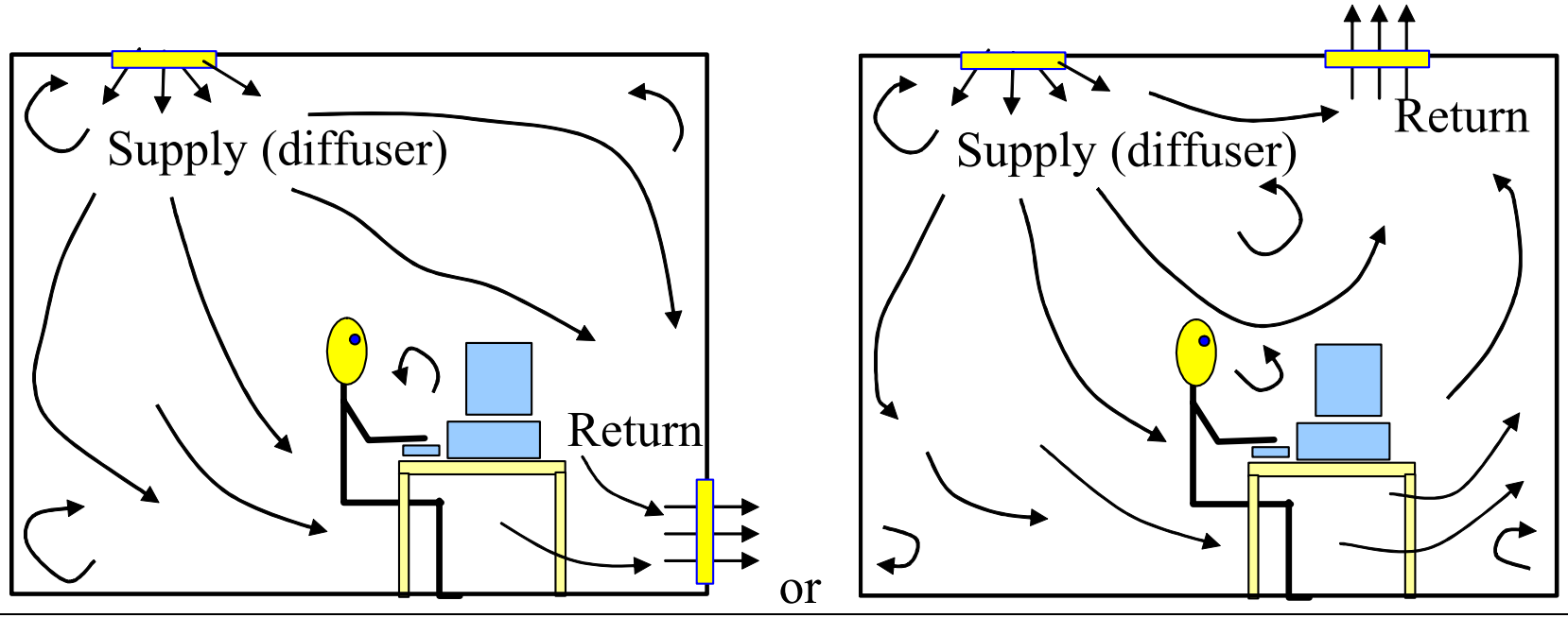
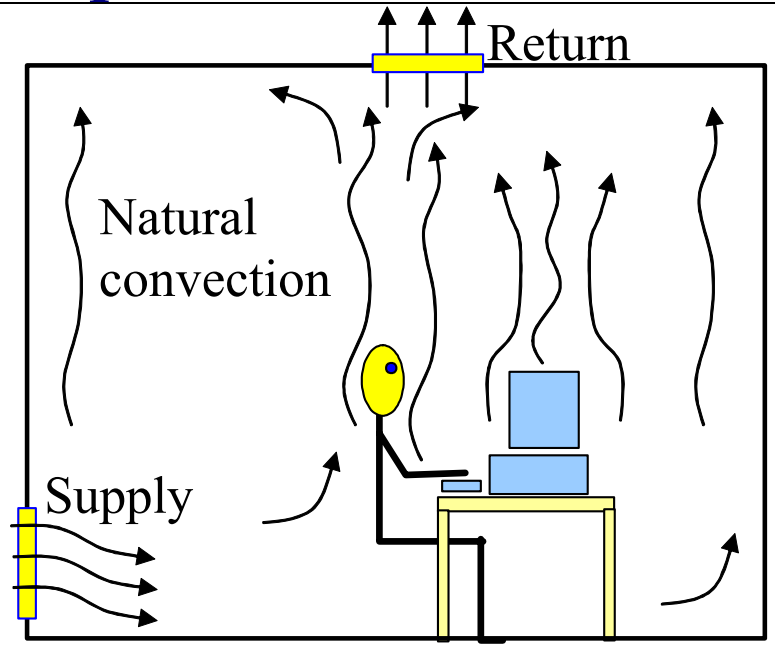
Dilution Ventilation versus **Displacement Ventilation**

Dilution Ventilation



- Mixing is enhanced (typically assume well-mixed conditions)
- Typical in USA in all construction (office, home, and industry)
- Used for both heating and cooling

Displacement Ventilation



- Mixing is suppressed (air is not well-mixed)
- More common in European countries
- Works best with cooling; less effective for heating

Definition of Displacement Ventilation

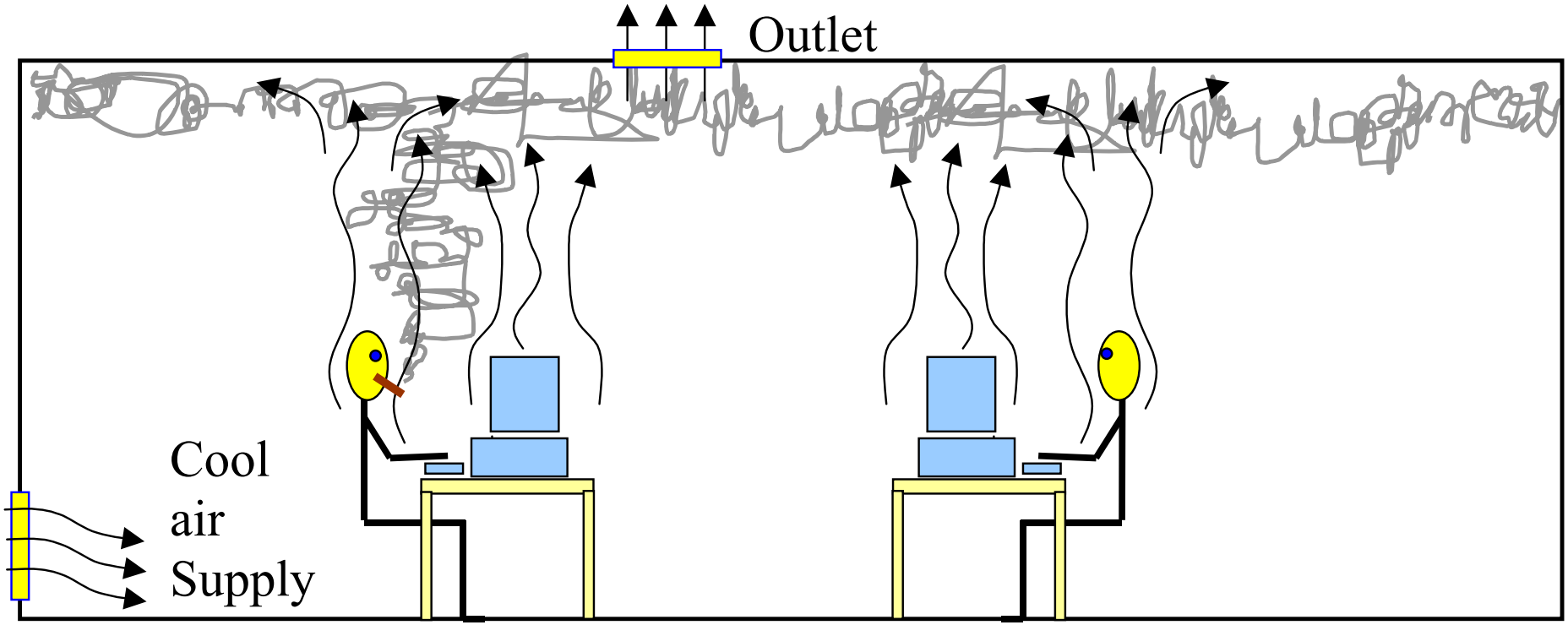
- Definition: "***Buoyancy-assisted forced ventilation***."
- Cool, fresh air introduced near the floor; warm, contaminated air removed from the ceiling.
- The displacement effect acts like a "piston" pushing the air upward.
- Assumes ***stratified*** (horizontal) layers of air in the room (warm air near ceiling, cool air near floor).
- Relies on ***natural convection*** (due to buoyancy) from people and/or objects to remove contaminated air *locally* ***where needed***.

(For a good general reference, see H. Skistad, *Displacement Ventilation*, 1994, Research Studies Press, Ltd.)

Usefulness of Displacement Ventilation

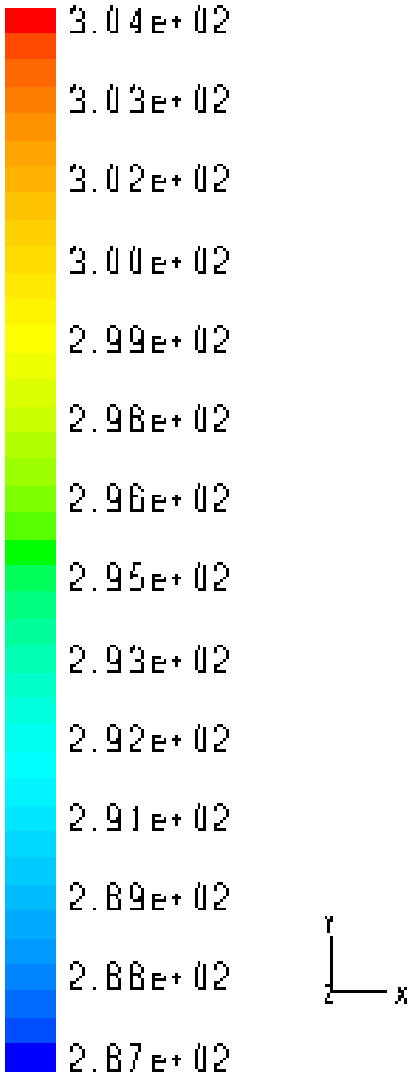
- Useful only for ***cooling*** rooms, not for ***heating*** rooms.
- Useful for ***removing air contaminants*** from concentrated sources (contaminants must be warmer and/or lighter than the surrounding air).
- For the same amount of ventilating air, displacement ventilation provides ***better air quality*** than does dilution ventilation.
  - Dilution ventilation mixes contaminants throughout the room
  - Displacement ventilation allows contaminants to naturally convect upward ***only where required***.

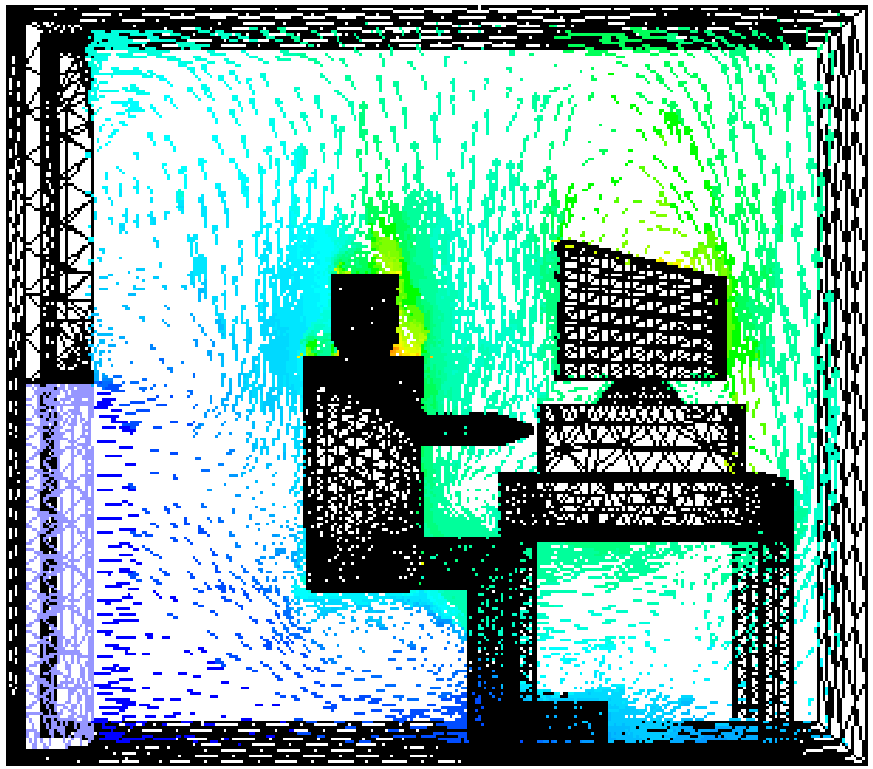
Example Application of Displacement Ventilation



Research – Cimbala, Garanich, Settles, & Miller (1998)

Cimbala, J. M., J. S. Garanich, G. S. Settles, and J. D. Miller. 1998. (abstract) Combined Schlieren Imaging and Numerical Analysis of Displacement Ventilation. *Bulletin of the American Physical Society*, Vol. 43, No. 9, p. 2016.





Centerplane velocity vectors

Velocity Vectors Colored By Static Temperature (k)

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