ABSTRACT

Electric vehicle charging stations (EVCS) are essential infrastructure within the broader electric mobility ecosystem, with their success typically assessed in terms of availability and charging speed. However, this technocentric framing often overlooks their fundamentally human purpose: EVCS are designed for users, and therefore the human dimension must be recognized as an equally critical component of infrastructure success, one that has received comparatively little attention in planning practice. To that end, the overarching goal of this dissertation is to examine EVCS through a human-centered lens, spanning from the cognitive to the behavioral level. To achieve this, the dissertation employs a mixed-methods approach, drawing on spatial analysis, stated preference experiments, behavioral modeling, and socio-psychological frameworks. By investigating accessibility and preferences at the cognitive level and evaluating utilization patterns at the behavioral level, this dissertation offers a comprehensive view of EV users' cognitive-behavioral interaction with EVCS, contributing to both the empirical and methodological understanding of human-EVCS interdependence.

The dissertation is organized into four interconnected studies, the first two of which address the cognitive level. The first study examines EV users' self-evaluation of EVCS accessibility, aiming to identify determinants that shape users' perceptions of their own accessibility, termed *perceived accessibility*, using survey data and EVCS spatial data. Results reveal that spatial EVCS opportunity, known as *calculated accessibility*, has relatively little to no influence on perceived accessibility, whereas individual characteristics, travel behavior, charging experience, and attitudes are better explanators of perceived accessibility. Building on this, the second study shifts to the subsequent cognitive process of EVCS selection: given that EVCS are perceived as accessible, which station should a user choose? To investigate this, the second study examines EVCS preferences with a particular focus on charging technology, combining conventional tethered charging (Level 2 and DC Fast Charging) with dynamic wireless power transfer (DWPT) technology using a stated choice experiment approach. From discrete choice model results, the baseline preferences indicate that DWPT has not yet emerged as competitive against tethered charging, particularly DCFC. Beyond technology type, EVCS attributes such as availability of amenities and waiting time are also found to influence station preferences.

The final two studies address the behavioral level in the form of EVCS utilization. The third study examines antisocial charging behavior, with a primary focus on overstaying, which is defined as a practice of occupying a charging space beyond the point of a completed charge. Employing evolutionary game theory and system dynamics modeling, this study evaluates the long-term effectiveness of action-contingent, outcome-contingent, and hybrid policy designs in discouraging overstaying behavior, while simultaneously deriving optimal policy configurations. Results demonstrate that hybrid policy designs outperform the other two approaches across evaluation metrics. Furthermore, the methodology enables the proposal of an optimal state-of-charge (SoC) limit policy, which can be further refined through time-window-based activation policy. In contrast, the fourth study examines the antithesis of antisocial behavior: prosocial charging behavior. Specifically, it investigates EV users' intentions to engage in prosocial charging through a socio-psychological lens, integrating the Theory of Planned Behavior and the Norm Activation Model. Results indicate that an individual's personal evaluation of prosocial charging behavior (attitude) exerts a strong influence on behavioral intention regardless of situational stakes, while internal moral obligation (personal norm) does not demonstrate a consistent influence on intention.

Taken together, this dissertation advances a niche but important area of inquiry: the interdependence between humans and infrastructure, specifically EV users and EVCS. The findings collectively demonstrate that the human dimension of EVCS warrants greater attention in planning and policy. To this end, the dissertation introduces the CHARGE framework, which synthesizes the policy implications emerging from its findings. Ultimately, this dissertation argues that integrating human-centered considerations into EVCS planning does not merely improve the quality of the infrastructure itself; it also reverberates outward, fostering a more sustainable EV ecosystem.