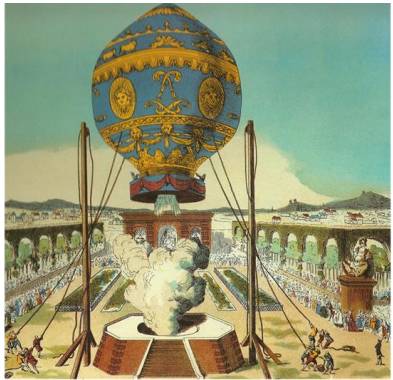


# ASSESSING MILD HYPOXIA EFFECTS ON THE CORIOLIS ILLUSION.

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**INTRODUCTION:** Since the days of the first lighter than air balloons, aviators often died from what must have been confusing new forces in the ether. Aviators still die if unprepared for hypoxia. It is well known that oxygen deprivation affects the central nervous system first and disproportionately to other systems. This is particularly insidious since the hypoxic individual will have difficulty recognizing and responding to their situation in time to save themselves. The vast majority of fatalities in general aviation result from pilot error. Only a small percentage of these are attributed to spatial disorientation (SD).



The first manned hot-air balloon, designed by the Montgolfier brothers, takes off from the Paris, on November 21, 1783



Left to right: Sivel, Tissandier and Croce-Spinelli on their fateful 1803 balloon (called the Zenith). Via McClure's Magazine.

Gaston Tissandier made observations of optical and atmospheric phenomena in many balloon flights.

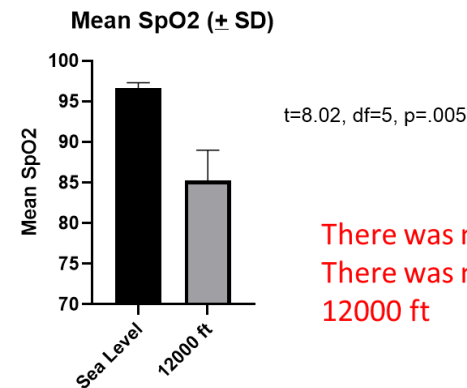
*"above Paris they flew for a new record. After an hour, Sivel and Croce were **already pale and very feeble**. By mutual consent Sivel .. **cut the cords** which kept .. three sacs of ballast .. the balloon ascended rapidly, and near 1h 30' all three of the aeronauts had fainted.*

*At 3 o'clock Tissandier became conscious; and at 4 o'clock it struck the earth at Ciron. **Sivel and Croce were dead**, their faces black and their mouths full of blood. The greatest height reached, as indicated by the self-registering barometer, was 8,540 to 8,600 meters (~27,090 ft; ~ -40°).*

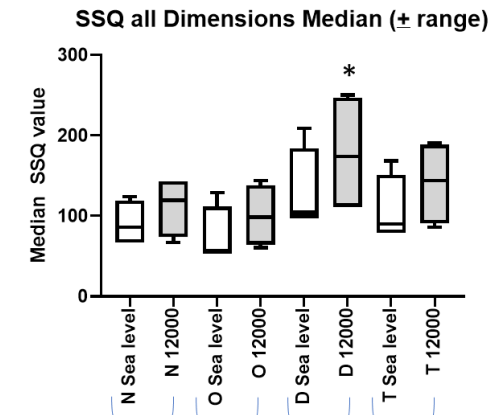
-American Journal of Science and Arts, (1875)  
"The catastrophe of the Zenith", 9, 481.

The costs and difficulties of maintaining a hypobaric chamber for hypoxia awareness training has been circumvented by the normobaric hypoxia chambers. A third device, individual hypoxia generators, have made it even easier to get supplemental training for a larger number of aviators than ever before. The use of hypoxia generators to stimulate the production of erythropoietin (EPO) and increase aerobic endurance has been well known among athletes since the 1968 Olympics in Mexico City favored those who had trained at high altitudes. The On Demand Hypoxia Trainer (ODHT) was designed more recently to fit the training needs of pilots in high performance aircraft.

**METHOD/RESULTS:** This research examined the effects of mild hypoxia, thousands of feet below the FAA mandated supplemental oxygen, on SD. The ODHT was used in this research and found to be an adequate, convenient and inexpensive means to induce mild hypoxia. The ability of the ODHT to quickly reach and maintain hypoxic oxygen saturation levels between 90-80% was first examined. There was considerable individual variation but average levels of 84% were observed after 15 minutes of donning the close fitting mask and maintained through the test period of 30 minutes. Once the mask was removed, normoxic levels were re-established within 2 minutes on average, However, returning to hypoxic levels only required 3 minutes on average after being off the mask for 5 minutes. The Coriolis illusion was used to assess the effects of mild hypoxia (84%) on the perception of movement. Participants were slowly spun 15 times in a Barany chair over 2 minutes with the head close to a 90 degree tilt from the upright. Upon returning to the upright, a profound disorientation was experienced as measured by the Simulator Sickness Questionnaire (SSQ) compared to the other dimensions of the SSQ.



There was no color vision loss.  
There was no cyanosis at 12000 ft



**DISCUSSION:** The ODHT have the potential to increase and improve research into the mechanisms of hypoxia. Since hypoxia training is not currently available to general aviation pilots, those who stand to suffer the most from pilot error/SD effects, the devices could finally allow training for this group and potentially save many lives. There is a need for an FAA approved protocol for these newer systems that will allow aviators to recognize the earliest symptoms of hypoxia.