APPLICATION BRIEF

What a Difference Social Distancing Makes

With the availability of an effective COVID-19 vaccine still on the horizon, social distancing is the one preventive measure we can employ outside our homes. Current guidelines recommend remaining at least 6 feet from our coworkers, neighbors or fellow shoppers — many of whom will be coughing when infected with the coronavirus. But is there a difference in person-to-person transmission when the parties are closer than 6 feet, or does distance not matter when a cough is covered and contained in the inside of an elbow? Computational fluid dynamics can be used to answer these questions and demonstrate the flow of droplets released through coughing.

Products Used:

Ansys SpaceClaim
Ansys Fluent
Ansys VRXPERIENCE

Solution

To solve for best-practice social distancing, Ansys experts used abundant, available data on droplet size and velocity to analyze droplet dispersion — through stagnant, ambient air — under three scenarios: 3-foot spacing, 6-foot spacing and 3-foot spacing with coughing into elbow.

Using Ansys SpaceClaim, our engineers modeled three people in close proximity to begin evaluating the coughing scenarios (Figure 1). Next, they employed Ansys Fluent to mesh the model and define the boundaries: floor and walls as slip-free and all others as pressure outlets. To model the expelled droplets, researchers used the discrete particle model (DPM) and available data to set the initial droplet conditions of 17 meters per second (velocity) and 50-400 microns (diameter distribution).

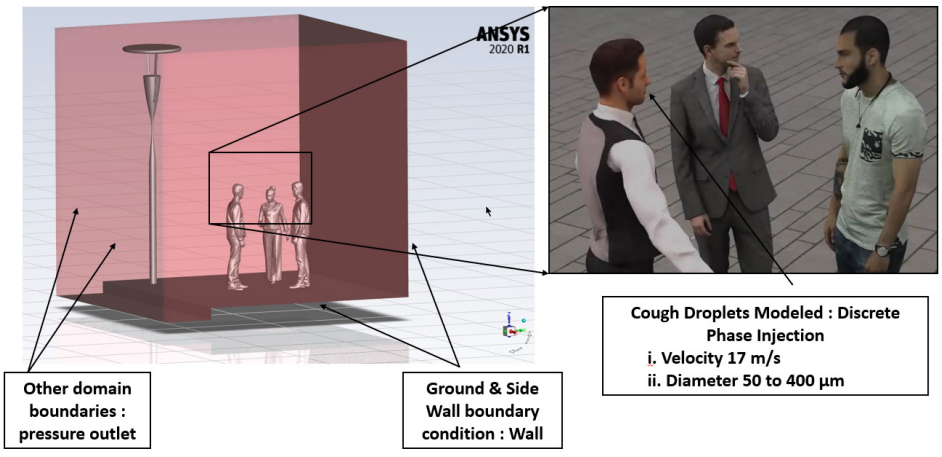
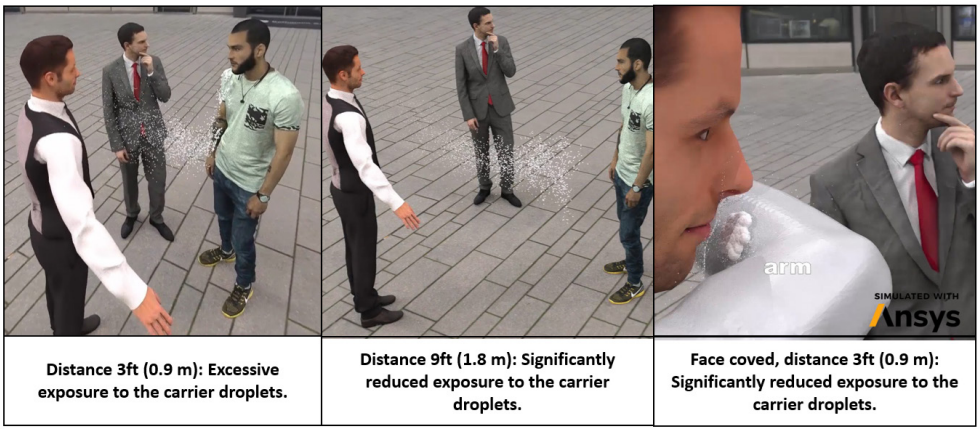


Figure 1: Computational domain and boundary condition for the CFD Simulation.

The cough particle trajectory results are rendered using Ansys VRXPERIENCE (Figure 2). Under the first scenario, cough droplets rapidly deposit on a person located 3 feet away from virus sufferer. In the second, where person-to-person distance is increased to 6 feet, the number of transmitted droplets decreases. This is due to the impact of gravitational forces that are now acting on the droplets over a longer distance. Lastly, in the third scenario, we see that when the cough is covered, most of the droplets are deposited into the arm, greatly reducing the number and speed of the droplets flowing through the air.

The simulations support the social distancing guidelines for the current virus and germ mitigation in general.



Distance 3ft (0.9 m): Excessive exposure to the carrier droplets.	Distance 9ft (1.8 m): Significantly reduced exposure to the carrier droplets.	Face coved, distance 3ft (0.9 m): Significantly reduced exposure to the carrier droplets.

Figure 2: CFD predictions of exposure to carrier droplets.

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Disclaimers
These simulations were designed to replicate physical behaviors under specific circumstances. They should not be considered medical guidance and do not account for environmental variants, such as wind or humidity.