Feasibility of a household travel survey by GPS in Paris Region ?

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CONTEXT

- Traditional Global Travel Survey 1976, 1984, 1991, 2001, 2011. French methodology « CERTU ». 18 000 households. Paper-based survey.

- Strong human intervention at each step.

- Very high cost (> 6 M €), especially due to surveyors.

- Demand of a more frequent survey, information about multi-modes, more accuracy on fundamental variables (duration, distance, routes, short trips).

PREDIT

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urbaines*

BT Q1000 X - QStarz

- Dimension : 72*46*20 mm
- Weight : 45 g
- 66 channels
- Chip last generation MTK II (can track very weak GPS signals)
- Autonomy : 41 h
- « A-GPS » (Assisted-GPS)
- Only one button (on/off)-> no burden
- No real-time transmission
- Cold start/Warm start/Hot start : 33 s/ 15 s/ 1 s
- Software Tripserver (connection with Google Earth)
- Price : 85 € (dec 2009)

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- 22 volunteers + 1 volunteer on iPhone :

- Double blind methodology : 2 teams
  - GPS-only survey (15 loggers)
  - Diary-based survey

  The two surveys were conducted at the same time by two different teams.

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- 7 weeks : from 2 to 4 volonteers per week

- Begin : monday 8 february 2010

- Precise protocol to follow

- Individual simplified survey (one page, for example, the most frequented locations)

- SMS system to remind respondents to switch on their logger and to reload the battery.

- GPS trips database, built by :
  - visual recognition,
  - helped by the simplified survey,
  - helped by the numerical land use on the Regional GIS (match routes and trip ends destination with land use)
- Diary trips database
- The merged database has :
  - 635 trips for the paper database
  - 509 trips for the GPS database.

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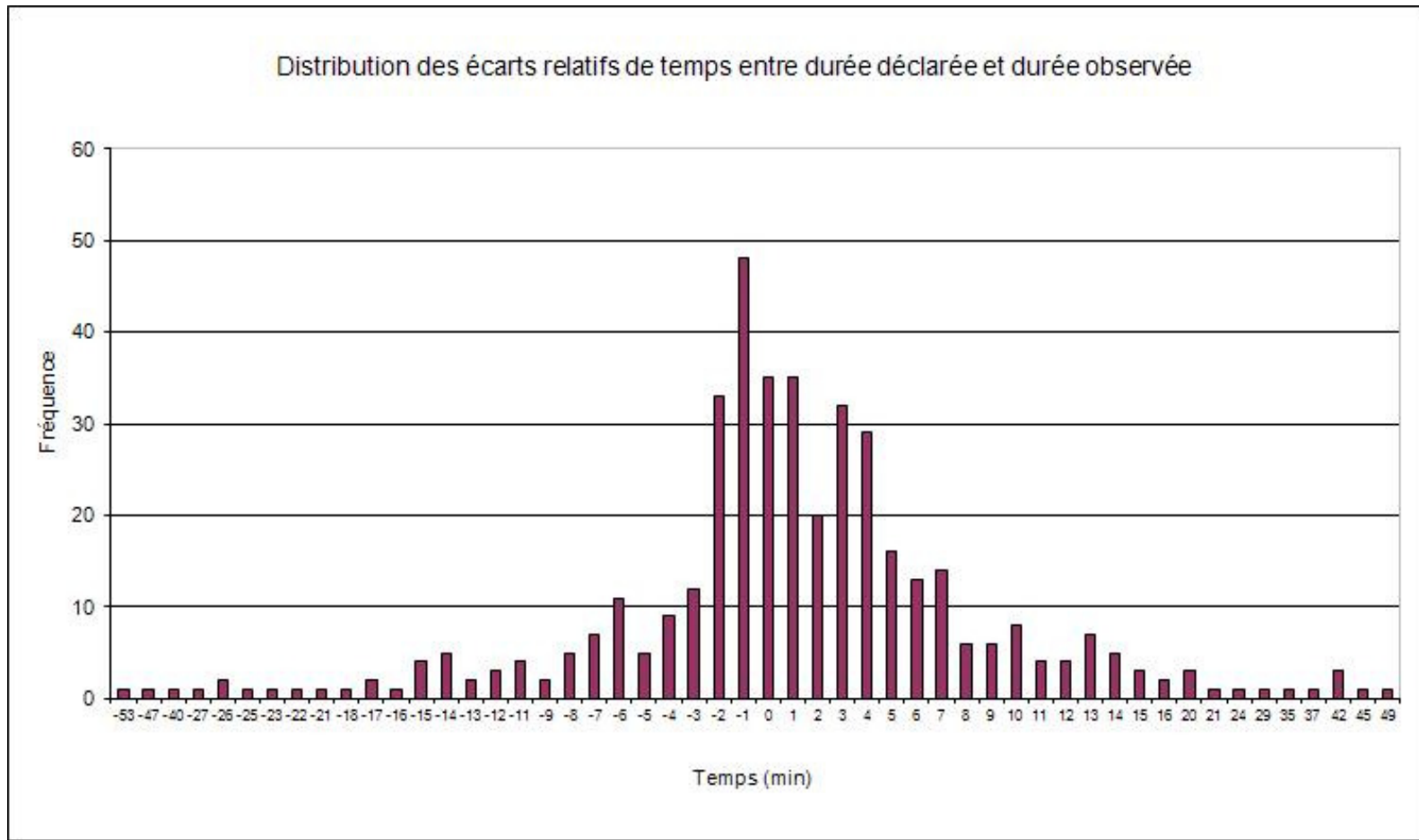régions
urbaines

By mode :

	GPS	Papier
TC	199	209
VP	90	92
Vélo	9	9
MAP	205	325
perte signal GPS	6	0
Nb déplacements	**509**	**635**

By detailed mode :

Mode	GPS	Papier	Mode	GPS	Papier
Bus	12	10	Métro + VP	1	
Bus + Métro	2	5	Noctilien	1	1
Bus + Métro + Grandes lignes	1	1	Perte de signal	4	
Bus + Métro + RER + Bus	1		RER	17	19
Bus + Métro + Train ban	1	1	RER + Bus	3	5
Bus + RER	4	4	RER + Métro	14	12
Bus + RER + Métro	1	1	RER + Train ban	2	1
Bus + RER + TGV	1	1	RER + VP Passager	2	1
Bus + RER + Train ban		2	TGV + VP	1	1
Bus + TVM	1	1	Train ban	6	7
Bus + VP passager		2	Train ban + Métro	3	3
Covoiturage		2	Train ban + VP	1	1
MAP	205	325	Tram	1	1
Métro	91	93	Tram + Métro	1	1
Métro + Bus	3	2	TVM	1	1
Métro + Grandes lignes + TER + Taxi		1	Vélo	9	9
Métro + RER	13	14	VP	64	55
Métro + RER + Bus	3	3	VP + RER + Métro	1	1
Métro + RER + VP	1	1	VP + TGV	1	1
Métro + TGV	1	1	VP + Train ban	1	1
Métro + Train ban	3	2	VP Passager	26	37
Métro + Train ban + Noctilien		1	VP passager + TVM	1	1
Métro + Train ban + VP passager		1	VP passager + TVM + Métro	1	1
Métro + Tram	1	1	**Total général**	**509**	**635**

- Difference of time between observed duration by GPS and declared duration in relative value:

Distribution des écarts relatifs de temps entre durée déclarée et durée observée

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Comparaison of purposes

Dépl. avec identité motifs O et D	259	39%
Dépl. déclarés, non observés par GPS	154	23%
Dépl. observés par GPS, non déclarés	28	4%
Dépl. avec motifs ambigus	148	22%
Dépl. avec motifs identifiés avec erreur	62	9%
Dépl. GPS sans motif car perte de signal	11	2%
Total	**662**	**100%**

Multi-modes in the week

Volontaire	VP	TC	VP+TC	Vélo	TC+vélo	MAP	PdT	Total jours semaine
1	3					2		5
2	2	1	1				1	5
3		4				1		5
4	1		1			1	2	5
5		2	2		1			5
6	1	3	1					5
7		4	1					5
8		4					1	5
9		4					1	5
10		3	1				1	5
11	3		2					5
12	3		2					5
13		4				1		5
14		5						5
15		2				1	2	5
16	4						1	5
17	2	1				2		5
18		4	1					5
19		5						5
20	3	1					1	5
21	2						3	5
22	1	3	1					5

Purposes correctly identified

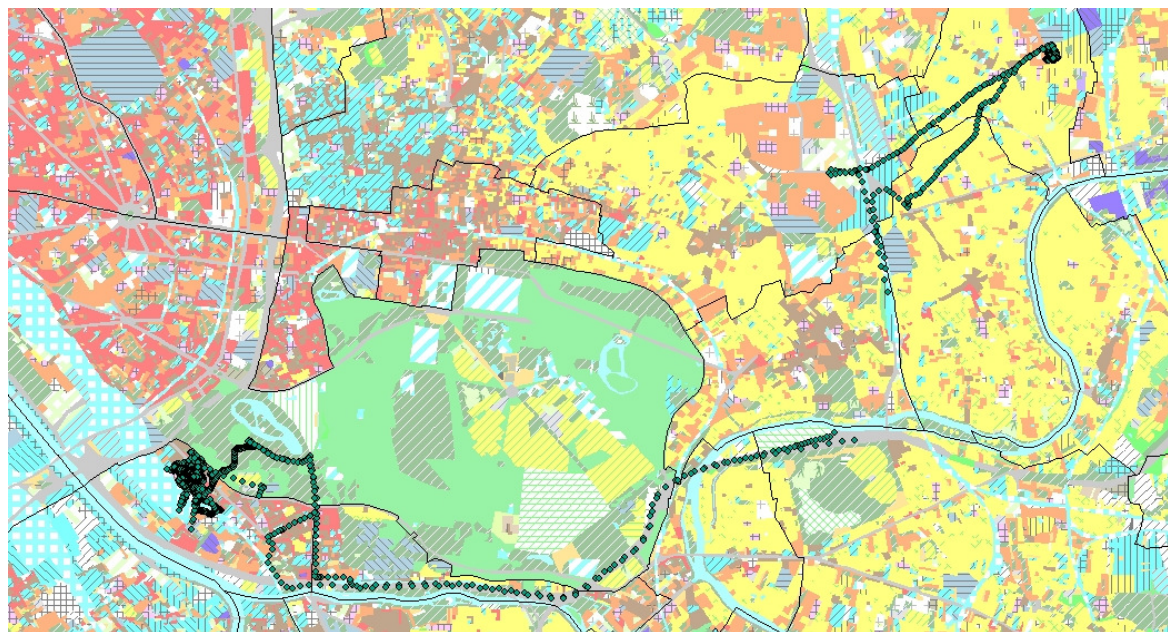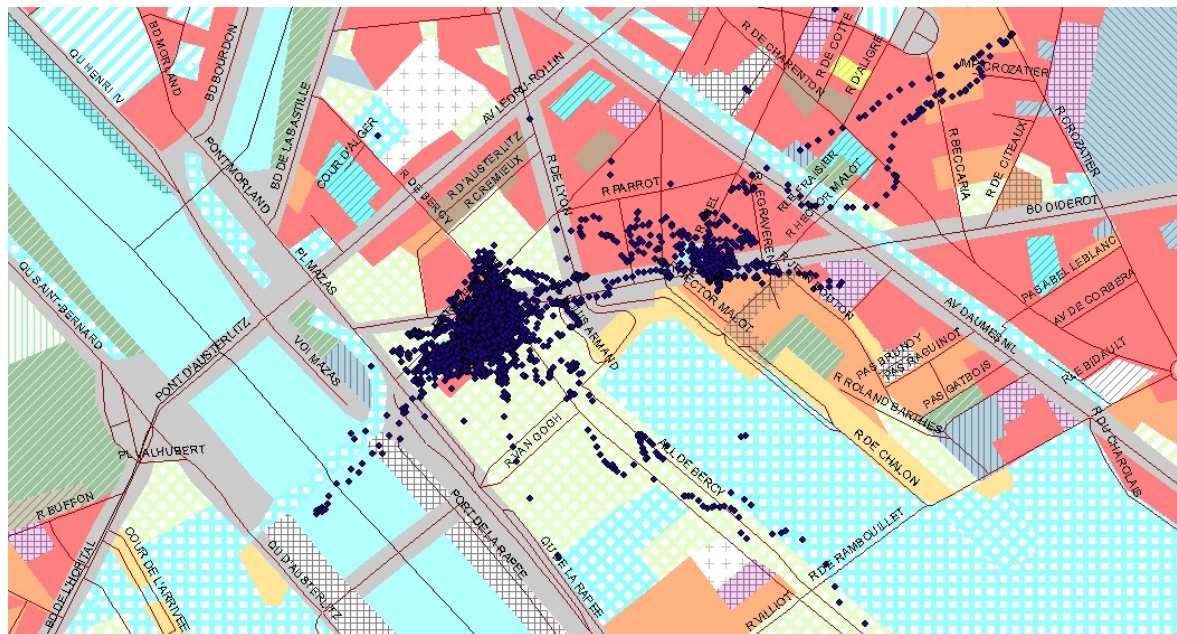|	
D <-> T	80
D <-> Aff. Pro	8
D <-> Achat	35
D <-> Ecole	12
D <-> Loisirs	20
D <-> Aff. Perso	36
Autres que D <-> T	50
Autres que D,T <-> Autres que D,T	18

259

- A lot of advantages : gain of precision on duration and distances, multi-day survey, minimum burden for the respondent, no surveyor at respondent's home

- No real problem for a human to detect the modes thanks to a GIS

- Five big drawbacks, that require manually checking despite potential automation of processing routines :

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1) Loss of a few very short trips (unexpected result !) because mixed with spurious points.

2) Problem of the transition indoor-outdoor-indoor because of warm-up times -> discontinuities in travel.

3) Purposes other than H, W are not always well identified despite GIS (core issue).

4) You don't know if driver or passenger.

5) Intermediate stops not always detected neither by human processing nor software.

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- The individual simple survey should be made *a posteriori* (« what were your destinations other than H and W last week ? »)

- To complement the GPS-only survey, a follow-up phone call will be necessary to confirm assumptions (purposes, passenger)

- The solution is not only based on post-processing but also on technology : specification and development of a new logger capable to switch from GPS to Wifi (indoors records) automatically and maybe equipped with additional inertial sensors.

- Due to the size of the real data set (7000 households), could the data imputation strategy be simply human or will it be necessary to automate the data post-processing to a large extent ?

To know more :

1) www.iau-idf.fr/egtpargps

2) GPS-only survey in Sydney (Australia) : see Stopher and Greaves' papers (2009-2011)

3) GPS-only survey in Cincinatti (USA) : see Giaimo and Anderson's papers (2009-2011)

4) Conventional travel surveys with sub-samples GPS surveys in Minneapolis (2010-2012), Los Angeles (2011-2013) and France (National Travel Survey 2007-2008)