Simulating a Functional Populace

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The goal of large scale video sensing of human activities in an urban setting requires a fundamental understanding of what human behaviors are likely, normal, or anomalous in such an environment. Since it is difficult and costly to run actual actor-based situations (e.g., *The Truman Show*), computer simulations can often provide the only realistic route for synthetic urban populace stimuli. Large-scale simulations are frequently done macroscopically, with limited models and graphics of the urban inhabitants and the architectural context, and thus fail to give a personal view of urban life that is crucial for appropriate sensing of and responses to observed behaviors. While many CG research groups are producing animated crowds of hundreds and even thousands of people, generally the agents are mostly just pedestrians wandering (often aimlessly) the traversable areas.

Our CAROSA system, created by Jan Allbeck, builds on top of computer graphics "crowd" simulations by adding an action ontology and agent models that together create data-driven, purposeful, functional individual agents. The CAROSA methodology includes scheduled, opportunistic, reactive, and aleatoric (stochastic) actions, mediated through a common parameterized action and object representation (PAR), and executed by a flexible behavioral engine. CAROSA is also designed to facilitate user generation of activity scenarios by using off-the-shelf software tools, and provides a realistic and principled approach to scenario generation. By using PAR, human activities can be referenced to object features rather than absolute places in the 3D geometry, so that changes to the underlying environment precipitate behavior and animation adaptations without user involvement.

Near future efforts will center on the design and evaluation of computational simulation systems that seek out and link macroscopic urban data, features and properties with individual and group characteristics to achieve plausible microscopic population simulations. Achieving these goals will require acquiring and using available data on a given populace, their activities, preferences and cultural mores, understanding and using the temporal scales, geographical citing, transportation network, meteorological context, and cultural events that occur in urban settings, and using as many of those parameters as possible to affect and drive microscopic human scale simulations. Video analyses may also be used to establish characteristics of existing urban populace activities and provide evaluation ground truth for comparing simulated situations. By having a broad view of an agent's physical and cognitive relationship to the urban environment, the "hand-off" between distributed video sensors also may be facilitated as the broader assessment of normal or anomalous behaviors over extended distances becomes possible.