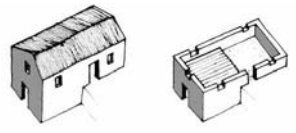
of a summer afternoon, simultaneously displaying our body, our tan, and our favorite bathing suit.

Excess body heat, including that of animals, has traditionally been used to heat houses. Sometimes, farm animals and the family have shared a single space. But often, as in the Greek hills of Zarakas in the Peloponnese, the main living space was separated. As in this example, the hill slopes away, allowing just enough headroom below to shelter the animals whose body heat rises through the wood floorboards to the room above. Combined with the heat from a stove at the opposite end of the house, the family remains quite comfortable throughout the winter. Sometimes, they even sleep directly over the animals to save burning precious fuel in the stove.



Greek Farmhouse on Hillside with Stable Below Living Quarters. (Based on a drawing by Helen Alexaki in *Greek Traditional Architecture, Peloponnese,* edited by Dimitris Filippidis 1990, 25.)

A grander example of body heat tempering a space is the great jousting hall in the Hrad, the fortress-palace of Prague. Today, only scattered groups of tourists enter the hall, perhaps having first walked across the busy Charles Bridge spanning the Vltava River. But in its heyday, eager spectators would have lined the hall's opposing walls for winter jousting. At a signal, starting from either end of the long space, knights on horseback charged each other with couched lances, the cheering crowd supporting its favorites.

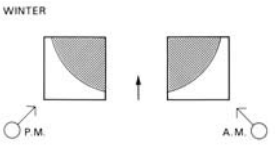
Without the heat of the crowd, the knights, and their steaming horses, such a big space would have offered little protection from the intense cold of a Prague winter. Nor would the two fireplaces, one placed at either end of the hall, have offered much relief unless one sat close to the flames.

Vladislav Hall, Royal Palace of the Hrad, Prague, Czech Republic: Once used for jousting, this largest secular space in Eastern Europe now serves for state functions.

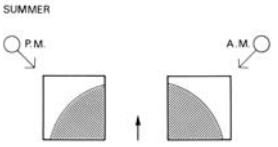
We can imagine a more modest example of sharing body heat in a simple one-room building. It is the morning of a winter day. Alone, you may move toward the sunny southeast corner for comfort; but as part of a group, you could actually move toward the colder northwest corner, out of

the sun, staying comfortable by sharing collective body heat. As time passes, the afternoon sun changes the places where both the individual and the group might find comfort.

Summer alters the earth–sun geometry and thus your movement inside the space. In North America, on a summer day, the sun rises quite far north of east and sets north of west, although at midday it passes to the south of the building. Thus, in the morning, you might move toward the southwest corner out of the sun, either alone or in a group. In the afternoon, you might move toward the southeast corner, again to stay out of the sun. Sharing the collected body heat of a group for comfort is clearly less effective in the summertime.

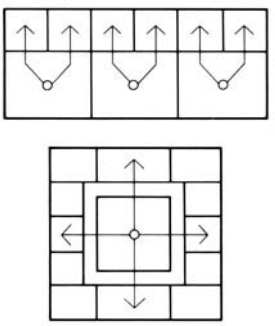


Winter Sunshine in a One-Room Space: Morning and afternoon.



Summer Sunshine in a One-Room Space: Morning and afternoon.

Instead of moving people, an alternate technique is to transfer body heat by low-velocity fans. For example, rooms that are fully occupied may produce more heat than required for comfort. The excess heat, when channeled through ducts, can usefully temper colder and less occupied rooms. Although this method requires less moving around, it also offers less variety and choice, less participation in the place.



Body-Heat Transfer from Large Occupied Rooms to Smaller, Less Busy Spaces.

On-Site Combustion and Decentralized Control

Beyond a limited temperature range, chemical changes in our body cells no longer keep us comfortable and we resort to means of energy conversion that are external to ourselves. Traditionally, this has meant lighting a fire and finding a dependable source of fuel to feed it. Then, because fires can be dangerous when lighted inside a building, they need to be controlled. From a wood fire in the middle of a room to the modern oil- or gas-burning furnace, solutions to the problem of control have characterized architectural styles throughout history.

Open fires have long been with us. Seen in the darkness across