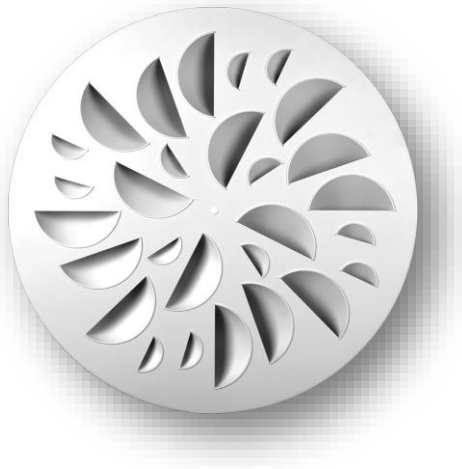
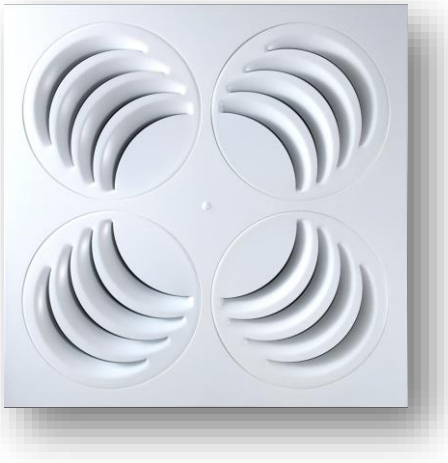
NEX AND PLAY DIFFUSERS

INNOVATIVE SOLUTIONS TO IMPROVE COMFORT AND EFFICIENCY



NEX-C



PLAY-S

The NEX and PLAY diffusers provide much more than just a unique and appealing look. Both diffusers offer revolutionary features and performance to help greatly enhance occupants' level of comfort while improving the overall energy efficiency of the ducted system.

In order to demonstrate how the NEX and PLAY diffusers help solve widespread air distribution problems, a quick overview of a few common issues is first presented.

COMFORT IS CHEAPER THAN DISCOMFORT

Comfort is extremely important in environments like office spaces and schools, for instance. Air distribution related discomfort can have numerous consequences including the following:

- Too many HVAC technician service calls
- Absenteeism
- Decreased employee performance
- Cost of overheating and cooling
- In extreme cases, cost of losing employees (re-hiring, re-training, loss of productivity)

Such consequences can quickly add up and become extremely expensive on an on-going basis. For businesses like restaurants, hotels and stores, discomfort can also result in customers shortening their stay, whether they do it consciously or not.

Let us look at an interesting example; one that is not easily measurable, yet it has been experienced by many people and follows common sense. Let us consider a nice restaurant with the following characteristics:

- A seating capacity of 300
- Open 360 nights a year
- Serves on average one customer per seat per night (great restaurants showing full occupancy can serve three customers per seat per night)
- Makes an average gross profit of $3 per drink or dessert

Computing **300 seats** X **1 customer/seat** X **360 nights**, we know that this restaurant serves **108,000** customers per year at dinner time only.

Unfortunately, some of these 108,000 customers experience high levels of discomfort related to heating, ventilation or air conditioning. The level of discomfort is not enough to formerly complain and leave the establishment; however, it is just enough for them to consciously - or subconsciously - decide to pass on that one last drink or dessert. In other words, a higher level of comfort would encourage them to stay just a bit longer.

Let us assume that, by mixing the supplied air more efficiently and, therefore, reducing the level of discomfort, we influence 2% of those customers to stay for just one extra drink or dessert. **The direct gain in gross profit would be $6,480 per year** (108,000 x 2% x 3$). The direct yearly profit gain for that business would be much more than the cost of replacing the current diffusers with high performance diffusers, only once.

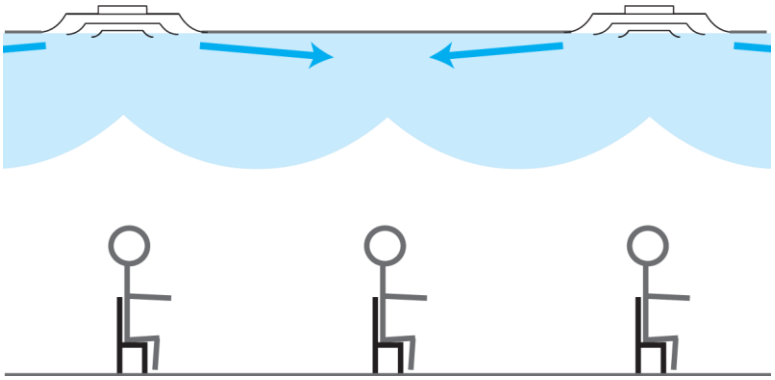
Again, this is not a scenario that is easily measurable. Numbers can be adjusted up and down at will; however, it is hard to argue with the fact that discomfort, such as feeling direct air drafts, or feeling too hot or too cold, does affect a customer's will to stay longer and consume more.

An interesting article by the American Council for an Energy-Efficient Economy (ACEEE) presents a small survey by Western Resource Advocates on Commercial Retail Air Conditioning. Of the 68 respondents, 88% found that the AC was occasionally too cold in retail establishments and 76% resolved the issue by bringing additional layers of clothes to maintain comfort.

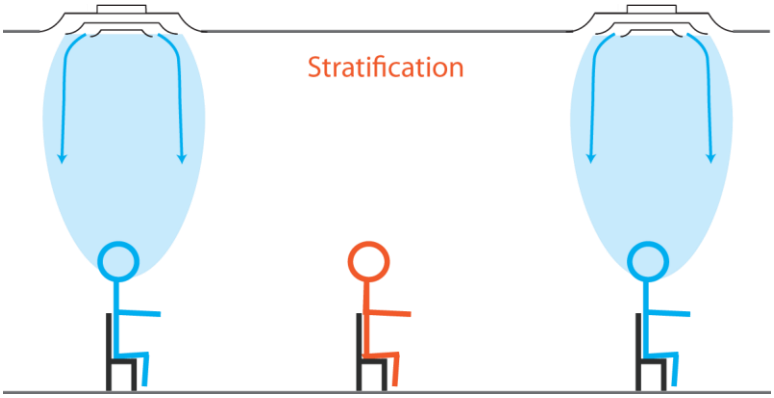
COMMON AIR DIFFUSION ISSUES CREATING SERIOUS DISCOMFORT

Discomfort in heating, ventilation and air conditioning can be caused by various components of the system. Assuming that the equipment, zoning, ducting and controls are all properly sized and installed, major issues can still result from inefficient diffusion of the supplied air.

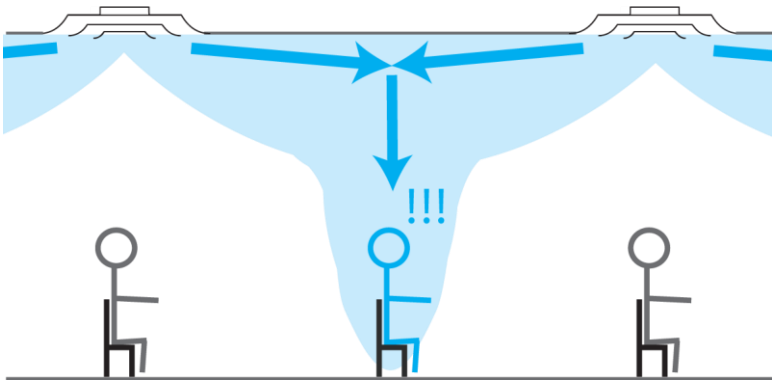
The example below shows a system that performs very well in average air conditioning conditions. Varying the volume and velocity of the air will however undeniably affect the diffuser's performance.



Almost ideal airflow in cooling mode



In cooling mode, cold air supplied at low velocity tends to "drop" from standard diffusers. Occupants right underneath the diffusers will feel colder while other areas will not be sufficiently cooled down. Stratification will also occur.



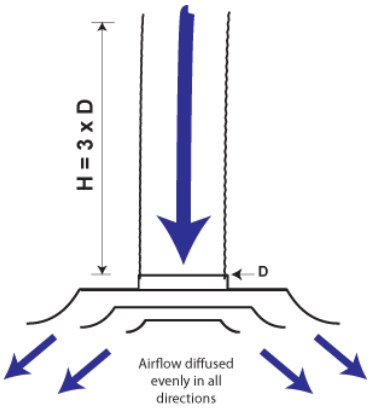
Air jets colliding at high velocity and deflected directly on occupants create the same level of discomfort as would direct jets of air on the head. The benefits of Coanda effect can quickly turn into a nightmare for some occupants.

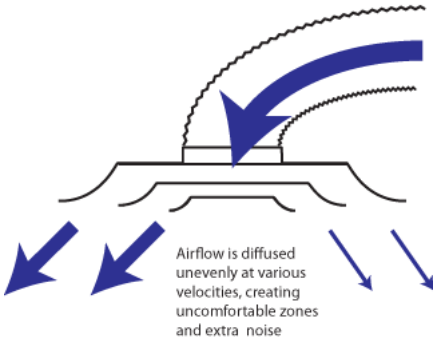
Perfect designs can be made for ideal conditions. However, in reality, variable air volume will seriously affect the theoretical performance. This is even truer in regions with highly varying climate and extreme temperature conditions. Even if the quantity and temperature of the supplied air is perfectly modulated by controls and equipment in response to room temperature, changes in supplied air temperature and velocity will directly affect the diffusers' air flow and performance. Using products that provide a higher tolerance to velocity and temperature variations can greatly improve average comfort despite changing or extreme conditions.

VAV diffusers have been designed in response to those issues. They are however quite expensive to purchase and often require extra cabling and installation time. Yet, most of them will only balance the air debit or vertical direction, without necessarily providing the most efficient diffusion and mixing of supplied air.

Another very common issue with air distribution comes from poor installation; sometimes because of negligence, and more often times because of physical constraints. A diffuser's theoretical performance assumes that the air is entering straight into the diffuser. In reality, it is very common to see installations using rigid ducts with 90 degree elbows or flexible ducts with kinks just before the air enters the diffuser. As a result, most of the air will be diffused through one or two ways, instead of four. Also, conditioned air will be supplied unevenly in the room, sometimes resulting in direct drafts, air drops or stratification.

In theory, the length of the straight duct entering the diffuser should be equal to 3 times its diameter. This is how products are tested in accordance to ASHARAE's standard 70-2006. In practice, ceiling space constraints or improper installation will result in angles or kinks affecting air direction coming in and getting out of a standard diffuser.





ENERGY EFFICIENCY

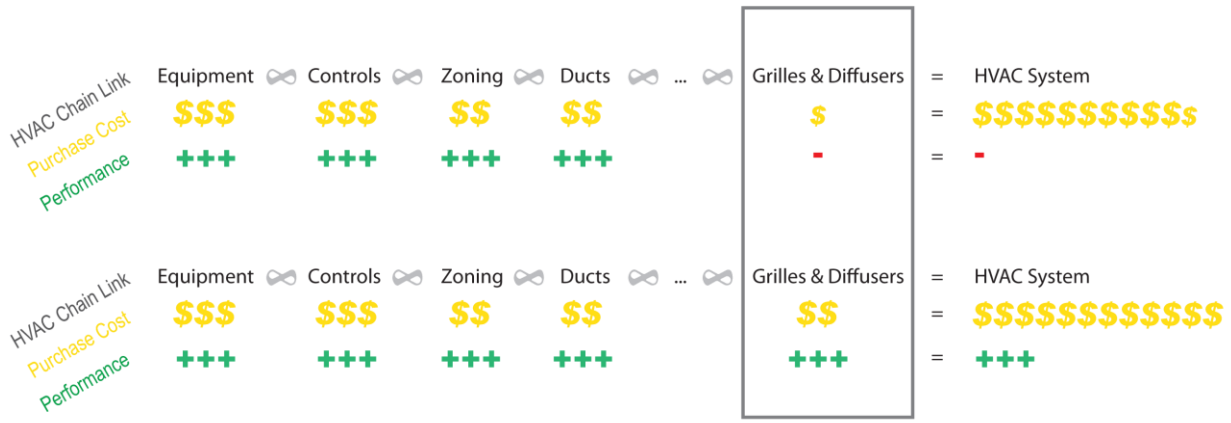
As previously mentioned, uneven mixing of the supplied air with room air creates stratification zones. Air stratification results in uneven room temperatures and humidity. The room's thermostats' and humidistats' accurate readings might be affected by odd or highly varying measures.

In cases where an HVAC system responds to off-measurements by over-heating or over-cooling, extra energy is wasted in the process of creating extra discomfort.

In cases of highly varying measurements, constant equipment modulation or regular interruptions might occur. Unnecessary variations in the use of equipment will generally use more energy in order to achieve the same result regardless of how efficient that equipment is.

The same principle applies to occupants having control over the thermostat. The higher the discrepancy between people in the room feeling too hot or too cold, the higher the probability of wasting energy without solving comfort issues.

An HVAC system is in fact a chain of components and a chain is only as strong as its weakest link. Air diffusion is the last and most inexpensive link of the ducted systems chain, yet it is very often overlooked at.

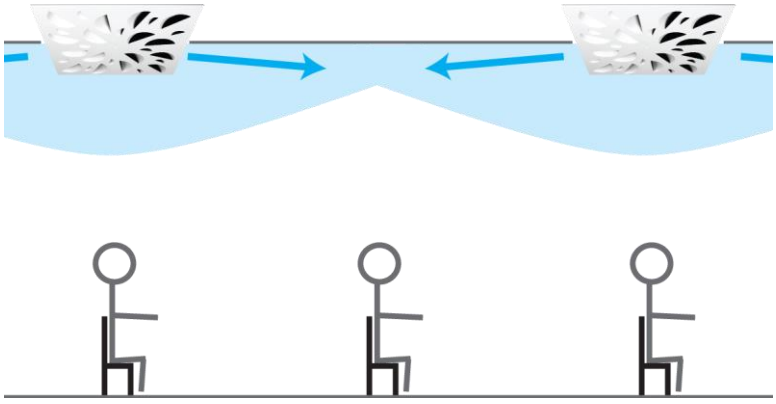


An HVAC system is a chain of components and a chain is only as strong as its weakest link. A well balanced system will offer a much better Performance/Cost ratio. Not investing in the cheapest links to improve the overall performance is a very common mistake.

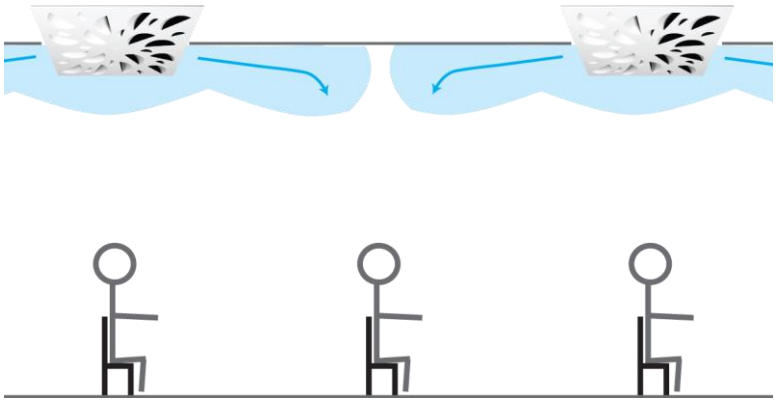
THE NEX

The NEX diffuser recently won the New Product Contest as the best New Heating Component. It is also ideal for cooling and VAV applications. The NEX efficiently mixes air with a high induction swirl pattern created by multiple jets of various sizes and velocities, thanks to its unique Concave Elements.

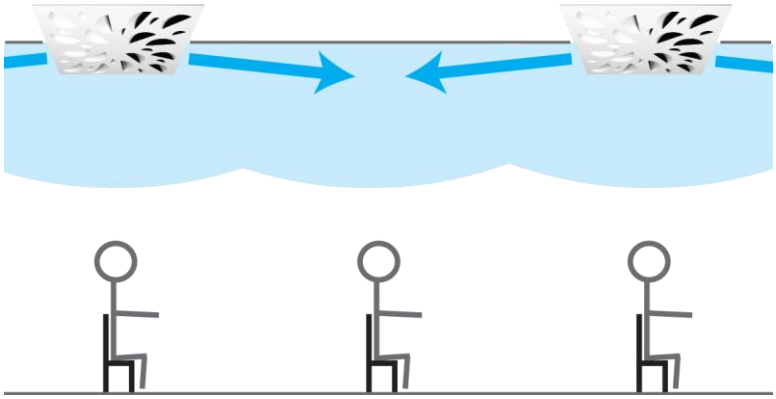
The NEX's high induction swirl pattern mixes more air, more evenly. It helps reduce stratification and provides a better tolerance to variations in supplied air temperature and velocity.



Standard NEX airflow in cooling mode

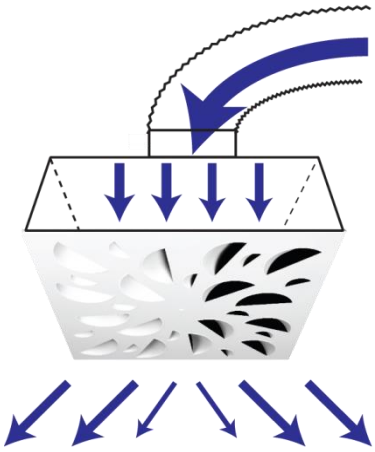


NEX has better tolerance to lower velocity



NEX also has better tolerance to higher velocity

Furthermore, the NEX - like the PLAY -is available with BOXSTAR and PERFAIR plenums that have a damper/air equalizer built-in the neck. Also, the air being diffused through NEX's multiple small concave elements rather than a few wide openings ensures a second layer of airflow equalization.

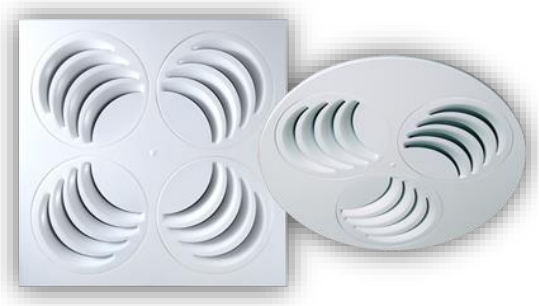


The NEX will often better perform than VAV diffusers at a fraction of the cost. It requires neither extra cables nor extra installation time. It can be used in retrofits as much as in new designs. It is available in square and round formats and is suitable for lay-in, drywall and open ceiling installations.

In addition to conventional performance data in isothermal conditions, extensive data is available on temperature correction factors and induction ratios for both the square and circular NEX. Most up-to-date versions of the datasheets are always available online at

http://effectiv-hvac.com/product-category/air-distribution/ceiling-diffusers/nex/

THE PLAY



It's already quite a challenge to theoretically design an HVAC system that will provide maximum comfort despite varying conditions. Imagine now how difficult it is to get the desired results considering factors which become more tangible in reality, but that were unknown at design time. A few examples are:

- Each individual's tolerance to heat and cold
- Cubicle layouts that can often be modified in open office spaces
- Possible addition of furniture and/or decoration that will deflect the airflow

Not only can those factors affect a theoretically perfect air distribution design's performance from the start, they will also most likely require constant adjustments over time.

Up until recently, the only solutions available to adjust air jet direction were:

- **Adjustable diffusers** which would only allow vertical airflow adjustment. This would be generally good for alternating between heating and cooling modes, but would not deflect the air away from a person, an obstacle or a colliding air jet.

- **Blocking a full way** even though the air flow might only require a 10 or 15 degree deflection to solve the problem. Another occupant might have been in the path of that initially unblocked way and enjoying the comfort it would provide. As a result, he or she might now feel uncomfortable. This is very common in open office spaces. Also, by blocking one or more ways, air velocity and throw are increased in the other ways.

These solutions often create new problems in the process of solving another and it is not uncommon that one service call leads to many more, constantly trying to solve new problems created by the precedent fix. Maintenance costs add up rapidly while new problems keep coming up. Occupants and owners become frustrated, often unfairly blaming HVAC technicians. Even the most qualified HVAC expert is limited to the solutions that are at his disposal.

The PLAY diffuser provides a new, revolutionary solution to those issues. PLAY is the first air diffuser featuring a full 360 degree horizontal adjustment. Each diffusion sector can be individually adjusted in order to supply an airflow that optimizes comfort despite varying constraints. The PLAY can act as a 1, 2, 3, 4 way, swirl or hybrid diffuser and each air jet can be deflected by as many degrees as required, in any direction.

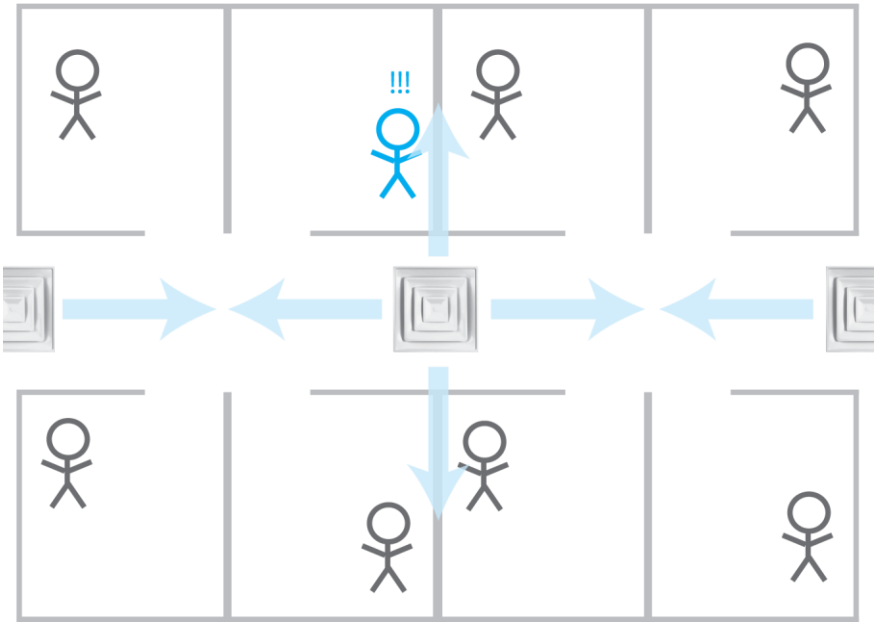
1 Way 2Way 3 Way 4 Way Swirl

One person or one object can be avoided without drastically changing the airflow and creating new major issues. Furthermore, the average service call cost should go down drastically thanks to the PLAY's ease of adjustability. It can be done from the face, while still in the ceiling and without tools.

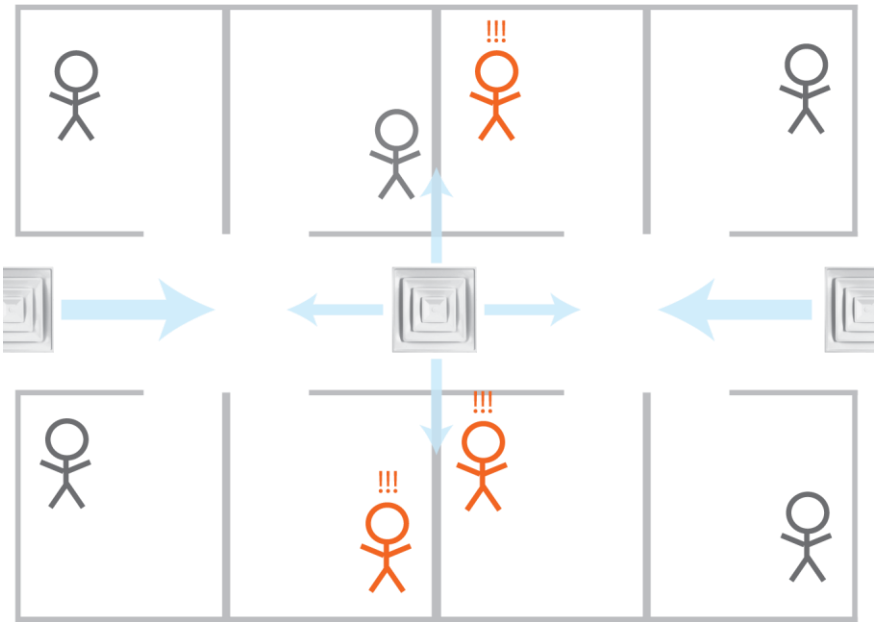
Let us take a very common example of an open office space with small cubicles. Out of 8 people in a given area, only one is feeling cold (in blue). That is a 12.5% discomfort ratio. Yet that person really has a low tolerance level to cold and complains. An HVAC technician is contracted to fix the issue. The most common solutions are:

1) To reduce the air volume coming out of that diffuser

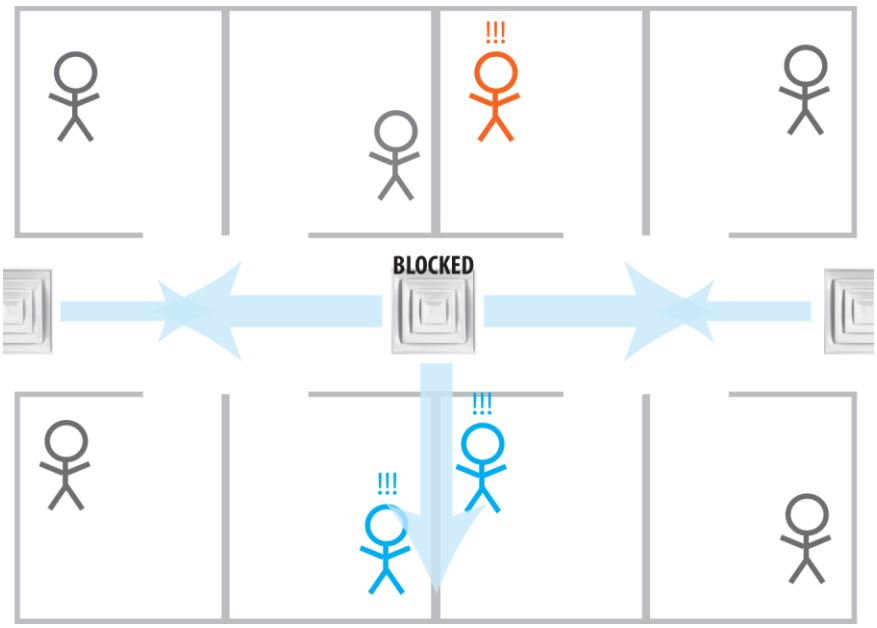
2) To block the way or direction in which the occupant feels discomfort



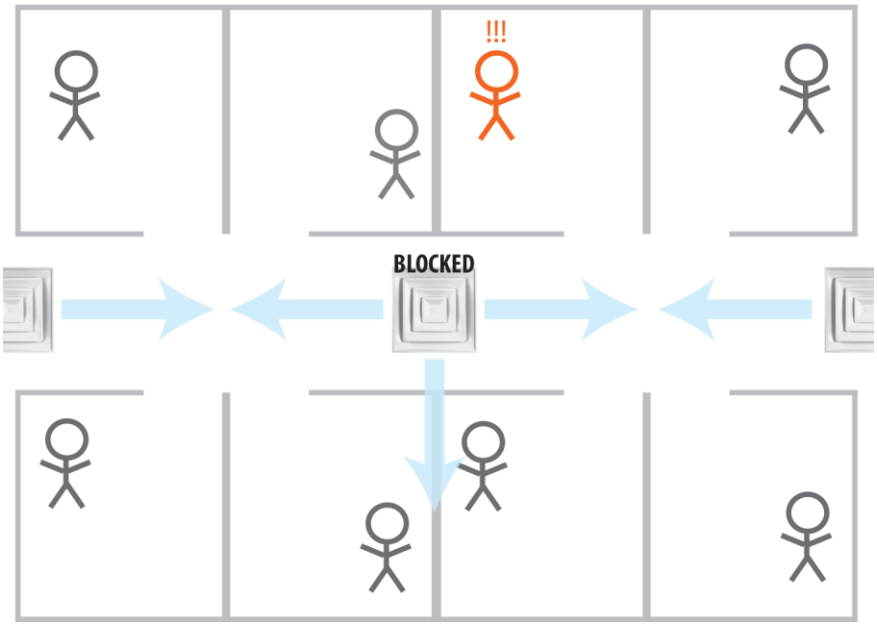
Open office space with small cubicles. One employee feels serious discomfort from cold air while others feel comfortable enough.



First solution: air volume is reduced for that diffuser. The initial complain is fixed; however, the three other employees now feel discomfort from a temperature that is too high. We now have a 37.5% discomfort ratio to deal with.



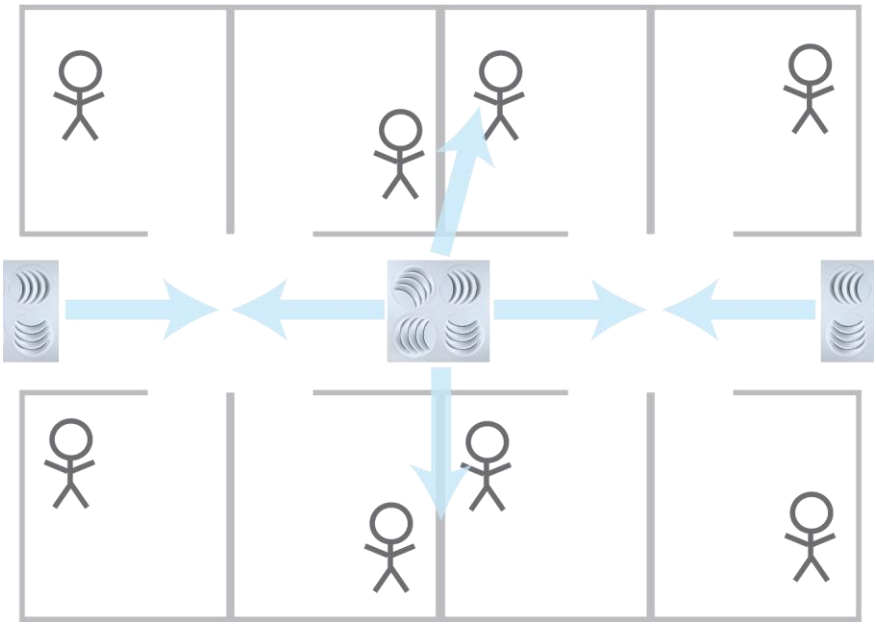
Second solution: we block one way and stop diffusing air in the direction where that employee is. However, another employee was in that way and now feels too hot. Furthermore, air debit is automatically increased in the other three directions and two other employees now feel discomfort from receiving too much cold air. Again, the discomfort ratio is 37.5%



Combination of both options: we block one way and reduce the air volume so other directions are not affected. We are back to a discomfort ratio of 12.5% and the problem has only been moved.

In all cases, we created new - equivalent or worse - problems in trying to fix the original issue. More expansive service calls will be placed, always affecting new people, which could eventually create conflicts between employees.

The PLAY diffuser provides a new solution to this very common problem. Only one quick - and therefore inexpensive - service call is required. One sector is adjusted by 10 or 15 degrees, just enough to redirect the air flow away from the employee who complained. The issue is fixed and other employees are not affected by the fix. We have achieved a 0% discomfort ratio.



Adjusting one sector of the PLAY diffuser by 10 to 15 degrees fixed the original complain without creating new problems.

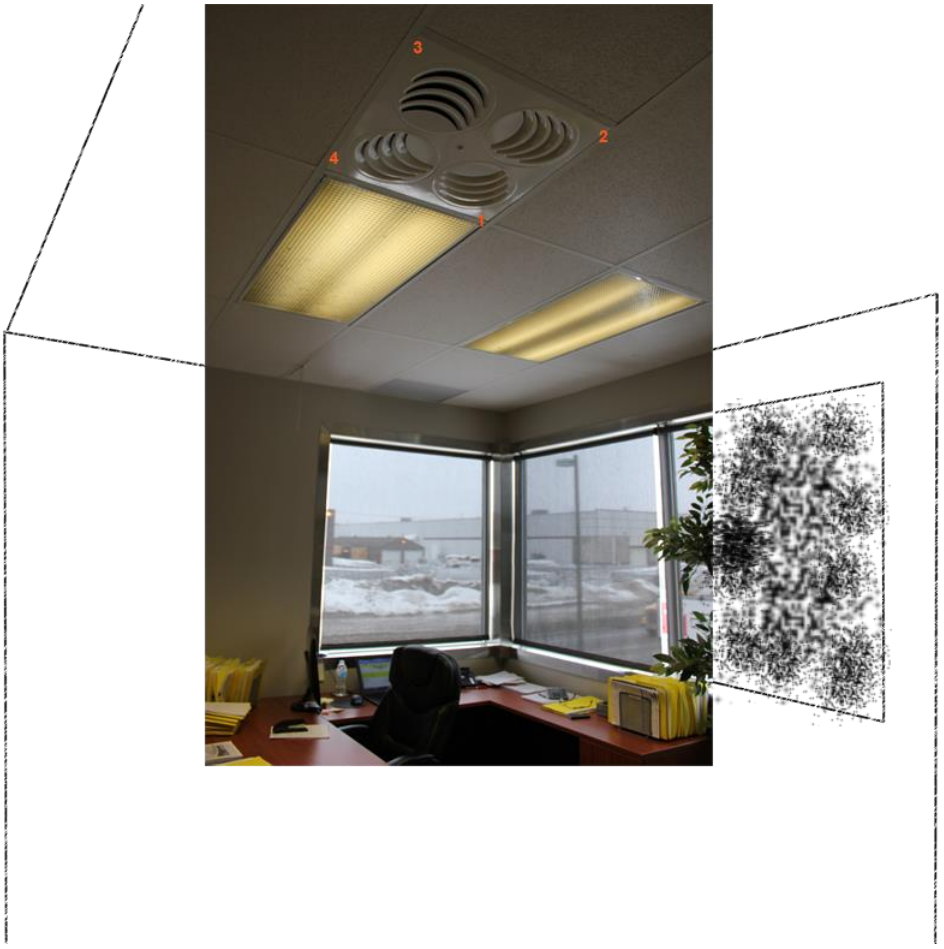
Better level of comfort through adaptability, fewer and cheaper service calls are some of the main benefits provided by the PLAY diffuser.

The PLAY diffuser is available in square and round formats and is suitable for lay-in, drywall and open ceiling installations. It is now also available in 48" x 12" rectangular shape, which allows for new design possibilities and solutions.

PLAY FOR COMFORT AND ENERGY EFFICIENCY

Another great example of application for the PLAY diffuser comes from an Engineer's office. In winter, this office's temperature is colder than the average temperature of the building because of its large windows. Also, the main desk being in the windowed corner and away from the office door, temperature differences and cold drafts were a definite issue. During the summer, when the cooling mode is at its maximum, the problem becomes the exact opposite, where what was cold in the winter is now hot in the summer.

The standard diffuser installed here was replaced by the PLAY which was adjusted in order to get an optimal airflow.

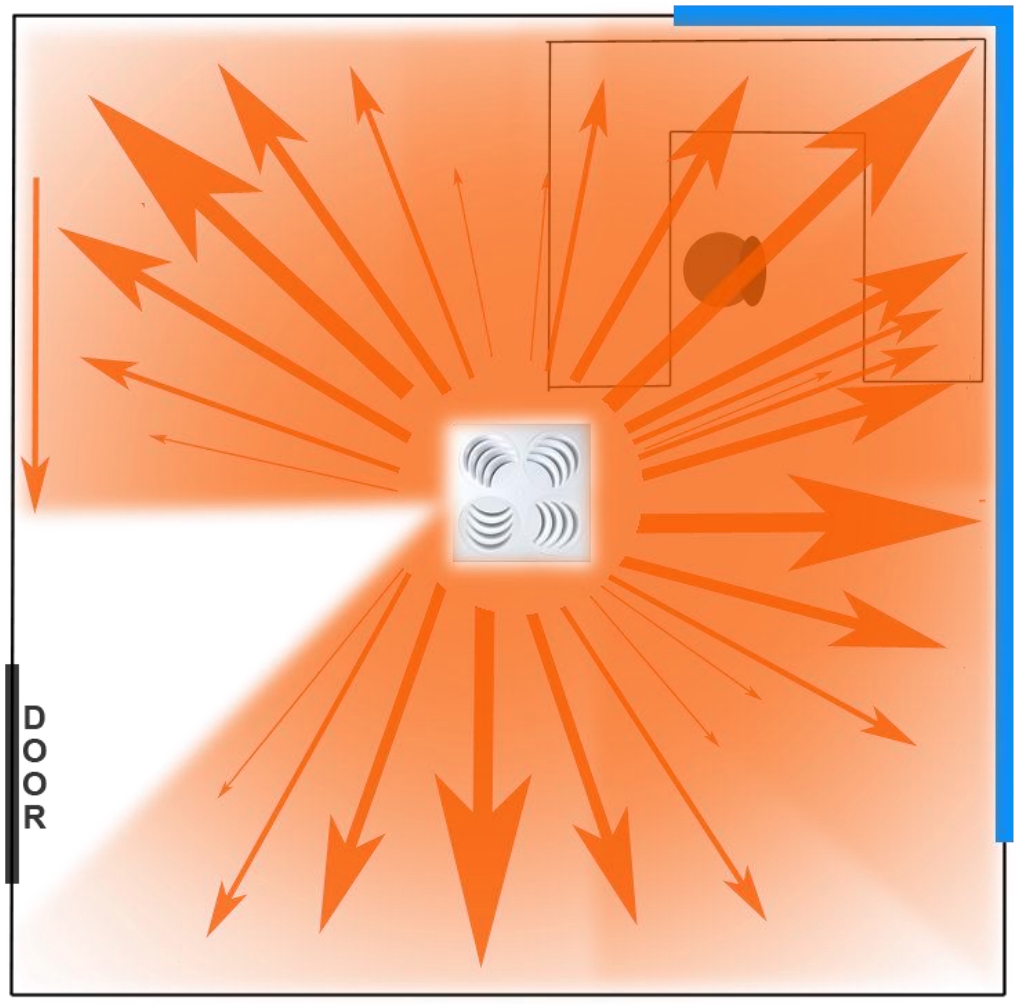


Simple example of a PLAY-S diffuser tested in an Engineer's office in Montreal

- Sector 1 was set at 45 degrees to cover the critical windowed corner behind the desk.
- Sector 2 was set directly towards the rest of the windowed wall to cut the cold and concentrate more heated air towards the desk.
- Sector 3 was directed towards the center of the back wall.
- Sector 4 was directed towards the last corner and away from the office door in order avoid throwing hot/cold air directly through the door.

The picture below shows the office door viewed from the window corner

The next image better illustrates the full room configuration and airflow.



This closed office with large windows is much colder than building average in winter time. PLAY Sectors have been adjusted to cover the whole office with heated air, with exception of the door which is almost always open and gives an already well-conditioned hallway. Contrarily, more heated air is supplied towards the large windows.

The overall result is a much improved level of comfort and better efficiency, which is achieved by heating the windowed wall and corner more efficiently while still supplying heated air in most of the office space - and only the office space, not the already comfortable hallway.

Blocking one or more ways of a standard diffuser would not have achieved the same results. An adjustable diffuser set to a vertical throw would have sent hot air directly on the occupant; yet, cold air drafts would have been felt coming from the window. Receiving direct cold air in summer would have been even worse. Even a VAV diffuser would not have offered a matching solution.

No other diffuser would have allowed the same level of comfort while optimizing the energy used for heating or cooling that office.

The PLAY will often better perform than VAV diffusers at a fraction of the cost. It requires neither extra cables nor extra installation time. It can be used in retrofits as much as in new designs. It is available in square 24” x 24”, round 25” diameter and rectangular 48” x 12” shapes. It is suitable for lay-in, drywall and open ceiling installations.

In addition to conventional performance data in isothermal conditions, extensive data is available on temperature correction factors and induction ratios for PLAY diffusers. Most up-to-date versions of the datasheets are always available online at http://effectiv-hvac.com/product-category/air-distribution/ceiling-diffusers/play/

IN CONCLUSION

Whether we are dealing with new constructions or existing buildings, the NEX and PLAY diffusers offer new efficient solutions to old, common and yet unsolved air distribution problems.

For a cost difference that is negligible compared to the other links of the chain, the NEX and PLAY can significantly reinforce the very important link that is air distribution, while improving both the level of comfort and energy efficiency of the whole system.

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Architectural and Comfort HVAC Solutions

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