Temporal Variability in Transit-Based Supermarket Access

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Tools & Techniques

**Create a multimodal network dataset with GTFS data**

- Combine streets and GTFS data
- Use Add GTFS to a Network Dataset tool to configure input data
- Set up connectivity policy
- Use a custom evaluator to calculate transit travel time
- Use stop-street connectors to apply a boarding delay

**Motivation**

**Spatial inequities in access to healthy food**

- Many urban regions in the US contain neighborhoods with low access to healthy foods, commonly referred to as “food deserts” (Barclay 2013, McKinnon et al. 2009).
- Food desert residents are at risk of maintaining less nutritious diets, which can lead to numerous chronic conditions, including cardiovascular disease, obesity, diabetes, and cancer (Hung et al. 2004, Joshi et al. 2001).
- Recent research suggests that the link between poor health outcomes and residing in a food desert is less than certain (An and Sturm 2012), perhaps due to static and lenient spatial definitions.
- It is necessary to incorporate urban dynamics, like residents’ mobility, when defining the spatial extents of food.
- Accessibility changes throughout the day for transit-dependent residents.
- The added burden of low spatial access via transit to healthy foods could drive an increased dependence on local options like convenience stores.

**Data & Methods**

- We analyzed walking/transit access to supermarkets in the Cincinnati area.
- We used the Add GTFS to a Network Dataset tools and custom ArcGIS geoprocessing scripts.
- GTFS data are from the Southwest Ohio Regional Transit Authority (SORTA) and the Transit Authority of Northern Kentucky (TANK).
- Street data were obtained from OpenStreetMap.
- Supermarkets and a year-round farmers’ market are considered as healthy food vendor locations. They are geocoded using addresses obtained through a business directory.

**Analysis & Exploration**

- Calculate transit accessibility
  - Use ArcGIS Network Analyst tools
  - Find the walking/transit travel times between OD pairs
  - Calculate travel time for every minute of the day
  - Use custom python geoprocessing scripts for post-processing, using the split 3 and multiprocessing modules

**Findings**

- Because transit service changes minute-by-minute, travel times to supermarkets can vary significantly.
- Some census blocks have supermarket access within 20 minutes 100% of the time because they are within walking distance of a supermarket. Others never have 20-minute access. However, some have 20-minute access for part of the day, due to the ebb and flow of transit service.
- Most census blocks with less than 100% access experience 5-20% access.
- Those who live farther from supermarkets experience greater variability in travel time.
- Very few census blocks have transit access to three supermarkets within 20 minutes.