The Human Perils of Scaling Smart Technologies Evidence from Field Experiments

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Smart-home technologies have been heralded as an important way to increase energy conservation. While in vitro engineering estimates provide broad optimism, little has been done to explore whether such estimates scale beyond the lab. We estimate the causal impact of smart thermostats on energy use via two novel framed field experiments in which a random subset of treated households have a smart thermostat installed in their home. Examining 18 months of associated high-frequency data on household energy consumption, yielding more than 16 million hourly electricity and daily natural gas observations, we find little evidence that smart thermostats have a statistically or economically significant effect on energy use. We explore potential mechanisms using almost four million observations of system events including human interactions with their smart thermostat. Results indicate that user behavior dampens energy savings and explains the discrepancy between estimates from engineering models, which assume a perfectly compliant subject, and actual households, who are occupied by users acting in accord with behavioral economists’ conjectures. In this manner, our data document a keen threat to the scalability of new user-based technologies.