Fluid architecture: hybrid solid-fluid building envelope

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In its 12,000 years of history, Architecture has been a constant field of experimentation. New forms, styles, materials, theories and technologies emerged one after the other. One element in design, however, remained constant over the course of history. Our built environment was based on solid materials and with that we inherently accepted the limitations that came with it. The paradigm-shift of utilizing water as building material is therefore about much more than simply taking advantage of the physical properties of water. It is about redefining the role of architecture, construction and the relationship between users and buildings.

Tea-Water Pavilion is a small experimental structure located in Feng Chia University in Taichung, Taiwan. The building is part of Water House Research Project that explores the potential of a hybrid (solid-fluid) building envelope. The structure is constantly monitored and modified to identify the advantages and possible limitations of a hybrid solid-fluid envelope before the building can be completed. The pavilion is a water-glass and water-steel skin, wrapped around a small space above the lake of the university campus. The pavilion is occasionally used as a classroom and for tea ceremonies. Water in this sense is present in 3 scales in the project: in the cup of tea, in the surrounding building skin and as the campus lake.

The goal of the Water House Research Project is to redefine building envelopes as we know them today. Solid skins are typically intended to isolate interior from surroundings to protect us from changes in the environment. Hybrid solid-fluid skin proposes an opposite approach and establishes a stable and comfortable microclimate by the automated responses and other properties of the fluid infill. Energy-efficient buildings do not have to be spaces with small windows and minimal volume/surface areas because for hybrid envelopes these properties are not hindrances anymore but opportunities. Buildings can be even completely transparent without compromising energy use and thermal comfort.

Additionally, water has a unique impact on the building’s skin as fluid flows slowly from one panel to another as a consequence of temperature differences. The result is something we named performative transparency which creates a unique spatial experience in the building.