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Konstadinos (Kostas) G. Goulias has been a professor of transportation at the University of California, Santa Barbara Department of Geography since 2004. He served as professor of transportation in the Civil and Environmental Engineering department of PennState University from 1991 to 2004, chaired the Transportation Research Board (TRB) of the National Academies *Task Force on Moving Activity Based Approaches to Practice* and the *Standing Committee on Traveler Behavior and Values* (of which he is an elected emeritus member). He is also the incoming chair of the *International Association for Travel Behavior Research* (iatbr.org). Goulias edited three books and published more than 300 research reports and papers and is the co-founder and co-editor in-chief of the journal *Transportation Letters*. He is often an organizer of international conferences including the most recent IATBR conference with the theme Mapping the Travel Behavior Genome (iatbr2018.org).

Exploring Fragmentation in Daily Rhythms of Activity and Travel Based on Place-Sequence Analysis

Kostas Goulias and Elizabeth McBride

Fragmentation of activities and travel is defined in this presentation as the sequencing of many short activities and trips that happen in a personal daily schedule. These are combined with other activities and travel that are much longer to form a complete string of episodes and durations of each episode by each individual we observe. Fragmentation in a schedule that is made of a sequence of activities means multiple switching between different activities in a day, e.g., the sequence of: escorting children to schools—go to work—eat meal with colleagues—run errand— go back to work—go to a social event—go back to work—pick up children from schools—go shopping—return home—escort a child to soccer practice—do some work using mobile technologies—escort child back home—work at home.

Complex patterns like this lead to increased transport demand because many activities are no longer bound to specific times and specific places, different people need to be escorted in different activity locations, and work can often be done ubiquitously. This is further enabled by Information and (tele)Communication Technologies (ICT) and the emergence of disruptive transportation services (e.g., Uber/Lyft) and automation (e.g., self-driving cars). The usual mode enabling fragmentation and flexibility in scheduling activities at different places is the private car. In this analysis we show that daily patterns with high fragmentation are also daily patterns with high use of the private car.

GeoTrans developed a new method of travel behavior analysis to examine daily patterns in a holistic way setting the foundation for deeper understanding on *how and why individuals engage in activity-travel fragmentation*. To do this we use *sequence analysis* that includes activity sequencing during a day at specific locations, activity duration by type, and their correlation with spatial opportunities as well as social and demographic characteristics. Examples of a new taxonomy are from the States of California and Washington that are used to assess the demand for autonomous vehicles and within household interactions to assess task allocation equity. Figure 1 shows one example of a recent taxonomy developed in GeoTrans with sequences that include places such as Home(H), Work(W), School(S), Travel(T), and Other(O). These sequences include 1440 minutes in a day assigned to locations(activities) and travel and then cluster analysis is applied to pairwise dissimilarities of these sequences to identify similar groups of daily schedules.

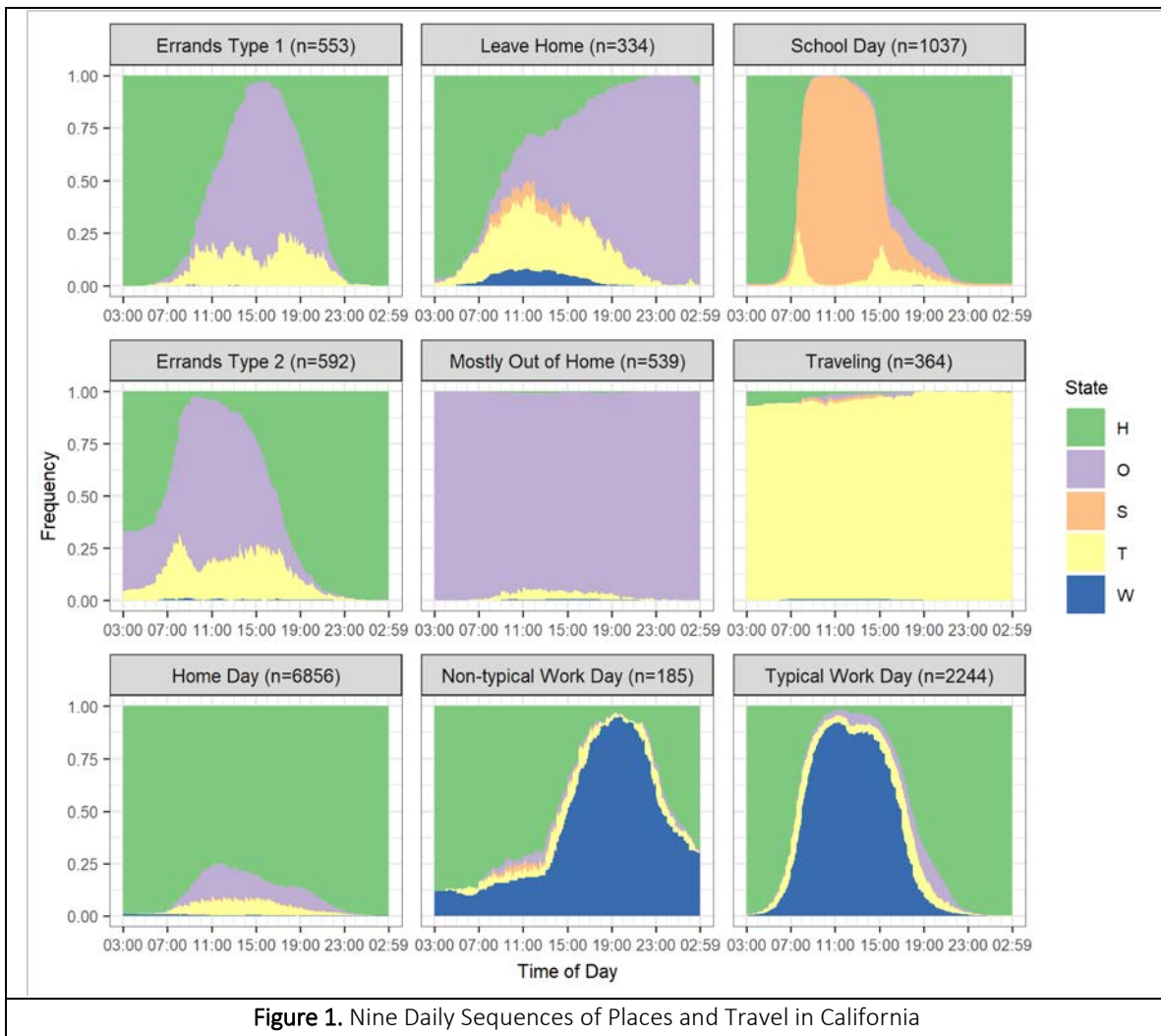


Figure 1. Nine Daily Sequences of Places and Travel in California