Better pen-and-paper surveys for transportation research in developing countries

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  with:
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- **Megan Ryerson (Univ. of Pennsylvania)**
- **Luke Jones (Valdosta State)**

- **COMPUTER-ASSISTED VS. PEN-AND-PAPER PERSONAL INTERVIEWS**

- **PIVOTING METHODS: RPSP CAPI & PAPI, *SISP PAPI***
- **SURVEY DESIGN AND QUALITY CONTROL**
- **METHOD EFFICACY**
- **ACKNOWLEDGMENTS**

Online: SP pivoted on RP

D.A. Hensher / Transportation Research Part A 40 (2006) 829–840

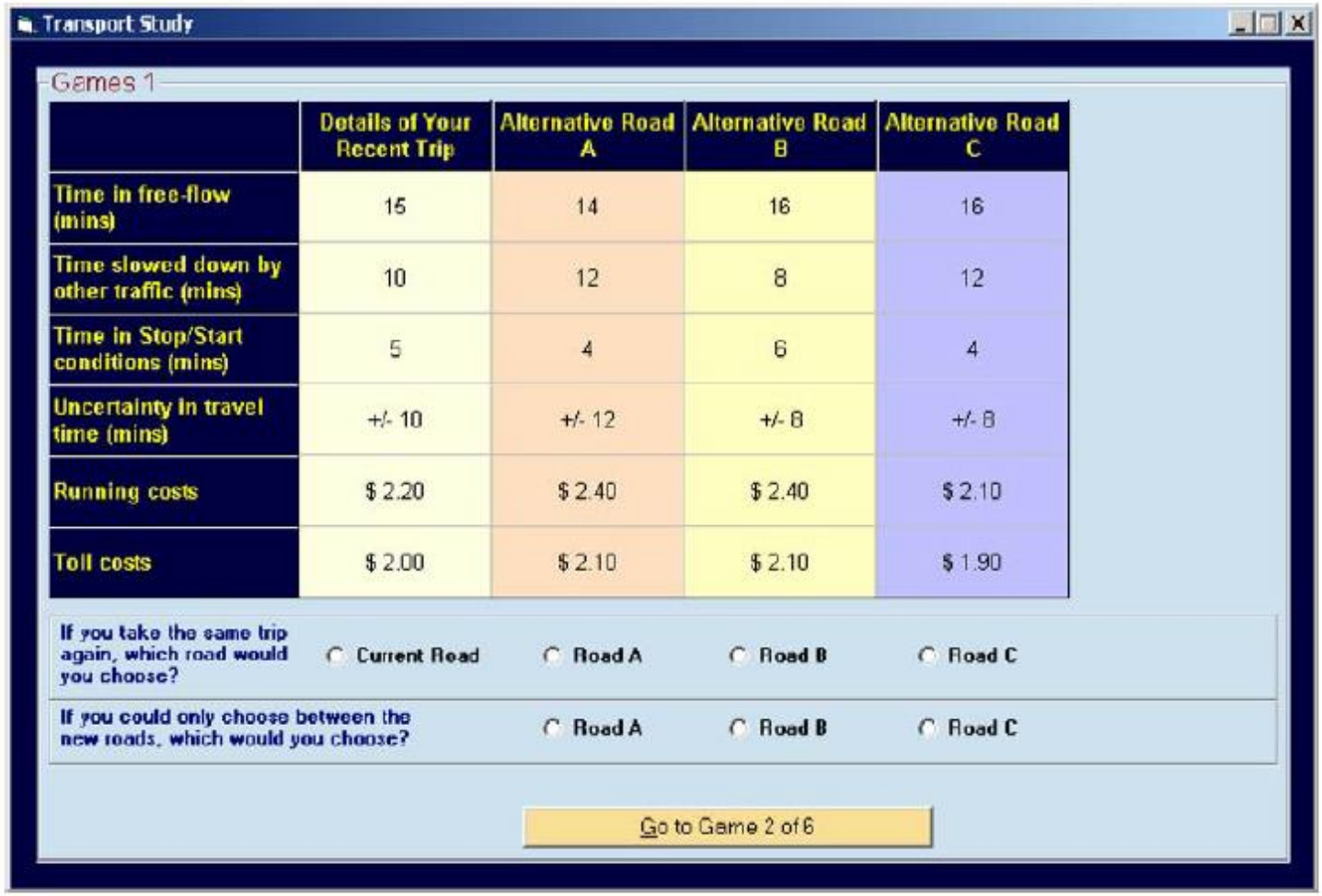
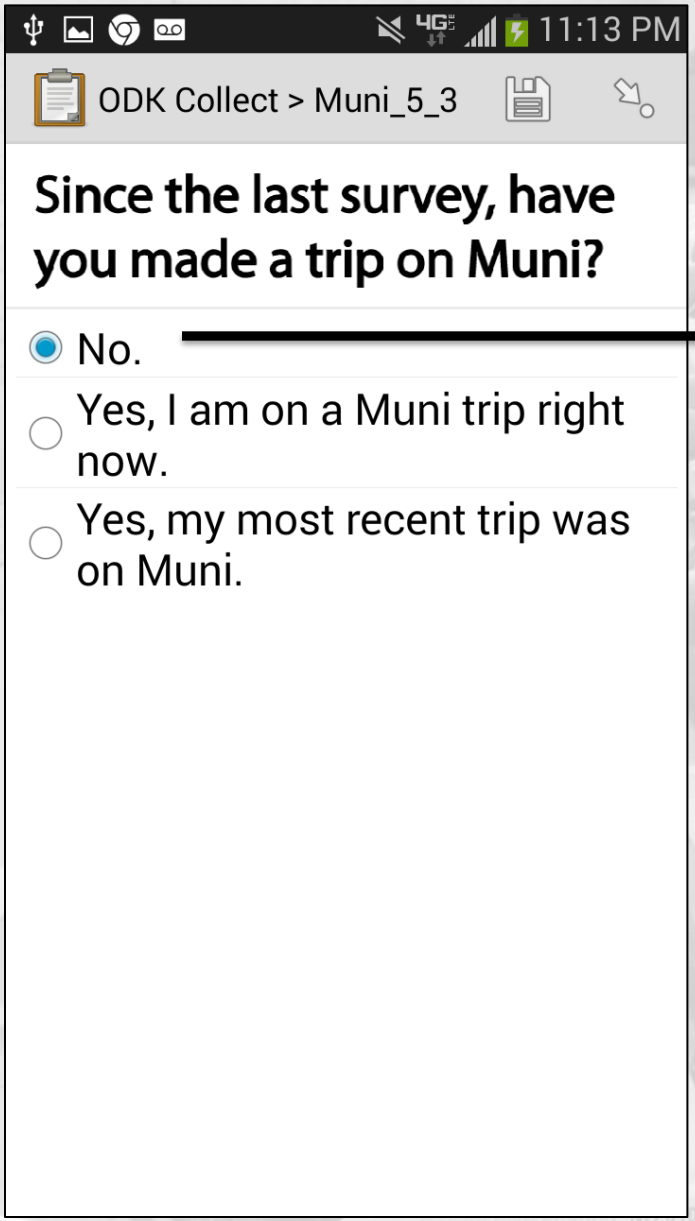
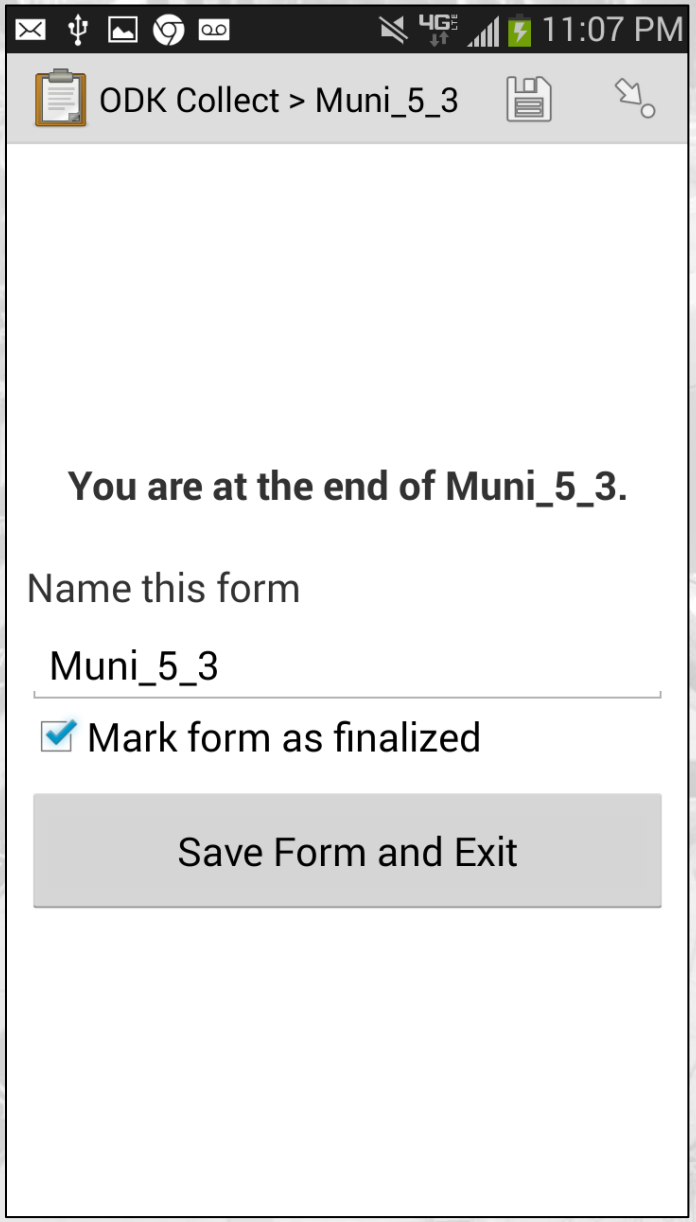


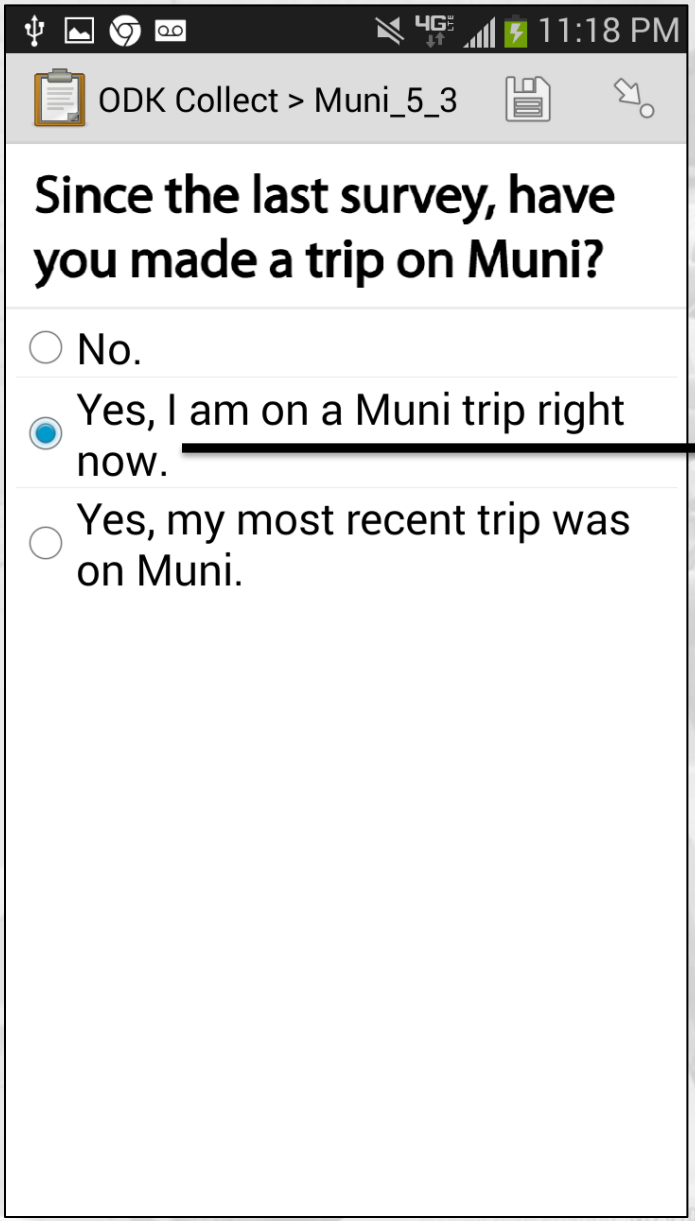
Fig. 1. Example of a stated choice screen.

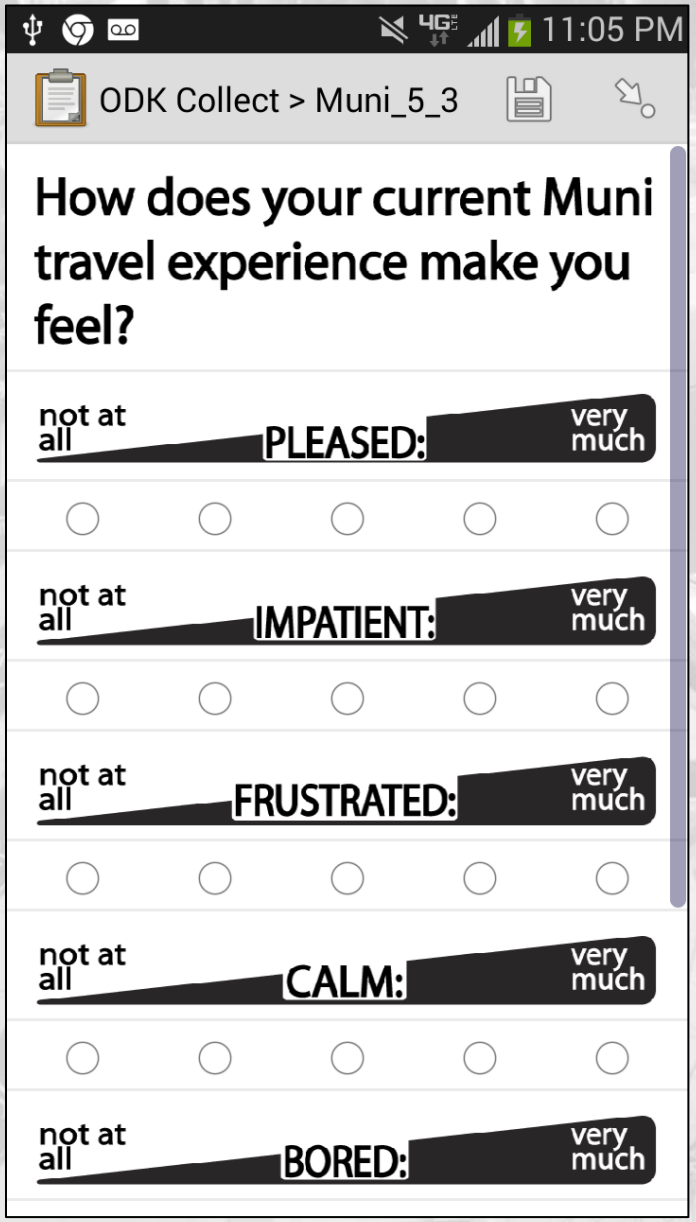
Mobile: dynamic, user responsive





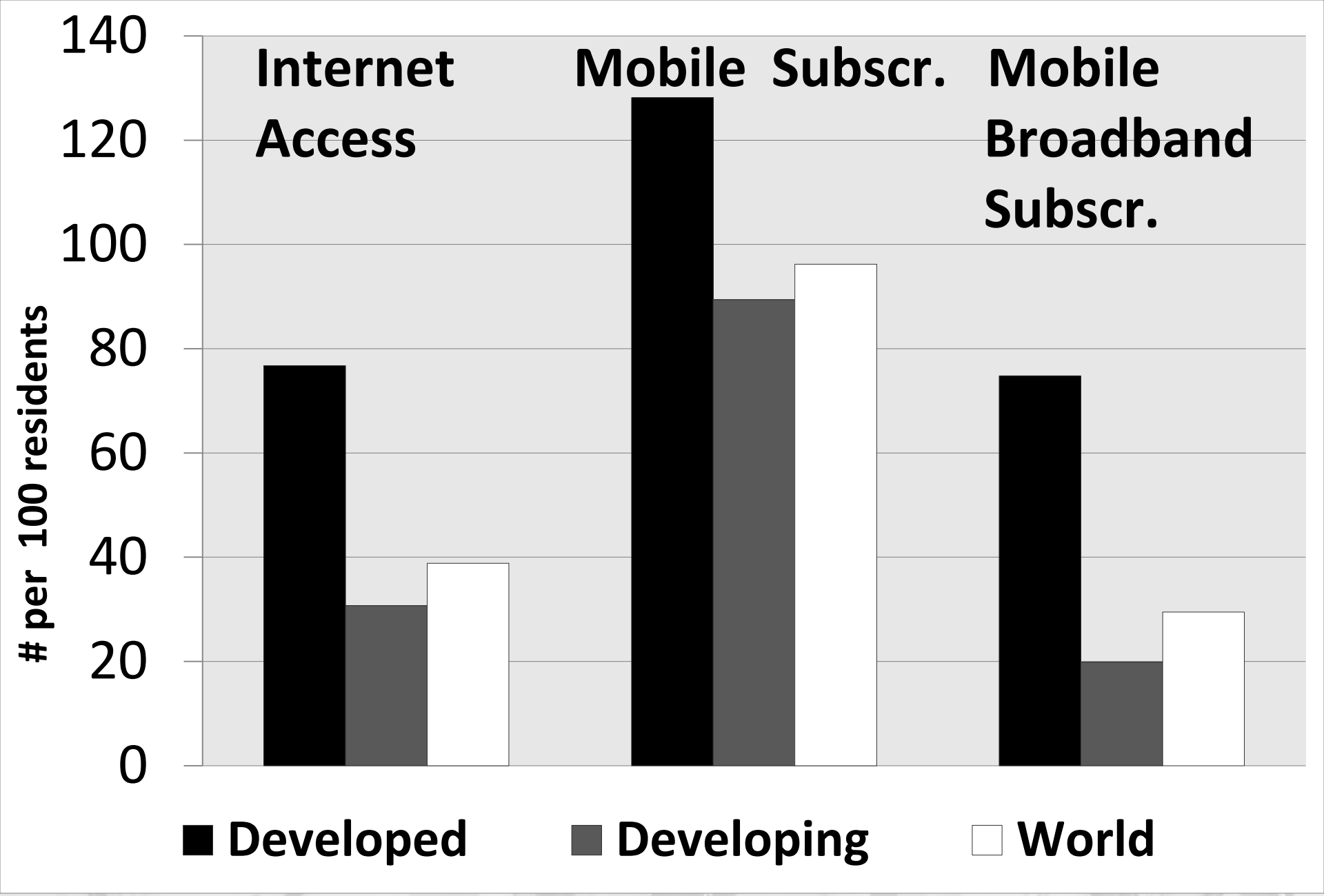
Mobile: dynamic, user responsive





Computer-Assisted Personal Interviews (CAPI)

- Dynamic, user responsive
- Quality control
- High fixed costs + lower labor needs (sometimes) → economies of scale
- But… high fixed costs + required computer/internet access → barriers to research (sometimes)



PROJECTED 2013 INTERNET AND MOBILE PENETRATION

(International Telecommunications Union – Key ICT Statistics 2012-2013)

The Persistent Pertinence of Pen and Paper

- Low fixed costs and no requirements for computer/internet access
- Easy to adapt and pilot
- Potentially greater labor demands
- Low fixed cost + wealth of labor → good (or only) solution for small to medium studies *ad hoc* studies

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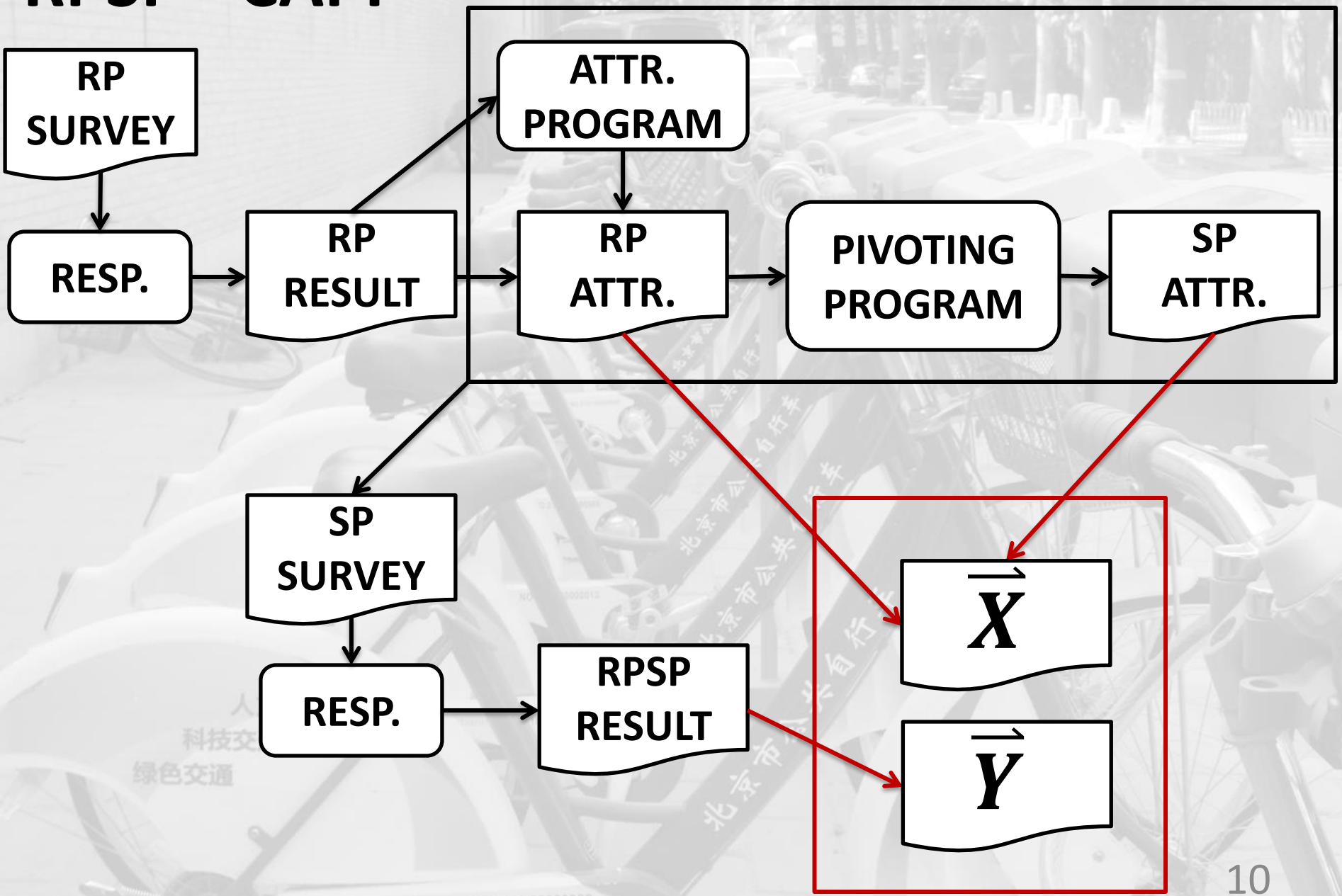
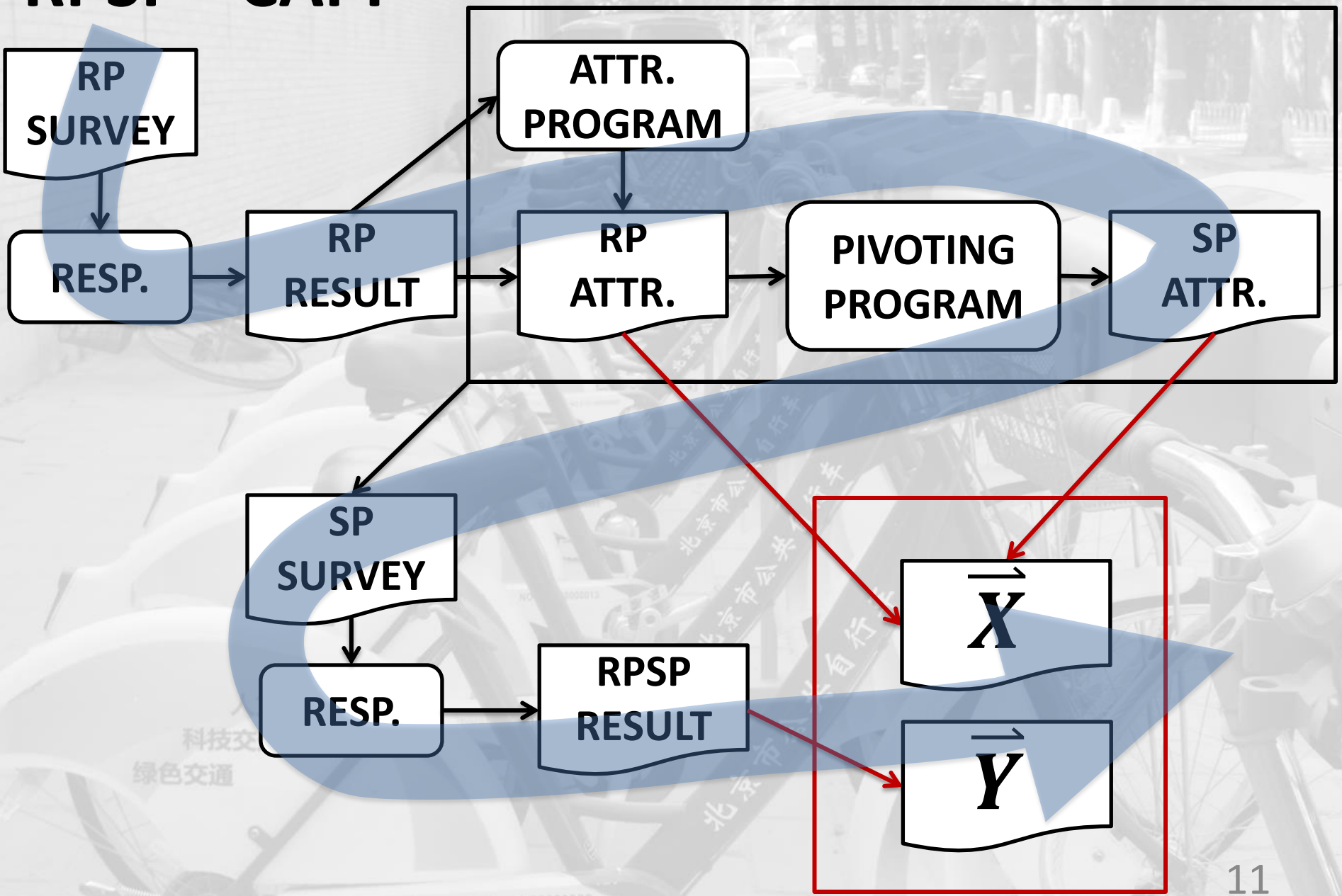
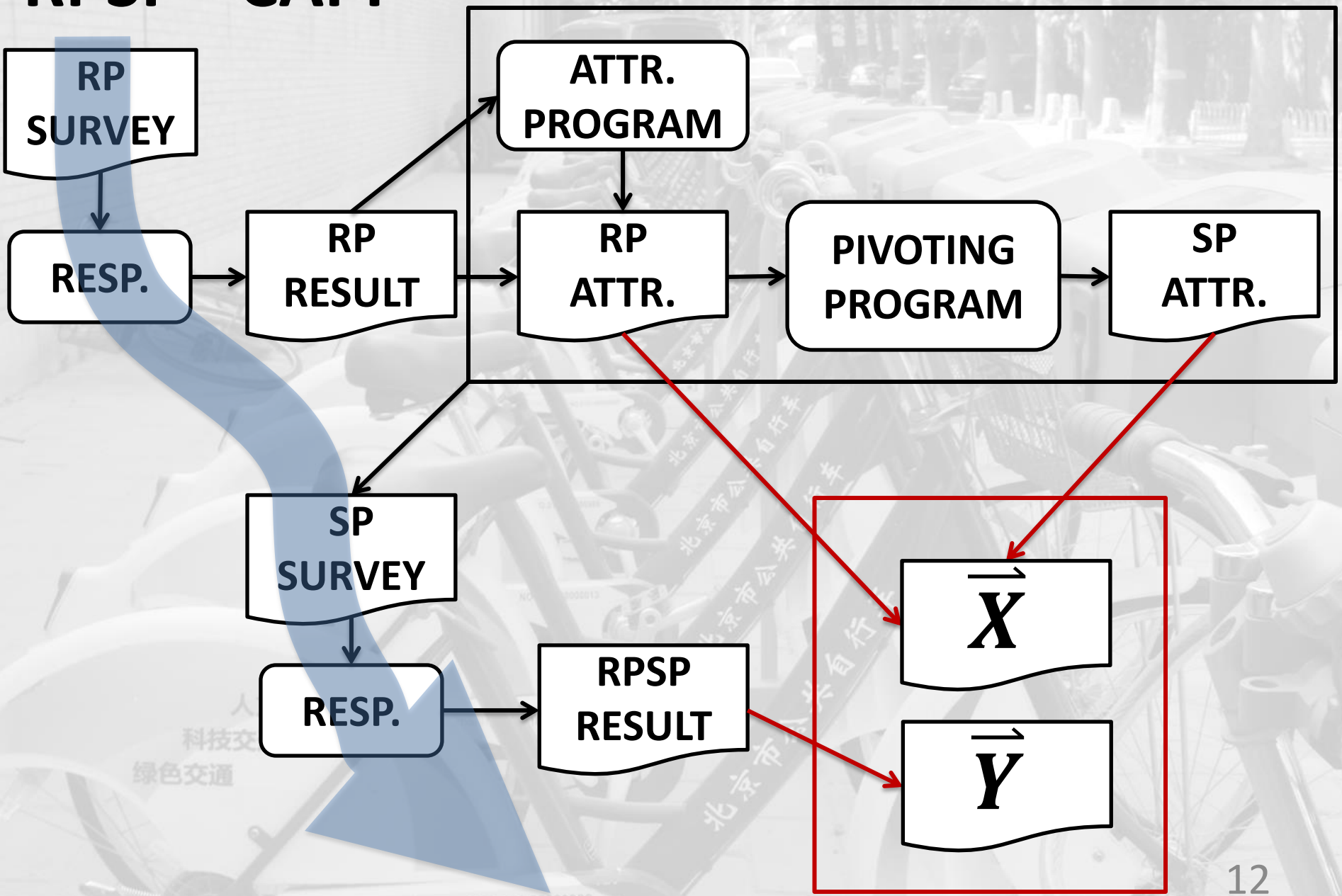
RPSP - CAPI


RP SURVEY
RESP.
RP RESULT
ATTR. PROGRAM
RP ATTR.
PIVOTING PROGRAM
SP ATTR.
SP SURVEY
RESP.
RPSP RESULT
$\vec{X}$
$\vec{Y}$

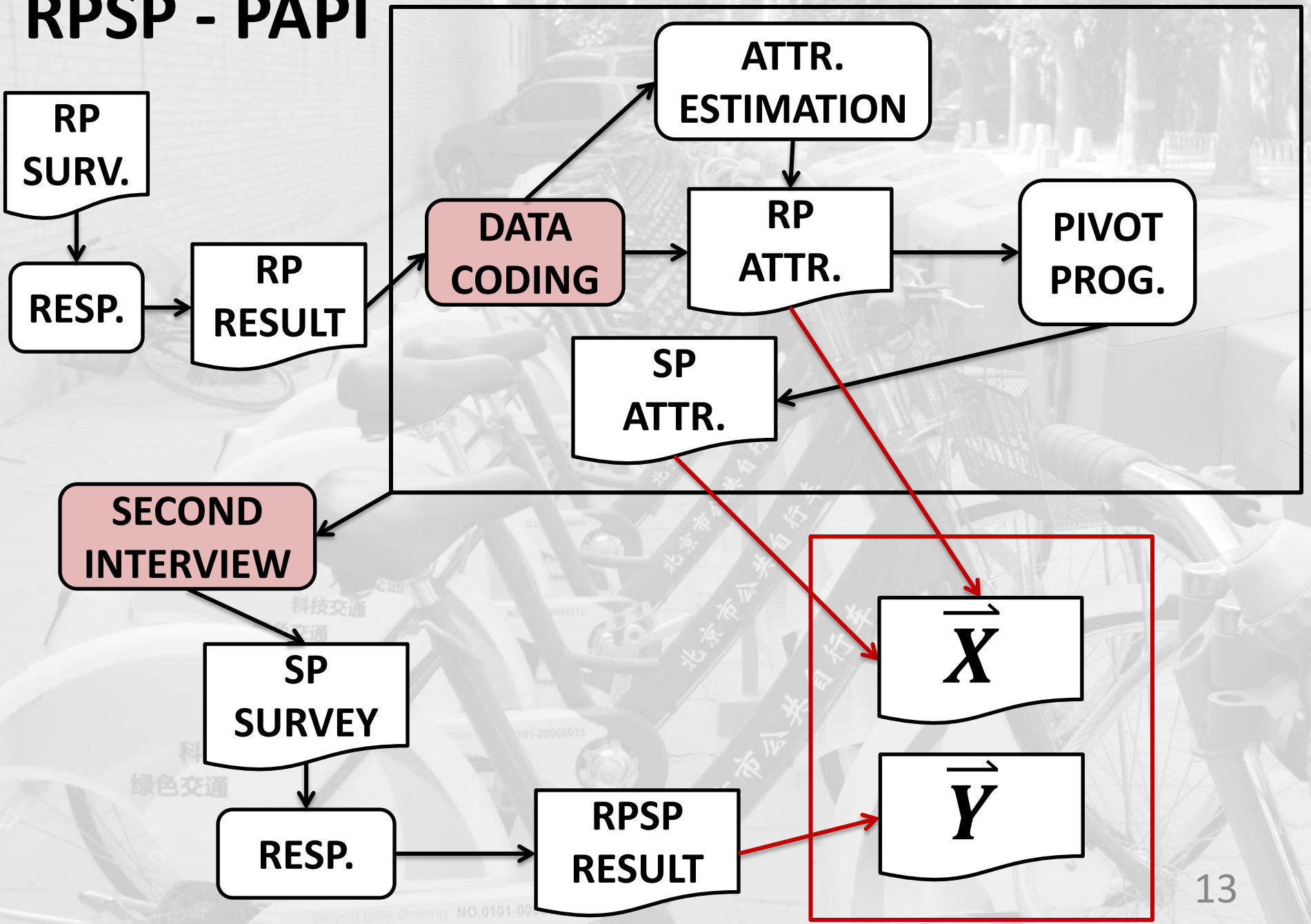
RPSP - CAPI


RP SURVEY
RESP.
RP RESULT
ATTR. PROGRAM
RP ATTR.
PIVOTING PROGRAM
SP ATTR.
SP SURVEY
RESP.
RPSP RESULT
$\vec{X}$
$\vec{Y}$

RPSP - CAPI

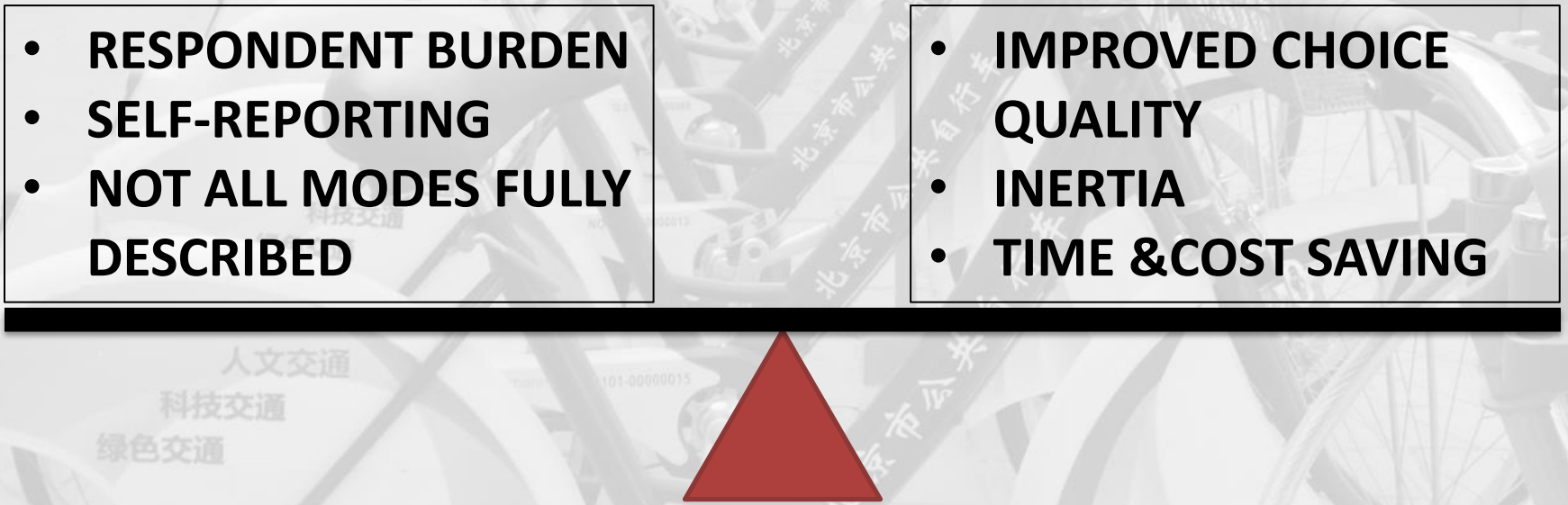

RP SURVEY
RESP.
RP RESULT
ATTR. PROGRAM
RP ATTR.
PIVOTING PROGRAM
SP ATTR.
SP SURVEY
RESP.
RPSP RESULT
$\vec{X}$
$\vec{Y}$

RPSP - PAPI

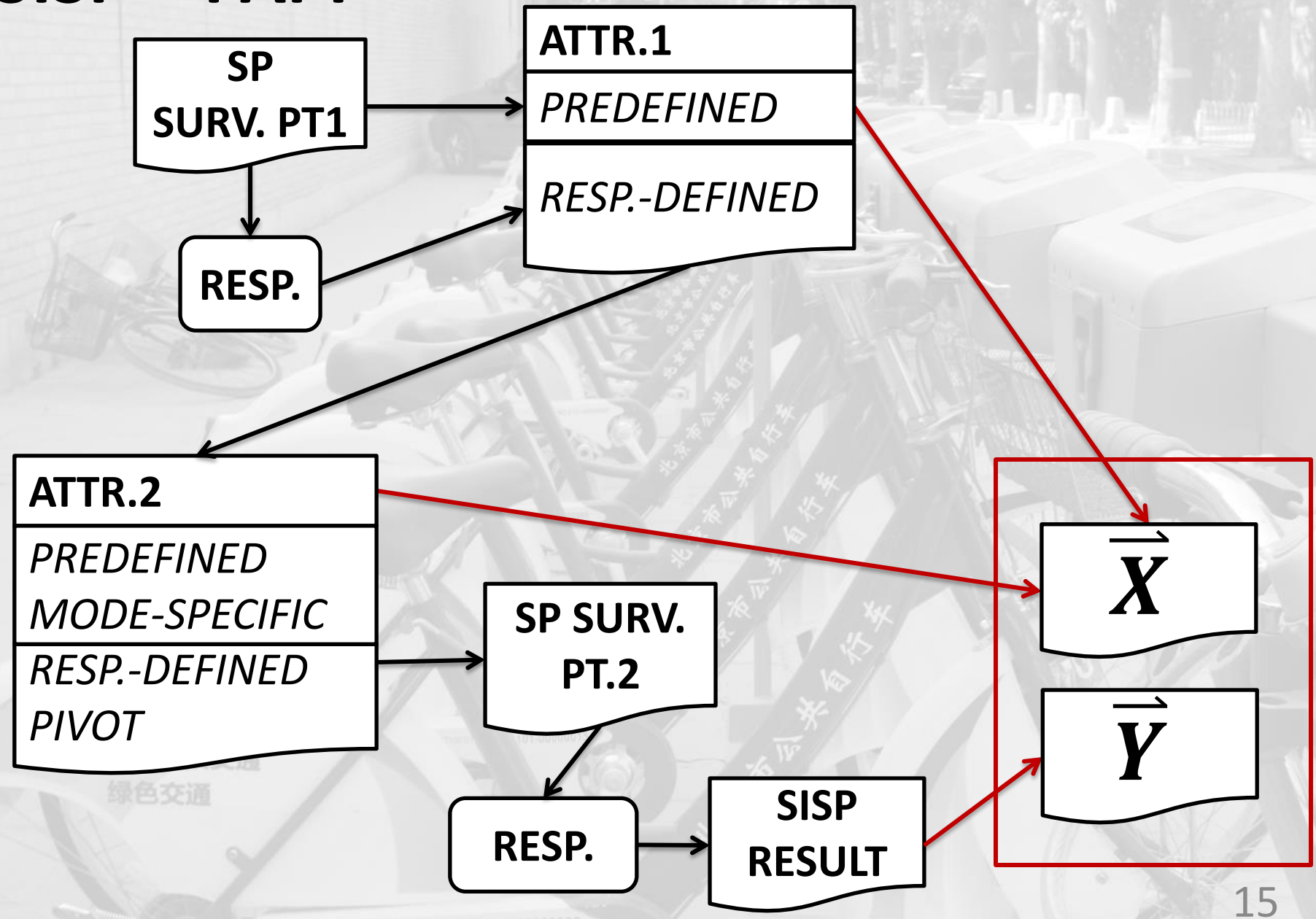

RP SURV.
RESP.
RP RESULT
DATA CODING
ATTR. ESTIMATION
RP ATTR.
PIVOT PROG.
SP ATTR.
SECOND INTERVIEW
SP SURVEY
RESP.
RPSP RESULT
$\vec{X}$
$\vec{Y}$

Single Interview SP Pivoting (SISP) PAPI

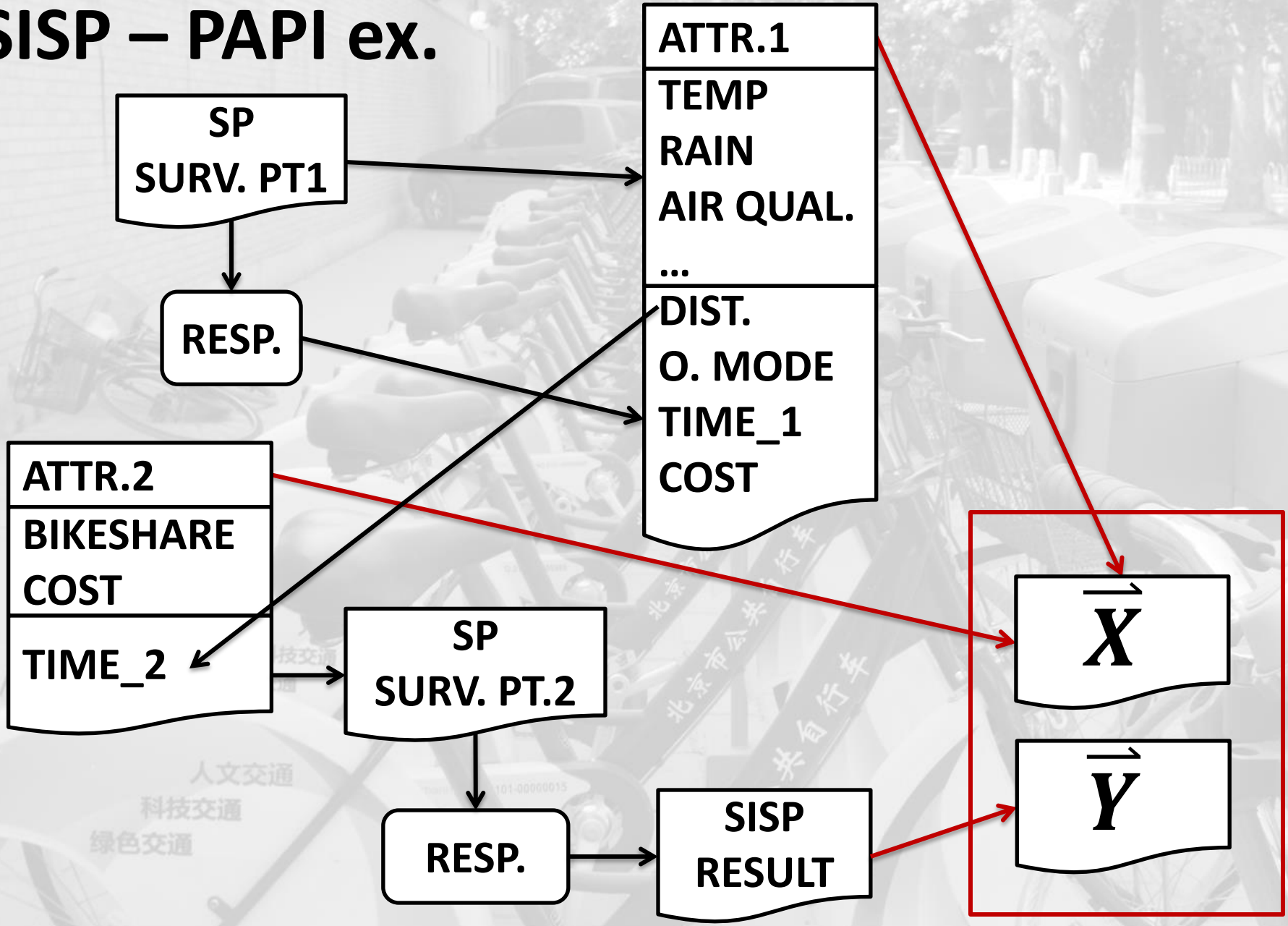
Tradeoff to capture advantages of pivoting within time and budget constraints



SISP – PAPI


SP
SURV. PT1
RESP.
ATTR.1
PREDEFINED
RESP.-DEFINED
ATTR.2
PREDEFINED
MODE-SPECIFIC
RESP.-DEFINED
PIVOT
SP SURV.
PT.2
RESP.
SISP
RESULT
$\vec{X}$
$\vec{Y}$

SISP – PAPI ex.


SP
SURV. PT1
RESP.
ATTR.1
TEMP
RAIN
AIR QUAL.
…
DIST.
O. MODE
TIME_1
COST
ATTR.2
BIKESHARE
COST
TIME_2
SP
SURV. PT.2
RESP.
SISP
RESULT
$\vec{X}$
$\vec{Y}$

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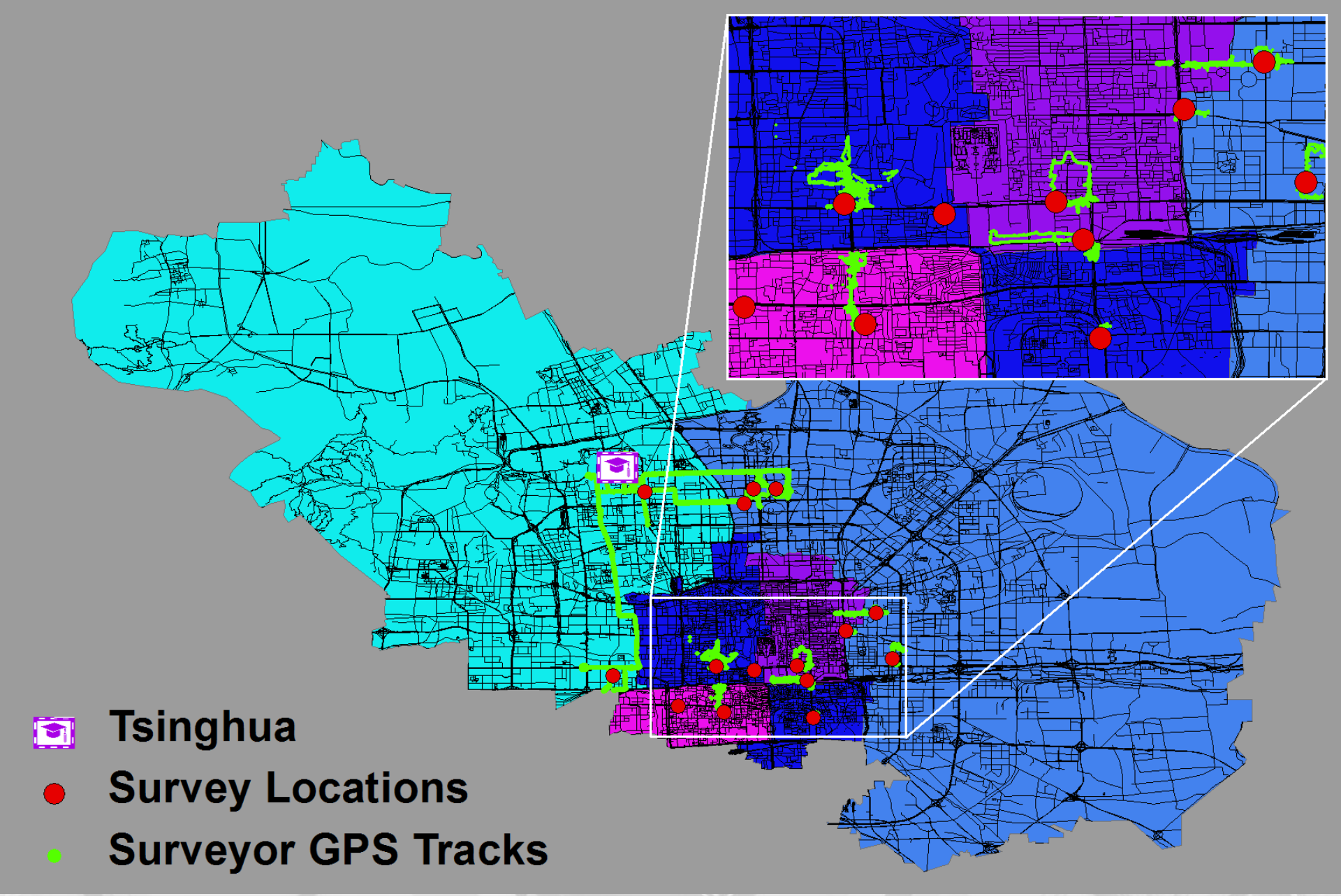
Tsinghua
Survey Locations
Surveyor GPS Tracks

北京市公共自行車租賃系統調查

问卷版本：1.1

第一部分			第二部分			第三部分				第四部分
请回忆一下您昨天的出行，填在下面的空行处，出行距离在 10 公里以内。 请给出您完整的**连续**出行信息，如从家到地铁站之间的步行等。			**假**设昨天您的出行条件是： 天气**晴**； 气温**-5°C**； 空气质量**好**； 交通拥堵情况**好**； 全程**无自行车道**。 （空气质量和交通拥堵情况都分为“好、中、差”三个等级。） 若您拥有私家车，假设您今天处于尾号**限行**状态。 请对每次行程分别选择您的出行方式并估计大概的花费和耗时。			假设您每次出门都可以使用公共自行车或公共电动车，花费和耗时如下：				请考虑花费和耗时，以及第二部分中的出行条件： 天气**晴**； 气温**-5°C**； 空气质量**好**； 交通拥堵情况**好**； 全程**无自行车道**； 尾号**限行**。
出行距离（尽量精确到 1km）	**起点** *1= 家* *2=单位* *3=学校* *4=商店* *5=饭店* *6=娱乐场所* *7=地铁站* *8=公共汽车站* *9=其他*	**终点** *1= 家* *2=单位* *3=学校* *4=商店* *5=饭店* *6=娱乐场所* *7=地铁站* *8=公共汽车站* *9=其他*	**您选哪种交通方式?** *1=公共汽车* *2=地铁* *3=自驾私家车* *4=搭乘私家车* *5=电动车* *6=自行车* *7=步行* *8=出租车* *9=摩托车* *10=其他*	**这样出门大概花多少钱？**（*考虑票价、通行费、停车费、燃油费等*） (元)	**这样出门大概花多少时间?** (分钟)	**公共自行车费用** (元)	**公共自行车耗时** (分钟)	**公共电动车费用** (元)	**公共电动车耗时** (分钟)	**在这样的条件下，您会选择公共自行车或公共电动车吗?** *1=不会* *2=会选择公共自行车* *3=会选择公共电动车*
						0		0		
						0		0		
						0		0		
						0		0		
						0		0		
						0		0		
						0		0		
						0		0		

清華大學交通實驗室

Part-1			Part-2		
Think back to yesterday. Tell me about all the trip links you made that were less than 10 km.			Now suppose that it is **sunny**, **15** °C, the air quality is **bad** and congestion is **bad.** Also suppose, even though this may or may not be the reality for the trip link you indicated, that bike lanes are available for **all** of the trip. If you have access to an automobile, assume your license plate is **restricted**. Given these conditions, please indicate the transportation mode you would typically choose for each of the listed trip links, and please indicate the approximate cost and travel time for each selected mode.		
Trip Length *(approximate trip length to within 1 km)*	**Origin** *1= home* *2=work* *3=school* *4=store* *5=restaurant* *6=entertainment* *7=subway station* *8=bus stop* *9=other*	**Destination** *1= home* *2=work* *3=school* *4=store* *5=restaurant* *6=entertainment* *7=subway station* *8=bus stop* *9=other*	**What Mode Would you Choose?** *1=bus* *2=subway* *3=car (drive alone)* *4=car (passenger)* *5=ebike* *6=bike* *7=walk* *8=taxi* *9=motorbike* *10=other*	**What would the approximate trip cost be?** *(include fare, tolls, parking, and approximate fuel)*	**What would the approximate travel time be?**

Part-3				Part-4
Suppose for each of the above trips that you had the opportunity to instead use a shared bicycle or shared electric bike. The costs and travel times are as follows:				Now please consider the costs and travel times as well as all the attributes described in Part-2: it is **sunny**, **15** °C, the air quality is **bad**, congestion is **bad** and bicycle lanes are available for **all** of the trip
Public bike cost (元)	**Public bike travel time** (分钟)	**Public ebike cost** (元)	**Public ebike travel time** (分钟)	**Which would you choose for each trip?** *1=same as Part-2* *2=public bike* *3=public ebike*
1		**2**		
1		**2**		
1		**2**		
1		**2**		
1		**2**		
1		**2**		
1		**2**		

SP SURV Pt.1

SP SURV Pt.2

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DATA COLLECTION: EFFORT AND USABILITY

- 623 surveys, 2.29 trip links per → 1,426 links
- 230 labor hours (≈22 min/survey)
- 1,181 links remained after filtering (82% usable)

MODELING

- **MNL switching model**
  - **Choice Set = {original choice, bikeshare, e-bikeshare}**
- **42 parameters estimated (21 significant below 5%)**
- **Useful policy implications:**
  - **Bikeshare and E-bikeshare are very different modes**
  - **Weather and air quality are important**
  - **Impact to existing transportation system**

Variable	Shared Ebike		Shared Bike	
	Parameter	(p-val)	Parameter	(p-val)
ASC_O	-6.31	(0.00)	-4.39	(0.00)
Distance [km]	-0.0854	(0.01)	-0.175	(0.02)
Air Quality Bad Indicator * Distance	Fixed	(Fixed)	Fixed	(Fixed)
Air Quality Medium Indicator * Distance	0.0194	(0.53)	0.158	(0.04)
Air Quality Good Indicator * Distance	-0.0153	(0.66)	0.133	(0.06)
Congestion Indicator	-0.581	(0.01)	0.169	(0.57)
Congestion Indicator * Female Indicator	0.812	(0.05)	0.563	(0.25)
License Plate Restriction Indicator	-0.066	(0.72)	0.415	(0.07)
Heavy Rain Indicator	Fixed	(Fixed)	Fixed	(Fixed)
Light Rain Indicator	0.527	(0.02)	0.78	(0.01)
No Rain Indicator	1.17	(0.00)	1.03	(0.00)
Temperature Cold Indicator * Distance	-0.0247	(0.49)	-0.0907	(0.10)
Temperature Hot Indicator * Distance	0.000619	(0.98)	-0.218	(0.00)
Temperature Comfortable Indicator * Distance	Fixed	(Fixed)	Fixed	(Fixed)
Original Mode Sheltered Indicator	Fixed	(Fixed)	Fixed	(Fixed)
Original Mode Not Sheltered Indicator	0.308	(0.19)	0.874	(0.01)
Original Trip Link by Bus	1.67	(0.00)	0.632	(0.16)
Original Trip Link was Transit Feeder	0.319	(0.14)	-0.156	(0.54)
Original Trip Link did not Involve Transit	Fixed	(Fixed)	Fixed	(Fixed)
Original Trip Link by Subway	0.696	(0.11)	-1.14	(0.27)
Age	0.321	(0.00)	0.0731	(0.07)
Age Squared	-0.00451	(0.00)	-0.000907	(0.05)
Higher Education Indicator	-0.686	(0.00)	0.221	(0.40)
Environmental Concern Indicator	0.811	(0.00)	0.35	(0.11)
Gender Female Indicator	-0.783	(0.02)	-0.356	(0.39)
Income	-0.132	(0.00)	-0.0201	(0.54)

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We wish to thank Professor Xinmiao Yang of Tsinghua University for his support. We are grateful to the following Tsinghua students for their work translating and administering the survey: Yue Wang, Wenbo Zhu, Shan Zhao, Shuang Chen, and Huihao Liu.

This research was supported by the following grants from the U.S. National Science Foundation: CAREER grant number CBET-1055282 and EAPSI fellowship number OISE-1210034.

Questions and comments are appreciated!