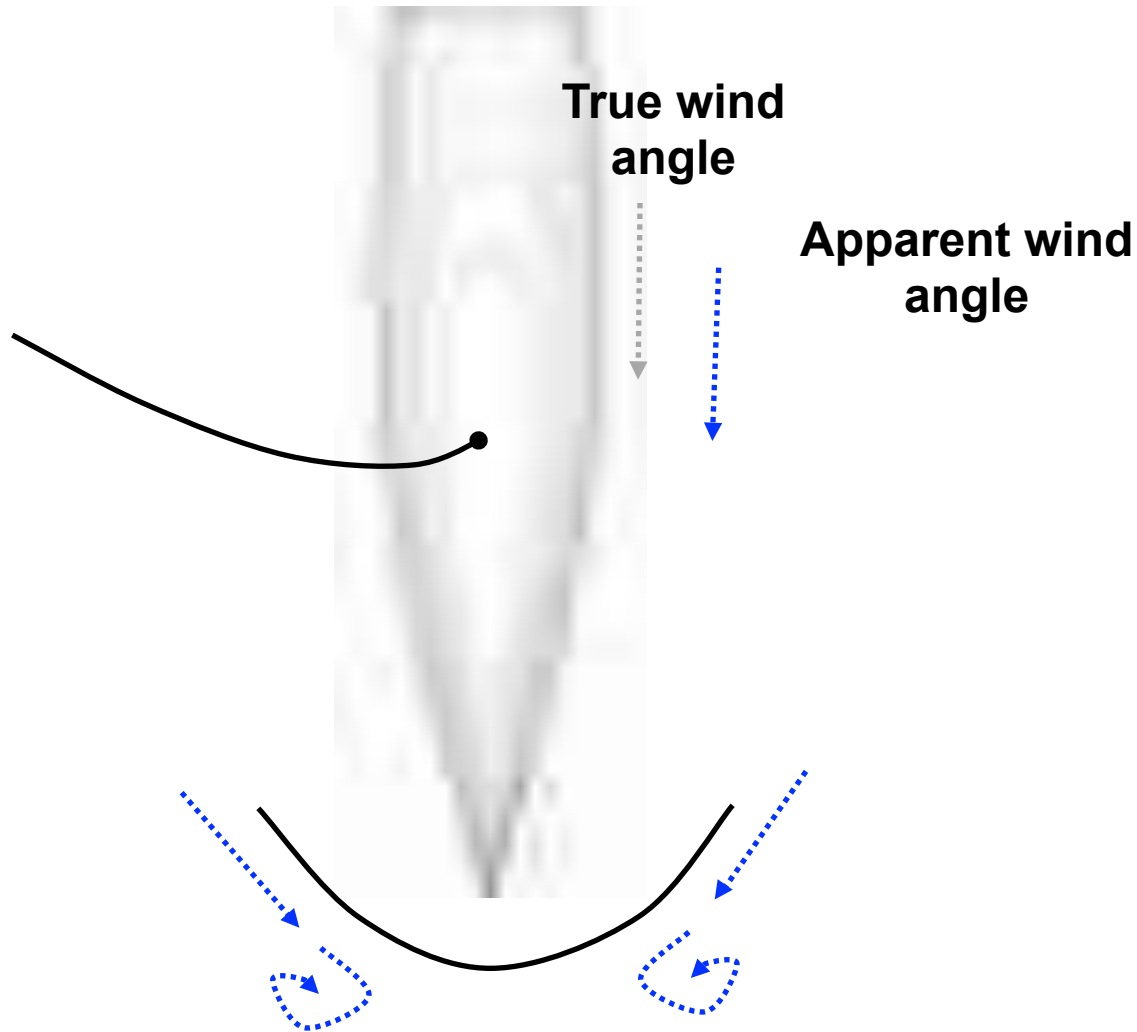


But there is a point of diminishing returns, where deep downwind angles are slow – because of lack of lift

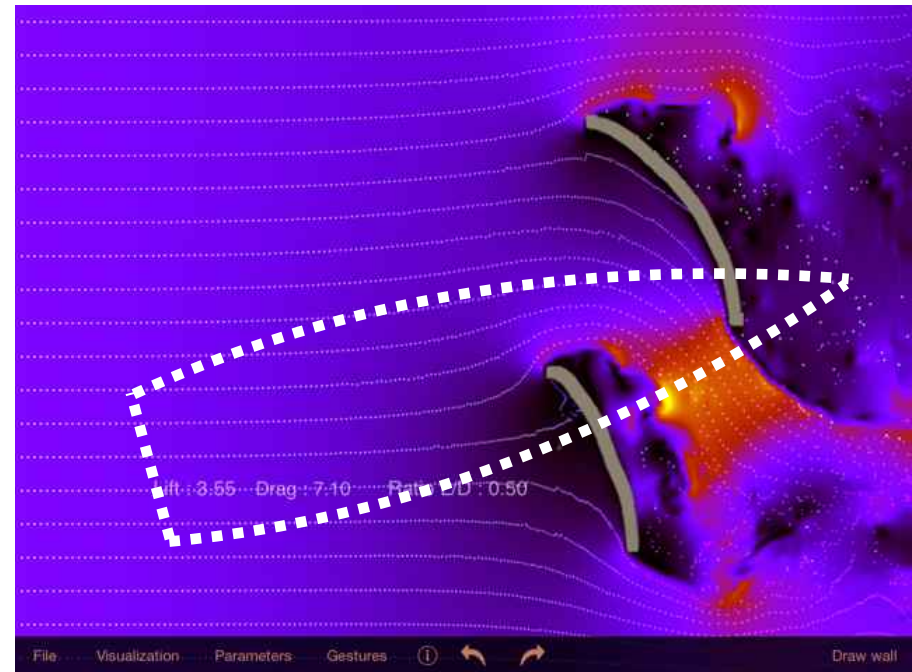
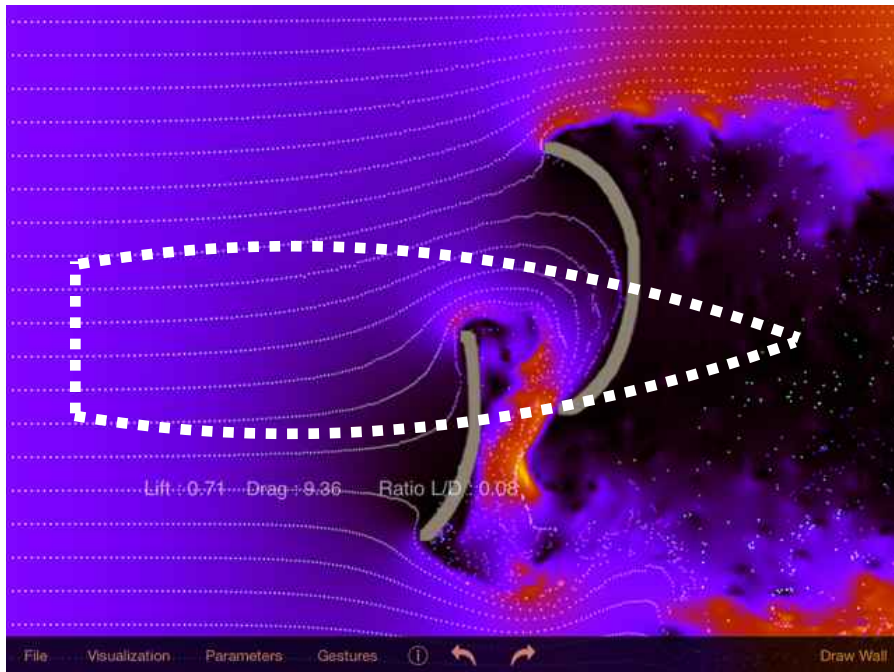


Key question:
If the wind velocity stays the same, but the true and apparent angles tighten, what happens to speed?

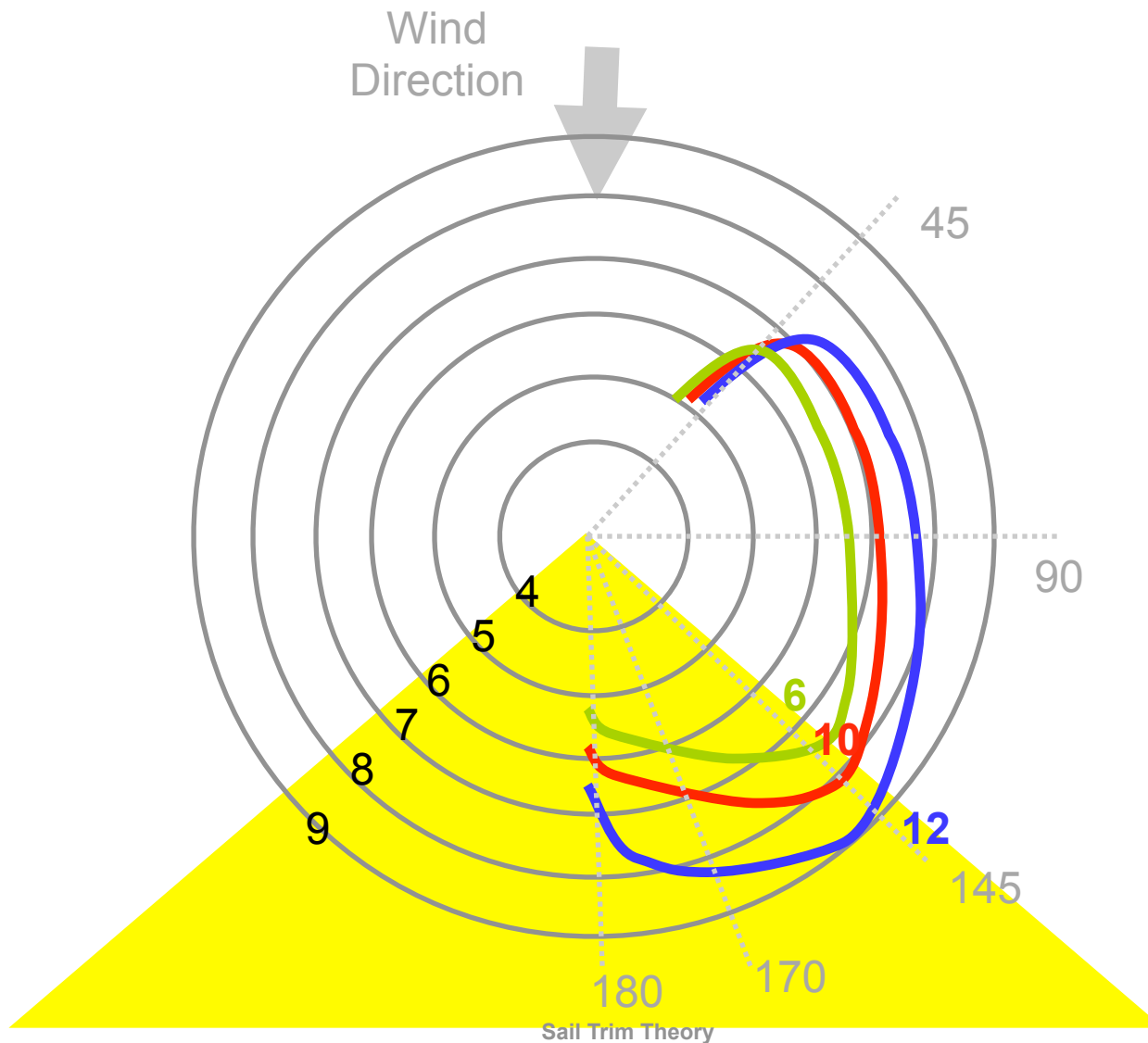
What actually happens is that lift is transferred to both luffs, but has to be disrupted behind



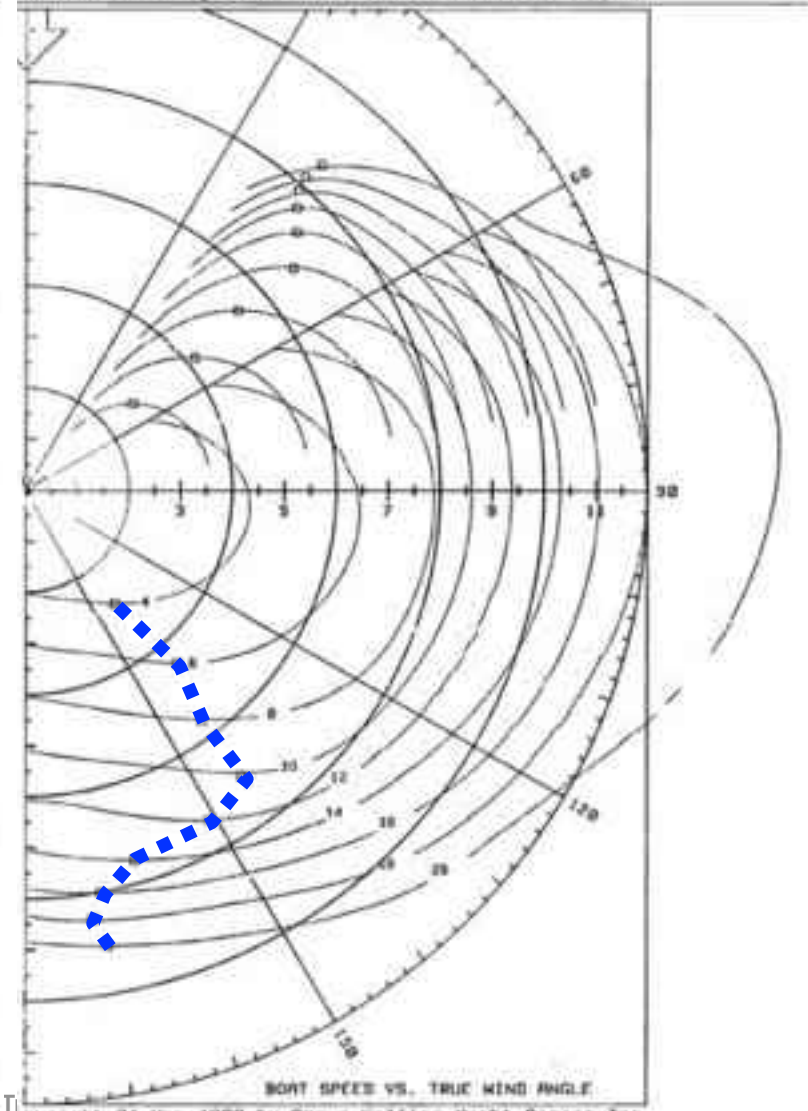
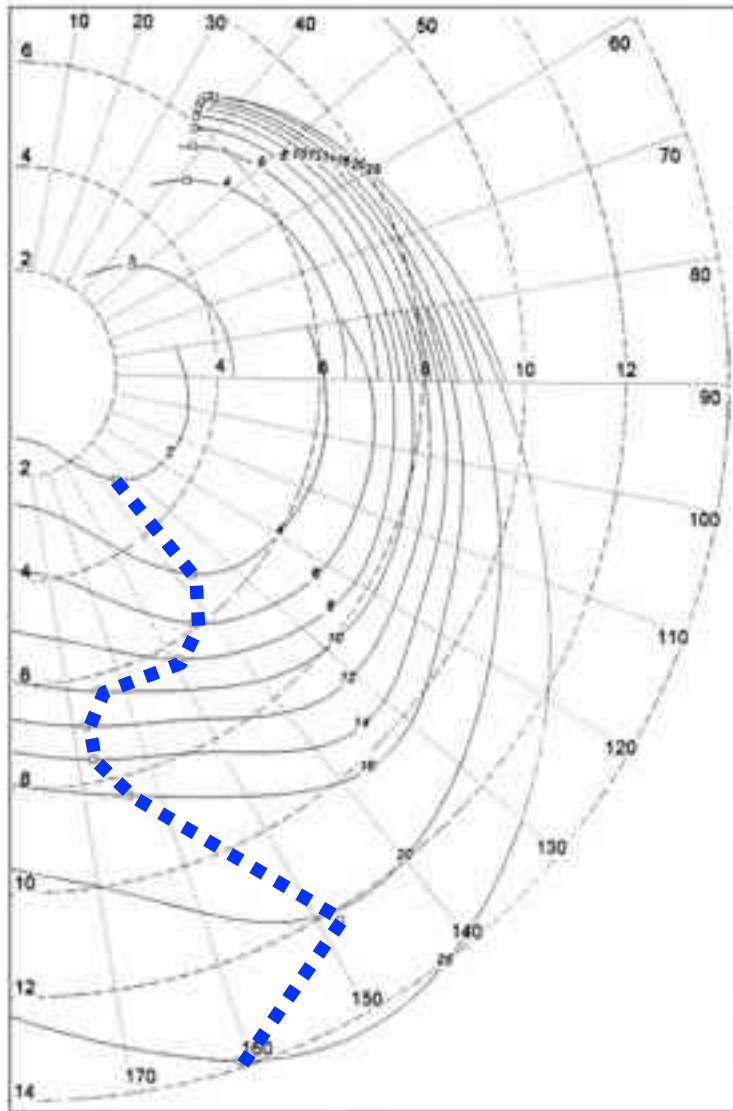
Why is dead down **not** a good idea?



...Polars show that reaching trim must be faster



Polars are boat dependent



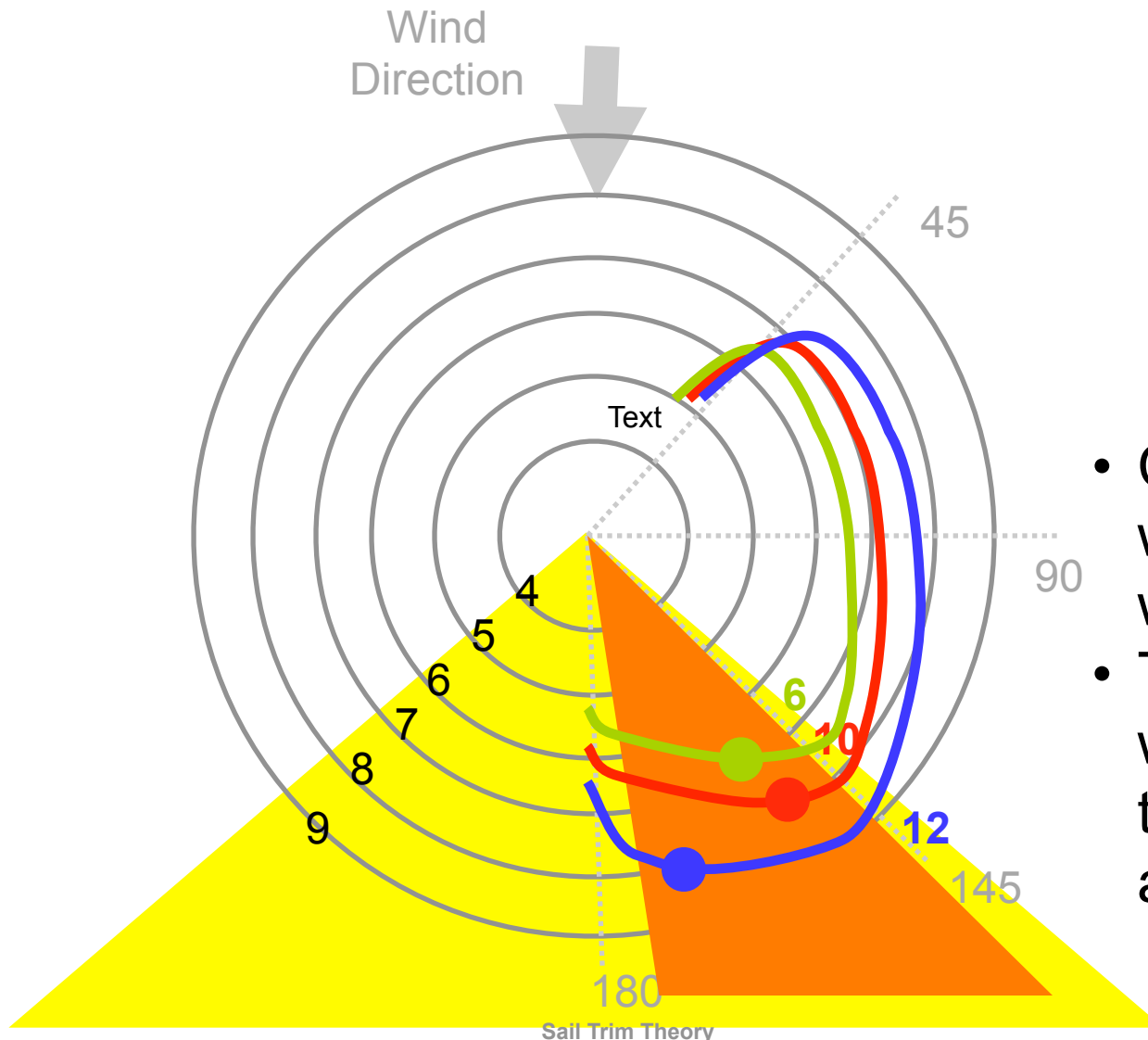
BOAT SPEED VS. TRUE WIND ANGLE

How to use Polars on board

SYRENA B-32 #46409

UP				DOWN			
TWS	BS	AWA	TWA	TWS	BS	AWA	TWA
3	2.6	26	24	3	2.4	85	136
4	3.6	27	48	4	3.3	84	135
5	4.4	26	46	5	4.4	80	136
6	5.1	26	45	6	4.9	85	136
7	5.6	25	43	7	5.3	95	140
8	6	24	41	8	5.6	102	144
9	6.1	24	40	9	6	110	147
10	6.2	23	39	10	6.2	117	150
12	6.4	23	38	12	6.3	143	162
14	6.5	24	37	14	6.8	152	165
16	6.6	25	39	16	7.6	146	161
20	6.8	26	39	18	10.5	120	150
24	6.9	28	40	20	13.4	95	135
28	7	29	41	20+	VF		

The trimmer and driver will take all – wind angle and velocity and boat characteristics, and find optimal angles



- Charts work in the winter
- The right way to do this is sail a lot

Links and sources

- Get the iPad Wind Tunnel App!
- More basics on foils:
http://www.uiowa.edu/~sail/skills/racing_basics/chap2.shtml
- In depth shape analysis:
<http://www.onemetre.net/>
- More on reading telltales:
http://www.wb-sails.fi/news/95_11_Tellingtales/Tellingtales.html
- If you'd like to join Syrena for a race to **see these concepts in action**, or if you'd simple like to share ideas, contact me at ndhayes1@gmail.com.
- This presentation is be available for download at <http://www.savingsailing.com>.