THE FUTURE OF ACTIVITY-BASED MODELLING AND BEHAVIORAL DATA COLLECTION

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Activity-based models

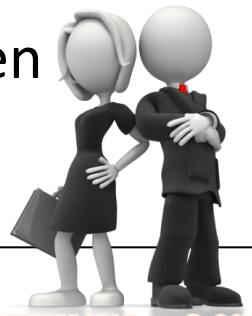
1. Scope

2. History

3. Progress in Eindhoven

4. Research agenda

5. Behavioral data Collection



Activity-based models

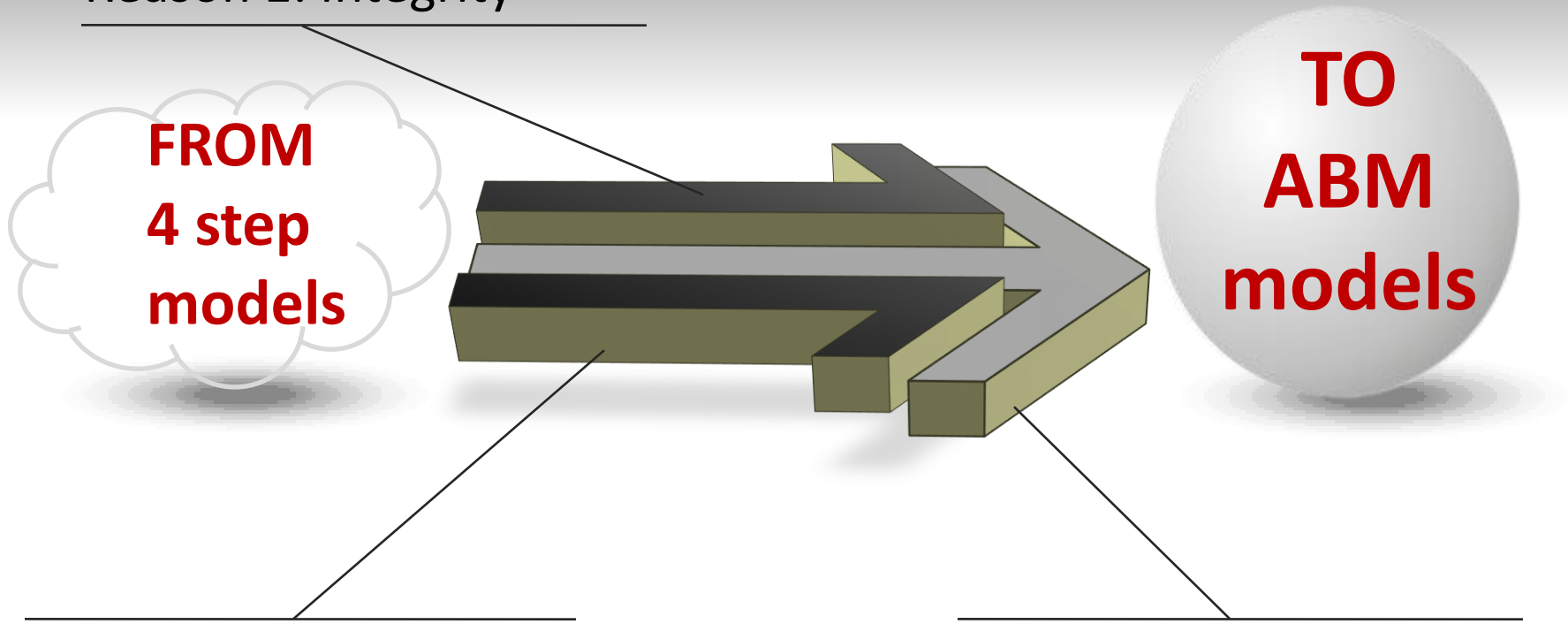
Scope

4 step versus activity-based models

4 step	ABM
Purpose. Destination. Mode. Route.	Activity type. Destination. Mode. Route.

Reasons for change

Reason 1: Integrity



Reason 2: Interdependencies

Reason 3: Behavioral basis

Activity-based models

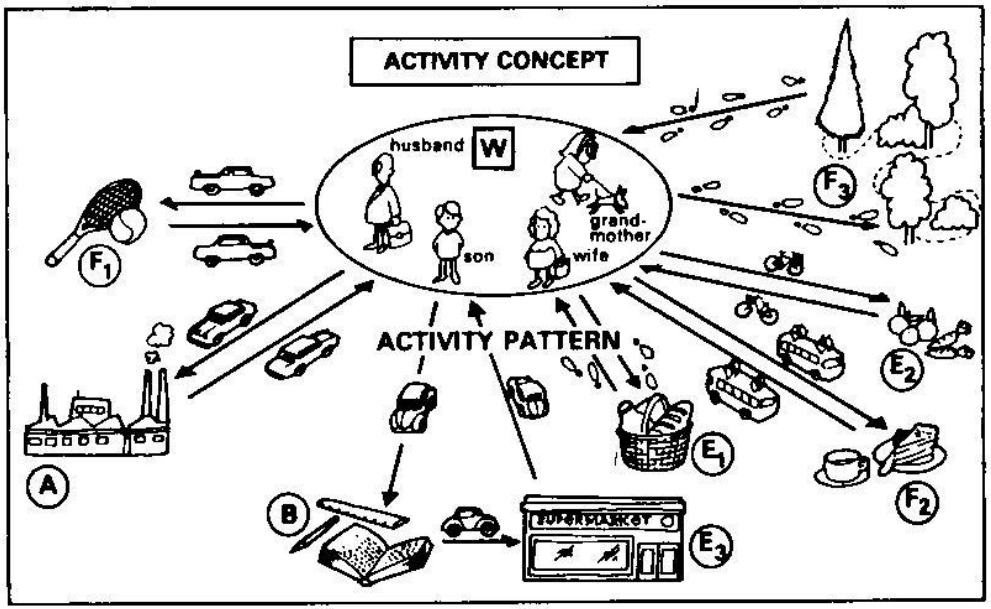
Models which predict how households organize their activities and implied travel, in time and space, subject to

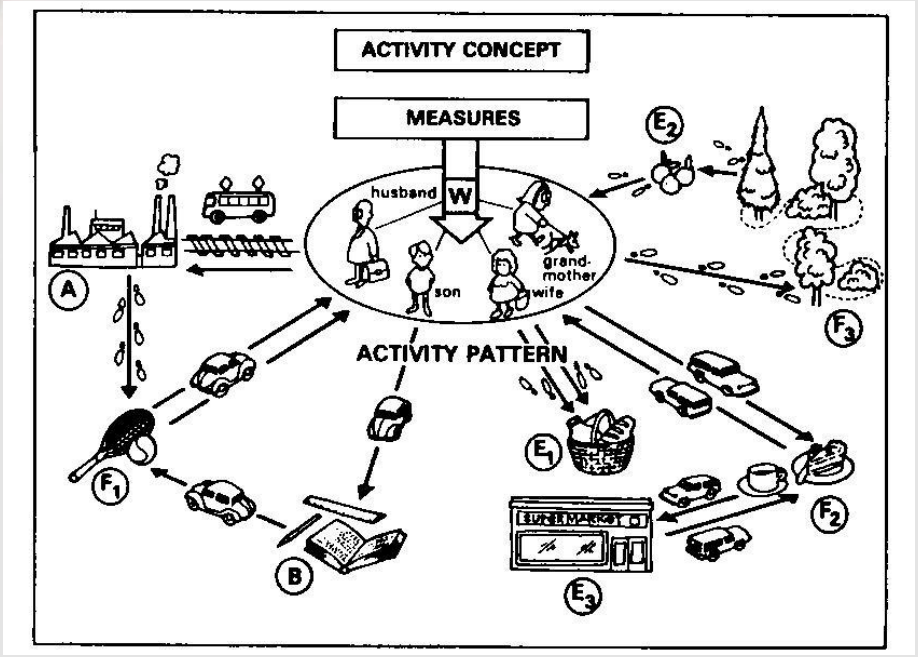
a set of constraints

Activity-based models

Are much more sensitive to a wide set of alternative ways of responding to exogenous policies

Focus on primary and secondary effects


ACTIVITY CONCEPT
husband
W
son
grand-
mother
wife
ACTIVITY PATTERN
F1
F3
E2
E1
F2
A
B
E3


ACTIVITY CONCEPT
MEASURES
husband
W
son
grand-
mother
wife
A
B
E_1
E_2
E_3
F_1
F_2
F_3
ACTIVITY PATTERN

4 step vs. activity-based models: resolution

4 step	ABM
Peak vs off-peak.	Minutes.
Traffic zones.	Parcel or zip codes.

4 step vs. activity-based models: representation

4 step	ABM
Trips. Individuals. Traffic zones. No constraints.	Activity episodes Household. People. Various constraints.

Activity-based models

History

History

CONSTRAINTS-BASED MODELS

1967

DISCRETE CHOICE MODELS

1978

COMPUTATIONAL PROCESS MODELS

2000

CONSTRAINTS-BASED MODELS

Theory
Behavior is primarily influenced by various kinds of constraints.

Specification
Set of constraints is applied to observed input activity-travel schedules.

Output
Check of feasibility of schedule

Social exclusion

Potential action space

Constraints-based models

Your Title Here

2012

2010

Extensions

1994

Kwan GISICAS

PROGRESS

1986-1995

Huigen BSP – Dijst MASTIC

1978

Lentrop PESASP

DISCRETE CHOICE MODELS

Theory
Probabilistic choice theory

Random utility theory

Specification
Algebraic typically linear function

Output
Predicted choices for set of travel choice facets

Discrete choice models

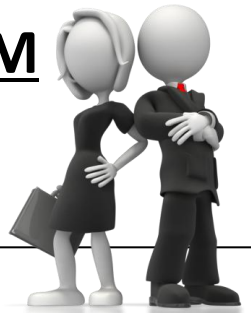
MNL:
1972

Non IIA models:
1978-1985

Nested logit:
1976

Hierarchical choice model:
2005

Mixed logit – LCM
1996 - 2005



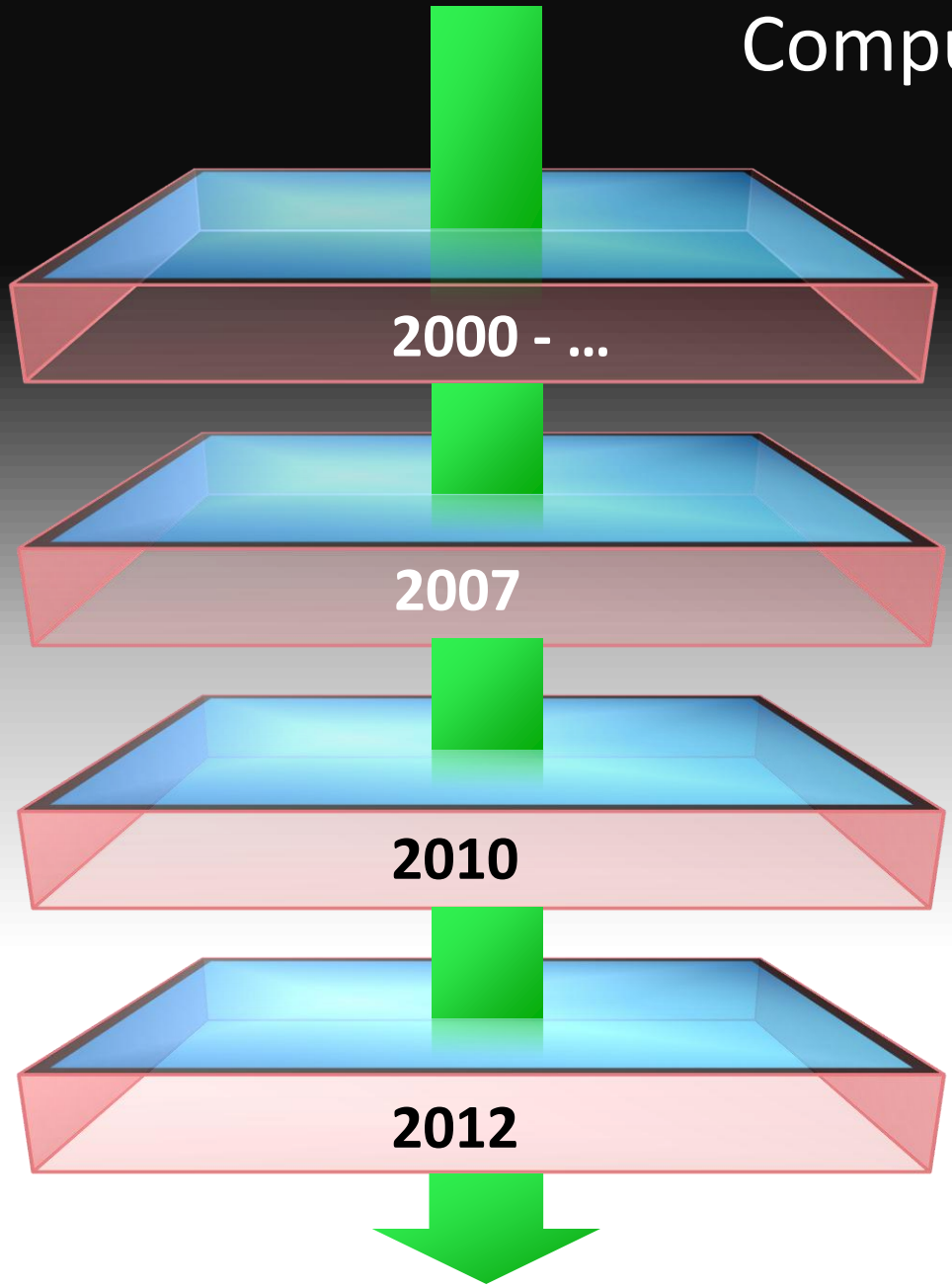
COMPUTATIONAL PROCESS MODELS

Theory
Context-dependent choice heuristics

Specification
If THEN ELSE Boolean expressions

Output
Simulated individual space-time trajectories

Computational process models



Albatross
(Arentze Timmermans)

Tasha
(Roorda Miller)

Feathers – Belgium

South Korea

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Constraints-based models

Incorporation of constraints
Integral choice sets

No adaptation
No activity generation
No notion of value

Discrete choice models

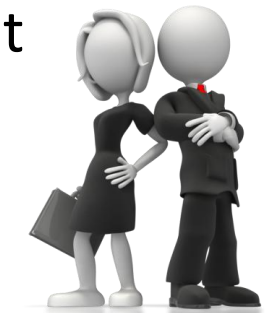
Simple representation
Easy to estimate
Easy interpretation

No constraints
Focus on outcomes
Strict behavioral assumptions

Computational process models

Preference and constraints
Flexible specification

Complex
Difficult to interpret



Comparison

FEATURES	CM-MODELS	DC-MODELS	CS-MODELS
Easy to develop	✓	✓	X
Data requirements	X	✓	X
Easy of application	✓	✓	X
Behavioral richness	X	X	✓

Activity-based models

Progress in Eindhoven

TIME WINDOW

Long

Life Trajectory Induced Activity Agendas

Environment

Social network

Information

Life trajectory

Mid

Multi-Day Multi-Person Task Allocation

Environment

Social network

Information

Life trajectory

Short

Daily Activity-Travel Rescheduling

Environment

Social network

Information

PROCESS

Long term dynamics

Plans (t)
Resources
Constraints

Plans (t+1)
Resources
Constraints

Desires
Aspirations
Nonactivated plans

Commitments (t)

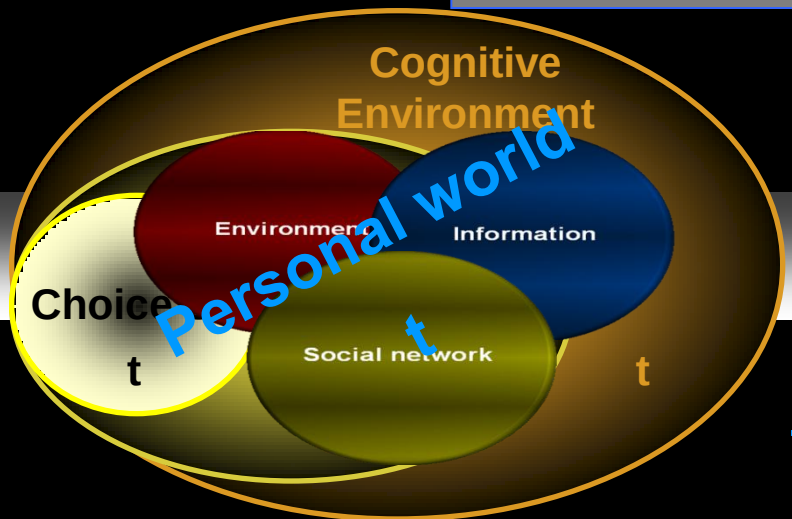
Non-activated, postponed plans

Updated Commitments (t+1)

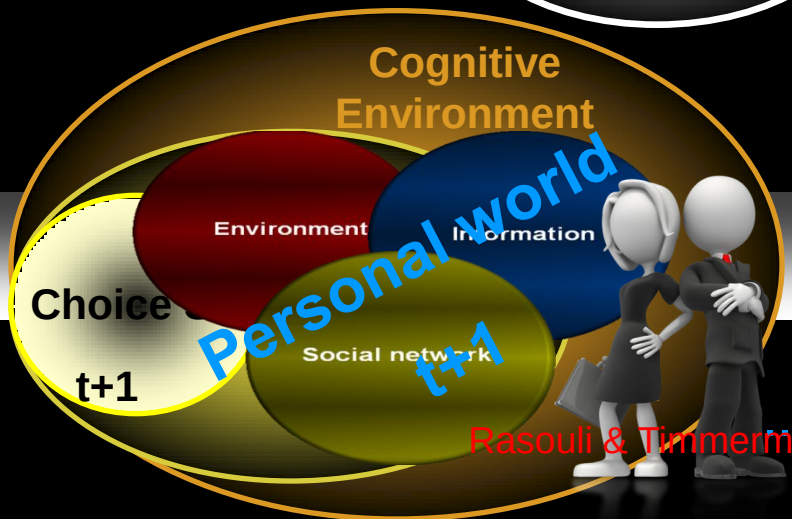
Planning

Activated, prioritized commitments (t)

Replanning/ Execution

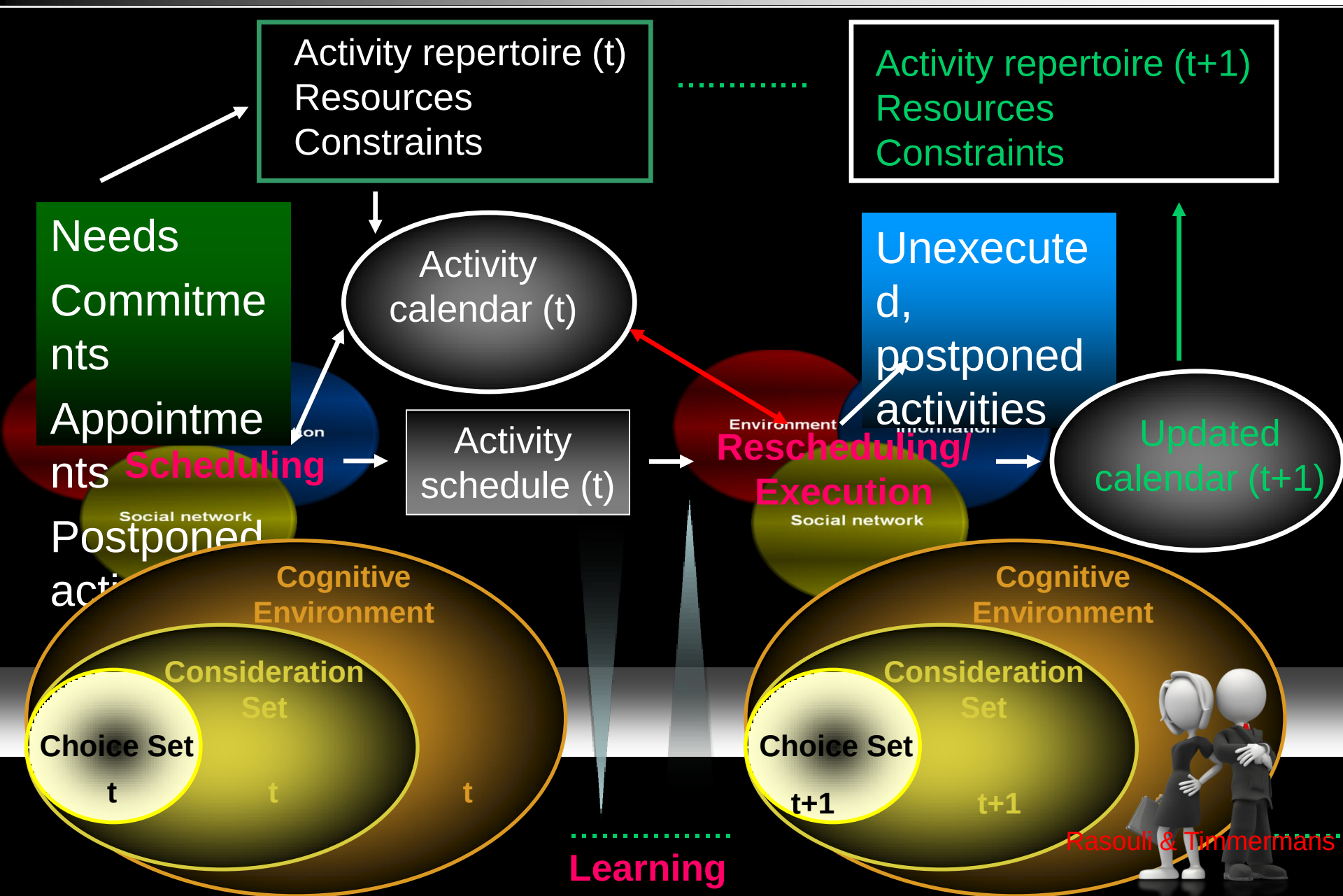


Learning

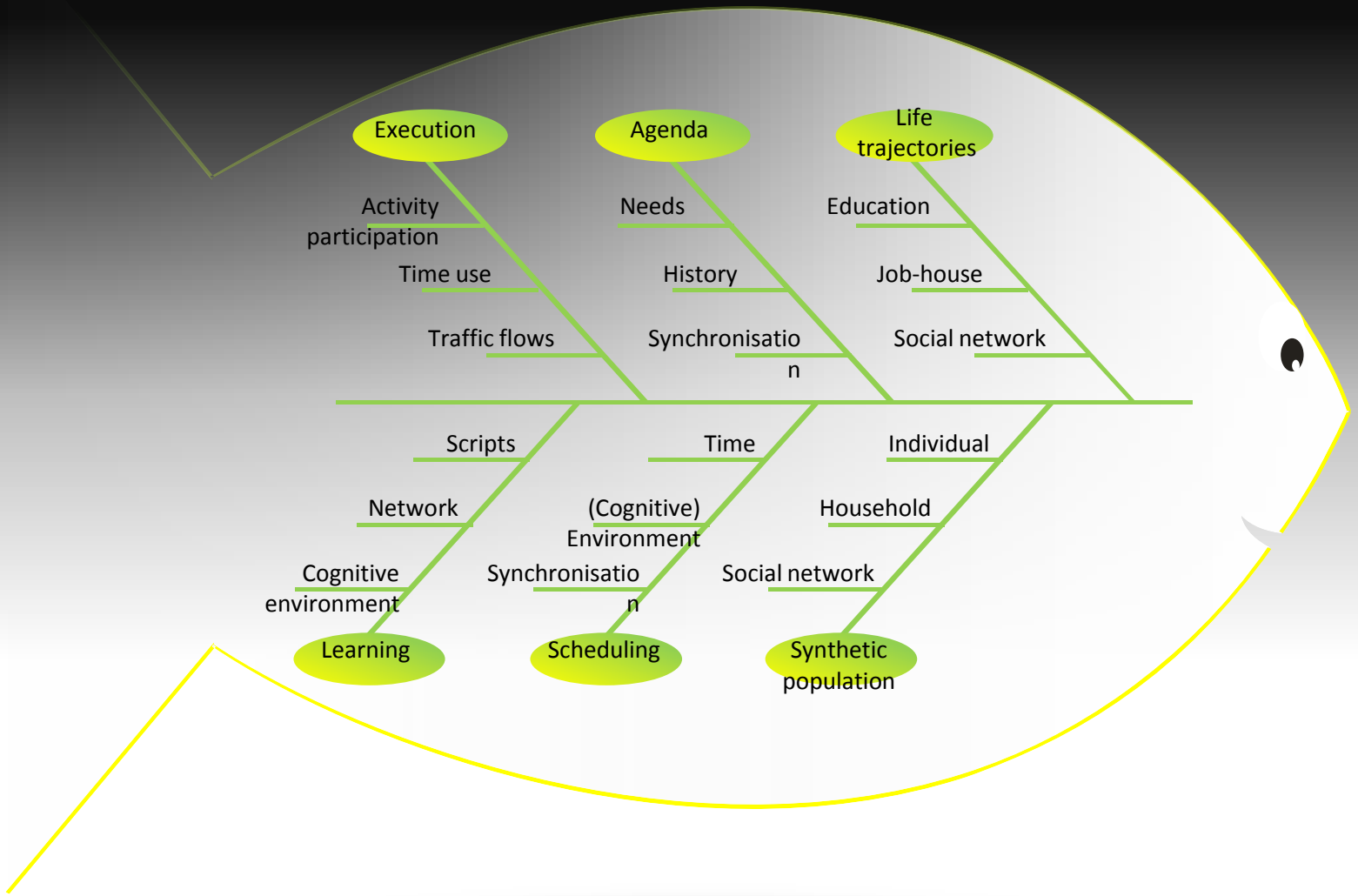


Rasouli & Timmermans

Short term dynamics



DYNAMIC ACTIVITY-BASED MODEL SYSTEM



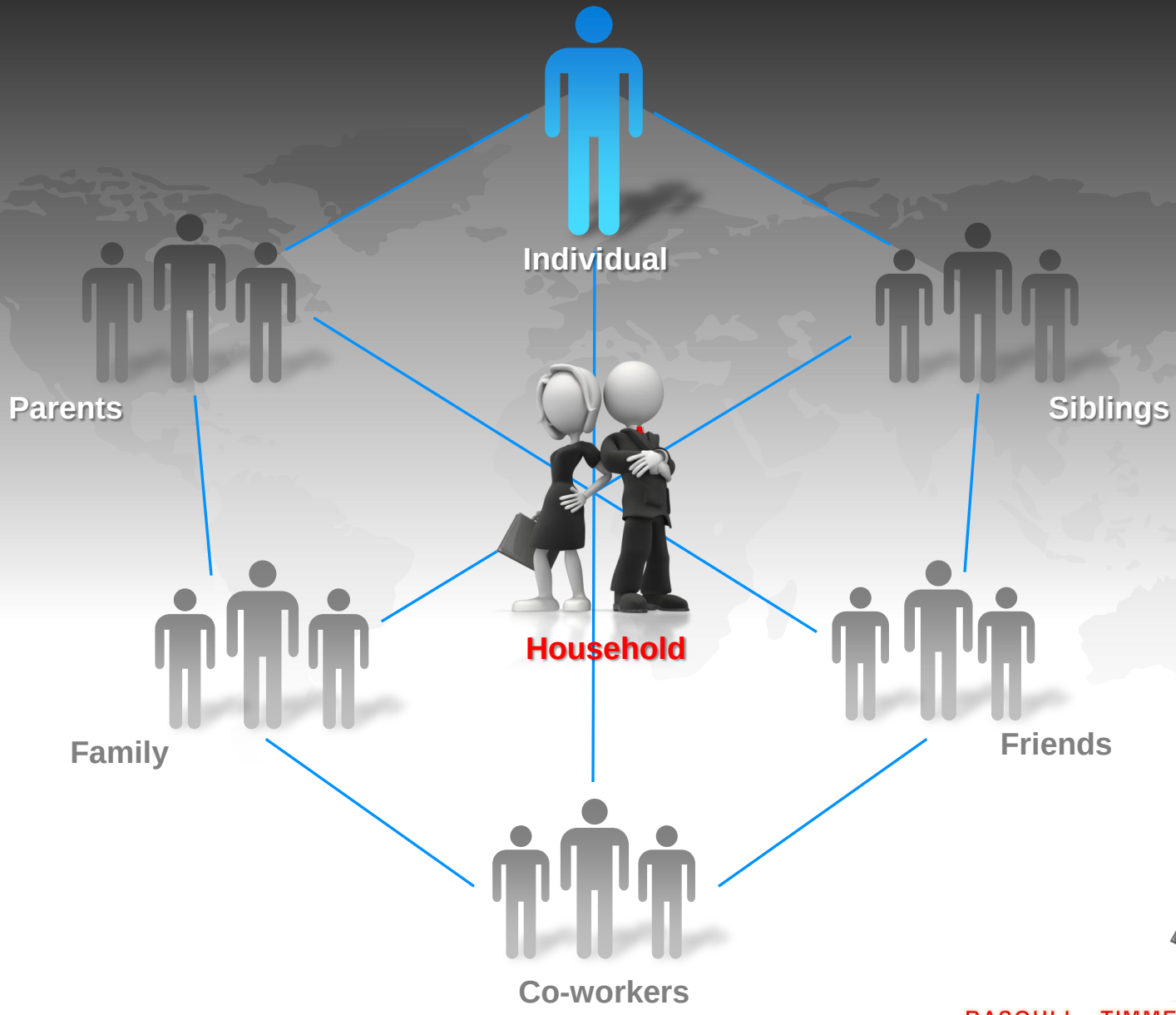
Activity-based models

Research agenda

FROM SINGLE DAY TO MULTIPLE DAY TO VARYING TIME HORIZON

Week 1	Week 2	Week 3	Week 4	Week 5
Work	School vacation	Cloths	Work	Work
Grocery shopping	Sports event	Theatre show	Grocery shopping	Grocery shopping
		Family reunion		City trip

FROM INDIVIDUAL TO HOUSEHOLD TO SOCIAL NETWORK

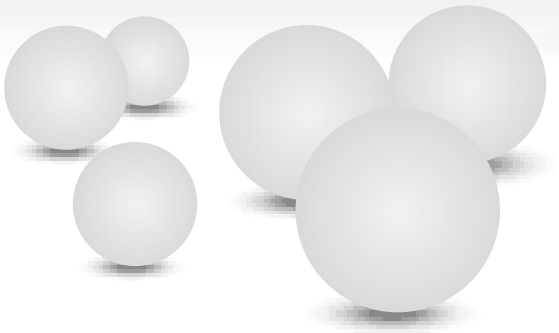


Household decision making

Shift from individual level models to household level models

- Resource allocation
- Task and time allocation
- Joint activity participation
- Joint travel arrangements

FROM OUTPUT MODELLING TO PROCESS MODELLING



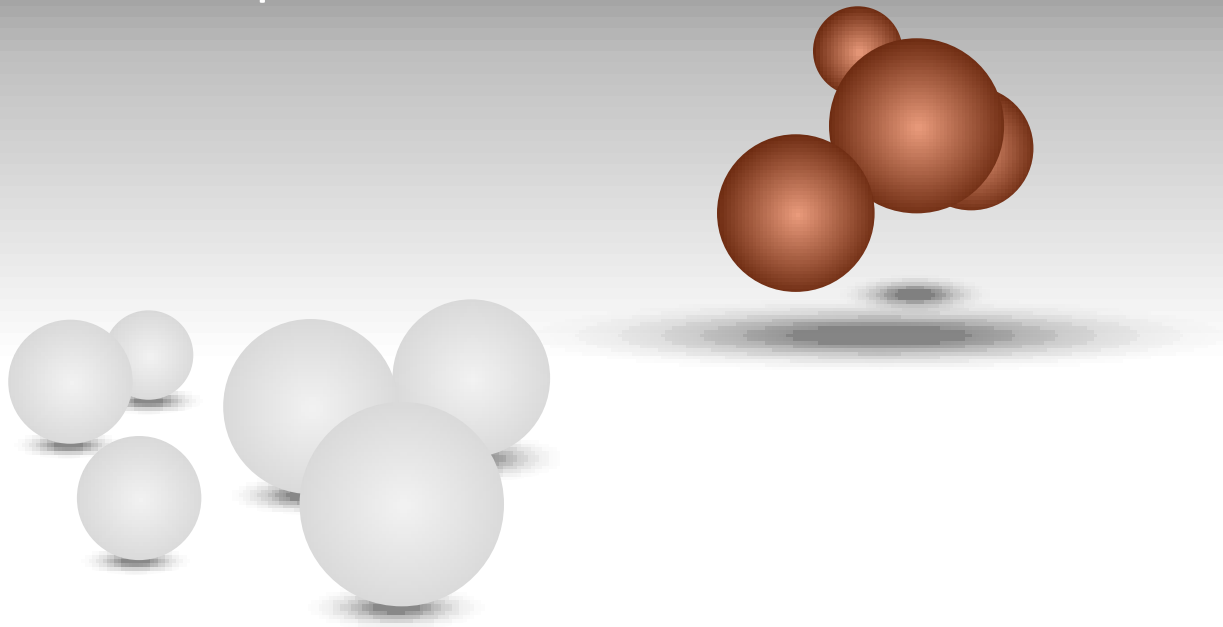
Needs, Preferences, Constraints

Activity-travel schedule

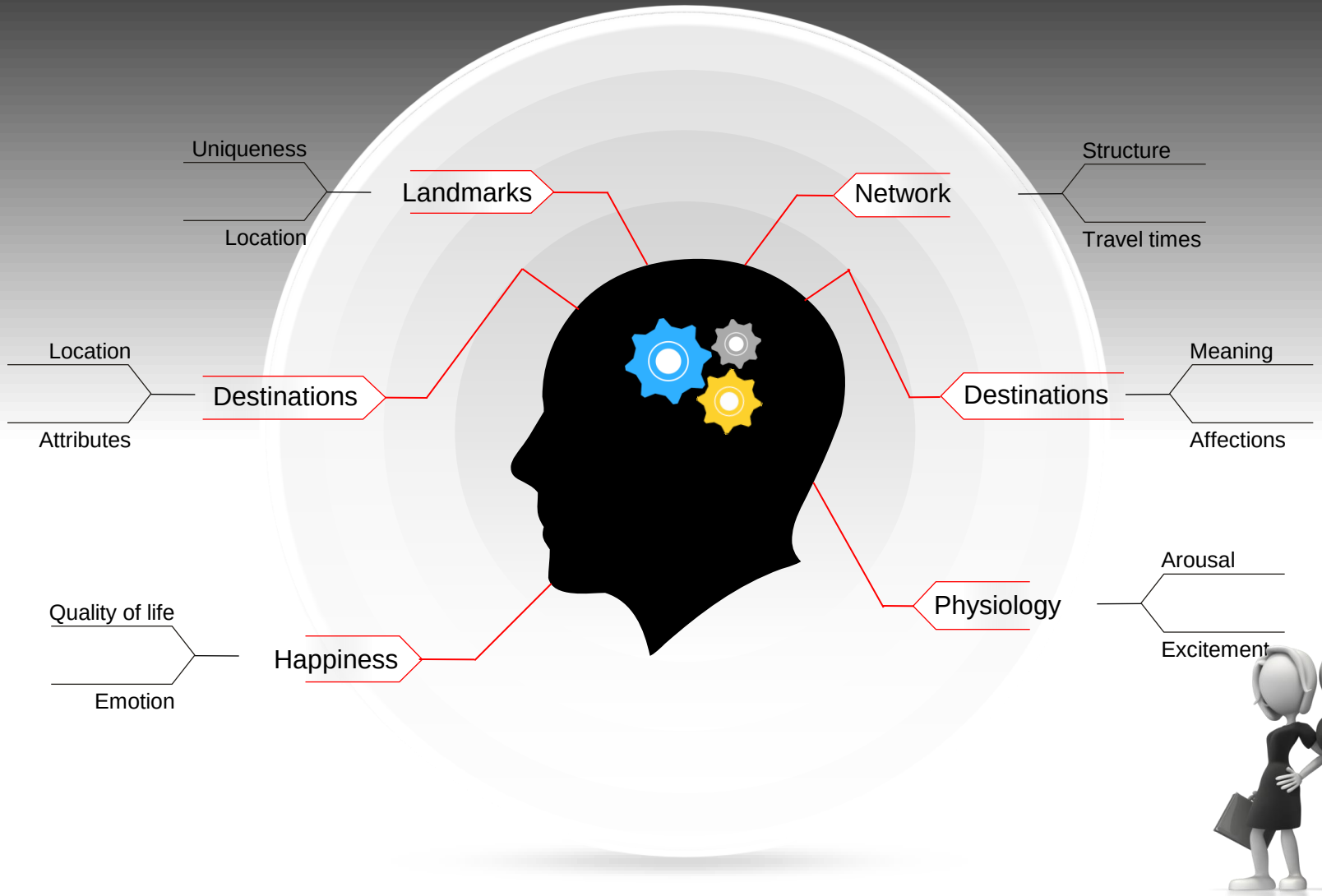
FROM OUTPUT MODELLING TO PROCESS MODELLING

Process is assumed more robust as outcomes as these depend on spatial structure and variance-covariances in the data.

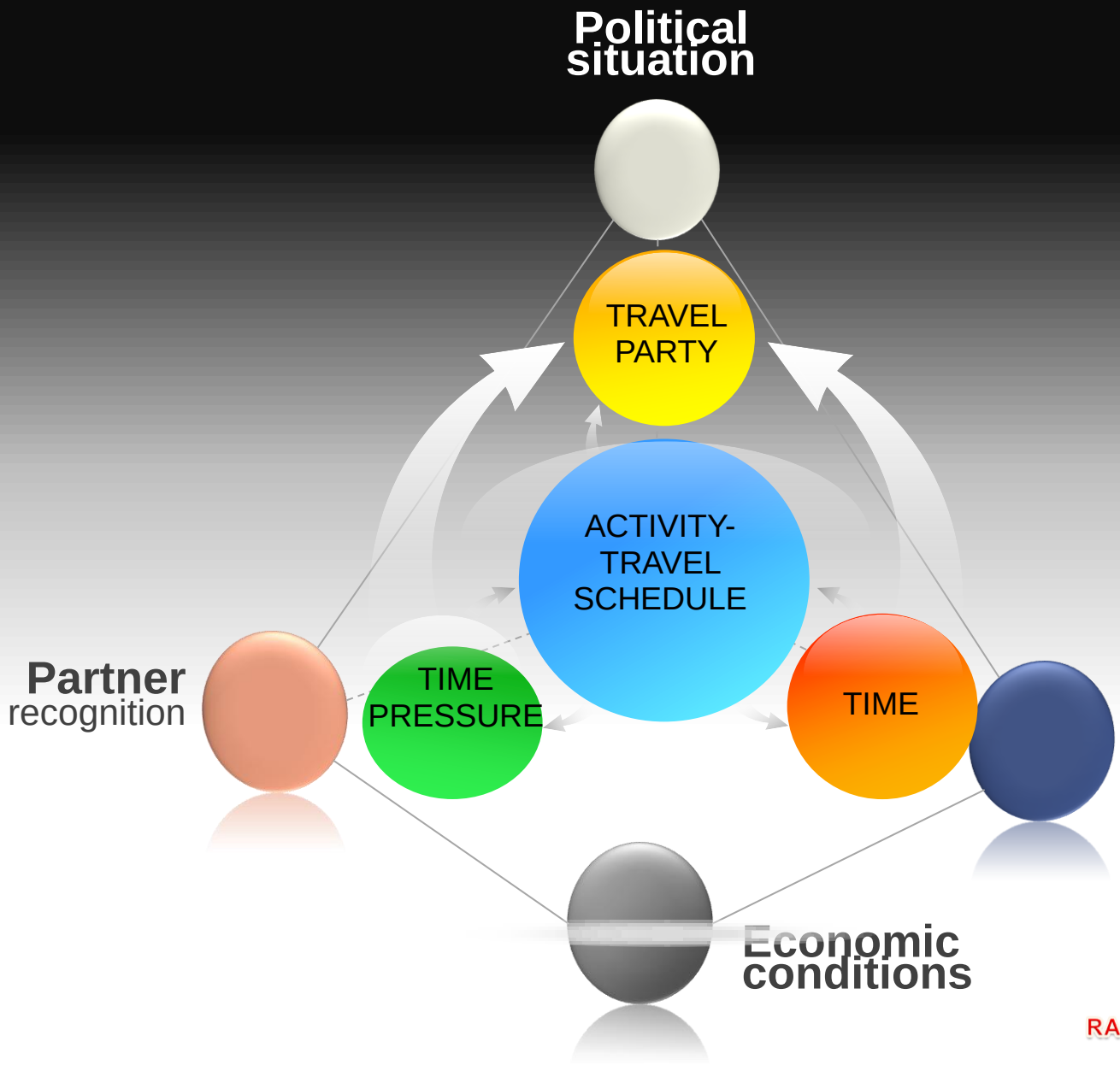
Current interest in modelling errror terms may be counterproductive



FROM PHYSICAL ENVIRONMENTS TO COGNITIVE-AFFECTIVE REPRESENTATIONS OF THE ENVIRONMENT



FROM CONTEXT INVARIANCE TO CONTEXT DEPENDENCY



FROM HOMOGENEITY TO BEHAVIORAL MIXING

Your Title Here

FROM HOMOGENEITY TO BEHAVIORAL MIXING

Your Title Here

MNL: specification and parameters the same for ALL agents

ML: specification the same for ALL agents, only parameters differ

LCM: specification and parameters the same for ALL agents within a class

Behavioral mixing: also different specification

FROM CERTAINTY TO UNCERTAINTY

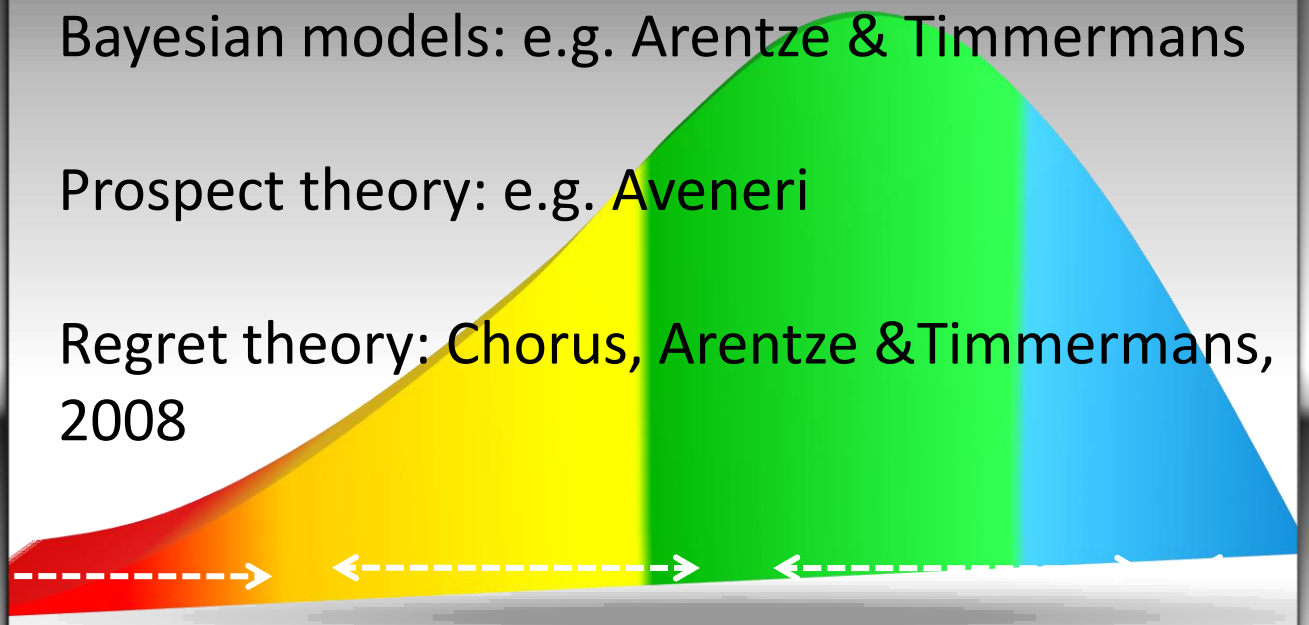
Your Title Here

Expected utility theory

Bayesian models: e.g. Arentze & Timmermans

Prospect theory: e.g. Aveneri

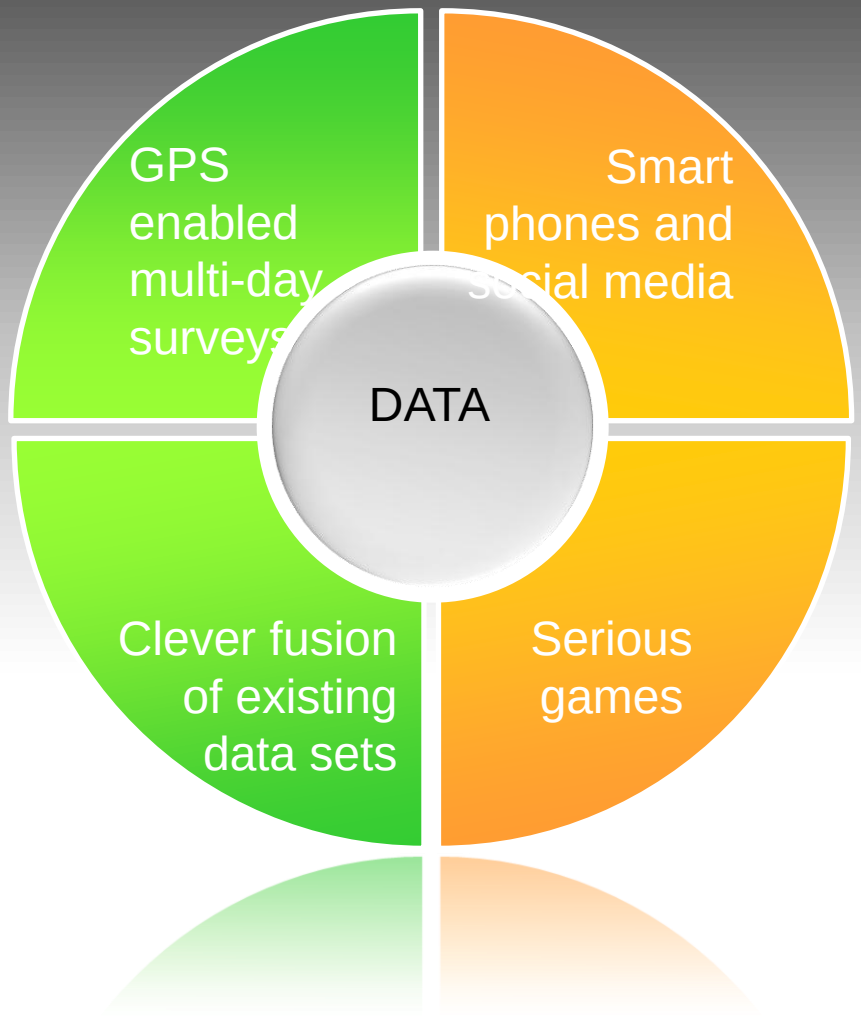
Regret theory: Chorus, Arentze &Timmermans, 2008



Activity-based models

Behavioral data collection

SHIFTS IN DATA COLLECTION



Questions

Thank You

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