

*Human Activity-Travel Behavior
under Spatio-Temporal Constraints*



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October 12, 2012

Objective and Questions To Be Considered Today

- Understand human activity-travel behavior by considering why people travel in their daily lives.
- “Why do we travel?”
- “Can we live without traveling?”

“Why Do We Travel?”

- **Travel**: Spatial movement of people from an origin to a destination
- **Travel** is a **demand, derived** from the desire to engage in **activities** at different locations.
 - Engaging in activities: **utility**
 - Traveling: **disutility** (except for driving, jogging, walking, etc. for diversions etc.)
 - People try to spend less **resources** (time, money, physical energy, etc.) for traveling.
- One of the four basic elements in City
 - “Living”, “Working”, “Recreation” and “**Travel**”
- Travel is represented in **space-time dimension**.

Elements of Travel and Activity



- **Travel**
 - Origin/Destination, Start/End Time, Trip Purpose, Travel Time, Travel Distance, Travel Mode, Travel Cost, With Whom, etc.
 - Where did you go? when, why, how, with whom?
- **Activity**
 - Activity Type, Start/End Time, Duration, Location, With Whom, etc.
 - What did you do? when, where, with whom?

Classification of Activities

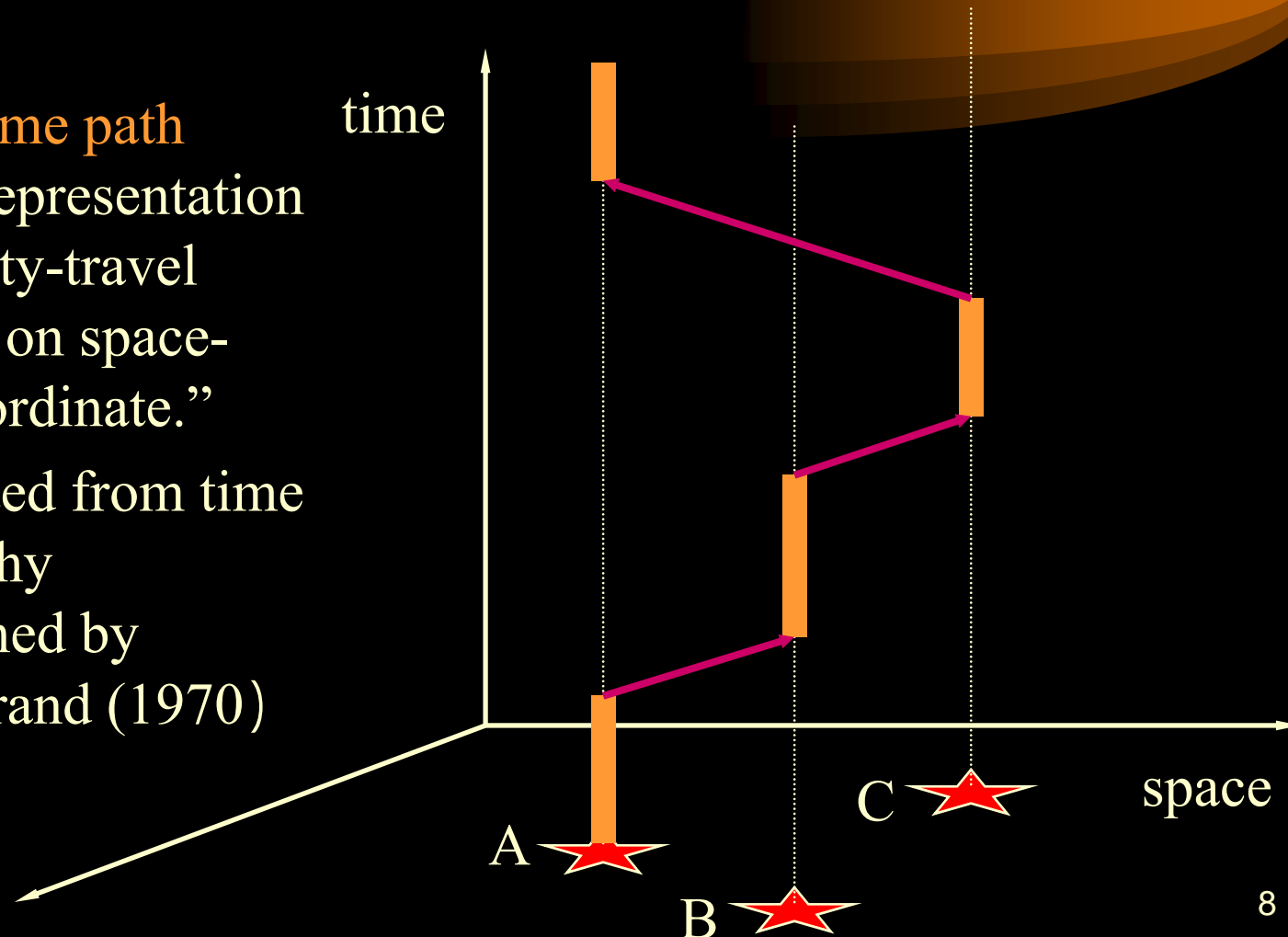
- **Mandatory (for individual living, maintaining life)**
 - Sleep, Meals, Personal Care, Medical Care, etc.
- **Maintenance/Subsistence (for household living, social life)**
 - Work, Study, Housework, Grocery Shopping, Childcare, etc.
- **Discretionary (for increasing level of satisfaction or quality of daily life)**
 - Resting, Drinking, Shopping, Watching TV, Web Browsing, Chatting, Mahjong, Pachinko, etc.

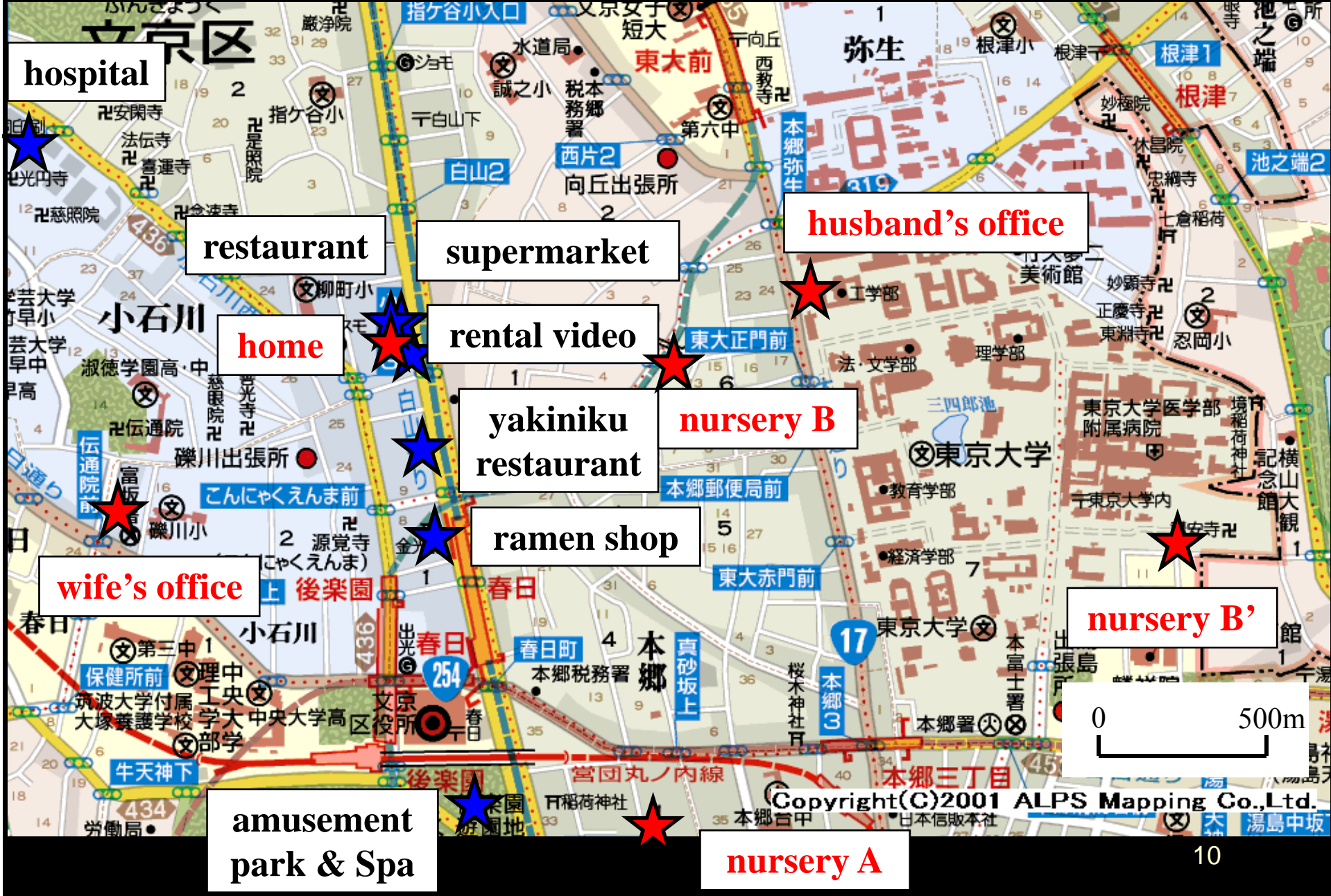
Generation of Travel and Destination Choice

- Utility of engaging in activities at a destination (+)
- Disutility of traveling (-)
 - Time, money, physical energy, psychological burden, etc.
- Utility of traveling (+)
 - Diversion, can be alone, enjoy scenery, physical exercise, etc.
- Engaging in activities at the destination where a total amount of the utilities is the highest.
- Grocery shopping by a person with small child:
 - 1. walk to a nearby supermarket with a baby-buggy
 - 2. cycle to a farther supermarket with a child
 - 3. drive to a suburban shopping mall with a child
 - 4. e-shopping at home with a child
 - 5. go shopping alone, grandparents take care of a child

Representation of Activity-Travel Pattern in Space-Time Dimensions

- **Space-time path** is "the representation of activity-travel patterns on space-time coordinate."
- Originated from time geography established by Hägerstrand (1970)




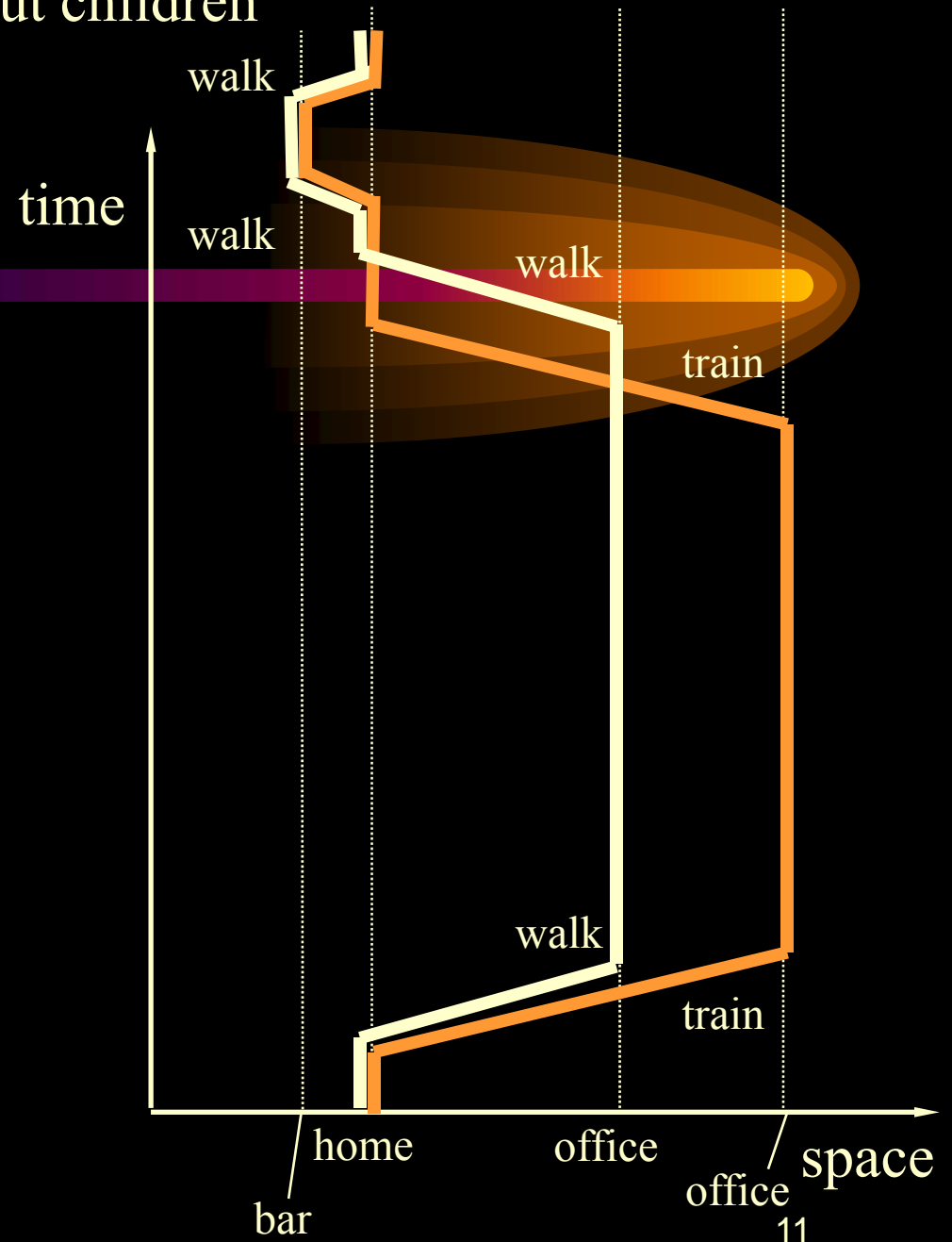


Working husband and wife without children

Life cycle stage A

husband : 

wife : 

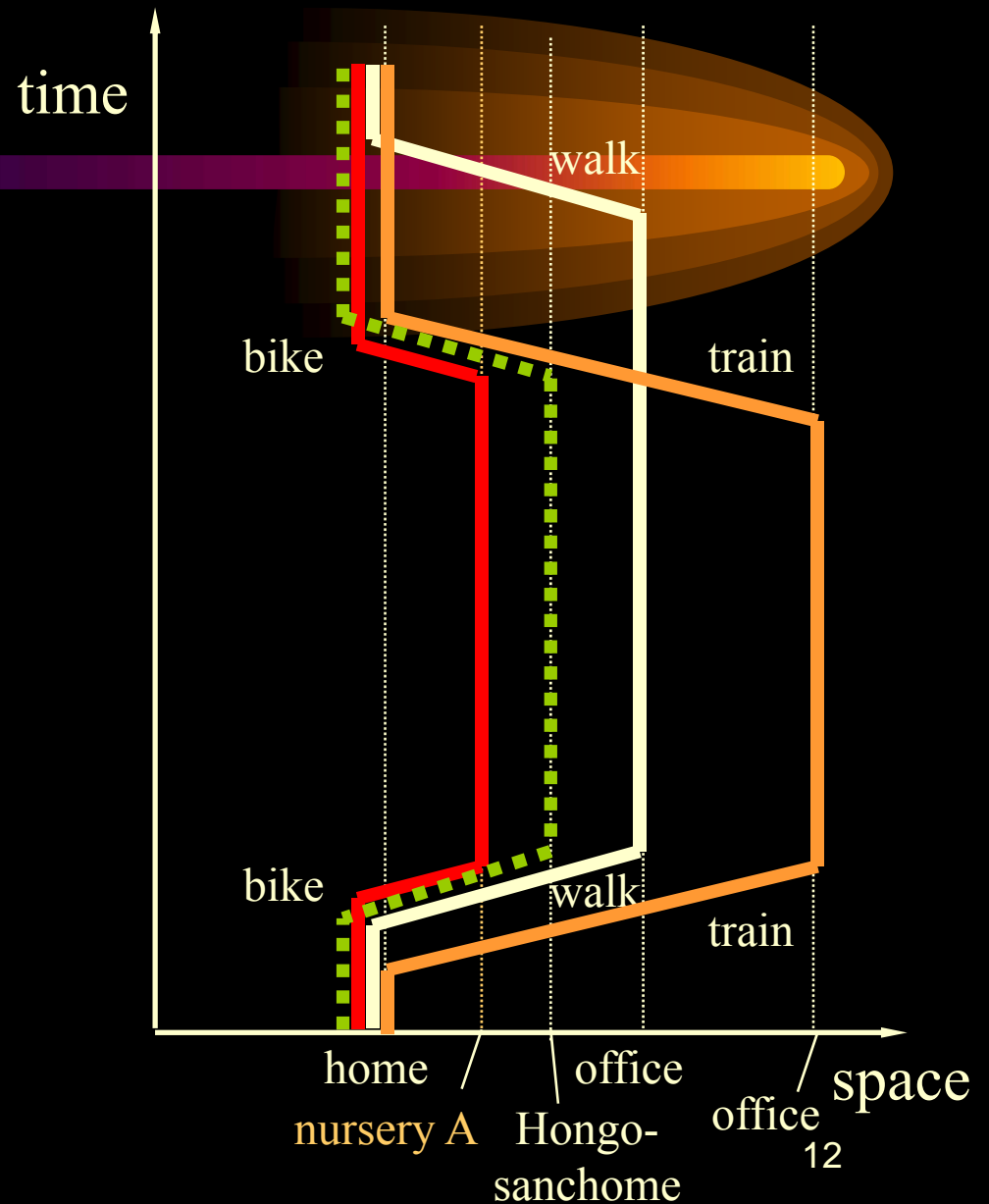


Working husband and wife with a pre-school child

Life cycle stage B

- take a son to the nursery: *husband, by bike*
- pick up a son: *wife, by bike*

husband : —
wife : —
son : —
bike : - - - -



The second child was born, wife have taken a year off for child-care

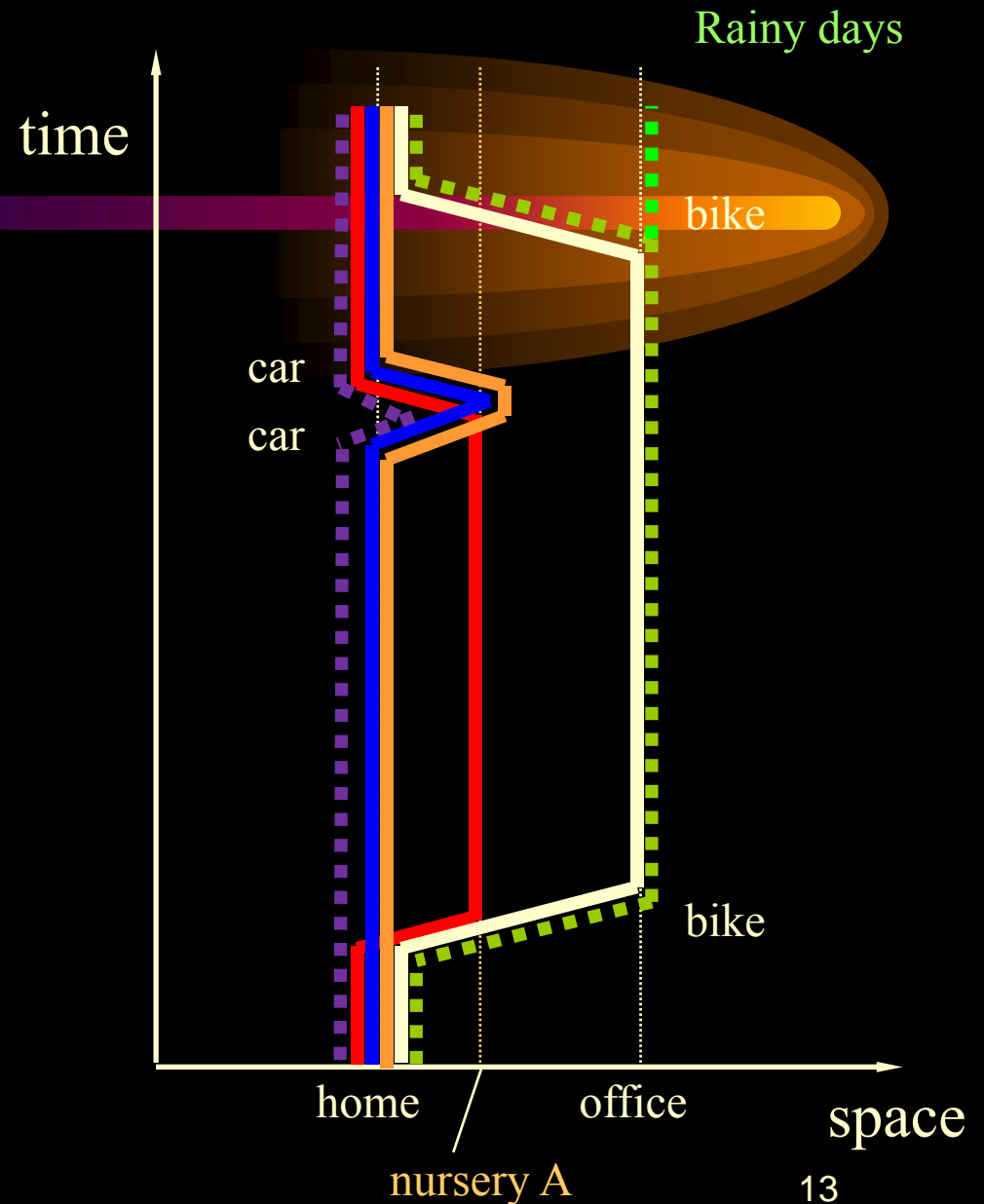
Life cycle stage B

- take the elder son to nursery

A: *husband, by bike*

- pick up the elder son: *wife with the younger son, by car*

husband	: ———
wife	: ———
elder son	: ———
younger son	: ———
car	: - - - -
bike	: - - - -



Wife has returned to the work in the night time with a baby-sitter's help

Life cycle stage B

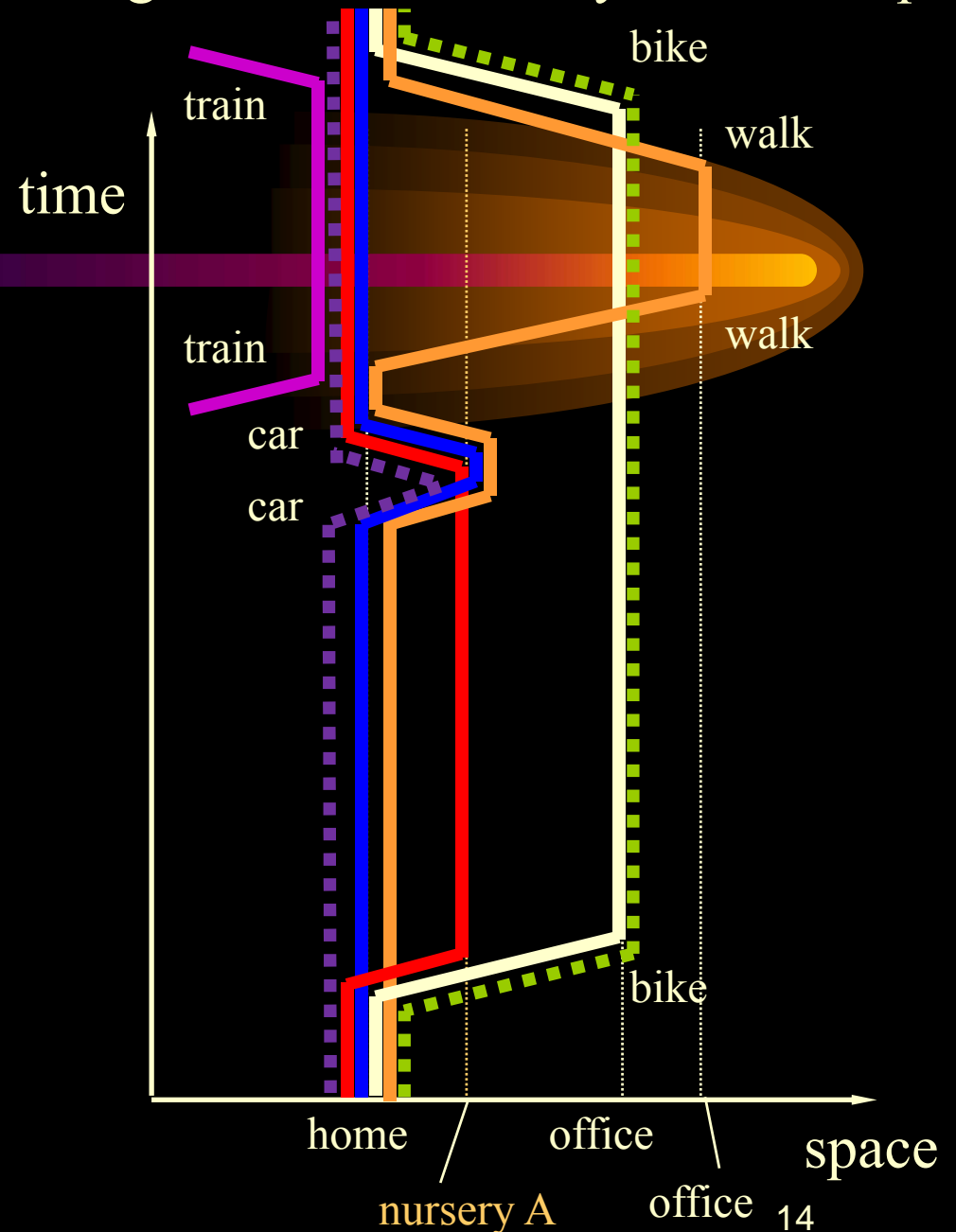
- take the elder son to nursery

A: husband, by bike

- pick up the elder son: *wife*
with the younger son, by car

- *a baby-sitter*

husband	:	—
wife	:	—
elder son	:	—
younger son	:	—
bike	:	- - -
car	:	- - -
baby-sitter	:	—

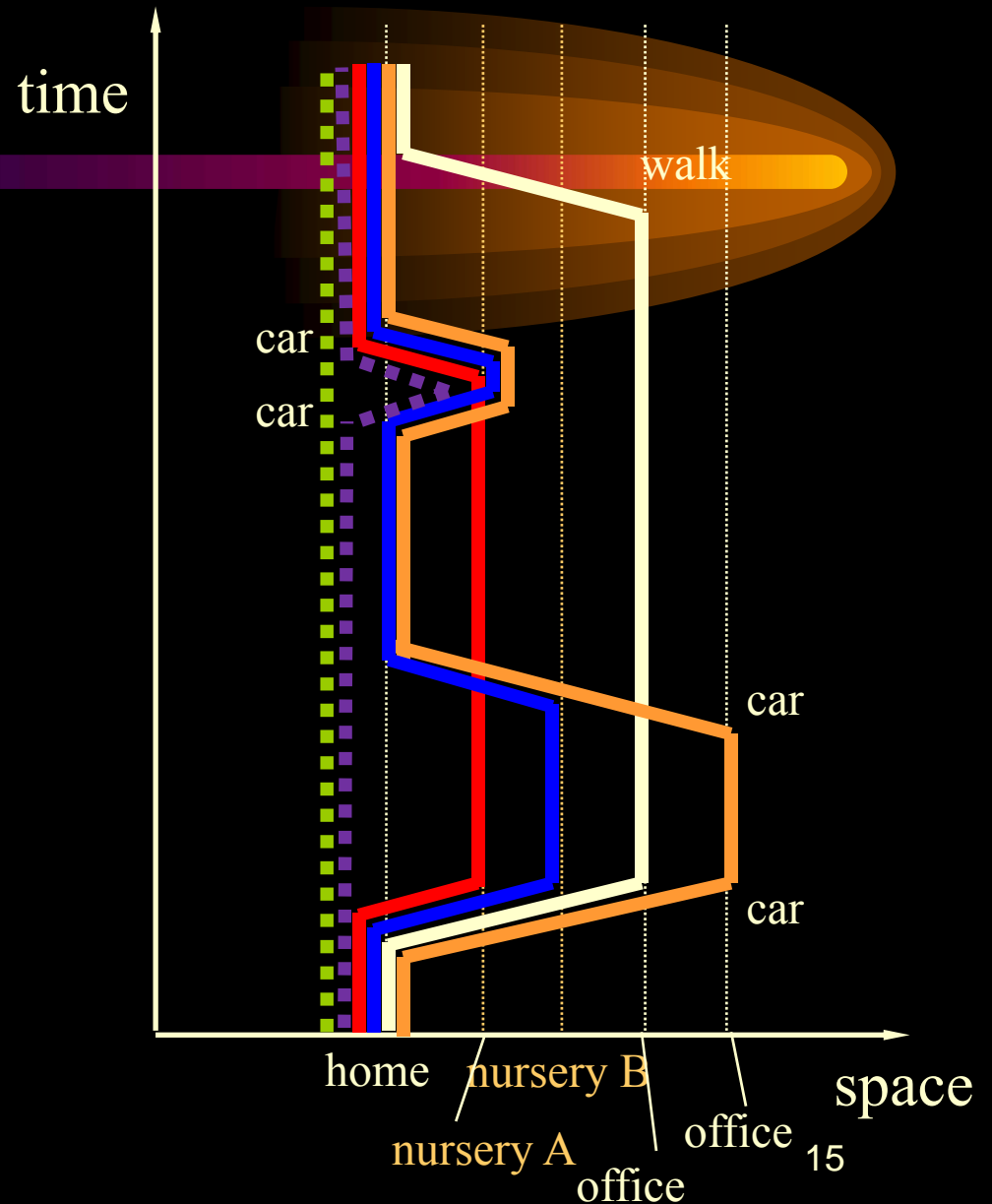


Wife works in the day time

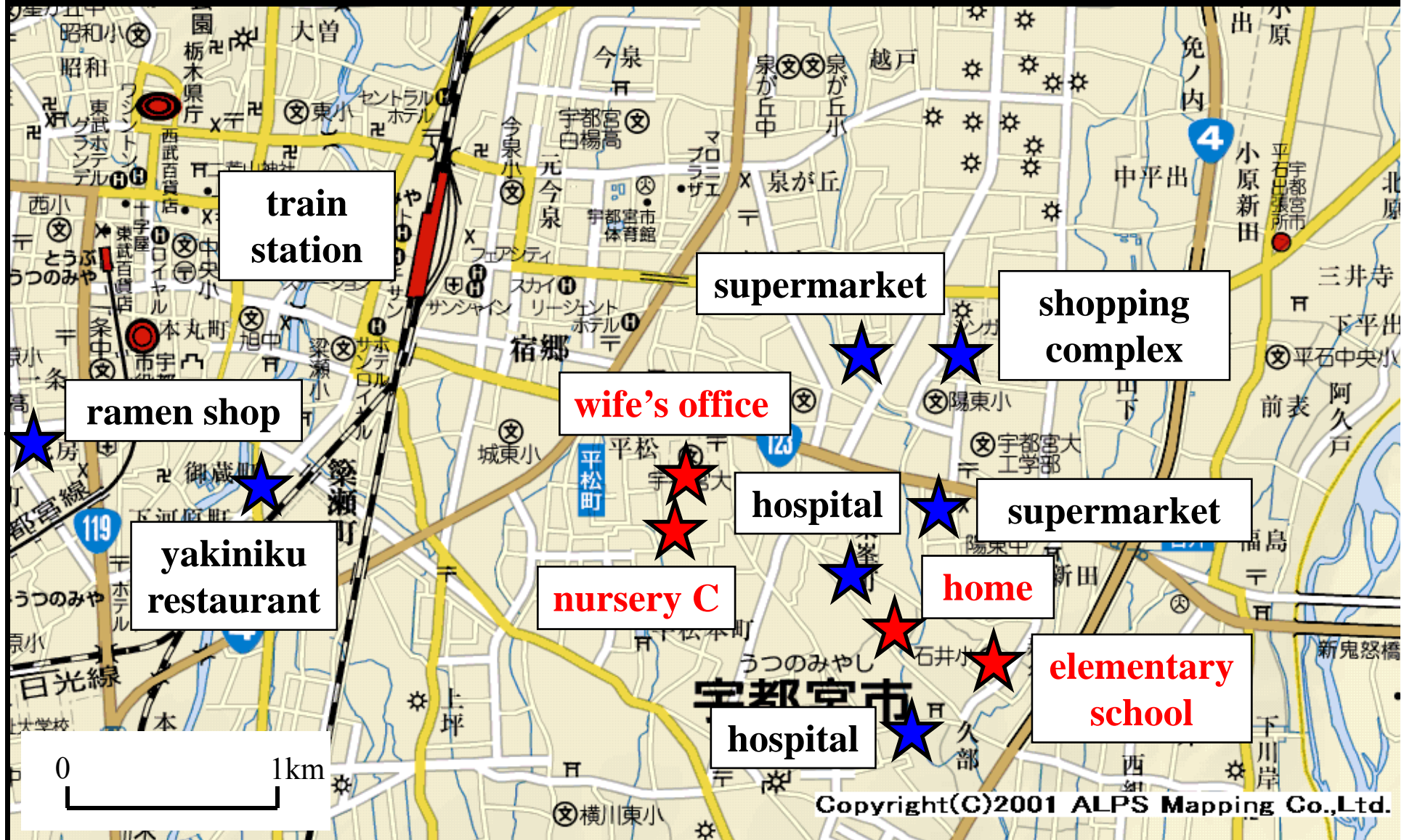
Life cycle stage B

- take the elder son to nursery A: *husband & wife with the younger son, by car*
- take the younger son to nursery B: *husband & wife, by car*
- pick up the younger son: wife, by car
- pick up the elder son: *wife with the younger son, by car*

- husband : —
- wife : —
- elder son : —
- younger son : —
- bike : ■■■■
- car : ■■■■



Wife changed job and moved house to Utsunomiya city



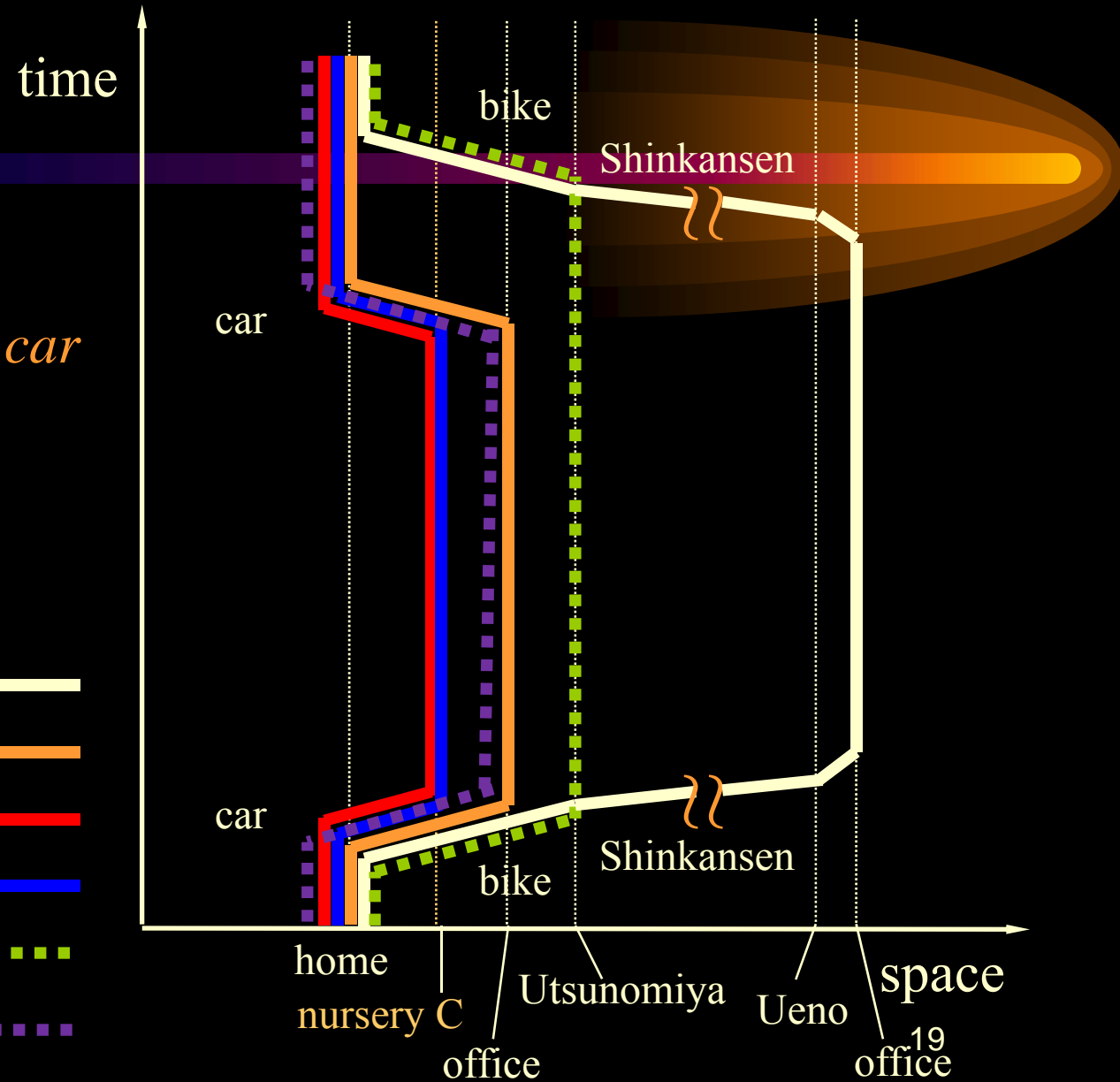


Wife changed job and moved house to Utsunomiya city

Life cycle stage B

- take two sons to nursery C: *wife, by car*
- pick up two sons: *wife, by car*

- husband : ———
- wife : ———
- elder son : ———
- younger son : ———
- bike : - - - -
- car : - - - -

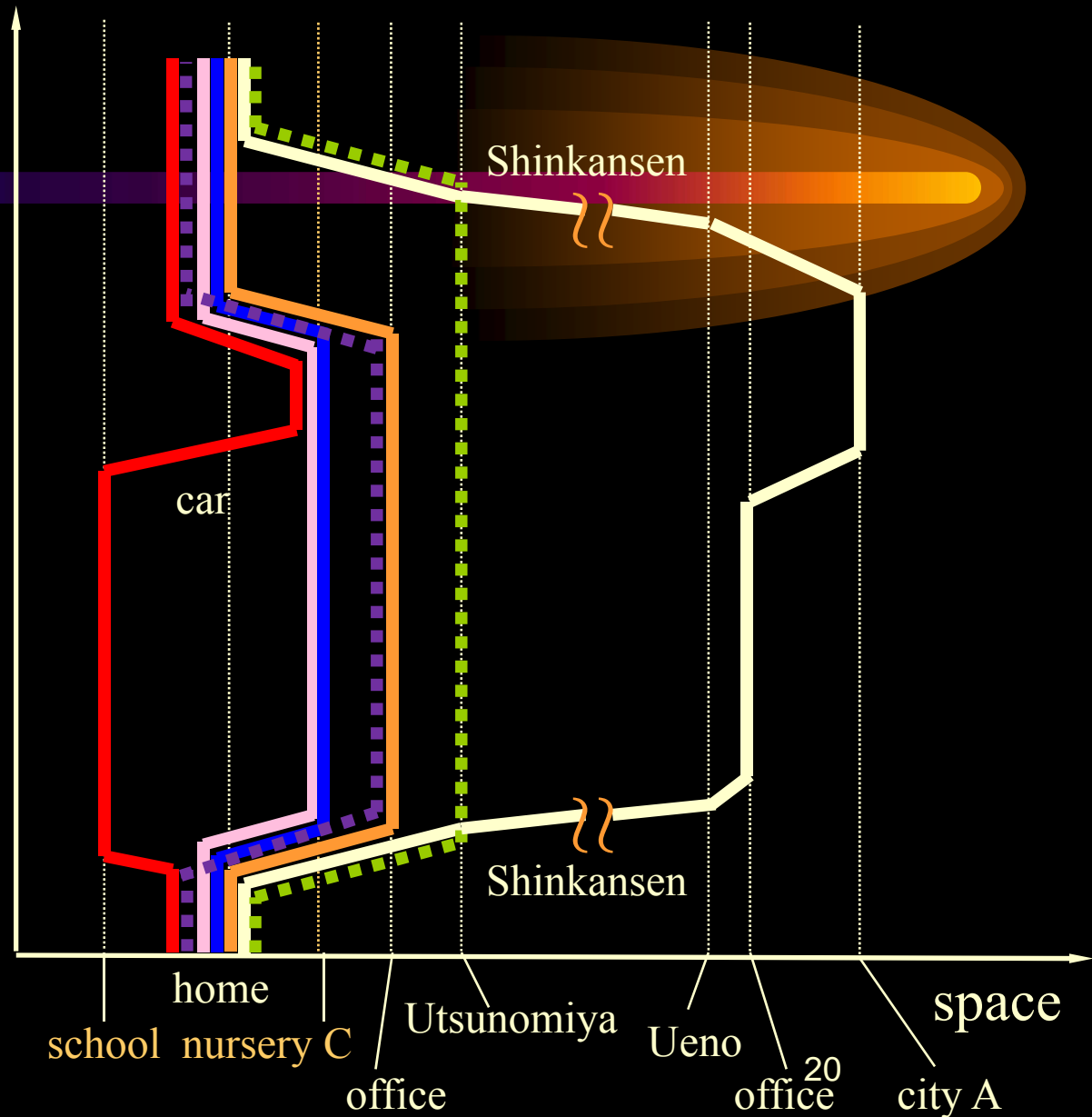


A daughter was born and the elder son enter an elementary school

Life cycle stage C

- take the younger son and a daughter to nursery C: *wife, by car*
- take the elder son from his school to nursery C: *nursery driver, by car*
- pick up two sons and a daughter: *wife, by car*

- husband : ———
- wife : ———
- elder son : ———
- younger son : ———
- daughter : ———
- bicycle : - - - - -
- car : - - - - -



Now, the second son enter an elementary school...

Life cycle stage C

• take a daughter to nursery C: wife, by car

• pick up a daughter: wife, by car

husband

wife

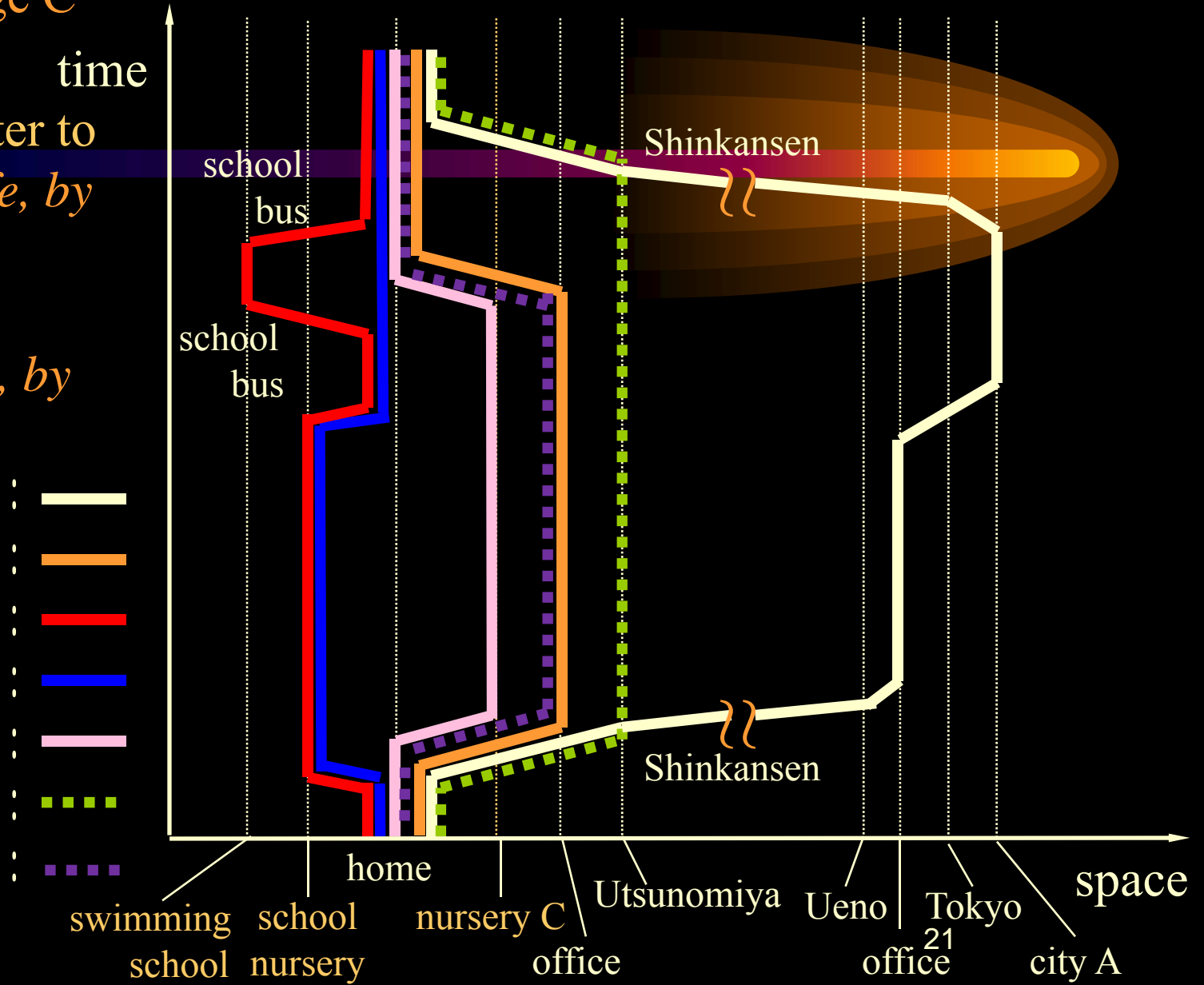
elder son

younger son

daughter

bicycle

car

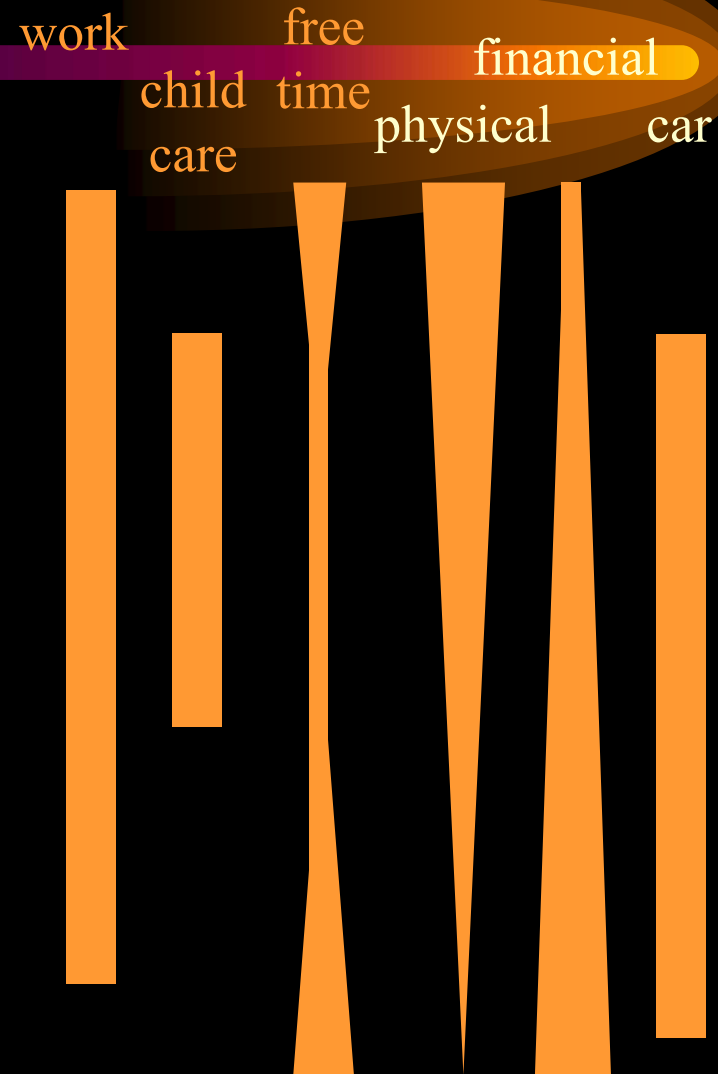


Descriptions and Definitions of Lifecycle Stages (Jones et al., 1983)

	Description of Group	Definitive Feature(s)
A	Younger (married) adults without children	Youngest person under 35 and no children
B	Families with pre-school children	All children under 5
C	Families with pre-school children <i>and</i> young school children	Youngest child under 5 and another child 5 or over
D	Families with young school children	Youngest child 5 or over but under 12
E	Families with older school children	Youngest child 12 or over but under 16
F	Families of adults, all of working age	Youngest 'child' 16 or over
G	Older adults, no children in household	Youngest person 35 or over <i>unless</i> in Group H
H	Retired persons	All persons 65 or over, or at least one 65 or over and none with full time job

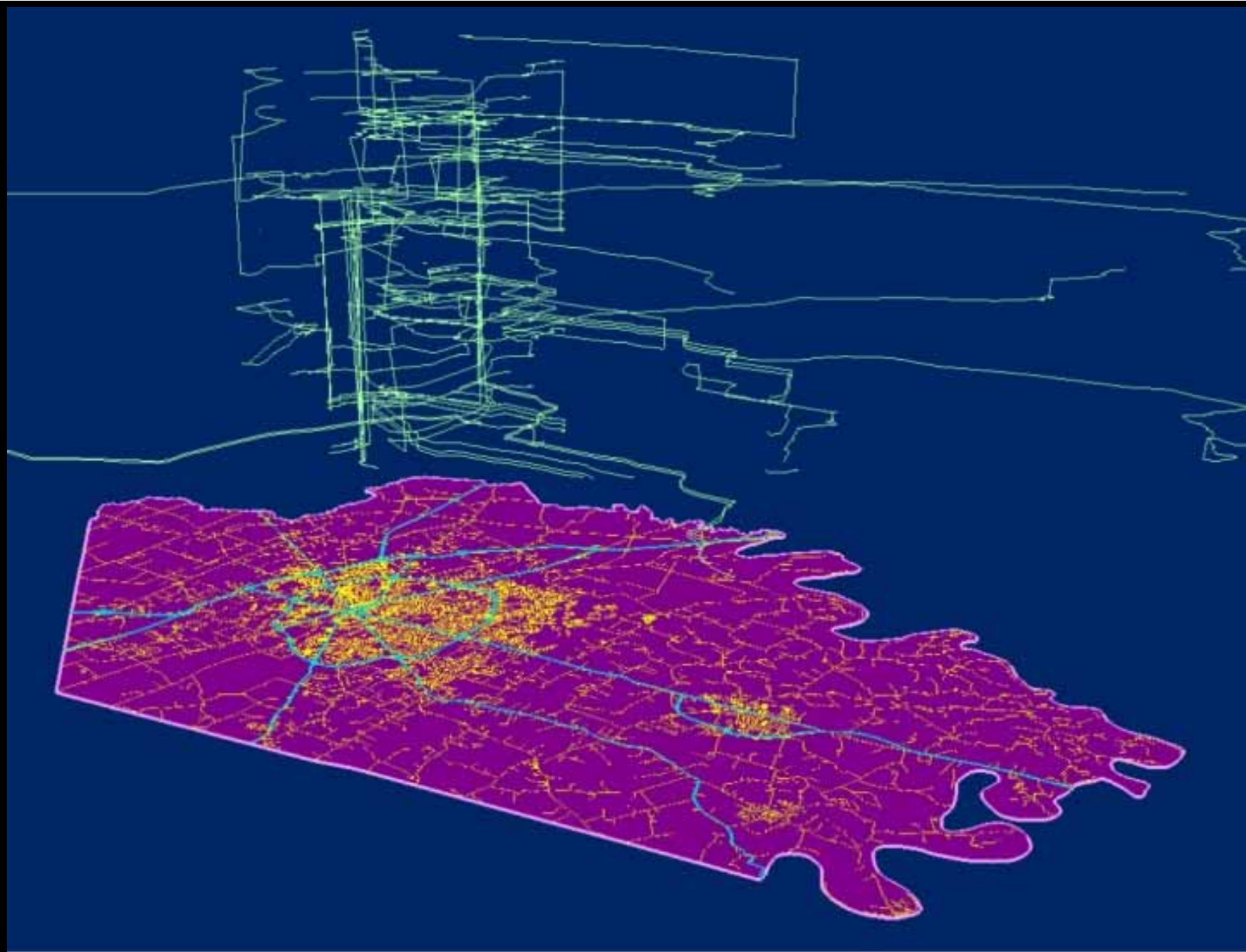
Lifecycle stages, daily activity demand, resources

- A** Younger (married) adults without children
- B** Families with pre-school children
- C** Families with pre-school children and young school children
- D** Families with young school children
- E** Families with older school children
- F** Families of adults, all of working age
- G** Older adults, no children in household
- H** Retired persons

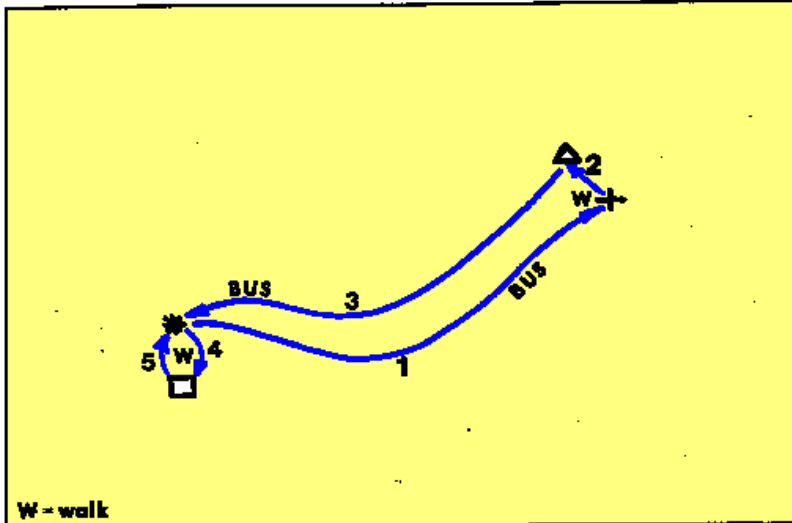




Space-Time Path in 3D-GIS (M.-P. Kwan's website)



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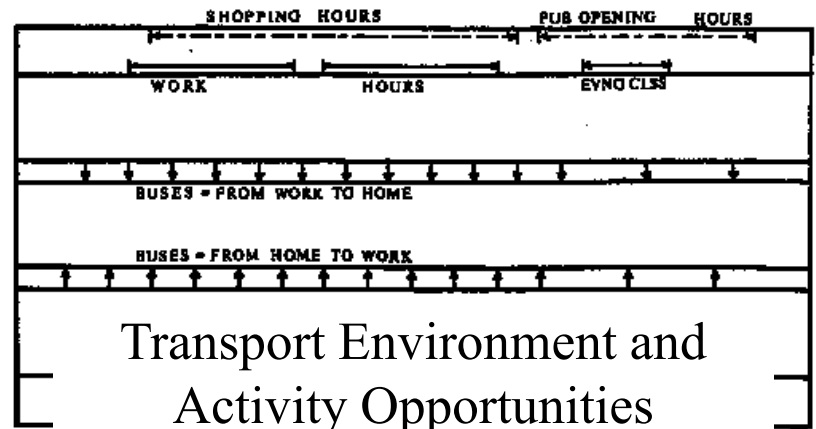
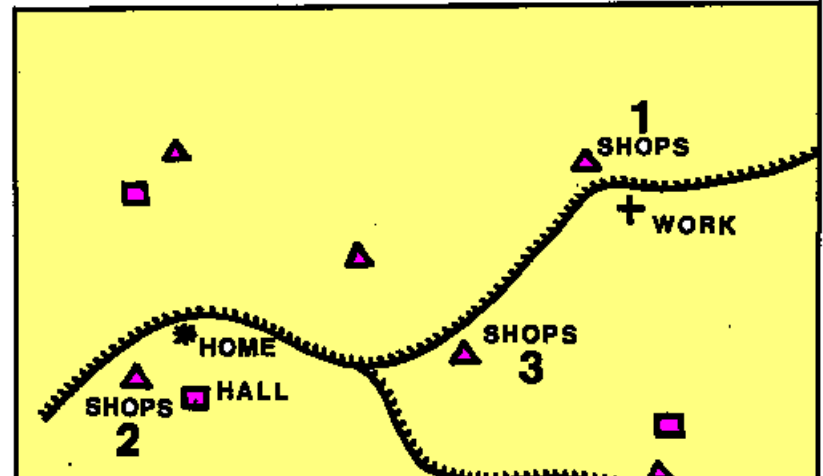


W = walk

TRAVEL



Travel Pattern

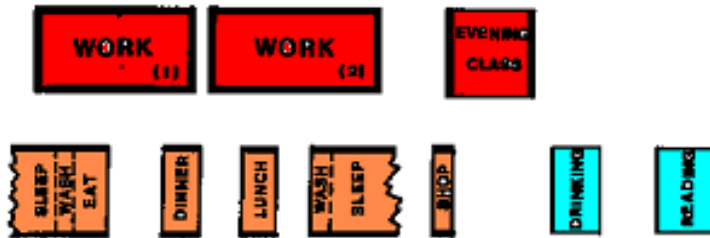


Transport Environment and Activity Opportunities

KEY :

COMPULSORY

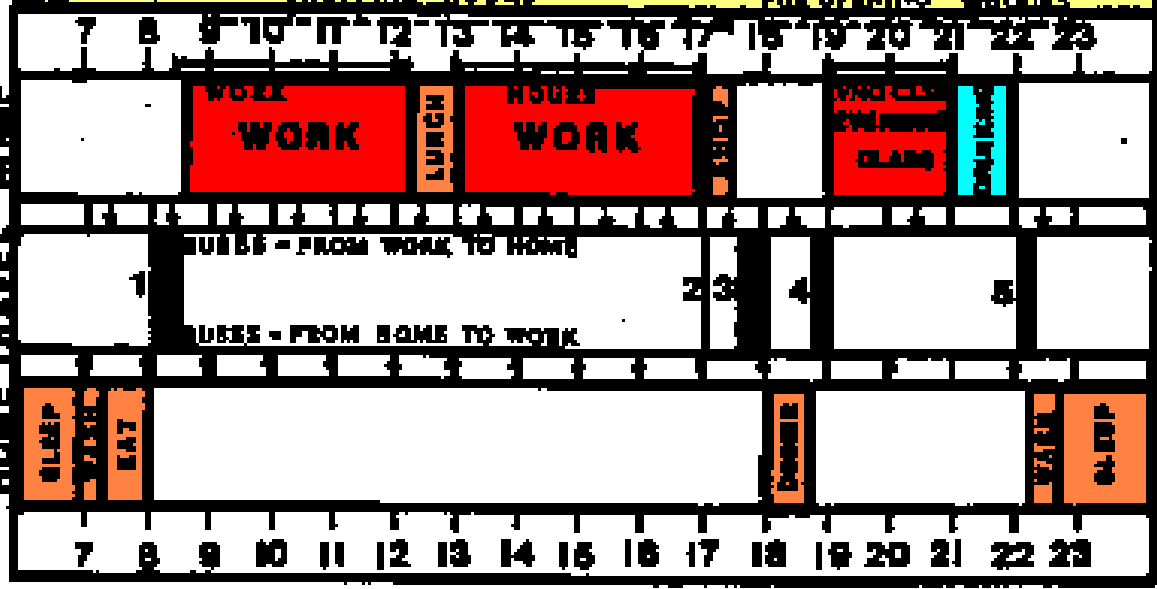
FIXED DURATION



Desired Activity Set



Time of Day



Constraints for Activity-Travel Patterns Proposed by Hägerstrand (1970)

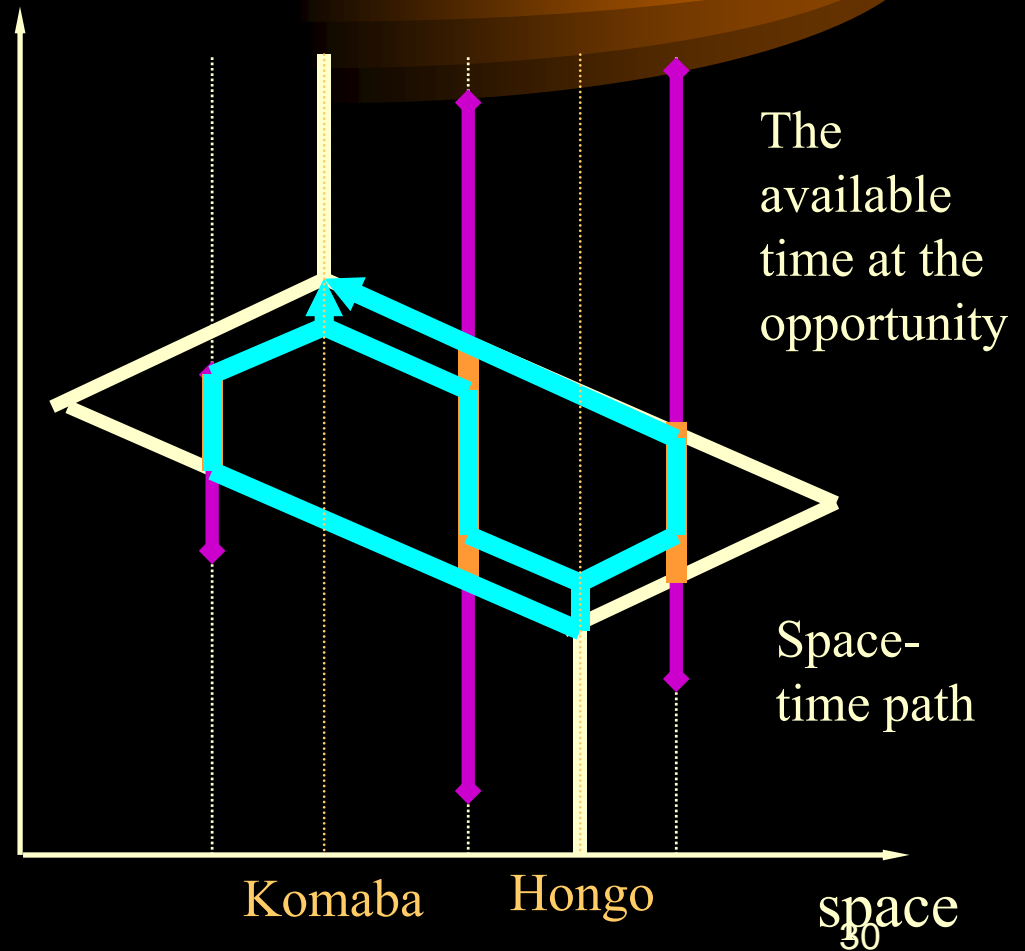
- Capability Constraints
 - Physiological characteristics and available mode
- Coupling Constraints
 - Individuals and materials must exist together at specific location and time
- Authority Constraints
 - Individuals can not be at specific location and time

Space-Time Prism and Space-Time Path (Hägerstrand, 1970)

Constraints

- Activity schedule
 - Spatio-temporal constraints of fixed activities
- Transportation network
 - Road network
 - Transit network
- Opportunities
 - Location
 - Opening hours

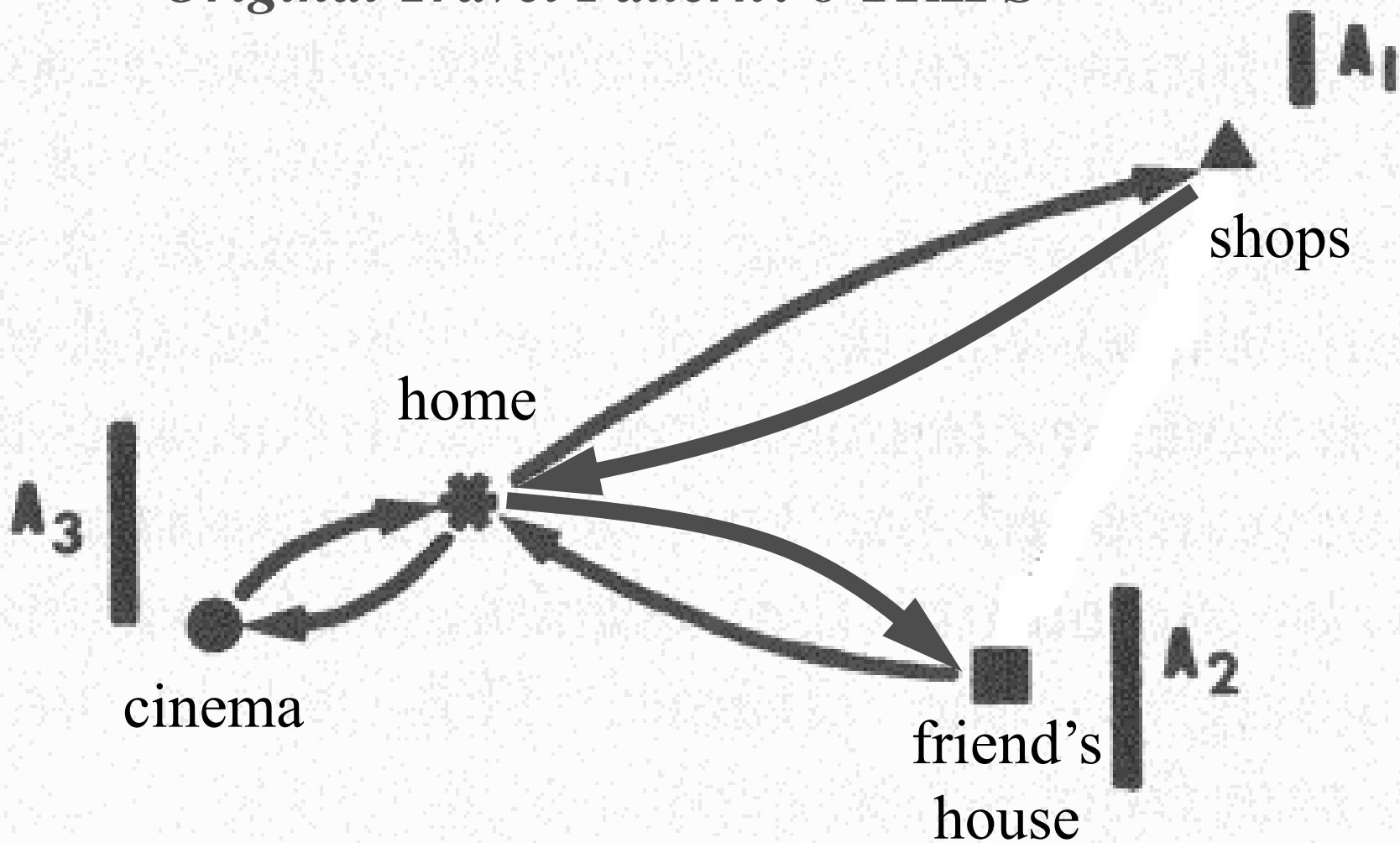
Larger prism provides us more opportunities!



“Can We Live Without Traveling?”

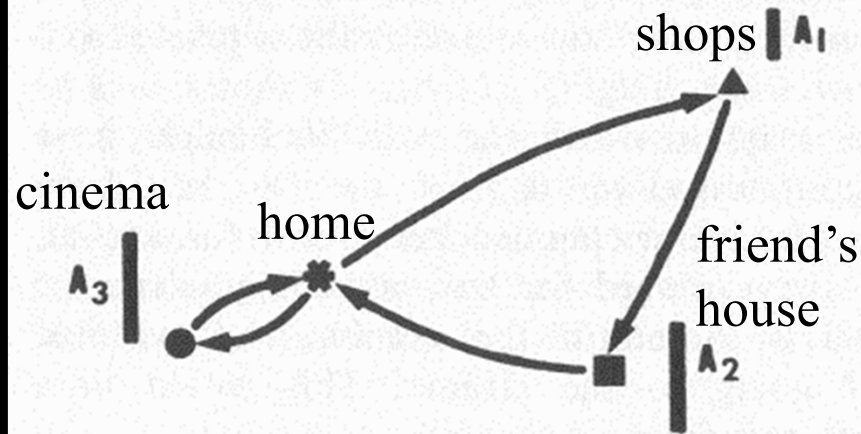
- Some activities can be outsourced to **other persons**
 - Other household members, Baby sitters, Housekeepers, etc.
- Some activities can be conducted by **telecommunications** (e.g. mobile phone, the Internet) and do not need to travel.
 - Telecommuting, Teleshopping, Teleconferencing, etc.
- If you can do “living”, “working” and “recreation” at one location, you need not travel to other locations.
 - Hongo campus?
 - Land use and locations of activity opportunities are critical factors

Original Travel Pattern: 6 TRIPS

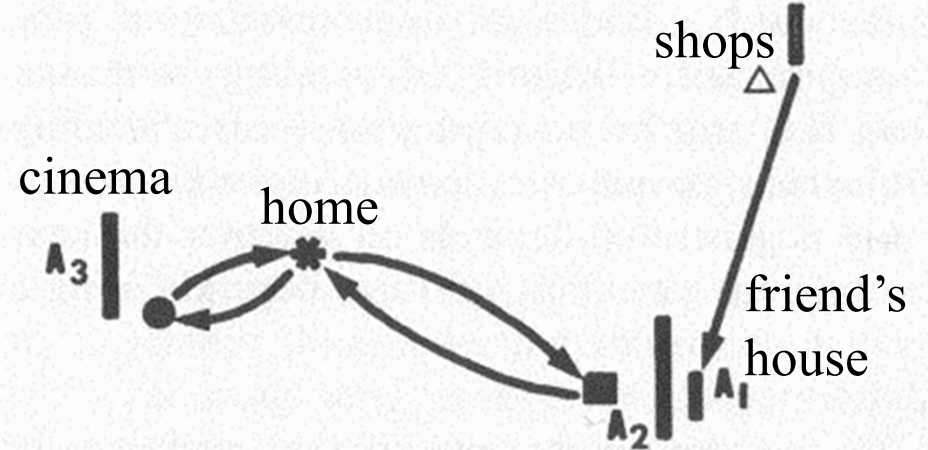


Alternative strategies (to reduce car use) for satisfying similar activity needs (Jones et al., 1983)

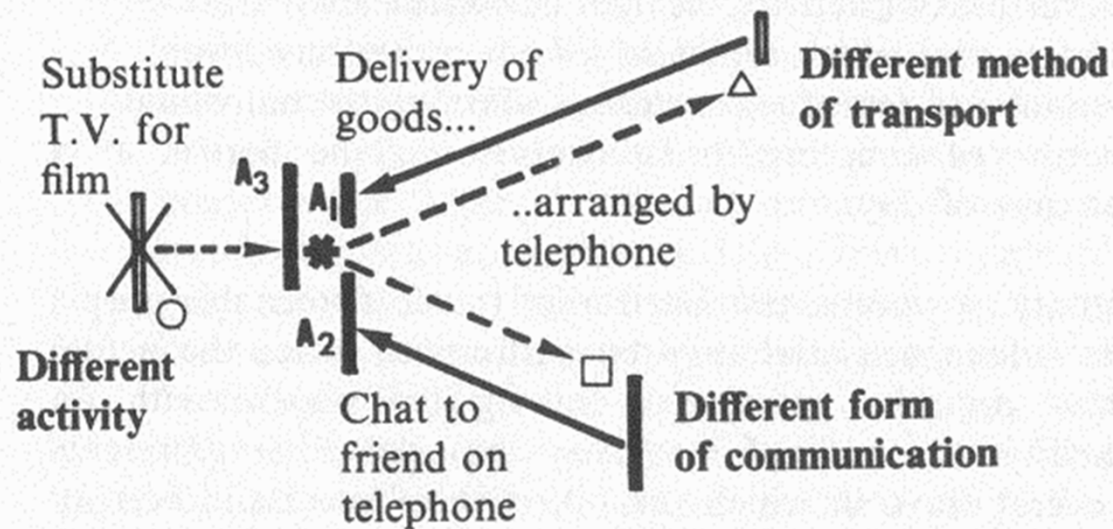
(a) *Revise Journey Structure: 5 TRIPS*



(b) *Consolidate Use of Sites: 4 TRIPS*

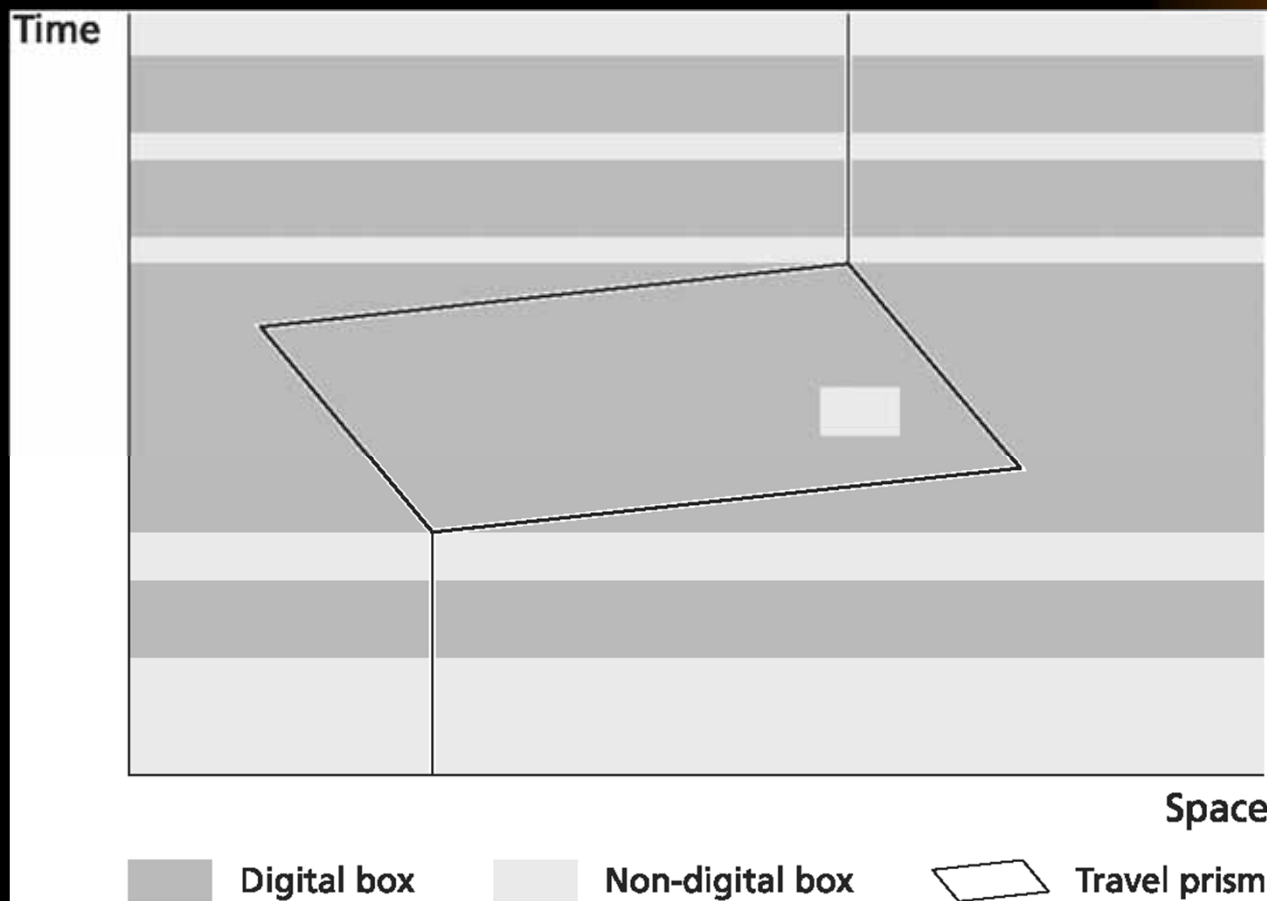


(c) *Substitutes for Personal Travel: 0 TRIPS*



Alternative strategies (to reduce car use) for satisfying similar activity needs (Jones et al., 1983)

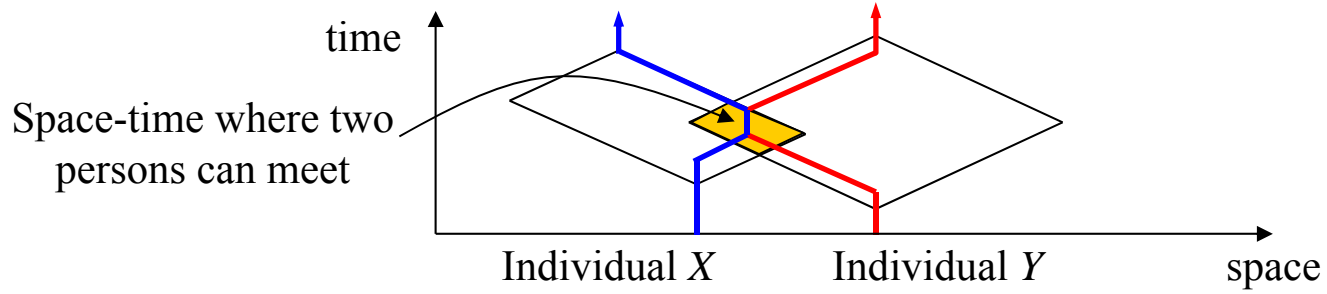
Space-Time Area Where Telecommunications Are Available



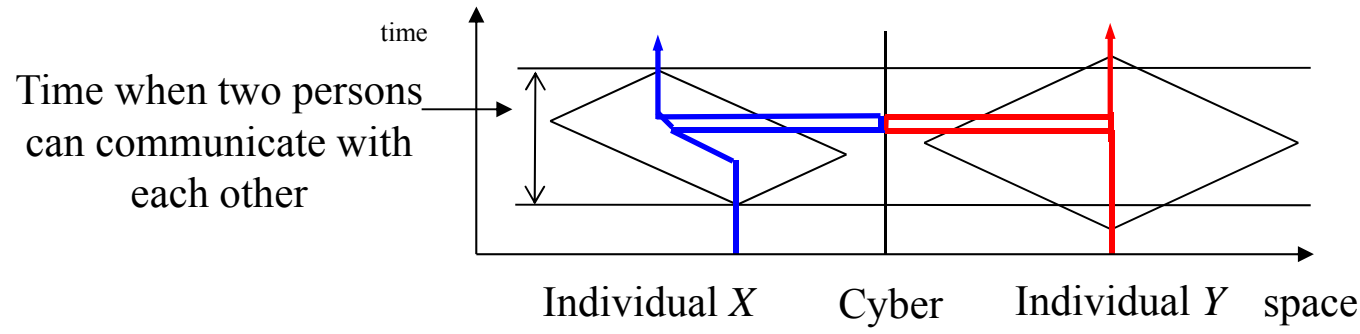
e.g., mobile phone is prohibited to use:

- during class,
- in hospitals,
- in theater,
- near priority seats on train,
- etc.

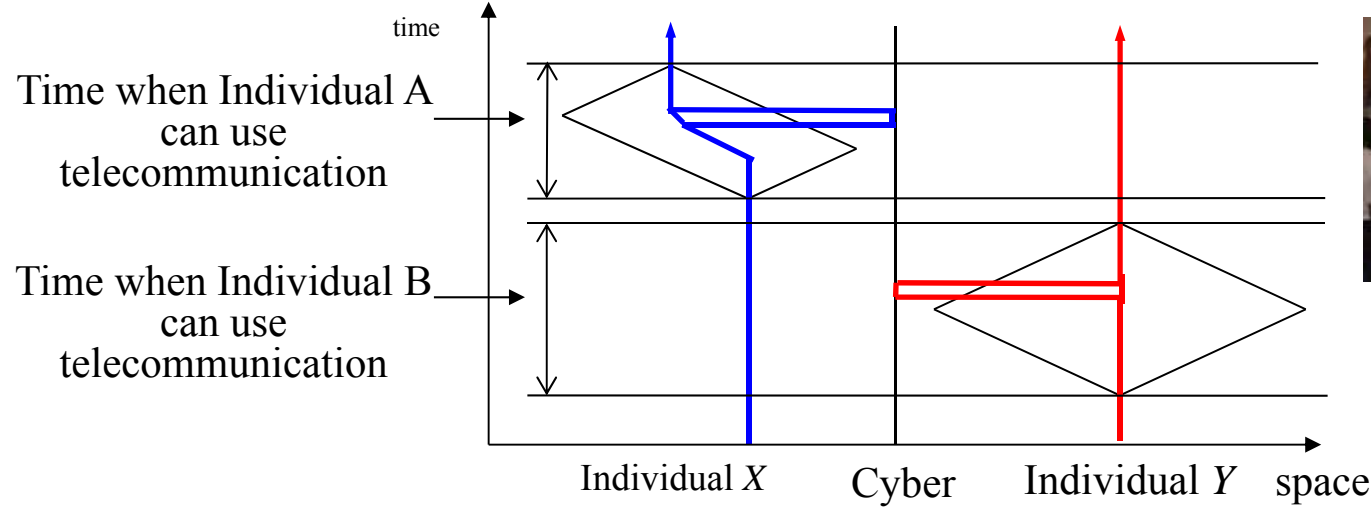
Concept of “digital box” (Dijst, 2004)



Meeting



Telephone



E-mail



Spatial and temporal constraints on communications systems

		Spatial coincidence of communicators required	
		Yes	No
Temporal coincidence of communicators required	Yes	Face-to-face meeting	Picture phones Telephones Cellular phones Teleconference (audio or audiovisual) Web conferencing and collaboration systems Instant messaging CB radio
	No	Refrigerator notes Hospital charts	Answering and recording machines Computer conferencing and bulletin boards E-mail Voice mail Mail Telegrams, telex, fax Printed publications

Positive Utility of Travel

- I would not like to stay at home all the day... I want to go out!
 - Positive utility of traveling itself
 - Physical exercise, enjoy scenery, feel wind, be alone, communication with people, enjoy driving, etc.
- Even if *teleportation machine* is available, you might travel.
- Desired commute time is not 0 minute (Mokhtarian, 2003)

Activities While Traveling

- Activities while traveling
 - ICTs and miniaturized electronic devices provide many activity opportunities while traveling
 - If people can engage in activities comfortably even while traveling, travel disutility will be reduced.
- Activities that people can engage in while traveling depend on:
 - Travel mode
 - Congestion level, sitting or standing, in-vehicle time, available portable devices, facilities equipped with the train, etc.
 - Individual trip purpose, level of physical fatigue, etc.
- Providing better environment in public transport could contribute to modal shift from car to public transport?

Wien, Austria



London, U.K.



Washington D.C., U.S.



Amsterdam, the Netherlands



Bangkok, Thailand



Dalian, China



Seoul, South Korea



Tokyo, Japan

Bangkok, Thailand



Dalian, China



Seoul, South Korea



Tokyo, Japan

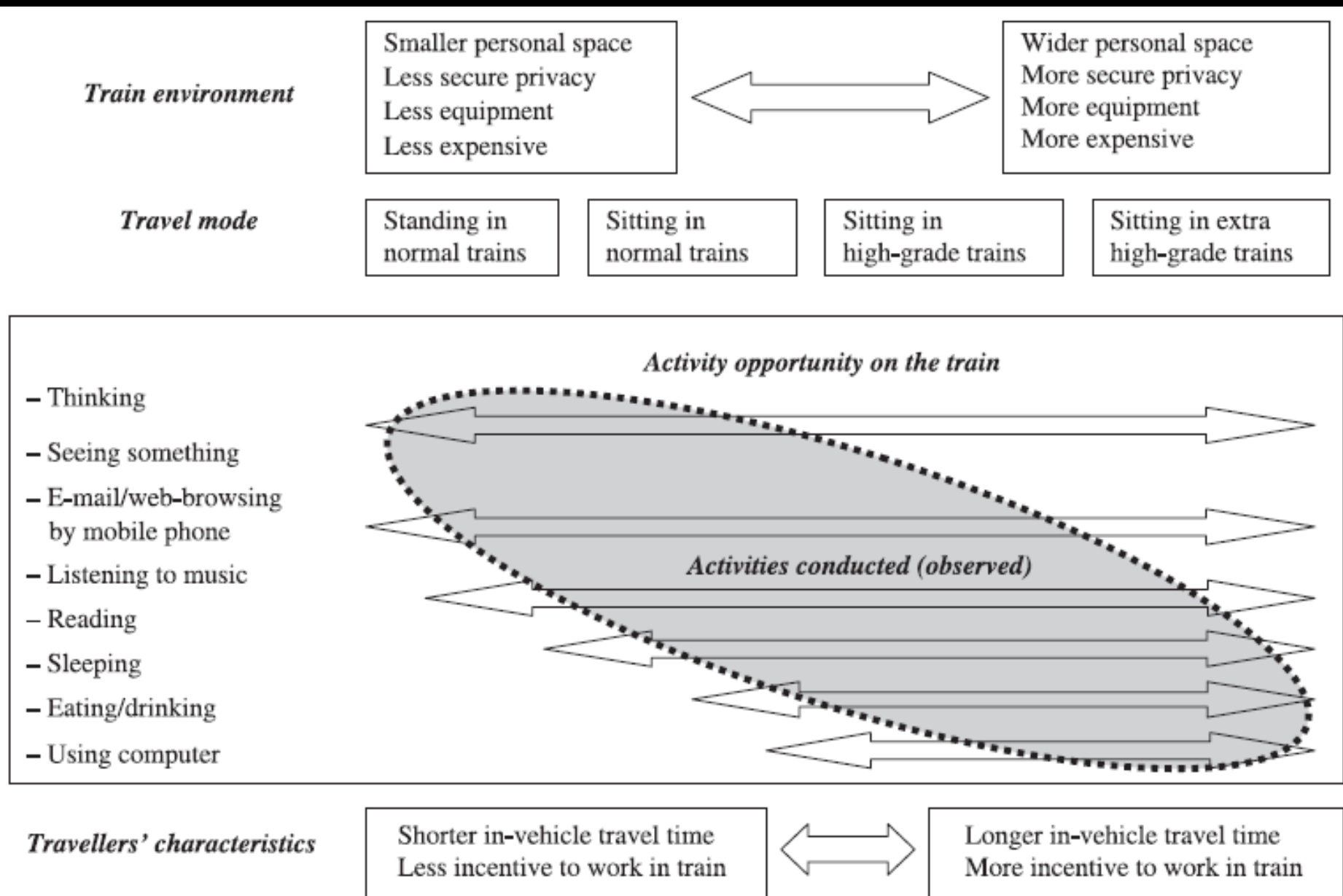


Activities that can be conducted while traveling (Ohmori & Harata, 2008)

	Walk	Bike	Car driver	Car pass.	Taxi	Bus	Train	Train station	Bus stop
Eat/Drink	B	B	B	A	B	A/B	A/B	A	A
Read books, etc.	B	C	C	A	A	A	A	A	A
Smoke cigarettes	B	B	B	A	C	C	B/C	B	B
Talk with comp.	A	B	A	A	A	A	A	A	A
Mobile phone	B	C	B	A	A	B/C	B/C	A	A
Mobile e-mail	B	C	C	A	A	A	A	A	A
PC/PDA	B	C	C	A	A	A	A	A	A
Music/Radio	B	C	A	A	A	A	A	A	A
Sleep	C	C	C	A	A	A	A	A	A
Sing songs	B	B	A	A	B	B	B	B	B
Think	B	B	B	A	A	A	A	A	A
See scenery, etc.	A	A	B	A	A	A	A	A	A

A: possible, B: possible but not recommended, C: impossible or prohibited

Travel environment, travelers' characteristics, and activity opportunity on the train (Ohmori & Harata, 2008)



Summary

- Travel is a **demand, derived** from the desire to engage in activities at different locations.
- Daily activity-travel pattern is a result of scheduling **desired activity set**, under **space-time constraints** of transport and land use systems, and other constraints of household, and personal perceptions and preferences.
- How will human activity-travel patterns change by the use of **ICTs**?
- What are cities and sustainable transport in the future?

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