During the 20th century, the museum environment was conditioned ever more strictly as heating, ventilation and air-conditioning technologies evolved: striving for the ideal conservation environment, collection preservation was prioritized and the thermal comfort of visitors was compromised. This has resulted in three problems: excessive energy consumption and costs, thermal discomfort, and moisture damage to historic buildings. Recent research has revealed that many objects tolerate variations in temperature and relative humidity better than expected fueling a global discussion on replacing the concept of an ideal environment by an appropriate environment. With a strong view on balancing collection conservation, historic building conservation, thermal comfort, and energy expenditure, this research explored dynamic control of the museum environment based on controlled fluctuations and seasonal adjustments of indoor temperature and relative humidity. The thermal comfort of museum visitors has been studied at Hermitage Amsterdam museum revealing their temperature requirements over the year. Moreover, a control algorithm for the automated setpoint calculation of indoor temperature and relative humidity has been developed that integrates collection needs and the thermal comfort requirements. Finally, this algorithm has been tested at full scale at Hermitage Amsterdam demonstrating energy savings of 50%. 

Clever Climate Control for Culture: Energy efficient indoor climate control strategies for museums respecting collection preservation and thermal comfort of visitors

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