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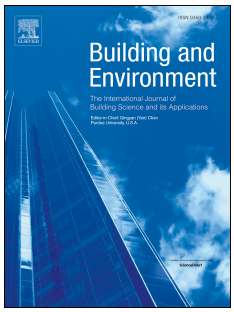

Ceiling fan air speeds around desks and office partitions

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Ceiling fan air speeds around desks and office partitions

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Abstract

Ceiling fans may cool room occupants very efficiently, but the air speeds experienced in the occupied zone are inherently non-uniform. Designers should be aware of several generic flow patterns when positioning ceiling fans in a room. Key to these are the fan jet itself and lateral spreading near the floor. Adding workstation furniture redirects the jet's airflow laterally in a deeper spreading zone, making room air flows more complex but potentially increasing the cooling experienced by the occupants.

This paper presents the first evaluation of the effects of tables and workstation partitions on a room's generic air flow and comfort profiles. In a test room with a ceiling fan, we moved five anemometers mounted in a "tree" at heights of 0.1, 0.6, 0.75, 1.1, and 1.7 m to sample a dense measurement grid of 7 rows and 6 columns. We tested five different table and partition configurations and compared them to the empty room base case. From the results we propose a simplified model of room airflow under ceiling fans, useful for positioning fans and workstation furniture. We also present comfort contours measured in two ways that have comfort standards implications. The measured data are publicly available on the internet.

Keywords: Ceiling fan; air speed; furniture; comfort cooling; corrective power

Highlights

1. We performed high resolution measurements of ceiling-fan-induced air flow in an empty room;
2. We compare this reference case to air flow profiles measured in the room with five different table and partition configurations. The data are included as publicly available supplementary material;
4. The initial ceiling fan flow in the room could be modeled as a free jet;
5. The subsequent room circulation, with and without tables and partitions, may be represented by an intuitive model for designers who are placing fans and furniture;
6. The extent of comfort cooling provided by the fan air flow can be represented by the metric 'corrective power'. Corrective power equates the cooling effect of the fan as an ambient temperature reduction, ^{o}C. We present the corrective power distribution in the room in two ways--with and without the air speed at ankle level--to evaluate air speed cooling effect. This evaluation is significant for thermal comfort standards.