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| **Ship’s Head before Tacking.** | **Ship’s Head after Tacking.** | **No. of Pointe difference.** | **State of the Wind.** |
| S. S. E. 1/2 E. | W. 1/2 N | 11 | Fresh breeze. |
| W. by S. 1/2 S. | S.S. E. 1/2 E. | 9 | Light airs. |
| S. S. E. 1/2 E. | W. by S. 1/2 S. | 9 | Light airs. |
| W. 1/2 N. | N. by E. 3/4 E. | 91/4 | Moderate. |
| N. W. by X. | E. by N. | 10 | Fresh breeze. |
| S. S. E. | W. | 10 | Very fresh. |
| W 1/2 S. | S. E. by S. | 101/2 | Very fresh. |

The second and third observations in this table were made on the same day. Their correctness receives farther confirmation from the circumstance, that when the Acorn was on the larboard tack, with her head W. by S. 1/2 S, the Columbine, another corvette of the squadron, was on the Acorn’s beam, and it was ascertained from an observer on board the Columbine, she was lying about SE. by S. on the starboard tack ; she must therefore have been lying as near the wind as the Acorn. The wind was very light, the rate by log being only one knot two fathoms ; the angle of lee­way, as observed by the wake, was seven degrees. It is desirable that similar observations should be made for all classes of ships ; the circumstances of sea, wind, and rate by log, should also be noticed, that when any comparison is in­stituted, a due allowance may be made for their influence.

We have seen that the velocity of the ship depends on the strength of the wind. Writers on naval architecture have advanced various opinions as to the practicable limit to the velocity of a ship, in comparison with that of the wind. Bouguer endeavours to prove that the velocity of a fast-sailing ship is, when going nearly before the wind, about 2/7ths of the velocity of the wind, and that merchant- ships seldom attain to more than one fifth of its velocity ; but he considers it not impossible that fast-sailing frigates may arrive at a velocity about equal to half that of the wind. Don Juan objects to Bouguer’s limit, as too restrict­ed ; he corroborates the opinions he advances by the re­sults which he has deduced from experiment and observa­tion on the actual performances of ships. He says that fast-sailing vessels acquire a velocity nearly cqual to that of the wind, even when going before the wind. The nearest approximation to this velocity which he observed was as twenty-one to twenty-three ; the average conclusion at which he arrives is, that when the course of the ship and the direction of the wind nearly coincide, the velocity of the ship is from 2/3ds to 20/27ths of that of the wind.

But in oblique courses it is very possible for the vessel to acquire a velocity even greater than that of the wind, if we admit the conclusions of Don Juan to be correct. The reason of this will appear evident on a very slight consider­ation. The velocity with which the wind acts on the sails after the ship has acquired motion is only its relative velo­city, that is, the excess of its actual velocity above the ve­locity which the ship has acquired in the direction of the wind. Now, when the directions of the wind and of the course of the vessel coincide, this relative velocity of the wind is only the difference between the actual velocities of the wind and of the vessel ; but when the course of the vessel is oblique to that of the wind, the relative velocity of the wind is the difference between the actual velocity of the wind and that part of the velocity of the vessel which can be resolved in the direction of the wind. Robison, in the article on Seamanship, says, that when the sails are square to the keel, and the wind right aft, the ship’s velo­city is in direct proportion to the relative velocity, and to the square root of the surface of the sails ; therefore, he says, “ in order to increase the relative velocity by an in­crease of sail only, we must make this increase of sail in the duplicate proportion of the increase of velocity.”

When the sails are oblique to the keel, he says “ the velocity of the ship is proportional to √ S ∙ V ∙ sin. *a ;* that

is, directly as the velocity of the wind, directly as the sine of the absolute inclination of the wind to the yard, and di­rectly as the square root of the surface of the sails.” This agrees with the conclusions that have been already drawn ; and it is evident that, the velocity of the wind remaining the same, and the sine of the angle of inclination of the wind to the yard becoming equal to the radius, or if the whole force of the wind act in a direction perpendicular to the yard, the velocity of the ship will depend on the area of the sails set, and may therefore, even theoretically speak­ing, be increased without limit.

From all the conclusions which have been deduced in the course of these remarks on the mutual action of the wind and water on a ship, it appears evident that the de­gree of perfection in the performance of a ship, whether with reference to her motion round an axis of rotation, or to her course through the water, depends very greatly on the suitableness of the disposition and proportion of the sail to the form of the vessel. That there should be an analogy between these elements is evident ; and experience and rea­son alike show’, that the more nearly the rig of a ship is suit­ed to the qualities of her form, the more nearly do her per­formances approach to perfection. Vessels which, from the proportions and form of their bodies, are capable of ly­ing near the wind, and of maintaining a weatherly course, cannot evidently be made to develope these advantages of form to their full extent, unless their rig is also appropriate for rendering such qualities available ; while vessels of which the form and proportions are not so adapted for sail­ing in oblique courses, by having a rig peculiarly adapted for such forms and courses, may even be unable to acquire the degree of advantage in these oblique courses that they would otherwise be capable of attaining, and at the same time fall far short of the velocity of which they might be capable in direct courses. In fact, in order that a ship may sail well, her form must not only be adapted for velocity and quickness of manœuvre, but her rig must be adapted to her form ; and she must be commanded by an officer com­petent to develope the advantages of both form and rig.

The first of the following tables was compiled from a work, Scales of Displacements, &c. by Mr Parsons, a mem­ber of the late School of Naval Architecture. The second was formed by Mr Henwood, another member of the same establishment, and published by him in an article in the United Service Journal. The third was by Mr Fincham, the master shipwright of Her Majesty’s dock-yard at Chat­ham, and published in the Papers on Naval Architecture.

These tables compose together a valuable analysis of some of the elements of construction of our ships of war, and, within their limits, cannot fail of proving useful to the naval architect ; because, as we have before said, naval ar­chitecture is a science of comparisons and analogies. To the reader of the foregoing pages of this article it need scarcely be observed, that there yet remain many difficulties opposed to its being perfected, and that these can only be removed by a rigorous course of inductive investigation applied to the results of a patient, an attentive, and, above all, a com­petent comparison of the reported qualities and perform­ances of ships, with an analysis of the elements of their de­sign. When the School of Naval Architecture shall be re­established, as it most assuredly will be, the exercises of the students in their calculations, and their experiments on ships, may be made available to this end, by gradually ob­taining the preliminary analysis of the whole navy of Eng­land ; a work of very far too great labour for any thing but the combined endeavours of many individuals to accom­plish ; and when accomplished, of too vast extent, and of too varied and too conflicting results, to he grappled with by any but by a mind apt to conceive, to collate, and to generalize, and competent to submit these generalizations to the ordeal of strict mathematical investigation.