TMIP Webinar Series

Activity-Based Modeling

Session 4: Frameworks and Techniques

The Travel Model Improvement Program

Speakers: John Gliebe & Joel Freedman

April 5, 2012

Acknowledgments

This presentation was prepared through the collaborative efforts of Resource Systems Group, Inc. and Parsons Brinckerhoff.

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- Moderator
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- Content Development, Review and Editing
  - Joel Freedman, John Gliebe, Rosella Picado, John Bowman, Mark Bradley
- Media Production
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2012 Activity-Based Modeling Webinar Series

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Institutional Topics for Managers	February 23
Technical Issues for Managers	March 15
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Learning Outcomes

By the end of this session, you will be able to:

- Discuss how household activity-travel diary data is used to define activities, tours, and daily patterns
- Describe how choice model structures are used to represent key aspects of activity-based model generation and scheduling
- Describe how discrete choice models are used and applied in activity-based modeling systems
- Discuss the various design decisions important to the development of activity-based modeling systems

Terminology

- Trip
- Tour
- Day pattern
- Schedule
- Discrete Choice Model
- Monte Carlo simulation

Key Concepts

- Activity-based models attempt to model an entire daily travel pattern for each individual in a population, as affected by transportation system level of service
- While activity-based modeling systems vary, they all represent certain key aspects of the activity-travel pattern creation through integrated model components
- Discrete choice models are the most commonly used analytical formulation for model components and are applied through Monte Carlo simulation methods
- Model design involves developing structural representation of decision process and how to treat modes, space, time, and other key model parameters

What is an activity-based travel model?

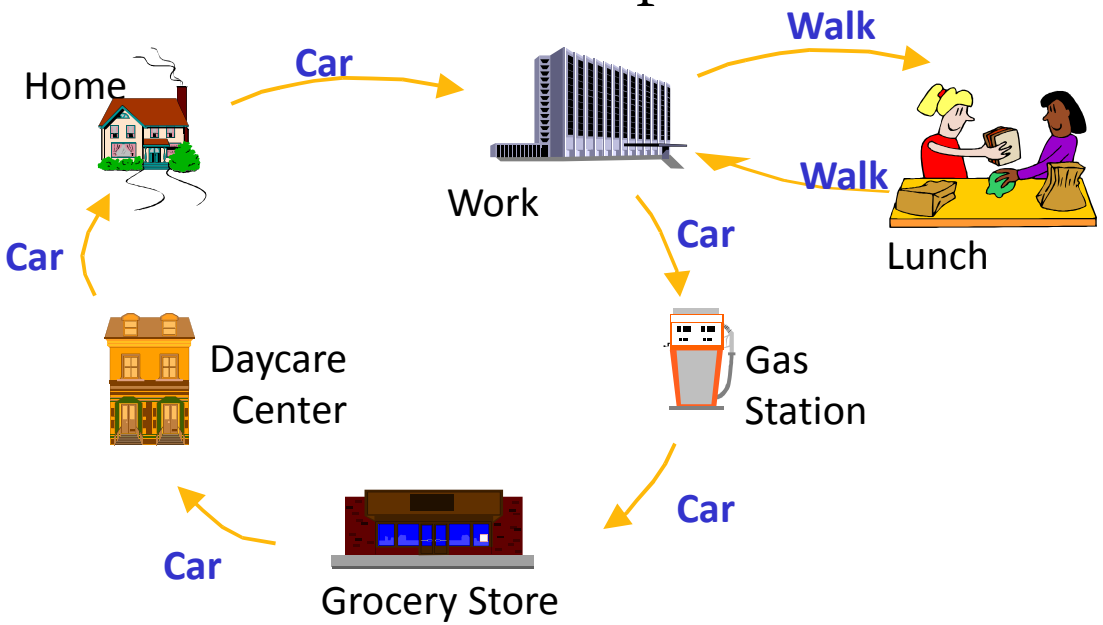
- Activity-based model differs from a trip-based model by modeling decisions to participate in activities
- The focus is whether, when and where to participate in activities, and for how long
- Travel is a derived demand. Trips are a means of traveling between out-of-home activity locations.
- Decisions related to mode and departure times are made to accommodate desired activity arrival and departure times
- Activity-based models represent each household and person individually, using simulation methods

Aren't "activities" just a fancy name for trip purposes? … Not really

- Activities have a duration (which we model) that has intrinsic value to the participant
  - Activity duration generates positive utility, up to a point, and this time is traded-off against the disutility of travel
- Modeling activities means allowing for the possibility of in-home substitutions and tradeoffs, such as:
  - Telecommuting from home
  - At-home social/recreational, eating and other activities
  - Reserving time to be at home to take care of children

Modeling Trips as Part of Tours

- **Tour:** a series of trips beginning and ending at home or work anchor locations
  - No more modeling for journey home from work separate from journey to work!
- Primary destination and intermediate stops
- Sub-tours
  - No more standalone non-home-based trips!



Common Themes of Activity-Based Travel Models

- Model tours as part of a person's ***entire day***
  - Identification of a daily activity pattern
  - When conditions affect one tour they affect a person's entire day of activities and travel!
- Schedule activities consistently in ***time*** and ***space***
  - Activities occur in available time windows
  - No person can be in two places at the same time!

Assembling Household Survey Diary Data for Model Development

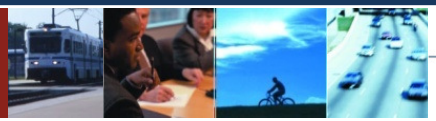
- Household activity-travel diary
- Person attribute file
- Household attribute file

hhid	perid	dayno	actno	activity	TAZ	arrive	depart	duration	trip time	trip mode	age	female	worker	income	autos
626	1	2	0	Home	39	0	7:00	0	0	none	55	0	1	14	1
626	1	2	1	Escort	82	7:05	7:10	5	5	auto driver occ 2+	55	0	1	14	1
626	1	2	2	Work	1290	7:20	15:25	485	10	auto driver SOV	55	0	1	14	1
626	1	2	3	HH Bus	160	15:50	16:10	20	25	auto driver SOV	55	0	1	14	1
626	1	2	4	Shopping	96	16:20	17:00	40	10	auto driver SOV	55	0	1	14	1
626	1	2	5	Home	39	17:10	19:00	110	10	auto driver SOV	55	0	1	14	1
626	1	2	6	Jnt Shop/Eat	87	19:05	21:00	115	5	auto driver occ 2+	55	0	1	14	1
626	1	2	7	Home	39	21:10		50	10	auto driver occ 2+	55	0	1	14	1
626	2	2	0	Home	39	0	7:00	0	0	none	10	1	0	14	1
626	2	2	1	School	82	7:05	13:40	395	5	auto passenger	10	1	0	14	1
626	2	2	2	Home	39	14:00	19:00	300	20	school bus	10	1	0	14	1
626	2	2	3	Jnt Shop/Eat	87	19:05	21:00	115	5	auto passenger	10	1	0	14	1
626	2	2	4	Home	39	21:10		50	10	auto passenger	10	1	0	14	1

From Diary Data to Activities

- Identify activity records
  - Place-based convention (one activity purpose per out-of-home location)
  - Some activities involve joint travel and participation
  - Activity durations are important part of scheduling activities and travel
- Familiar trip-based measures also used
  - Starting time, mode, travel time

hhid	perid	dayno	actno	activity	TAZ	arrive	depart	duration	trip time	trip mode
626	1	2	0	Home	39	0	7:00	0	0	none
626	1	2	1	Escort	82	7:05	7:10	5	5	auto driver occ 2+
626	1	2	2	Work	1290	7:20	15:25	485	10	auto driver SOV
626	1	2	3	HH Bus	160	15:50	16:10	20	25	auto driver SOV
626	1	2	4	Shopping	96	16:20	17:00	40	10	auto driver SOV
626	1	2	5	Home	39	17:10	19:00	110	10	auto driver SOV
626	1	2	6	Jnt Shop/Eat	87	19:05	21:00	115	5	auto driver occ 2+
626	1	2	7	Home	39	21:10		50	10	auto driver occ 2+
626	2	2	0	Home	39	0	7:00	0	0	none
626	2	2	1	School	82	7:05	13:40	395	5	auto passenger
626	2	2	2	Home	39	14:00	19:00	300	20	school bus
626	2	2	3	Jnt Shop/Eat	87	19:05	21:00	115	5	auto passenger
626	2	2	4	Home	39	21:10		50	10	auto passenger



From Diary Data to Tour Patterns

- Identify tours
  - Primary stop/destination of tours
  - Intermediate stops on first, second half of tour
  - Primary mode for tour
  - Start and end times for each tour

hhid	perid	dayno	tourno	actno	activity	TAZ	primary	int stops	arrive	depart	duration	trip time	trip mode	tour mode
626	1	2	0	0	Home	39	0	0	0	7:00	0	0	none	none
626	1	2	1	1	Escort	82	0	1	7:05	7:10	5	5	auto driver occ 2+	auto driver occ 2+
626	1	2	1	2	Work	1290	1	0	7:20	15:25	485	10	auto driver SOV	auto driver occ 2+
626	1	2	1	3	HH Bus	160	0	1	15:50	16:10	20	25	auto driver SOV	auto driver occ 2+
626	1	2	1	4	Shopping	96	0	1	16:20	17:00	40	10	auto driver SOV	auto driver occ 2+
626	1	2	0	5	Home	39	0	0	17:10	19:00	110	10	auto driver SOV	auto driver occ 2+
626	1	2	2	6	Jnt Shop/Eat	87	1	0	19:05	21:00	115	5	auto driver occ 2+	auto driver occ 2+
626	1	2	0	7	Home	39	0	0	21:10		50	10	auto driver occ 2+	auto driver occ 2+
626	2	2	0	0	Home	39	0	0	0	7:00	0	0	none	none
626	2	2	1	1	School	82	1	0	7:05	13:40	395	5	auto passenger	auto passenger
626	2	2	0	2	Home	39	0	0	14:00	19:00	300	20	school bus	auto passenger
626	2	2	2	3	Jnt Shop/Eat	87	1	0	19:05	21:00	115	5	auto passenger	auto passenger
626	2	2	0	4	Home	39	0	0	21:10		50	10	auto passenger	auto passenger

From Diary Data to Daily Activity Patterns

- Identify daily activity patterns
  - Usually defined by presence of tours by type, possibly number of tours by type
  - "Stay home all day" is a legitimate daily pattern

hhid	perid	dayno	tourno	actno	activity	TAZ	primary	arrive	depart	duration	trip time	trip mode	day pattern
626	1	2	0	0	Home	39	0	0	7:00	0	0	none	W-J
626	1	2	1	1	Escort	82	0	7:05	7:10	5	5	auto driver occ 2+	W-J
626	1	2	1	2	Work	1290	1	7:20	15:25	485	10	auto driver SOV	W-J
626	1	2	1	3	HH Bus	160	0	15:50	16:10	20	25	auto driver SOV	W-J
626	1	2	1	4	Shopping	96	0	16:20	17:00	40	10	auto driver SOV	W-J
626	1	2	0	5	Home	39	0	17:10	19:00	110	10	auto driver SOV	W-J
626	1	2	2	6	Jnt Shop/Eat	87	1	19:05	21:00	115	5	auto driver occ 2+	W-J
626	1	2	0	7	Home	39	0	21:10		50	10	auto driver occ 2+	W-J
626	2	2	0	0	Home	39	0	0	7:00	0	0	none	S-J
626	2	2	1	1	School	82	1	7:05	13:40	395	5	auto passenger	S-J
626	2	2	0	2	Home	39	0	14:00	19:00	300	20	school bus	S-J
626	2	2	2	3	Jnt Shop/Eat	87	1	19:05	21:00	115	5	auto passenger	S-J
626	2	2	0	4	Home	39	0	21:10		50	10	auto passenger	S-J

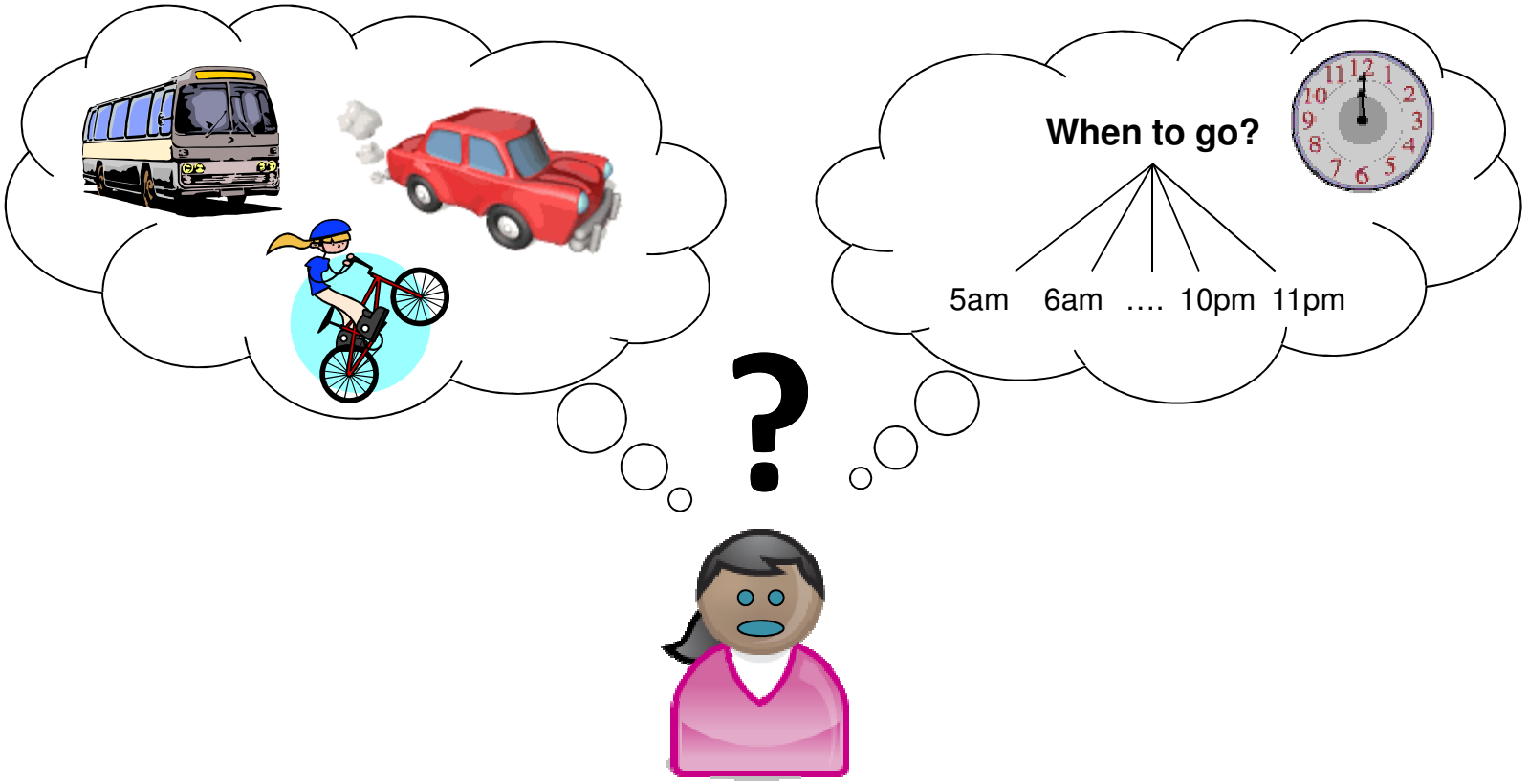
That's a lot of info…. How do we model this?

- Start with a synthetic population (basic demographics)
- Some information items represent long-term choices:
  - Predict household auto ownership/availability
  - Predict usual school and work locations
  - Predict policy-relevant "mobility" choices
- Some dimensions are based on the entire day:
  - Predict the choice of daily activity patterns
  - Predict the exact number of tours by purpose

(cont'd.) … How do we model this?

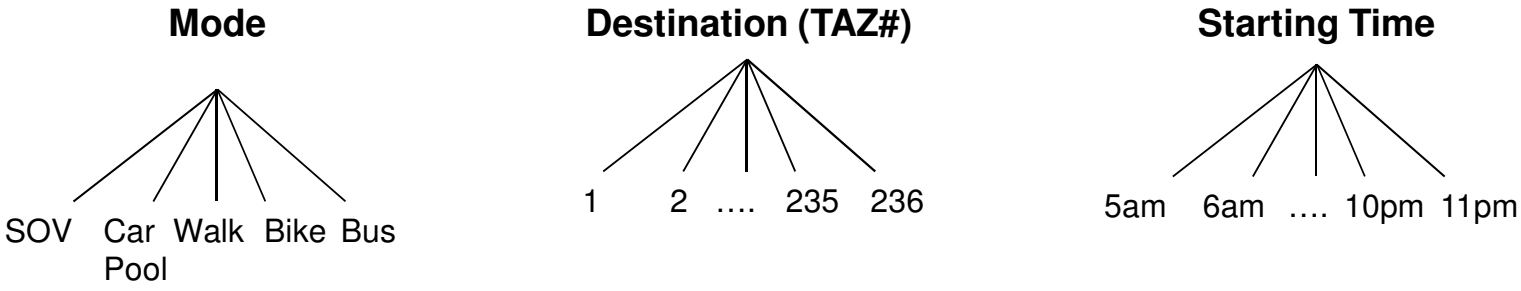
- Others dimensions are specific to tours:
  - Predict the primary destination of each tour
  - Predict the tour mode, start and end times
  - Predict the insertion of intermediate stops on the tour
- Finally, we get to individual activity stops…and trips!
  - Predict stop destinations, trip modes, departure times and activity durations
- Create a list of all the trips
- Assign trips to a network

How do we "predict" activity-travel choices?



- We assume that persons make many **deliberate choices** that collectively result in the activity patterns we observe

Choices may be defined by various decision dimensions… mode, space, time

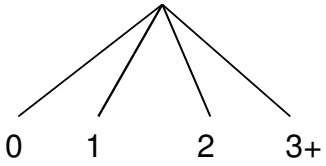


- Choices may be easy to distinguish… modes
- Some choices are made from a continuous source, but are parsed into discrete units for analytical tractability
  - Implications for treatment of modes, space and time in surveys, networks, assignment processes and geo-databases

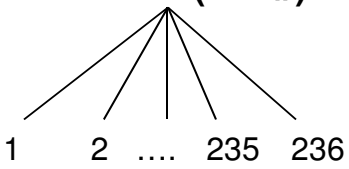
Different Choice Horizons

Long-Term and Mobility Choices

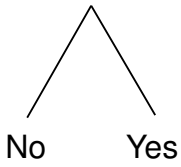
Number of Autos to Own



Workplace Location (TAZ#)

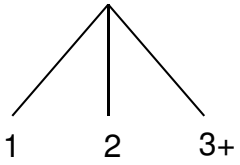


Buy Transit Pass?

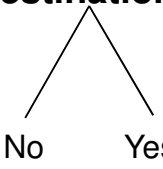


Daily Tour Pattern Generation and Stop Details

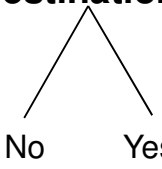
Exact Number of Shopping Tours



Add Stop Before Primary Destination?

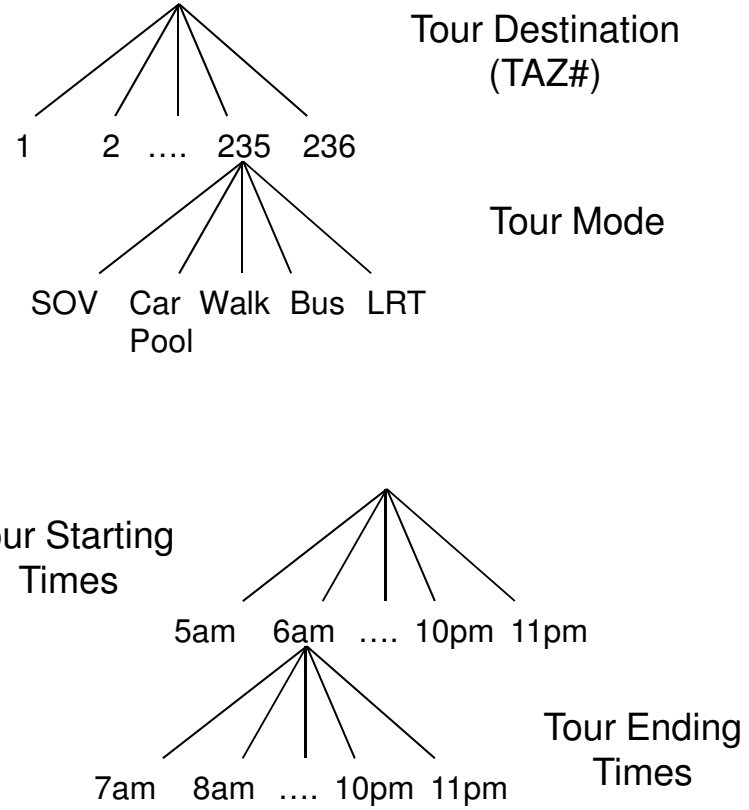


Add Stop After Primary Destination?

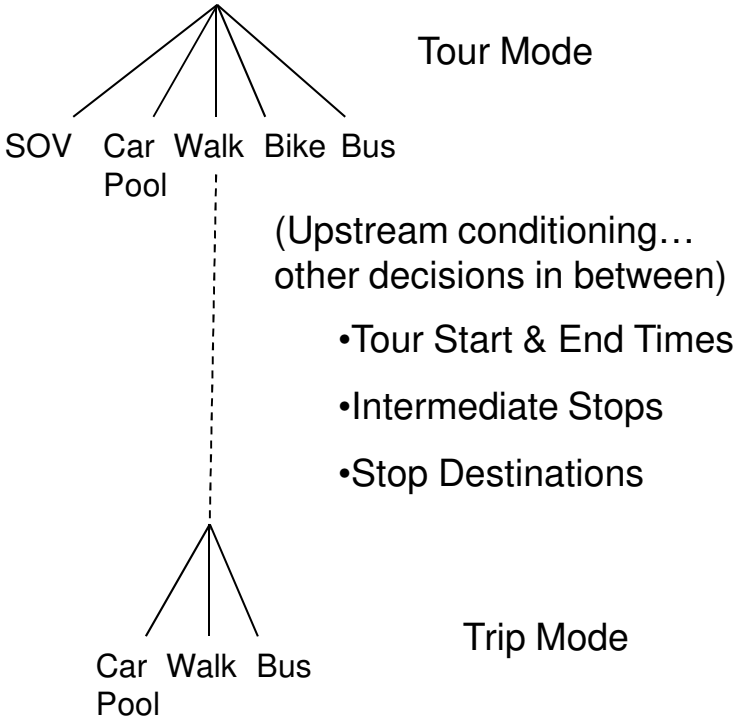


Joint and Conditional Choices

Joint choice (hierarchy assumed)

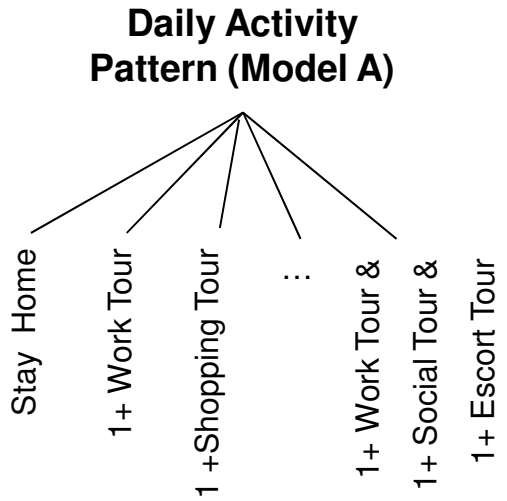


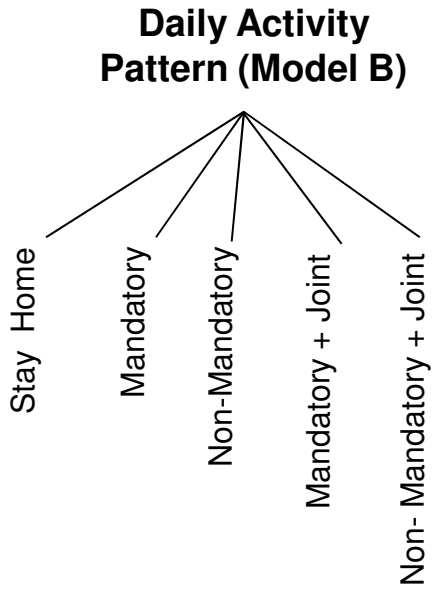
Conditional choice



Daily Pattern Choices (2 versions)

- Differences in activity-based model design are expressed in how certain choices are represented structurally, as well as their sequencing





Choice Theory

- Many decision rules and theories out there…
  - Lexicographic ordering, min-max ranking
  - Elimination by aspects
  - Risk minimization strategies, prospect theory
- We prefer to use **utility maximization:**
  - **Decision maker chooses the alternative that provides the highest utility among available alternatives**
    - Robust over a wide range of decision makers and contexts
    - Applied probabilistically: accounts for measurement error, random heterogeneity
    - Assumes complete information on important attributes
    - Assumes equal attention paid to all available alternatives

Random Utility Theory

- Decision-maker selects alternative that is perceived to offer the maximum utility from a set of alternatives that are mutually exclusive, also known as the choice set
- Observer does not know utilities
- Sources of Error
  - Missing variables
  - Unobserved taste variation
  - Measurement error
  - Incorrect functional form
- Observer treats errors in measured utility as random and additive, that is:

$$U_j = V_j + \varepsilon_j$$

Choice Probabilities

- Probability of choosing alternative *i* from a set of choice alternatives *C*

$$P(i:C) = \text{Prob}\left(U_i \geq U_j, \quad \forall j \subset C\right)$$

$$= \text{Prob}\left(V_i + \varepsilon_i \geq V_j + \varepsilon_j, \quad \forall j \subset C\right)$$

- Under general assumptions, the model is…

$$P(i:C) = \frac{\exp\left(V_i\right)}{\sum_{\forall j} \exp\left(V_j\right)}$$

- Probability is based on the difference in utility between alternatives

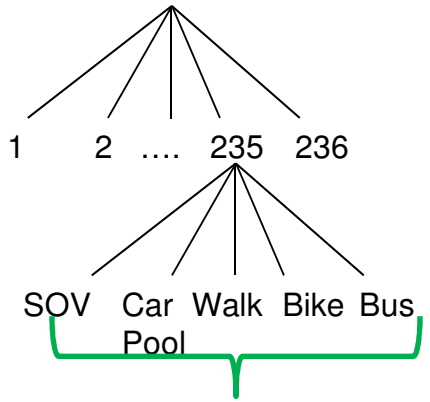
$$\frac{\exp(V_i)}{\exp(V_j)} = \exp(V_i - V_j)$$

Utility Expressions: Mode Example

$$\text{Utility}_{\text{transit}} = a * \text{in-vehicle time} + b * \text{fare} + c * \text{access time + egress time} + d * \text{wait time} + \text{mode-specific constant}$$

- V_i = Systematic Utility -- the weighted sum of the attributes
- a, b, c, d are the weights, or parameters, in the model
- Parameters are estimated from survey data or borrowed/asserted
- They convert the times and costs to *utiles*
- They are negative if multiplied by time/cost (*disutility*)
- The mode-specific constant is the value of the "non-included" attributes

Nested Logit Probabilities



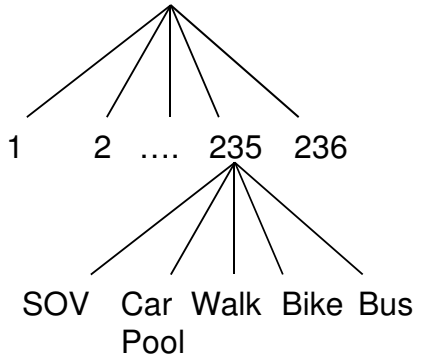
- Probability of mode *i* is conditional upon nest *n*: $P(i) = P(i \mid n) * P(n)$

$$P(i) = \frac{\exp(V_{i|n} / \theta_n)}{\sum_{j \in n} \exp(V_{j|n} / \theta_n)} * \frac{\exp\left[V_n + \theta_n \ln\left(\sum_{j \in n} \exp(V_{j|n} / \theta_n)\right)\right]}{\sum_{\forall m}\left[\exp\left[V_m + \theta_m \ln\left(\sum_{j \in m} \exp(V_{j|m} / \theta_m)\right)\right]\right]}$$

- θ are dispersion parameters specific to each nest
- **Log sum** terms represent composite utility of lower-level nested alternatives

Importance of Choice Sets

- The group of alternatives considered to be available to the chooser in a given choice context are the choice set
- The role of choice set formation and restrictions is important in activity-based modeling systems
- In conditional choice contexts, the upstream model choice will in many cases condition the availability of alternatives downstream (e.g. tour mode→trip mode)
- The presence of an alternative in a downstream choice will affect the composite utility of the upstream choices



Prediction: Allocation vs. Simulation

- Classical 4-Step Trip-Based Model—Mode Choice
  1. For each market segment, defined by trip purpose and household demographic group, predict the probability of each mode for each O-D pair.
  2. Allocate the number of trips for each segment and O-D pair to modes in proportion to their predicted probabilities.
  3. Sum over market segments to form trip tables.
- Activity/Tour-Based/Simulation—Mode Choice
  1. Predict probability of each simulated chooser selecting each mode for a specific O-D pair and purpose.
  2. Use Monte Carlo random draws to predict mode choice.
  3. Sum over choosers and purposes, grouped by O-D pair, to form trip tables for network assignment.

Monte Carlo Prediction

1. Predict the probability and cumulative probability for each alternative outcome

	SOV	HOV	Bus	LRT	Walk	Bike
Probability	0.56	0.28	0.03	0.08	0.01	0.04
Cum. Prob.	0.56	0.84	0.87	0.95	0.96	1.00

2. Draw a random number from a uniform distribution on the unit interval (0…1): **e.g. Rand() = 0.76**
3. Select the alternative with the range on the cumulative probability array that includes the random draw

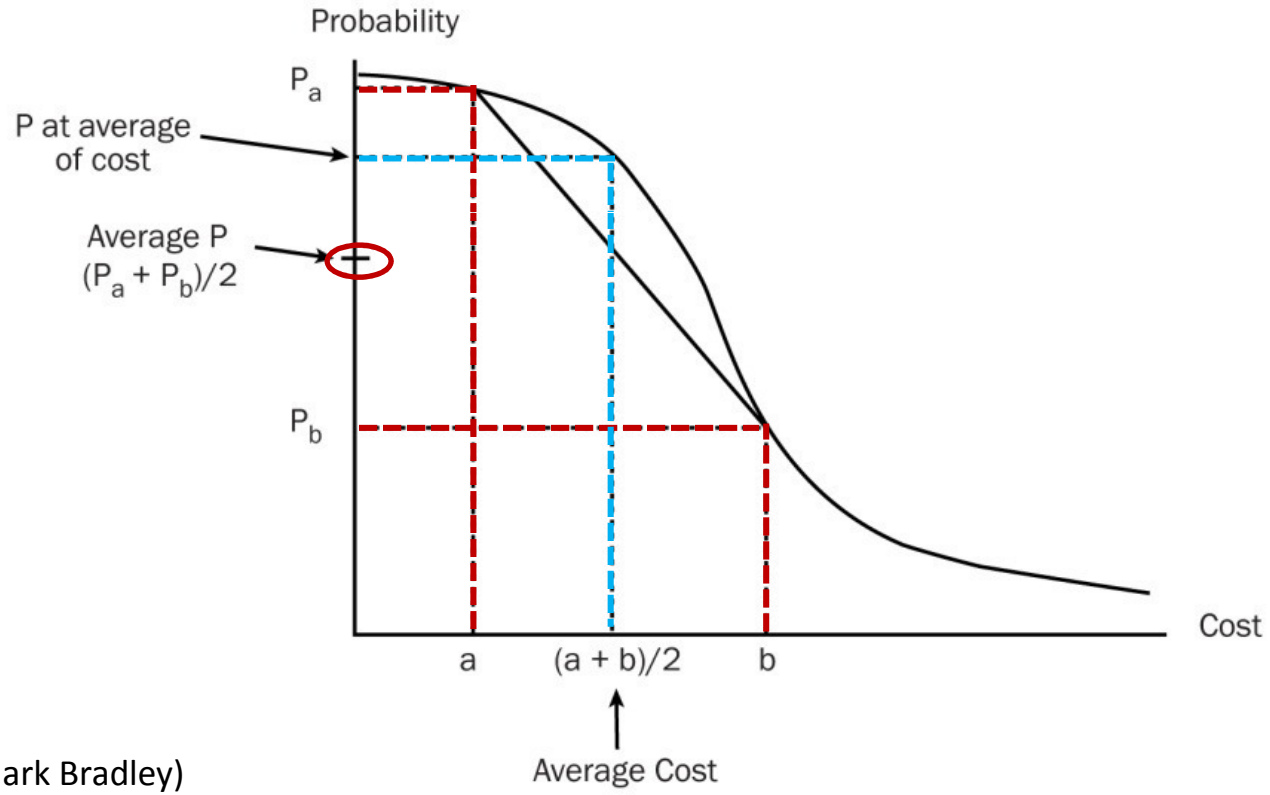
	SOV	HOV	Bus	LRT	Walk	Bike
Lower Bound	0.00	0.57	0.85	0.88	0.96	0.97
Upper Bound	0.56	0.84	0.87	0.95	0.96	1.00

Monte Carlo Simulation Advantages

- Advantages
  - Computational efficiency (when number of segments exceeds number of agents)
    - Full availability of all variables
    - Outcomes of previous model components can be used as explanatory variables in subsequent components
  - Provides distribution of results
  - Avoids aggregation bias

Logit Models and Aggregation Bias (I)

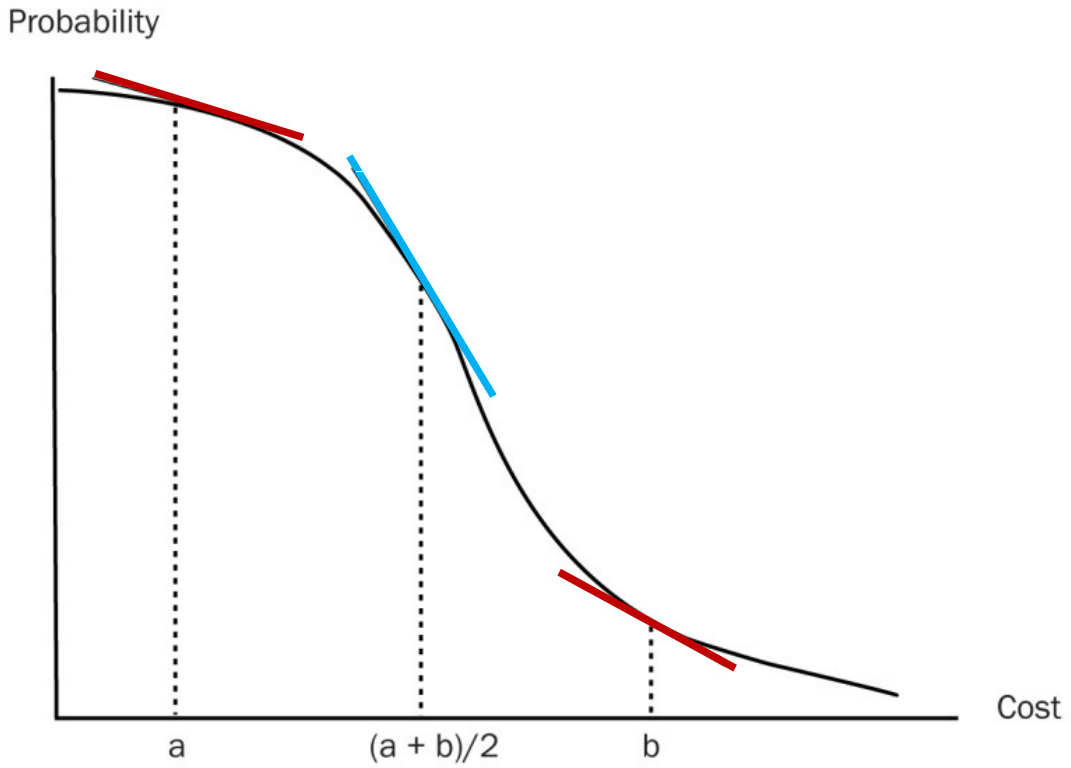
- Average probability is not equal to the probably at the average of explanatory variables.



(Graphic source: Mark Bradley)

Logit Models and Aggregation Bias (II)

- The average impact of a change (average of slopes at a and b) is not equal to the impact calculated at the average of the explanatory variables.



(Graphic source: Mark Bradley)

Monte Carlo Simulation: Output Variability (Sample Error)

- Disadvantages
  - Requires multiple runs in order to obtain expected values
  - Use of the same model, same inputs, but different random seed will generate different results
- Implications for forecasting
  - Dependent on number of agents, probability of choice
  - Law of large numbers→consistent estimates for aggregate outcomes
- Ways to compensate
  - Fix seed
  - Average results
  - Sample replication and weighting

Questions and Answers

The Travel Model Improvement Program

Activity-Based Model Design

- Overall activity-based modeling design philosophy
  - Primarily reflected in modeled day patterns, activity typology and prioritization, and sequencing of model steps
- Decide on treatment of key design elements
  - Defining characteristics of the population
  - Defining spatial units of analysis and accessibility calculations
  - Defining important long-term and mobility choices
  - Defining tour types and organizational elements
  - Defining activity purposes and treatment of joint travel
  - Defining time units and scheduling algorithms
  - Defining primary, secondary and access modes
- Decide on sequencing of models
- Integration with network supply models

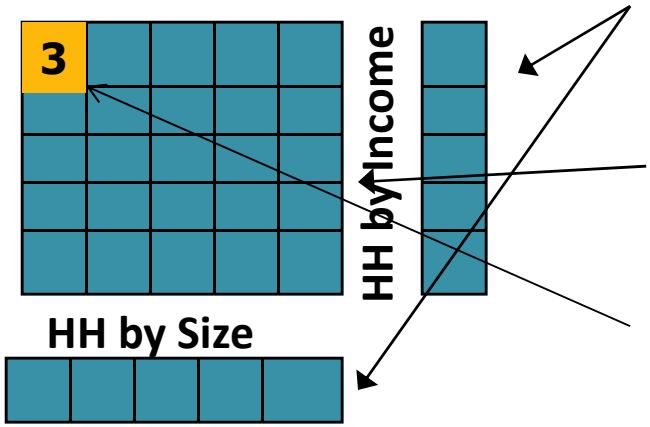
Role of Person Types

- Model segmentation
- Summarize outputs
- Explanatory variables in models
- Constraints on available alternatives

No.	Person Type	Age	Work Status	School Status
1	Full-time worker	18+	Full-time	None
2	Part-time worker	18+	Part-time	None
3	Non-working adult	18 – 64	Unemployed	None
4	Non-working senior	65+	Unemployed	None
5	College student	18+	Any	College +
6	Driving age student	16-17	Any	Pre-college
7	Non-driving student	6 – 16	None	Pre-college
8	Pre-school	0-5	None	None

From San Diego ABM

Construction of a Synthetic Population



Step 1 – Begin with control totals for each zone

Step 2 – Generate the joint distribution of targets for each zone

Step 3 – Choose the household and person records for each cell from PUMS/ACS

PUMS Household File

HHID	SIZ	INC	WRK	SF	AGE_HH
1	1	1	1	0	24
2	1	1	0	1	23
3	1	1	0	1	43
4	1	1	1	0	32
5	1	1	1	1	34
6	2	2	2	0	49
7	2	2	2	1	67
8	3	2	2	1	15
9	3	2	2	0	12

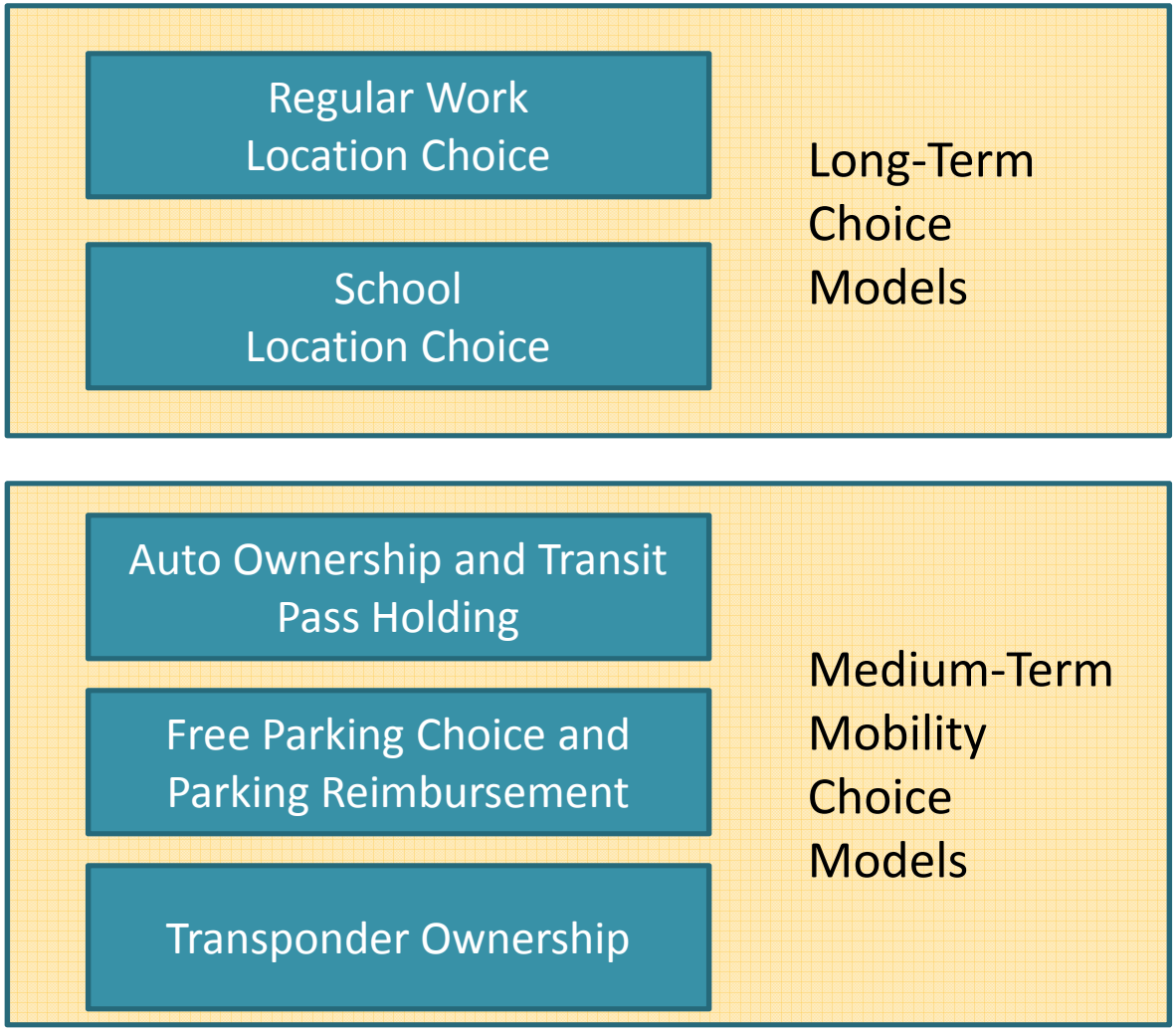
Household File

HID	SIZ	INC	WRK	SF	AGE_HH
1	1	1	1	0	24
3	1	1	0	1	43
5	1	1	1	1	34

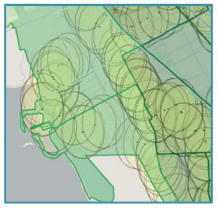
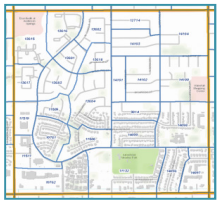
Person File

HID	PID	AUT	INC	WRK	GEN	AGE	EMP
1	1	1	1	1	0	24	1
3	1	3	1	0	0	43	1
5	1	0	1	1	1	34	0

Long Term and Mobility Choices



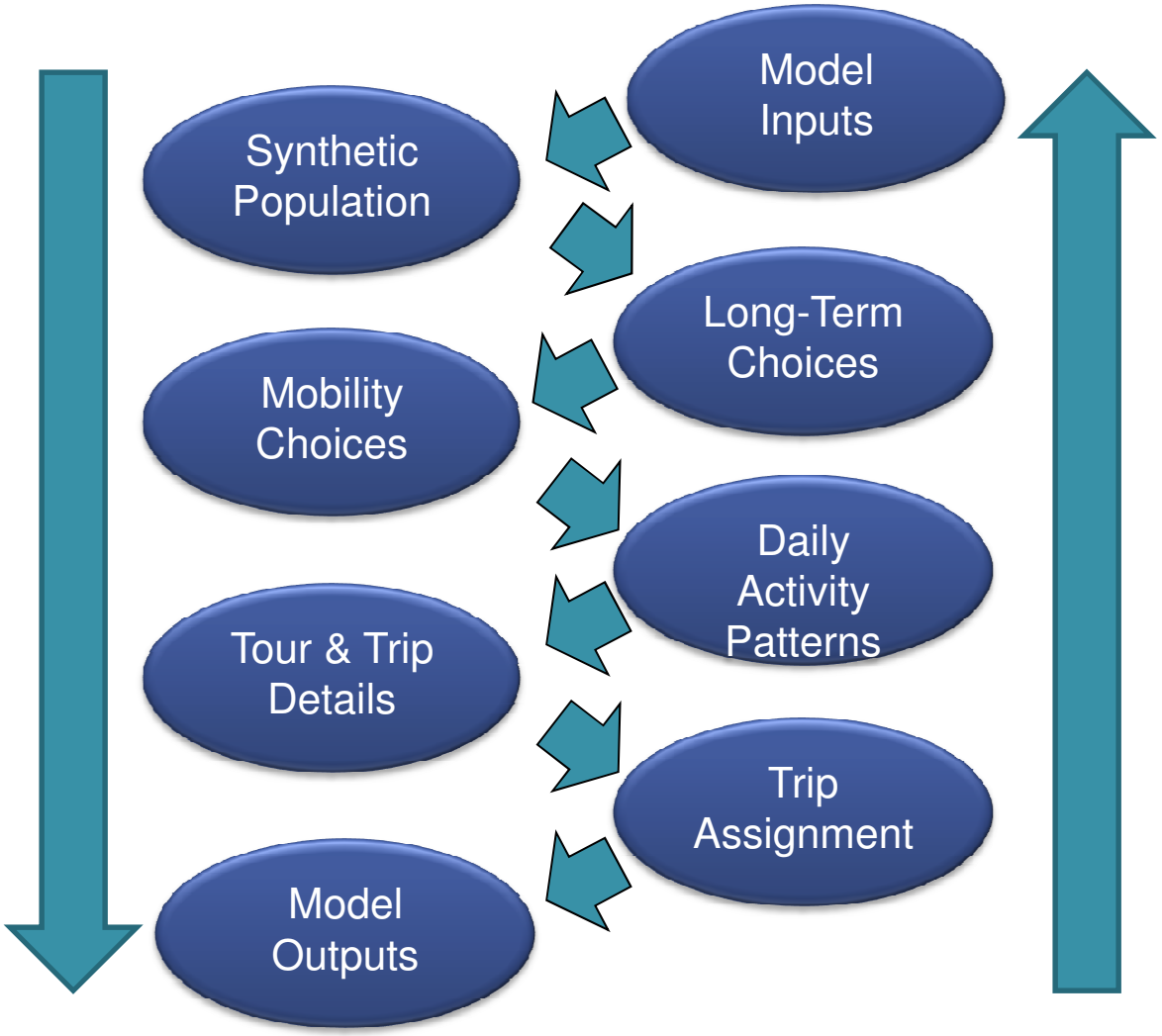
Treatment of Space

Spatial Representation	Diagram
Zones •Already exists for most MPOs •The most aggregation error, particularly for non-motorized and transit modes	
Sub-zones • Created by buffering around transit lines, stops • Improved representation of walk-transit, but may not be consistent with skims • Doesn't help with non-motorized representation (intra-zonal walk and bike)	
Micro-zones • Created by sub-dividing zones (7-10:1) • Best representation of transit accessibility when coupled with stop-stop skims • Improved representation of non-motorized time	
Parcels • Created via parcel database • Improves representation of walk-transit, but need to make consistent w/ skims • Best representation of non-motorized time	

Accessibilities

Downward Integrity:

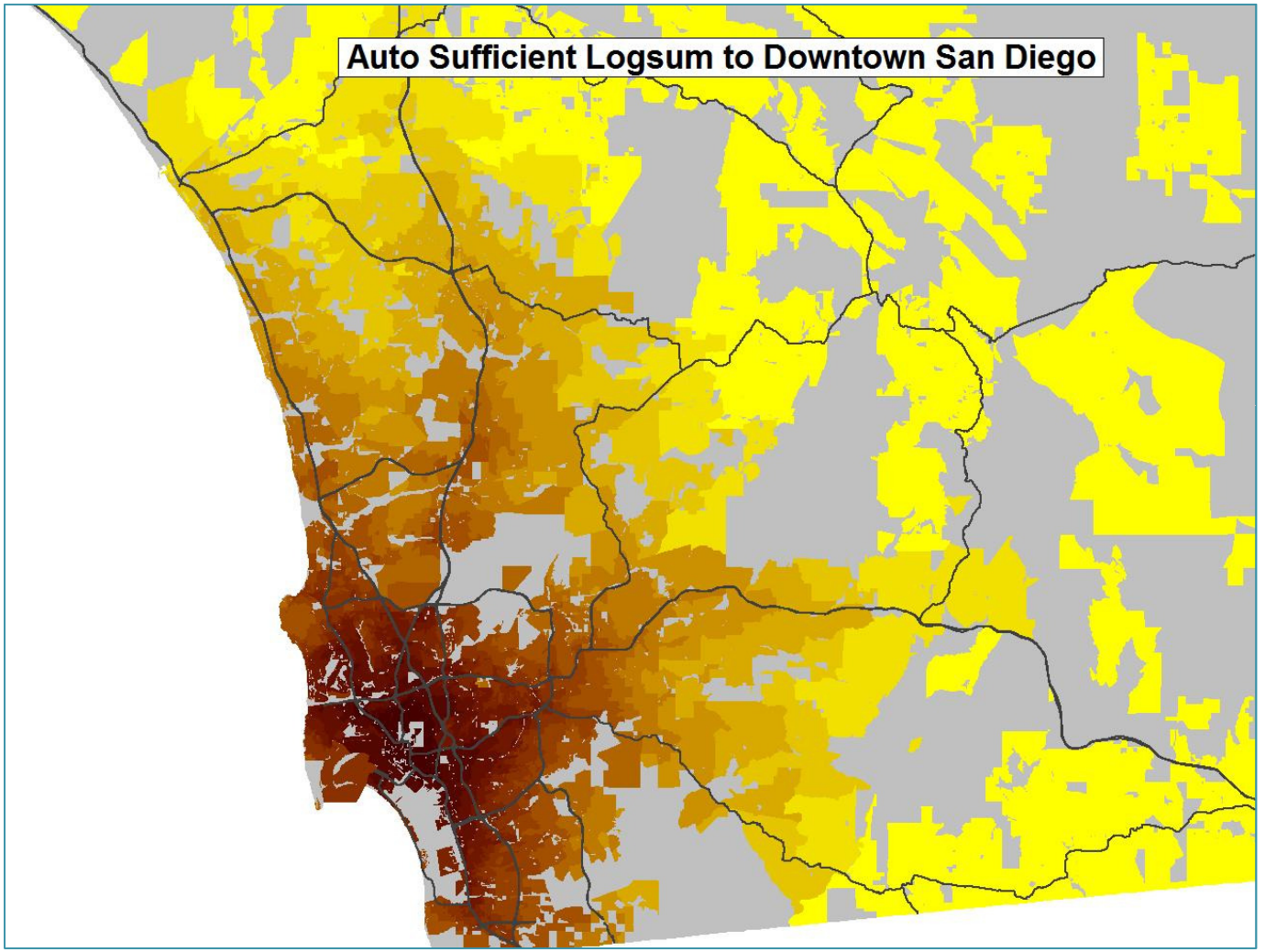
Choices made in higher models affect choices made in lower models



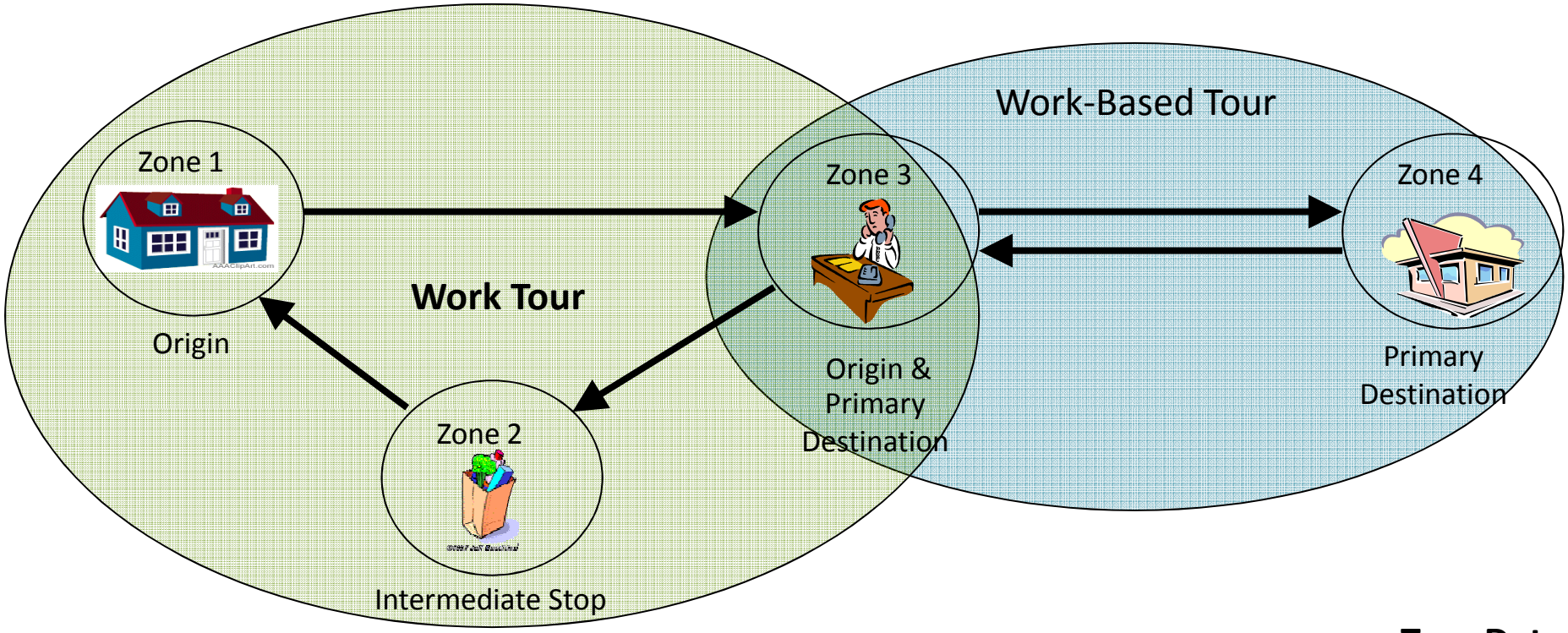
Upward Integrity:

Expected utility of making choices in lower models affect choices made in higher models

Plotting Accessibility: Mode Choice Log Sums



Treatment of Tours and Trips



Tour Data

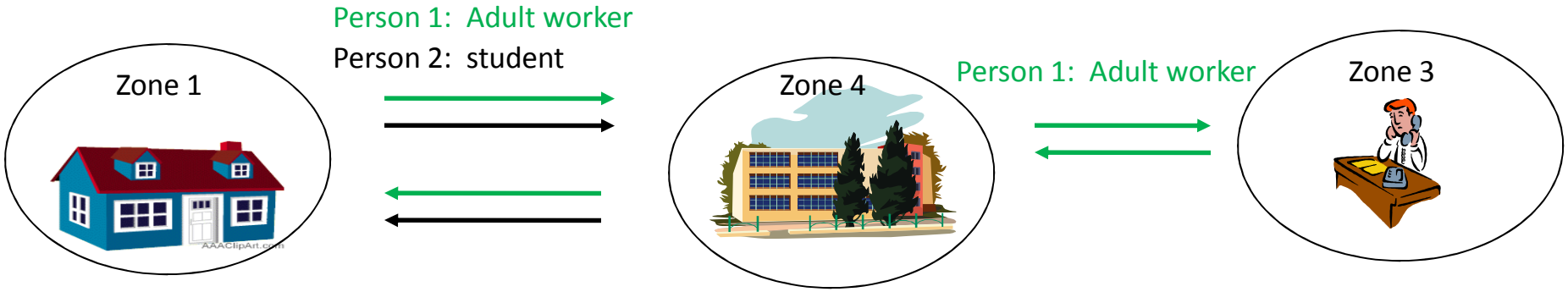
HH #	Per #	Tour #	Purpose	Origin TAZ	Destin. TAZ	Outbound Stop1 TAZ	Return Stop1 TAZ	Mode	Outbound Time	Return Time
1023	1	1	Work	1	3	0	2	Transit	7 :30AM	5:00 PM
1023	1	2	Work-Based	3	4	0	0	Walk	12:00 PM	1:00 PM

Activity Purposes

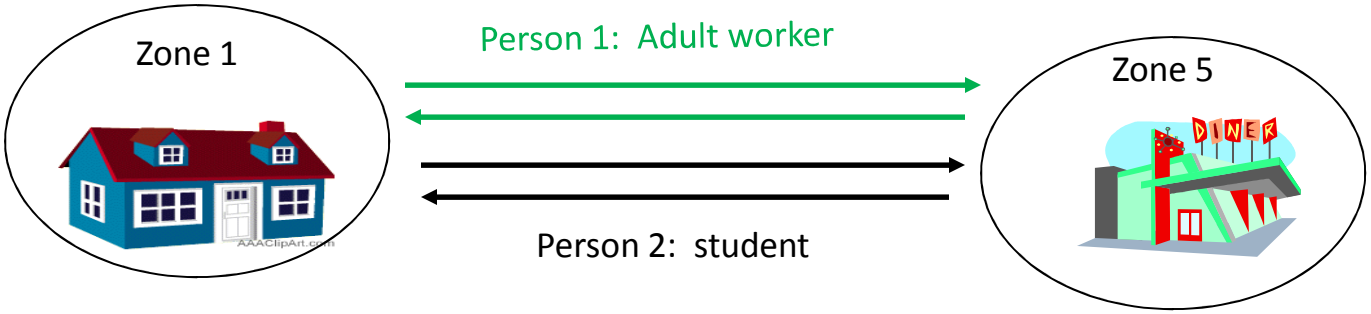
- Mandatory activities
  - Work, School, University
  - Least flexible in terms of generation, scheduling
  - Foundation of daily activity pattern for workers & students
  - Some models differentiate between:
    - work-from-home, and out-of-home
    - Pre-school, K-8, high school purposes
    - Community college and major university
- Maintenance activities
  - Escort, Shop, Other Maintenance (e.g., personal business)
  - Activities performed on behalf of household
- Discretionary activities
  - Eating out, Social/recreation, Other Discretionary (e.g., medical)
  - Most flexible in terms of generation, scheduling
- Activities on work-based sub-tours

Joint Travel

- Partially joint travel: Person 1 (worker) escorts person 2 (student) to school

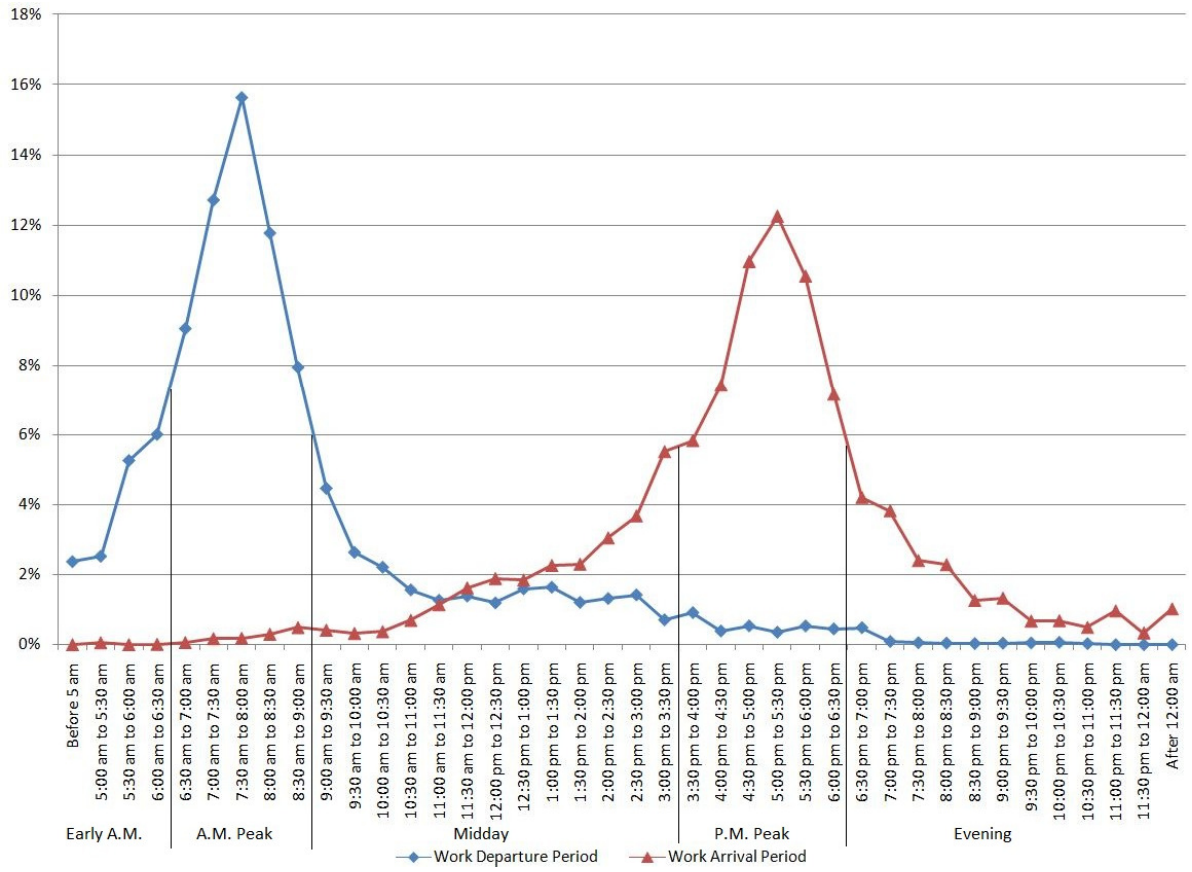


- Fully joint travel: Person 1 (worker) and person 2 (student) both go to dinner and return together

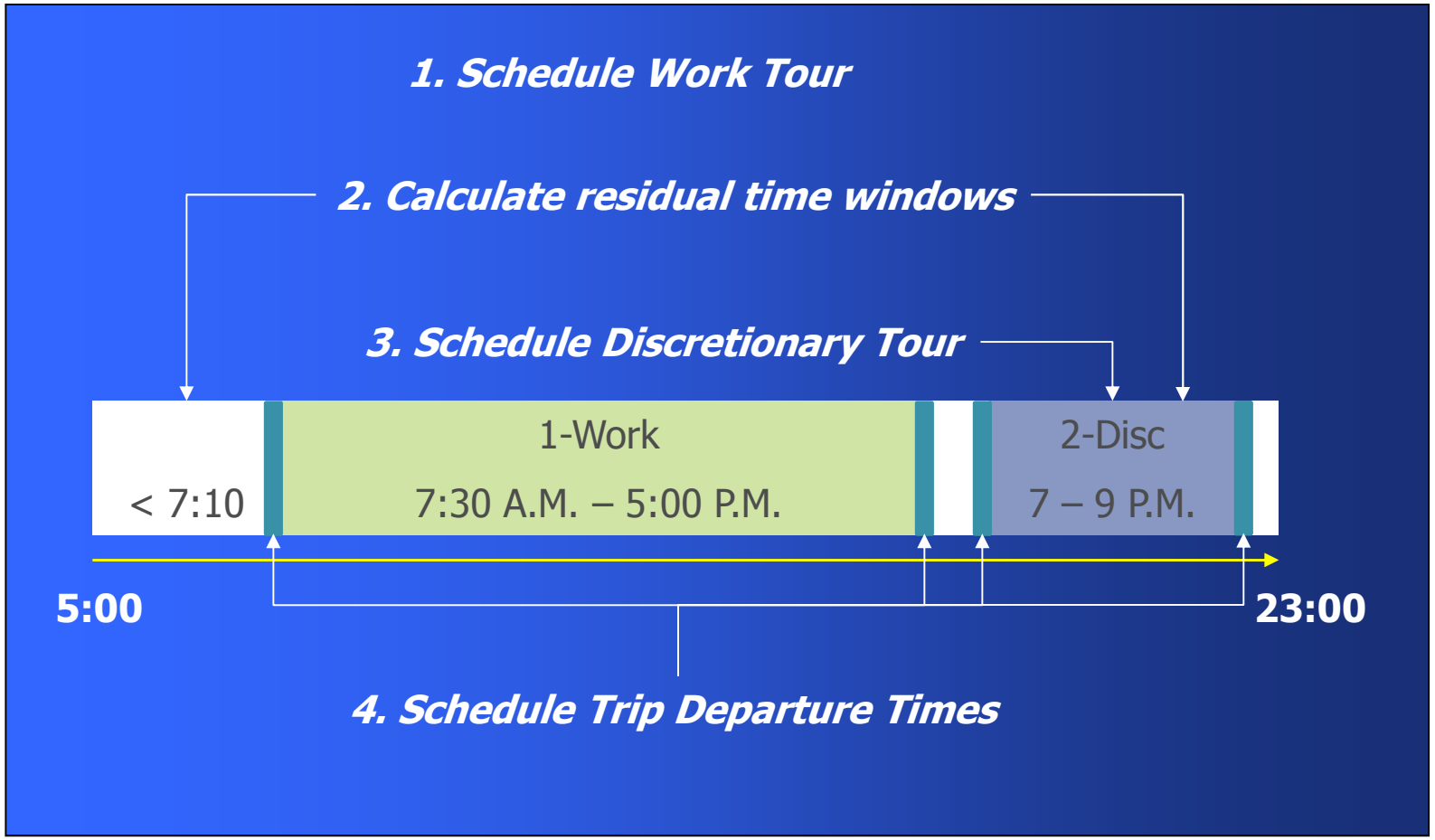


Treatment of Time

- Different temporal systems used
  - 5 time periods, hourly, half-hourly, continuous
- Many models have more aggregate time periods for skims and disaggregate time periods for activity scheduling
  - Example: 5 periods for level of service matrices, half-hourly periods for scheduling activities



Activity Scheduling



Tour and Trip Mode Choice

HOV Lanes

Bus Rapid Transit

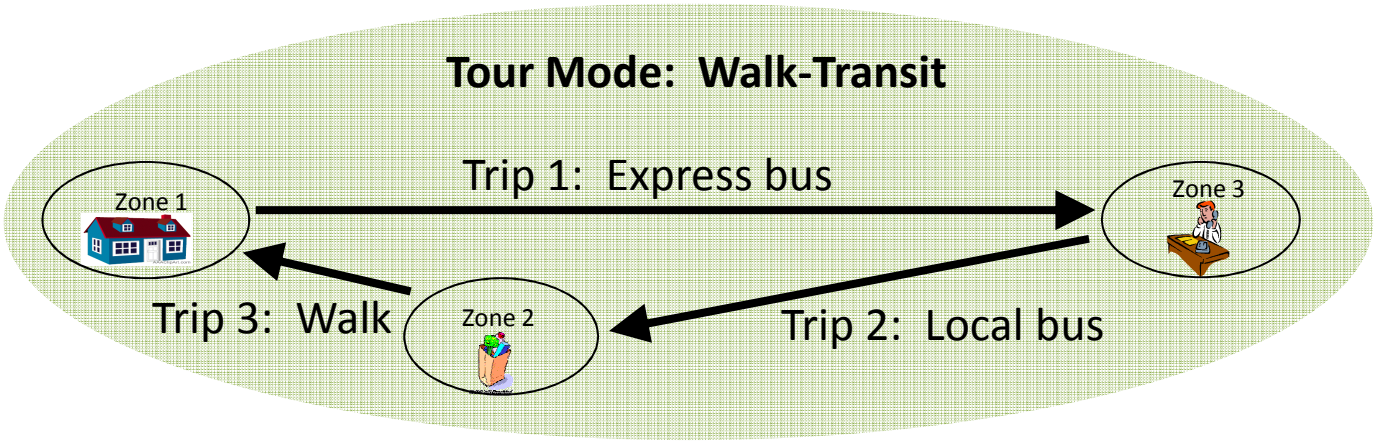
Light-Rail

Heavy Rail

Commuter Rail

Treatment of modes

- Tour mode versus trip mode
  - Tour mode is the overall mode for the tour
  - Trip mode is the actual mode chosen for each trip on the tour
- Other considerations
  - Auto driver versus passenger?
  - Explicit line-haul mode (local versus express versus rail) choice?
  - Park-and-ride versus kiss-and-ride?
  - Explicit toll\HOV choice?



Sequencing Models

1. Select Primary Destination
Based on composite utility

3. Select Primary Mode

2. Select Departure\Arrival Time

4. Select Stop Location
Based on additional cost

Network Integration

Activity-Based Demand Model

Output: Trip Lists

hhid	perid	dayno	tourno	tripno	activity	OTAZ	DTAZ	depart	trip mode	age	inc grp
626	1	2	1	1	Escort	39	82	7:00	HOV-2	55	4
626	1	2	1	2	Work	82	1290	7:10	SOV	55	4
626	1	2	1	3	HH Bus	1290	160	15:25	SOV	55	4
626	1	2	1	4	Shopping	160	96	16:10	SOV	55	4
626	1	2	0	5	Home	96	39	17:00	SOV	55	4
626	1	2	2	6	Jnt Shop/Eat	39	87	19:00	HOV-2	55	4
626	1	2	0	7	Home	87	39	21:00	HOV-2	55	4

Feedback

DTAZ

OTAZ	1	2	3	4	5	6	7	8	9	10
1	1.94	3.40	5.38	6.03	6.54	7.61	8.77	8.09	3.55	5.73
2	3.81	1.89	3.68	4.26	5.25	7.78	8.54	7.87	5.64	7.87
3	4.82	3.41	2.12	3.51	5.04	6.69	7.28	5.96	5.26	7.72
4	6.69	4.02	3.11	2.18	3.47	5.36	5.87	5.46	6.00	8.42
5	8.98	5.52	5.19	4.03	2.33	5.59	7.00	7.57	9.37	10.62
6	8.44	7.15	5.86	5.81	4.58	2.55	3.78	6.50	8.85	10.31
7	12.40	9.30	7.53	6.88	7.15	5.02	4.24	8.20	11.16	11.78
8	11.44	7.69	5.35	5.58	6.95	7.35	7.74	4.65	8.91	10.08
9	5.53	6.35	6.35	8.98	10.13	10.34	11.07	10.55	4.25	5.90
10	7.85	7.84	9.24	11.81	13.80	12.38	13.14	13.68	6.82	3.28

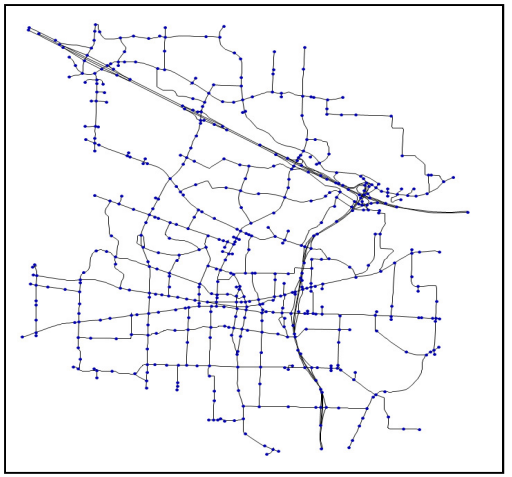
Create Skims by Time Period and Mode

Create Trip Tables by Time Period and User Class

DTAZ

OTAZ	1	2	3	4	5	6	7	8	9	10
1	901	1027	179	742	1562	436	171	174	246	102
2	172	568	107	454	820	143	63	64	43	17
3	592	1673	825	2734	4161	965	455	570	231	87
4	234	1001	440	3018	5006	1081	523	488	132	50
5	79	442	162	1208	5140	720	260	176	31	17
6	126	345	173	900	3343	2525	977	331	50	26
7	71	356	209	1329	3023	2397	1761	396	48	33
8	60	370	261	1242	1977	688	346	771	62	35
9	1370	1890	622	1349	2297	850	382	370	935	459
10	1323	2394	497	1091	1409	894	397	271	838	2203

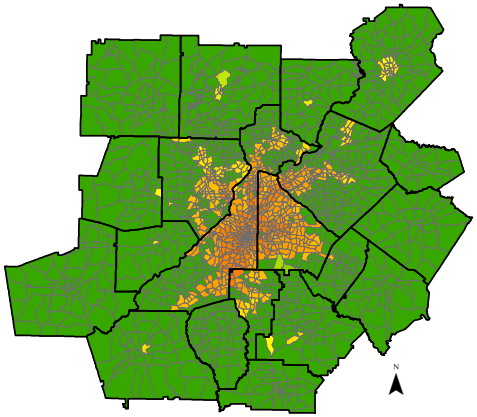
Network Assignment



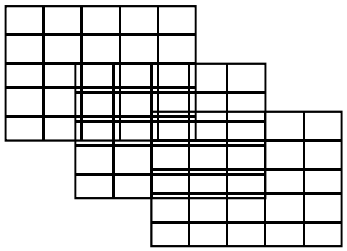
Forecasting, Performance Measures & Software

Household Data, Person Data, Tour/Trip List

HID	PID	TID	PUR	MOD	SB	SA	OTAZ	DTAZ	S1TAZ	S2TAZ	TLOR	TLDS
1	1	1	2	1	0	1	943	987	0	964	1	3
1	1	2	1	2	1	0	943	731	856	0	3	3
1	2	1	4	1	0	0	943	952	0	0	1	2
1	3	1	2	4	1	1	943	565	698	982	1	2

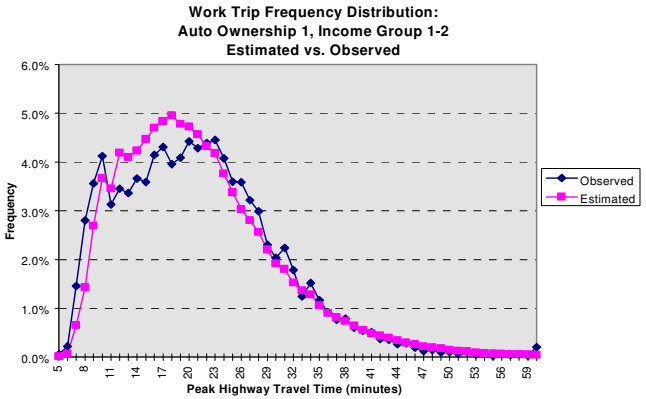


Maps, Graphics



Trip Tables

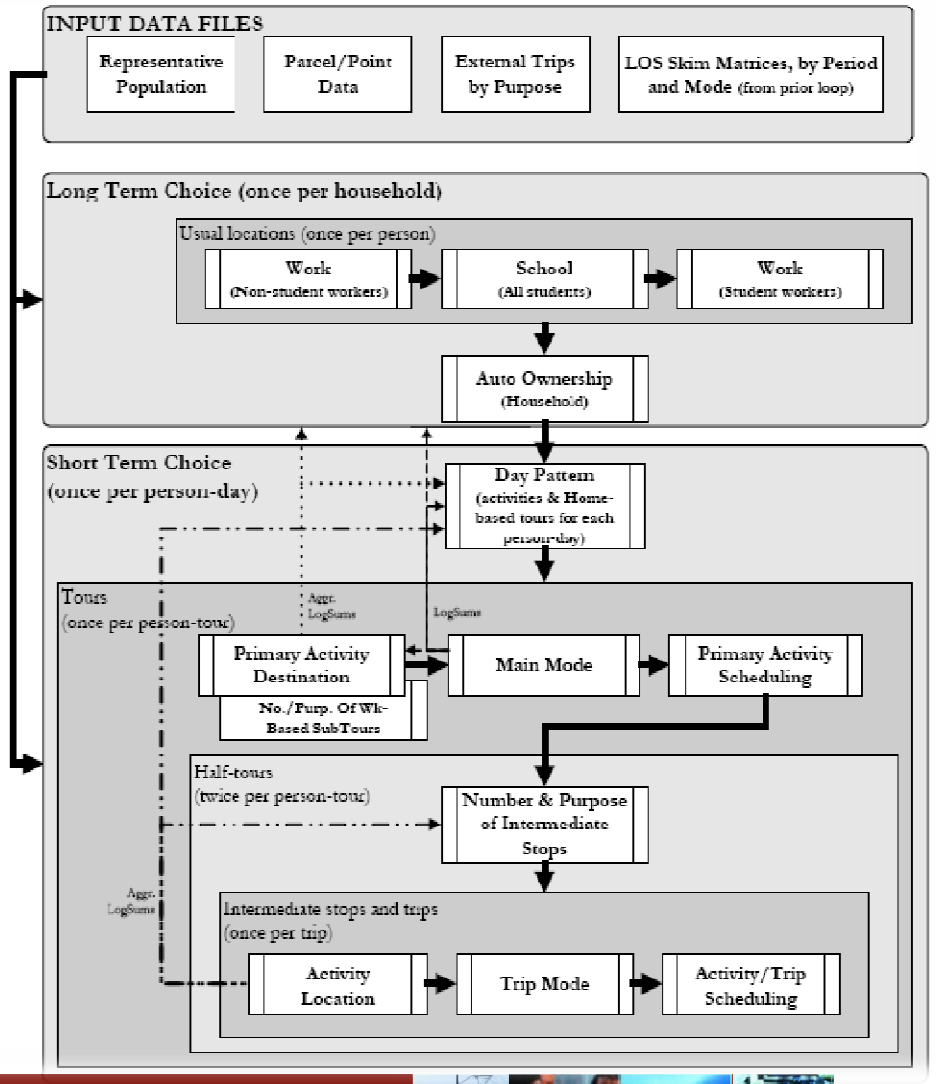
Assignment



Other Summaries

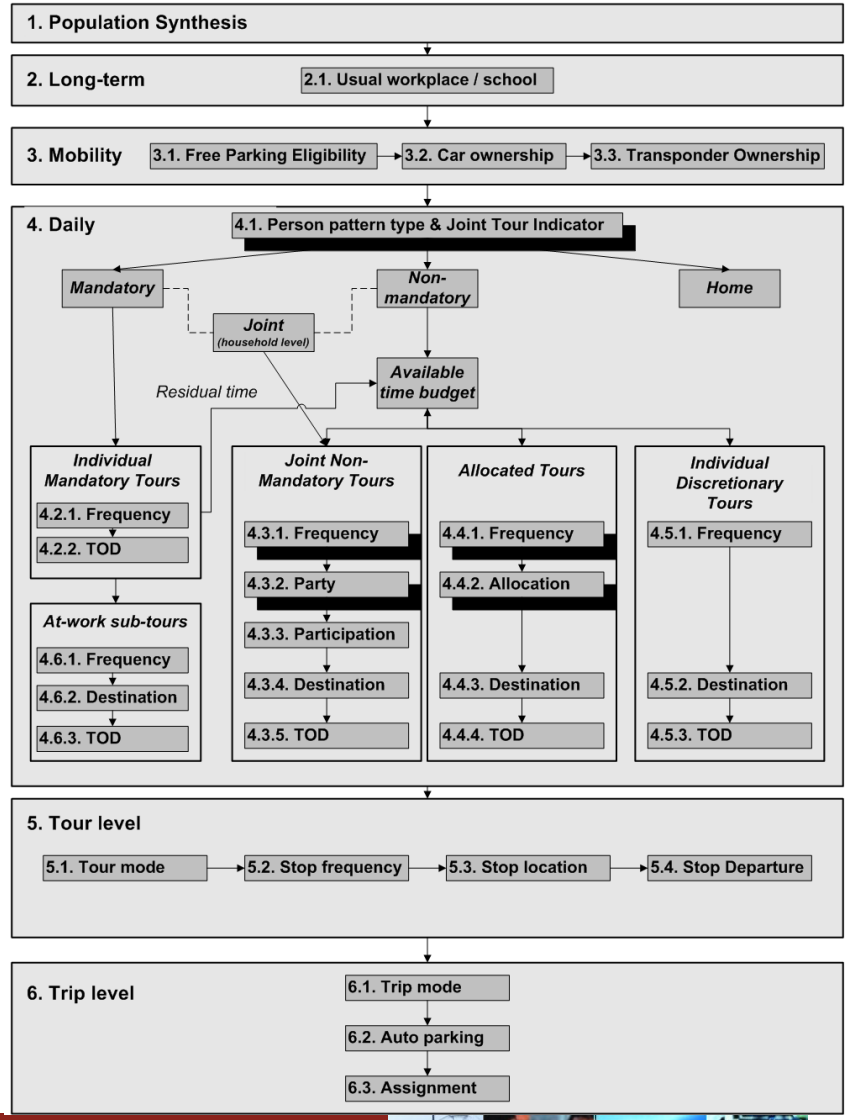
Activity-Based Model Designs I

Sacramento Council of Governments (SACOG) DaySim Model Design



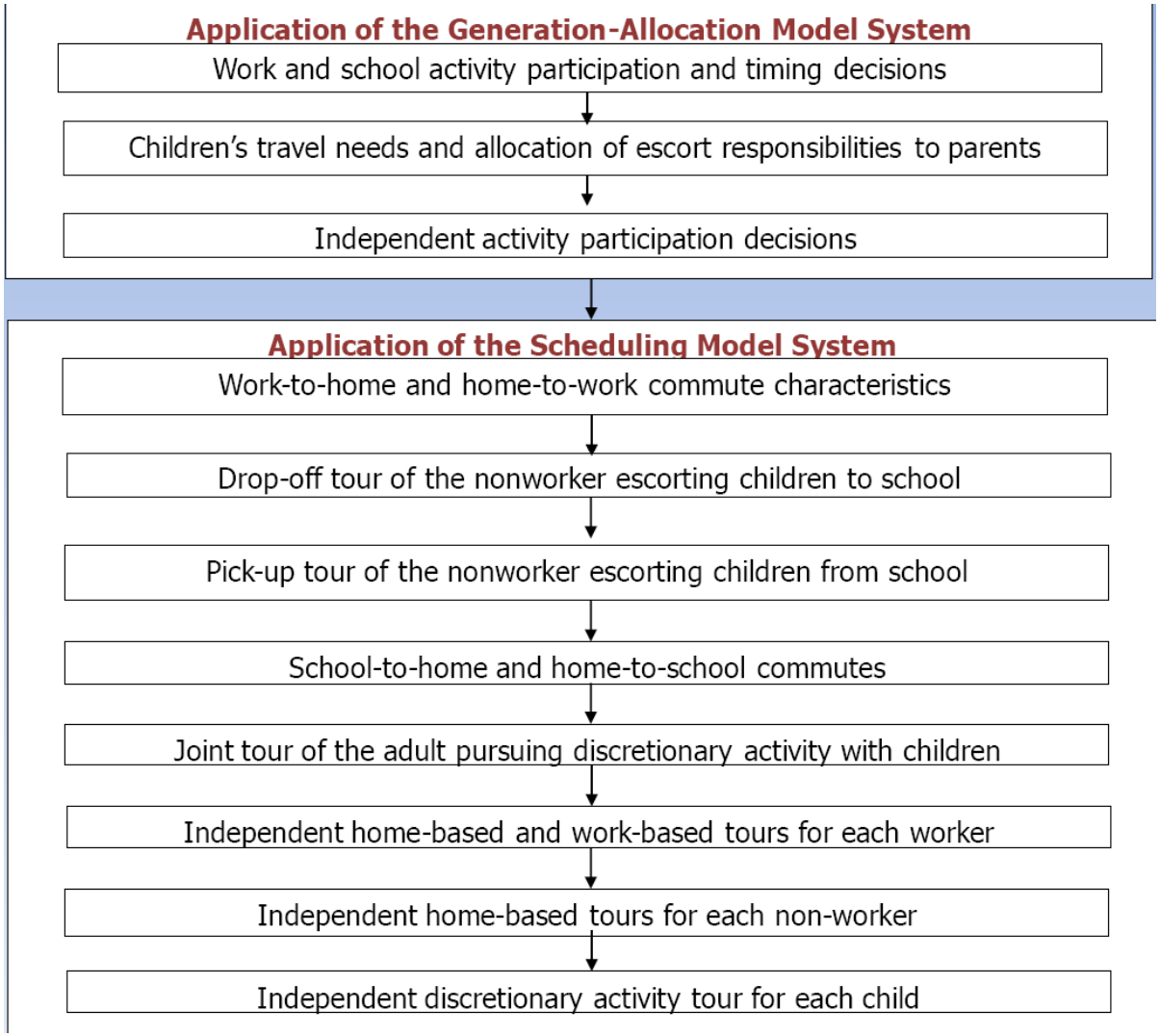
Activity-Based Model Designs II

Coordinated Travel – Regional Activity-Based modeling Platform (CT-RAMP)



Activity-Based Model Designs III

Comprehensive Econometric Micro-simulator for Daily Activity-travel Patterns (CEMDAP)



Practical Implications of Different Designs

- Tradeoffs: Policy Sensitivity vs. Cost to Implement
  - More realism and policy sensitivity means more complexity…
    - More development costs, input data, computational load
      - Additional hardware and software investments may be needed
    - Understanding how model mechanics and lead to outcomes becomes more challenging
  - Model developers respond through designs that…
    - Add more detail where important to key policy considerations
    - Generalize detail where it does not make a meaningful difference
      - Spatial and temporal resolution
      - Activity purpose and mode definitions
      - Model structures

Ongoing Research

- Model structure
  - In-home versus out-of-home activities
  - Full treatment of joint travel
  - Car allocation and fleet models
  - Integration with dynamic traffic assignment (DTA)
  - Land-use model integration
  - Emissions model integration
- Extensions to choice models
  - More, inter-related alternatives – spatial, temporal detail
  - Combining discrete and continuous alternatives
  - User heterogeneity

Review: Learning Outcomes

- Discuss how household activity-travel diary data is used to define activities, tours, and daily patterns
- Describe how choice model structures are used to represent key aspects of activity-based model generation and scheduling
- Describe how discrete choice models are used and applied in activity-based modeling systems
- Discuss the various design decisions that are important to the development of activity-based modeling systems

Questions and Answers

The Travel Model Improvement Program

2012 Activity-Based Modeling Webinar Series

Executive and Management Sessions	
Executive Perspective	February 2
Institutional Topics for Managers	February 23
Technical Issues for Managers	March 15
Technical Sessions	
Activity-Based Model Frameworks and Techniques	April 5
Population Synthesis and Household Evolution	April 26
Accessibility and Treatment of Space	May 17
Long-Term and Medium Term Mobility Models	June 7
Activity Pattern Generation	June 28
Scheduling and Time of Day Choice	July 19
Tour and Trip Mode, Intermediate Stop Location	August 9
Network Integration	August 30
Forecasting, Performance Measures and Software	September 20

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