Japanese Trains, the Kingfisher, and Shock Waves

As humans, we are constantly immersed in a gaseous substance that we call air. This gas – comprised of oxygen, helium, and carbon dioxide – has density. In other words, it has weight and volume. Due to this fact, an amazing phenomenon, known as wind resistance, occurs when any large object moves at any given speed. The faster the object is moving, the greater the wind resistance. You have probably felt the effects of wind resistance when in close proximity to a vehicle traveling fast enough to create a small breeze once it has passed. This effect, sometimes known as a vortex, is the result of the air mass "accumulating" in front of the vehicle as it moves down the road.

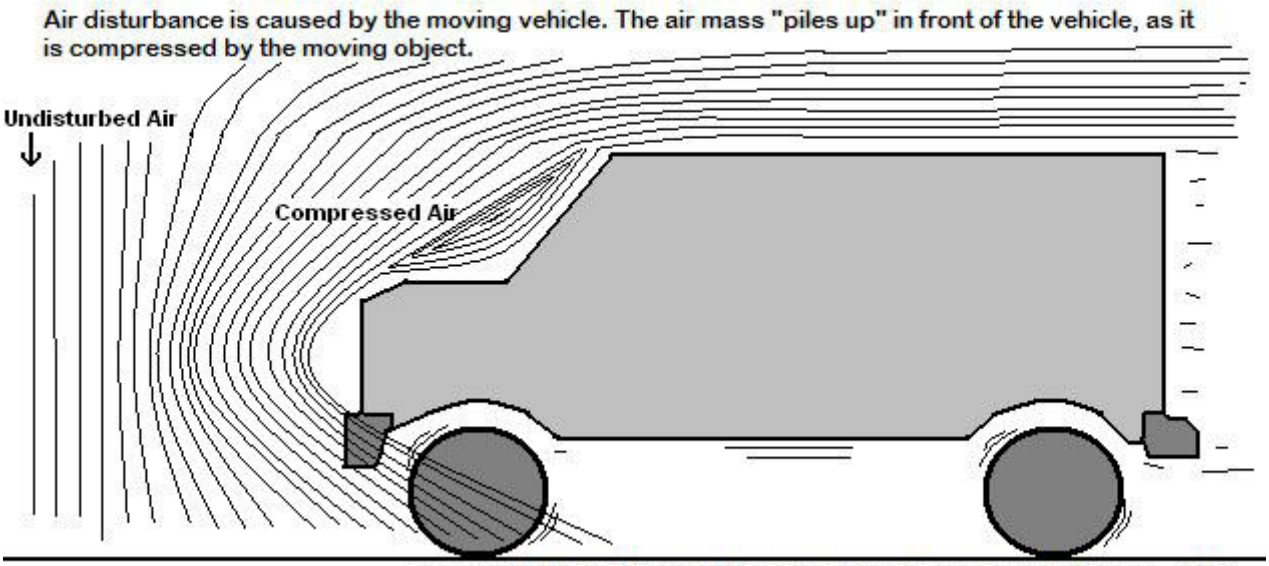


Image Credit: Caleb Kautt, Creation Evangelism Tools Ministries, 2012.

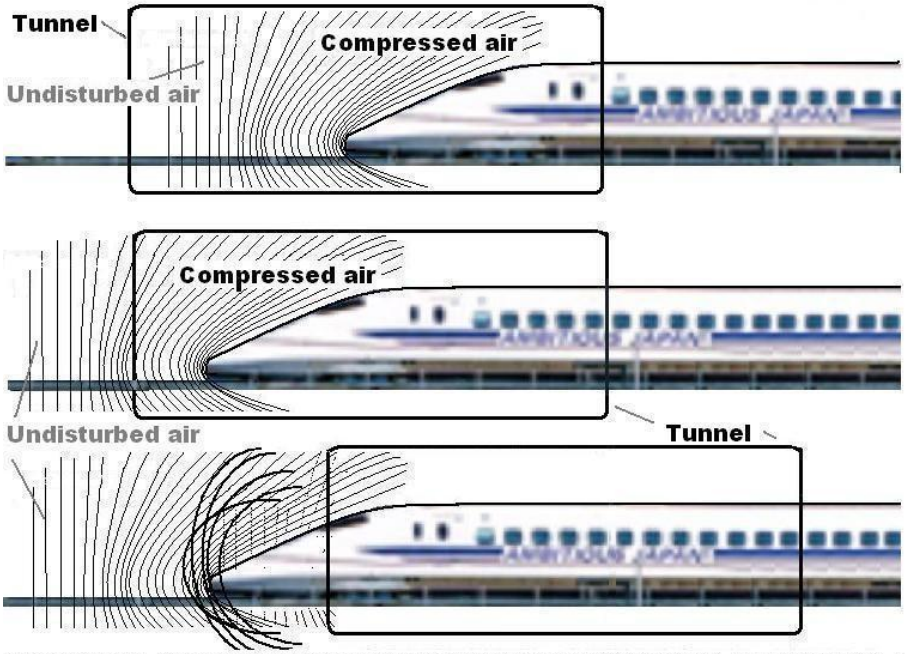


Image credit: Japan National Tourist Organization; and Caleb Kautt, CET Ministries, 2012

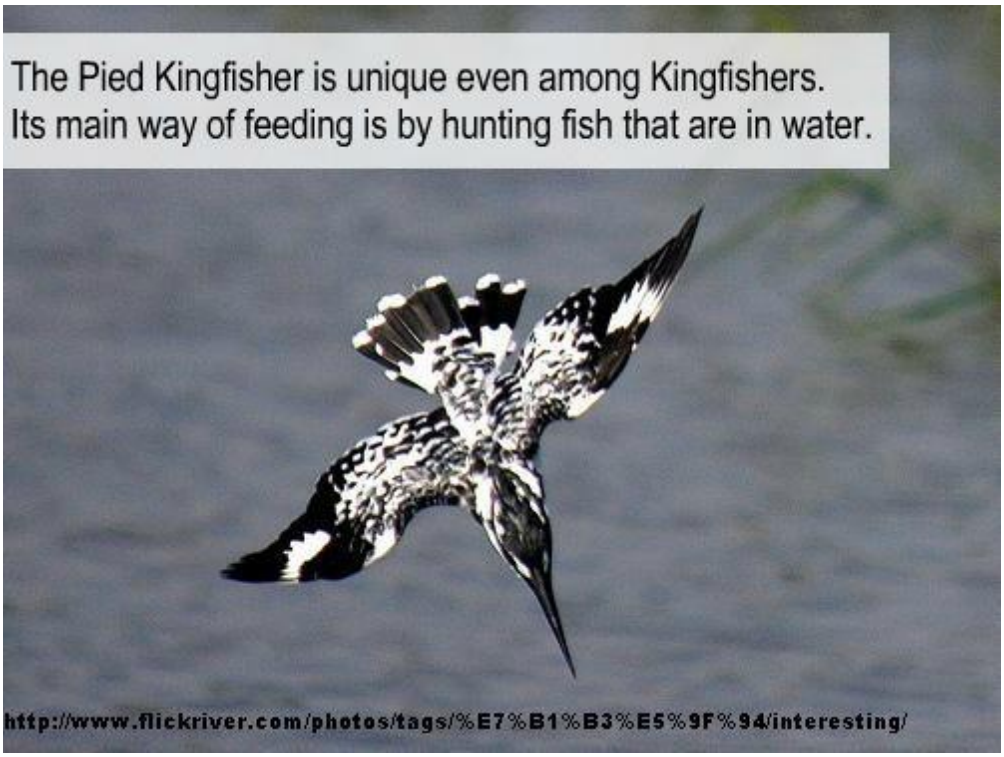
When an object is traveling at a high rate of speed and then enters a tunnel, the air being compressed in front of the vehicle is exponentially higher while it is in the tunnel than the normal air mass accumulated in front of the vehicle when it is traveling out in the open. Certain regions in Japan's high-speed rail network have many dozens of tunnels.

People who lived in the area of these tunnels complained of the loud thunderclap caused by the trains traveling at 300 kilometers per hour (approx. 187 mph) when they exited the tunnel.

As the train exits the tunnel, the high pressure pocket of air immediately expands outward and upward, slowing down as a result of this expansion, while the train continues forward, piercing the air mass. This creates a shock wave, causing a thunderclap.

This problem confounded the Japanese engineers and scientists. They pondered upon whether or not there may be something in nature that they could study that would give them ideas as to how they could redesign the bullet trains to make them less of a noise pollution problem. They were looking for something – anything – that regularly went from dwelling in one substance (like air) to dwelling in another substance (like water) quickly, by diving or some sort of activity, with little to no shock wave when it traversed from one substance to the other. The Pied Kingfisher was just such an example of a creature that traverses between two substances efficiently and relatively smoothly.

At just under seven inches long, the Pied Kingfisher is unique even among Kingfishers. Its main way of feeding is by hunting fish that are in water (hence the name "Kingfisher"). However, it is how it hunts these fish that makes it the "king" of all fishers. As the Kingfisher hovers at 10 meters (approx. 32 feet) above the water, its keen eyes search the water below for any viable prey. Once a tasty treat has been spotted beneath the surface of the water, the Pied Kingfisher begins a quick, but controlled, descent into the water, beak down. As the kingfisher zeros in on its target, it is imperative that its prey not know that the kingfisher is on its way into the water. The piercing of the water by the kingfisher's beak causes a shockwave to be sent out into the surrounding waters, and could easily be detected by the sensitive hairs on the fish's body. Fish that escape the kingfisher react only 1/50 of a second faster than those that do not escape.1 The shape of the Pied Kingfisher's beak is what makes its trip into the water more covert. Shaped any differently, it would create an even larger shockwave, and its success at catching any fish would be significantly less.



The efficacy of the Kingfisher's beak was recognized by the Japanese engineers as being one that they should emulate in the design of the high speed trains. Having done so, the noise pollution caused by the train's exit of the tunnel was greatly reduced, and the trains consumed 15% less electricity due to the lower air resistance in the new design.

The keen observation by the Japanese engineers of the incredible genius God has displayed in His crafting of the Kingfisher serves as a reminder that mankind has copied their Creator.

Footnotes:

1 http://www.youtube.com/watch?v=6YRM0sy3xIY