# The Korean Heating Effect
## : from Wright's Usonian Houses to the Eichler Homes in California

**Hyon-Sob Kim**
Department of Architecture, Korea University

## Abstract
**The purpose of this paper is to demonstrates "diversity and mixtures of cultures" in architecture – the topic of this session – by showing how the principle of the traditional Korean floor heating system called *ondol* was transferred to mass-produced houses in the post-war America. As previously investigated (Kim, 2010 & 2020), the floor heating of Frank Lloyd Wright (1867-1959)'s Usonian houses was inspired by his own experience of the *ondol* room in Tokyo in 1910s. Jacobs House I (1936-37) in Wisconsin was the first case. On the other hand, Usonian houses in turn had a strong influence on the Eichler homes that the developer Joseph Eichler (1900-74) mass-produced in California between 1949 and 1974. In other words, the Eichler homes adopted many Usonian features, including the floor heating or what was generally called "radiant heating". This Usonia-Eichler connection was described by Paul Adamson in *Eichler: modernism rebuilds the American dream* (2002). Based on these facts, this paper argues that the Korean heating principle influenced, though indirectly, the floor heating system of the Eichler homes. It means that traditional Korean architecture contributed to the development of mass-produced houses in the post-war America, no matter how small the contribution may look. This Korean heating effect also manifests cross-fertilisation of cultures – which is emphasised by the session topic.**

## Introduction
Culture always flows and mixes with others, creating diversity while keeping its own uniqueness. Architecture also illustrates this cross-fertilisation of cultures. Now it is acknowledged that East Asian cultures inspired Western modern architecture though the reverse influence seemed more crucial. Among them, this paper focuses on the Korean floor heating principle that the American master Frank Lloyd Wright (1867-1959) adopted in his Usonian houses from Jacobs House I (1936-37) onwards. That is because his modern application of the Korean heating possibly influenced many American homes through numerous followers of him. This possibility was hinted at the Eichler homes, the mass-produced houses built in California between 1949 and 1974, in which floor heating was the most typical feature. The developer Joseph Eichler (1900-74) initiated this project with the design of "everyday modern", targeting ordinary middle-class families who dreamt an American dream in suburbs.[1] Very importantly, the prototype of the Eichler homes was based on the developer's own experience of staying in the Bazett House (1938-40), one of Wright's Usonian houses in California, and he employed a Wrightian architect as his first designer. If the Korean-inspired Wright's heating was transferred to the mass-produced houses for anonymous clients, this must be a substantial example that shows how modern architecture digested different cultural sources. This paper aims to investigate into the process of the transfer, along with the meaning of it.

## Korean floor heating and Frank Lloyd Wright's Usonian houses
In traditional Korean architecture, the floor-heated room by the *ondol* – literally 'warm stone' – is considered one of the most significant elements.[2] Wright's own words explains the *ondol* room or "Korean room" very succinctly: "The Korean room meant a room heated under the floor. The heat of a fire outside at one corner of the floor drawn back and forth underneath the floor in and between tile ducts … the smoke and heat going up and out of a tall chimney at the corner opposite the corner where the fire was

burning."[3] The story of Wright's encounter with the Korean heating was vividly recorded in his *Autobiography* (1943) and *The Natural House* (1954), and its historical meaning has been discussed by the author.[4] In short, Wright experienced it in Japan in 1910s (or possibly 1920), during his visit to Tokyo for the new Imperial Hotel project (1913-23) and regarded it as "a matter *not of heating at all* but an affair of *climate*". Consequently, he could apply an electrical floor heating to the bathrooms of the hotel, and returning to America, realised floor heating in the Jacobs House in Madison, Wisconsin, using steam and hot-water pipes.[5] We know that the house is important as the first example of the Usonian houses, which Wright designed economically for ordinary families in the "Usonia" – his own term for the USA – after the Great Depression. Therefore, the floor heating applied to the Jacobs House can be counted even more important. Wright built many Usonian houses before his death in 1959, and they had the floor heating as one of the most typical characteristics.

The Bazett House (1938-40) in Hillsborough, California, is also the case. Differently from the Jacobs House that has an L-shaped plan on a rectangular grid, it formed a V-shaped plan on a hexagonal grid. However, the two modest houses as typical Usonians have many things in common, in addition to the gridded plan. They are, for example, a compact organisation of the inside, the enclosure of the garden by their two wings, the combination of the brick walls (including the fireplace with a chimney) and the board-and-batten walls (including the succession of floor-to-ceiling windows), the carport, overhanging eaves, built-in furnishings, and the like. Nonetheless, what should be mentioned first is, of course, the floor heating, which created a new type of warmth and eliminated "ugly" radiators. The heating system consists of a boiler in a small cellar and a concrete slab that sits on a gravel bed and heating pipes, and it operates by forcing hot air or water to circulate from the boiler throughout the pipes.[6]

## Mass-produced Eichler homes (1949-74) adopting floor heating

It would be interesting to find out that the mass-produced Eichler homes in California adopted the floor heating or radiant heating, strongly influenced by Wright's precedents. What is more interesting is the fact that Eichler had rented the Bazett House before starting the housing business in late 1940s. The connection between the Usonian houses and the Eichler homes was fairly described by Paul Adamson in *Eichler: modernism rebuilds the American dream* (2002). However, he could not notice any allusion to Korea in the Usonian heating system while emphasising Eichler's borrowing of "radiant floor heating" from the Bazett House.

The Eichler project was one of the most remarkable housing developments in the post-war America, when the country suffered from a housing shortage owing to returning veterans from the war and the following baby boom. Building 11,000 houses between 1949 and 1974, it deserves a comparison with the better-known Levittown project in Long Island, New York, which, though, realised many more houses in a shorter period, up to 17,450 between 1947 and 1951.[7] Yet, Eichler pursued more modern designs than Levitt & Sons, making the most of talented architects in California. One of them was Robert Anshen (1909-64), the first architect for Eichler and also an admirer of Wright like Eichler. Though briefly mentioned above, Eichler had lived in the Bazett House between 1943 and 1945 and left affected by the stay. Anshen also had an opportunity to look around the inside of the house during Eichler's residency. At one point, he even regarded himself as "a successor to Wright".[8] It means that the Bazett experiences of both the developer and the architect played a significant role in designing the Eichler homes.

As a matter of course, Anshen's designs for Eichler came to adopt the basic principles of the Usonian houses although the Eichler's mass-producible units for anonymous clients needed to be much more straightforward, compact and so economical than the Wright's customised houses. Let's take the AA-1 model (1949-50) for example. It was the first prototype of the Eichler homes and had once been regarded by the architect himself as "one of the best houses he ever designed".[9] We can recognise here that its T-shaped plan is so efficiently arranged to include all necessary rooms (the living room combined with a kitchen and dining area) within the limited space, but it looks much ampler because the interior space visually expands towards the outside through a series of floor-to-

ceiling windows. In this design, the floor heating system was considered useful to create a cosy warmth as well as a simple space not hindered by radiators. Also, the slab-on-grade that incorporates heating pipes – copper pipes in the Eichler's case differently from wrought-iron ones in most of the Usonians[10] – did away with the conventional basement as Wright's Usonians did; it could make the house look modern and lower the construction cost. Eichler made the most of the new heating system in its advertisement when the AA-1 houses for Sunnyvale Manor subdivision in Palo Alto were on marketing.[11]

In addition to Sunnyvale Manor, Anshen completed four more subdivision projects for Eichler in the San Francisco Peninsula in 1950, while Eichler continued employing other talented architects to refine the previous models and to meet new demands. Accordingly, the Eichler homes could evolve in diverse ways. A steel-frame house type was introduced in mid 1950s; the incorporation of the atrium became a distinctive feature of the Eichler homes from late 1950s; and some models expanded its size to respond to the economic boom in 1960s. Despite these transformations, the Eichler homes kept the basic principles that the earlier models adopted. The floor heating was one of them.

## Conclusion: cultural diversity and mixtures in architecture

The discussions so far could be summarised through syllogistic reasoning. First, Wright's experience of the Korean *ondol* room inspired him to apply the floor heating principle to his Usonian houses. Second, the floor heating system of the Eichler homes was directly influenced by that of Wright's Usonian houses. Third, therefore, the Korean *ondol* room influenced, though indirectly, the floor heating system of the Eichler homes. It means that traditional Korean architecture contributed to the development of mass-produced houses in the post-war America, or to the rebuilding of the American dream (though the heating system was not established as a typical method in the country afterwards). This may be called a 'Korean heating effect'. Very ironically, however, it seems that Korea came to inversely import the modernised floor heating system from America when the latter helped the reconstruction of the former after the Korean War (1950-53) – though this counterinfluence is yet to be studied, particularly in comparison with Koreans' own efforts to modernise the traditional *ondol* system since the Japanese colonisation period (1910-45). In conclusion, we can argue that this interesting intersection of 'heat flows' demonstrates "diversity and mixtures of cultures" in architecture – the topic of this session.[12]

## Endnotes

1. Paul Adamson, *Eichler: Modernism Rebuilds the American Dream* (Layton UT: Gibbs Smith, 2002), p. 23.
2. It is comparable with Chinese *kang* and the Roman hypocaust but different from them in several aspects. Concerning it, see Hyon-Sob Kim, "The appearance of Korean architecture in the modern West', *Architectural Research Quarterly* 14, no. 4 (December 2010): 349-361.
3. Frank Lloyd Wright, *An Autobiography* (San Francisco: Pomegranate, 1943), p. 495.
4. Kim (2010), *op. cit*., and Hyon-Sob Kim, "The First Adoption of the Korean *Ondol* Principles in Usonian Houses", *SPACE* 632 (July 2020): 30-37.
5. The initial steam heating was replaced by a more efficient hot-water heating a couple of years after the client's moving into the house. Herbert Jacobs, *Building with Frank Lloyd Wright* (Carbondale IL: Southern Illinois University Press, 1978), p. 59.
6. One construction photograph of the Bazett House (The Frank Lloyd Wright Foundation Archives) illustrates how the heating pipes were installed in typical Usonian houses.
7. Levittowns, not only in New York but also in Pennsylvania and New Jersey, installed a similar floor heating that could also be connected to Wright – therefore, possibly connected to Korea. A research on it will be followed.
8. Adamson (2002), *op. cit*., p. 80.
9. Adamson (2002), *op. cit*., p. 65.
10. It was only later that copper pipes were introduced to the Usonian houses. John Sergeant, *Frank Lloyd Wright's Usonian Houses* (New York: Whitney, 1976), p. 28.
11. The ad in the *Daily Palo Alto Times* (2 February 1950) highlighted the heating as its first noticeable feature. Its copy was published in Adamson (2002), *op. cit*., p, 65.
12. We can further consider the present floor heating system that utilizes plastic tubes – typically the polyethylene tubes known as "PEX" – rather than the previous metal ones. This is a big improvement that came through crucial refinements by several companies in Sweden and Germany in 1950s and 1960s. Kiel Moe, *Thermally Active Surfaces in Architecture* (New York: Princeton Architectural Press, 2010), p. 93.

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