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Aviation history is based on quite primitive aircraft. Until the first powered flight, humankind experimented with many different variants of unpowered flight ranging from kites to gliders. We can see that early aviation pioneers were clearly inspired by the grace of avian soaring high above in the heavens. Even today as we look skyward, we observe birds naturally demonstrating their avian precision as they effortlessly navigate swirling wind currents.

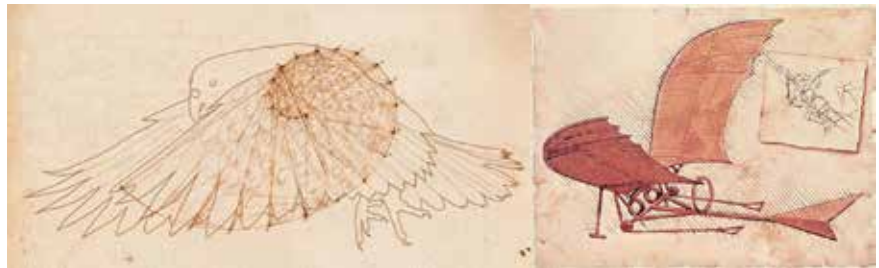
Exactly “how birds evolved to fly” and “how the first aircraft designs evolved to fly” follow the same type of narrative. Some scientists support the arboreal hypothesis and suggest that the ancestors of Archaeopteryx (first record of a flying dinosaur) lived in trees and glided into flapping flight but it’s argued that the claws of Archaeopteryx were not suited for climbing. Other researchers support the cursorial hypothesis and suggest that these ancestors used their long, powerful legs to run fast with their arms outstretched, and were at some point lifted-up by

The Effects of Avian Bio- inspiration on the Birth of Flight

air currents and carried into flapping flight. Also, before powered flight some inventors made flapping air vehicles and fixed wing gliders too. In these trials, the glider became the most successful model throughout aviation history thereafter.

different bird species and knew the details of each. In the Codex on the Flight of Birds, da Vinci discusses the crucial concept of the relationship between the center of gravity and the center of lifting pressure on a bird’s wings. With the knowledge he acquired he created more than 500

propulsion system should generate thrust but that the wings should be shaped to create lift. He observed that birds soared long distances by simply twisting their arched wing surfaces and deduced that fixed-wing machines would fly if the wings were cambered. In addition, one of his most

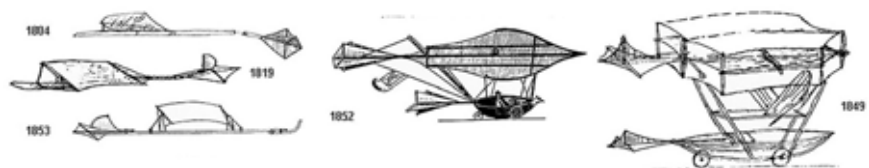


Inventors such as Abbas ibn Firnas, Hezarfen Ahmed Çelebi etc. tried to fly with human-made bird wings, a concept that Leonardo da Vinci played an important part in developing. In da Vinci’s time, there were no clear distinctions between occupational groups, and he was a biologist as much as an engineer. He is famous for his drawings and ability to visualize a landing pigeon without having had slow motion cameras to demonstrate his observation skills. It’s known that he could distinguish

sketches which include ornithopter, glider, and aerial screw designs. His designs are a splendid combination of zoology, botany, mathematics, physics and engineering.

After da Vinci, Sir George Cayley is sometimes called the 'Father of Aviation'. A pioneer in his field, he is credited with the first major break-through in heavier-than-air flight. Cayley was the first to understand and explain in engineering terms the concepts of lift and thrust. He realized that the

important discoveries was the power difference he found as a result of comparing the muscles of humans and birds. While 2/3 of the strength in all muscles is in the pectoral muscles (breast muscle) of a bird, in a man the muscles available for flying, would not exceed one-tenth of his total strength. That was the point where he understood the ornithopter is useless for human-powered flight. Then, he resolved to design a fixed wing aircraft and improved a glider which he





flew around 900 feet before it crashed in 1853.

German aviation pioneer Otto Lilienthal had read about Sir George Cayley's work and spent many years studying the flight and glide of birds. Also, he published a book called "Der Vogelflug als Grundlage der Fliegekunst - Birdflight as the basis of aviation" and a series of articles. Lilienthal designed and built gliders based upon the information that he had gathered. He made about 2,000 flights in at least 16 distinct glider types which resembled modern hang gliders. Lilienthal crashed in his glider and broke his back on August 9th 1896 and died the next day. With his findings, successful flights and Sir George Cayley's works would inspire the achievements of Wright Brothers and future success in powered flight.



Gustave Whitehead had been Lilienthal's assistant before Lilienthal started glider flights, but Whitehead had never been part of the flight trials. He went to Brazil as a sailor then moved to the USA in 1893. He pursued his dream of flight and he had great knowledge of birds from his childhood. He first constructed Lilienthal's type of gliders and then worked on powered aircraft. In his flight experiments, he simply shifted his weight to one side more than the other to control the aircraft, as he had noticed that birds make use of this technique when he was studying birds in flight. Stanley Yale Beach's report referred to powered flights in 1901 by Whitehead, and included these phrases:

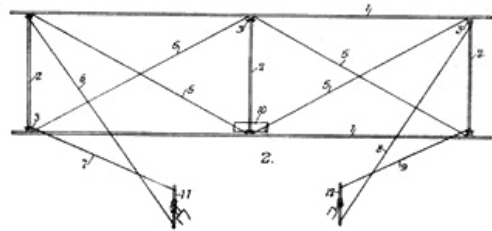
'Whitehead in 1901 and the Wright brothers in 1903 have already flown for short distances with

motor-powered aeroplanes,' 'Whitehead's former bat-like machine with which he made a number of flights in 1901,' 'A single blurred photograph of a large bird-like machine constructed by Whitehead in 1901 was the only photo of a motor-driven aeroplane in flight.'

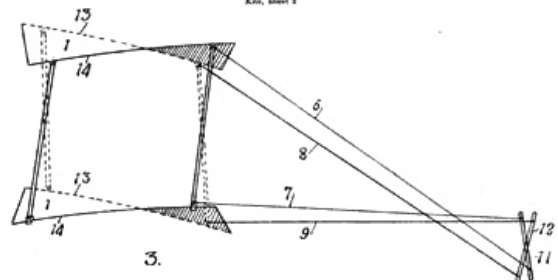
After a short time, the Wright brothers first conducted literature research to find out the state of aeronautical knowledge at their time. They read about the works of Sir George Cayley and

maintained its "balance in the air chiefly by twisting its dropped wing. This twist increased the air pressure on the dropped wing and restored the bird to level flight." They believed that they could use this technique to ensure roll control by warping or by changing the shape of the wing.

In summary, all the inventors who put effort into the invention of powered, heavier-than-air manned flight, are people who have worked on observing



Deland's Exhibit, Drawing of Wright's 1898 Kite, sheet 2



the hang-gliding flights of Otto Lilienthal. The Wright brothers spent a lot of time observing birds in flight. They realized that birds soared into the wind and that the air flowing over the curved surface of their wings created lift. Birds change the shape of their wings to turn and manoeuvre. Wilbur Wright noticed that a buzzard

birds and had become experts in bird flight. Could we have ever reached the level in aviation that we have reached now without the reference and observation of birds and flying mammals, these magnificent creatures of flight that have emerged as a result of billions of years of evolution? 🐦