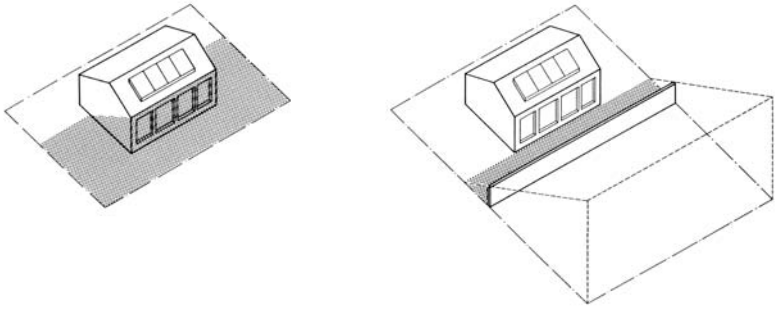


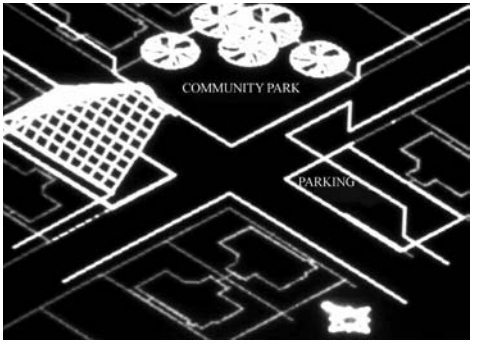
Shadows: (Left) Without solar-access zoning, there is no guarantee of sunshine. (Right) The heights of shadow fences can be set to control the solar envelope, thus the shadowing impact on neighboring buildings, while maximizing buildable volume. (Drawings by Daniel Wright in *Sun Rhythm Form* by Knowles 1981, 122f.)

rather than the ground, thus allowing the solar envelope to rise and gain volume. Different heights of shadow fences will affect the shape and size of the envelope.[4]

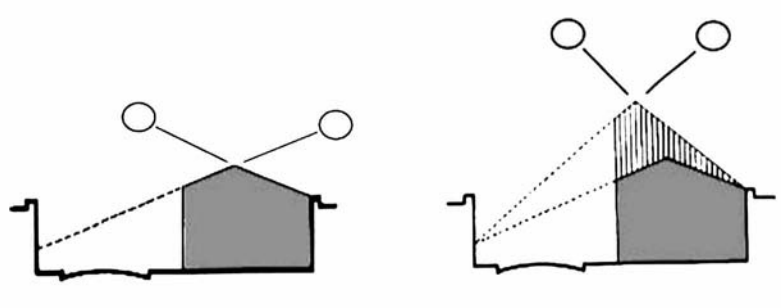
Shadow fences, being imaginary, do not actually cast shadows but instead allow shadowing of adjacent properties within limits set by community values. The height of the shadow fence can be set in response to any number of different surrounding elements, such as windows, party walls, or courtyards. The height of the shadow fence may also be determined by adjacent land-uses. For example, housing may have lower shadow fences, and thus less overshadowing, than some commercial or industrial uses where rooftop access for solar collectors may suffice.

Second, the envelope provides the largest possible building volume within time constraints, called *cutoff times*. The envelope accomplishes this by defining the largest theoretical container of space that would not cast shadows on neighboring properties between specified times of the day. Cutoff times that are specified very early in the morning and late in the afternoon will result in smaller volumes than would result from later times in the morning and earlier times in the afternoon.

Shadow Fences: The solar envelope is generated to meet shadow fences that are set according to surrounding land uses and community values. It can extend beyond its own site to meet shadow fences across the street. The shadow fences vary in height, for example, higher for parking and lower for a community park.



When shadow fences are set at all property



Space–Time Limits: (Left) Shadow fences on surrounding properties set the envelope's volume (gray). (Right) Varying the cutoff times will change the envelope's volume.

lines (sides as well as front and back), including any adjacent streets or alleys, solar envelopes are shaped with tilted facets defined by the sloping rays of the sun. Each separate face of the envelope is defined by a different time of day or season of the year. And because the wintertime sun angles are lowest, they are usually the main determining factor of envelope form.

A Design Analysis Tool

The solar envelope provides architects and urban planners with a design analysis tool for understanding and implementing solar access to buildings for both passive and active systems, for solar heating, solar control, and day lighting. The solar envelope provides zoning for low-impact development and opens new aesthetic possibilities for both architecture and urban design.

One of the chief objections to solar-access zoning has come from developers concerned with the loss of property rights. But extensive research shows that when achieved by using the solar envelope, solar access does not automatically result in the elimination of tall buildings nor does it mandate suburban densities. Floor-to-area ratios (FARs) as high as 7.5 for mixed-use development and housing densities in excess of 100 dwelling units per acre (du/ac) (247 du/ha) can be achieved.[5] This far exceeds subur-