One-way carsharing +Electric Vehicles

Latest findings from the Montreal case study

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Communauto 20 ans déjà !

CIRRELT

mobilité

Agenda

Introduction

- Case Study

Impact of the service on consumer behaviour

- Methodology
- Descriptive analysis
- Electric Cars
  - Travel distances
  - Travel Locations
  - Model

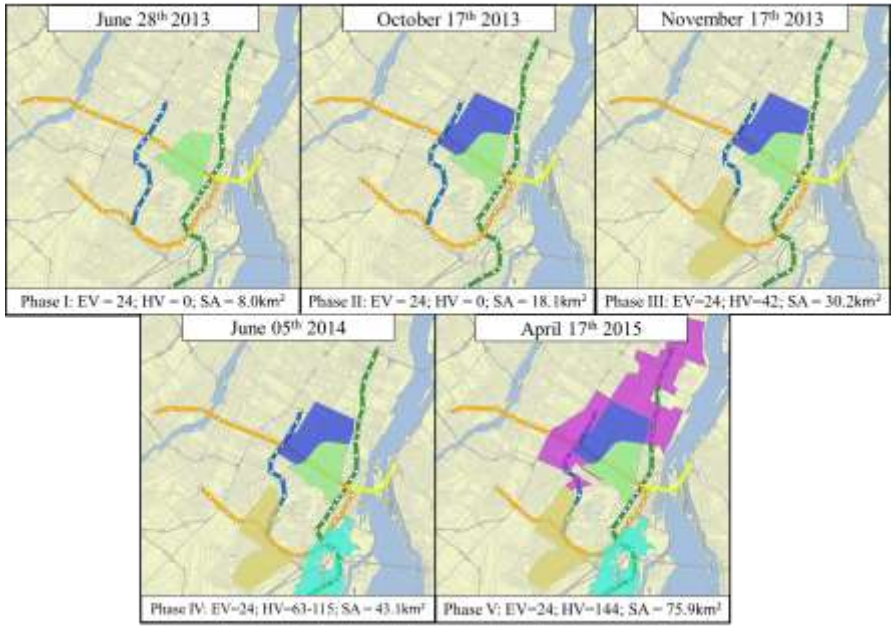
Conclusion

- Limitations
- What comes next?

Introduction

Case Study

Auto mobile



- Introduced in June 2013 in Montreal with 24 EVs
- Several expansions of the service area have been made (8 km^2 → 76 km^2)
- In July 2015 expansions to Quebec City
- Now 300 cars (30 in Qc)

Case Study

Why introduce free-floating?

- Take advantage of the attractiveness of this offer to increase interest in carsharing
- Meet the demand from our customers for this type of service
- Better answer demand 24/7
- Take advantage of a replacement fleet pool for our traditional offer

Case Study

With reservation…

…or without reservation

Our concerns

- How to successfully position the new offer in terms of pricing?
- Will this new service be profitable?
- What will the impact of this new offer be in terms of market cannibalization for our traditional offer?
- How to meet this challenge while integrating as many electric vehicles as possible?

Case Study

The pricing issue

- *Auto-mobile* basic subscription plan FREE
- Attract new customers towards Communauto full subscriptions plans
- Integrate the two offers' pricing plans
- Maximize attractiveness of the 2 combined offers

Case Study

38¢/min $12/hour $50/day

$0.20/km fee after 100 km

Pay 30¢/minute instead of 38¢ at all times !
The hourly and daily rates remain unchanged.
Savings of over 20% !

Use an *Auto-mobile* at your package's rate!
$1.70/hour + 23¢/km

The pricing issue

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Case Study

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Case Study

25 minutes / 8 km (5 mi)

Basic *Auto-mobile* subs. plan: ….. 9,50$
Communauto full subs. plan: …… 7,50$
Communauto Value *Extra* plan: .. 5,24$*
Auto-mobile Unlimited: …….. 0,00 $

*2 hours minimum charge = 1,70 $/hour X 2 + 23¢/km X 8

The pricing issue

- *Auto-mobile* basic subscription plan FREE
- Attract new customers towards Communauto full subscriptions plans
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- Maximize attractiveness of the 2 combined offers

Case Study

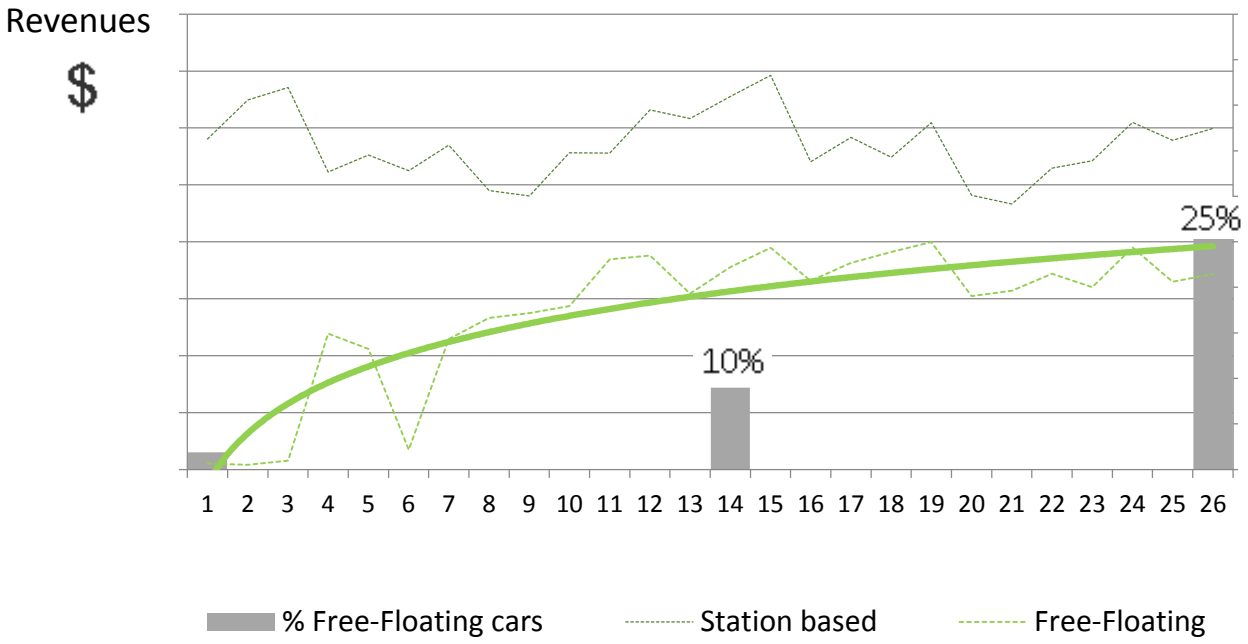
The profitability issue

- Will this new service be profitable?
- What will the impact of this new offer be in terms of market cannibalization for our traditional offer?
- How many vehicles can the market absorb, and how fast ?
- How to meet this challenge while integrating as many electric vehicles as possible?

Case Study

The profitability issue

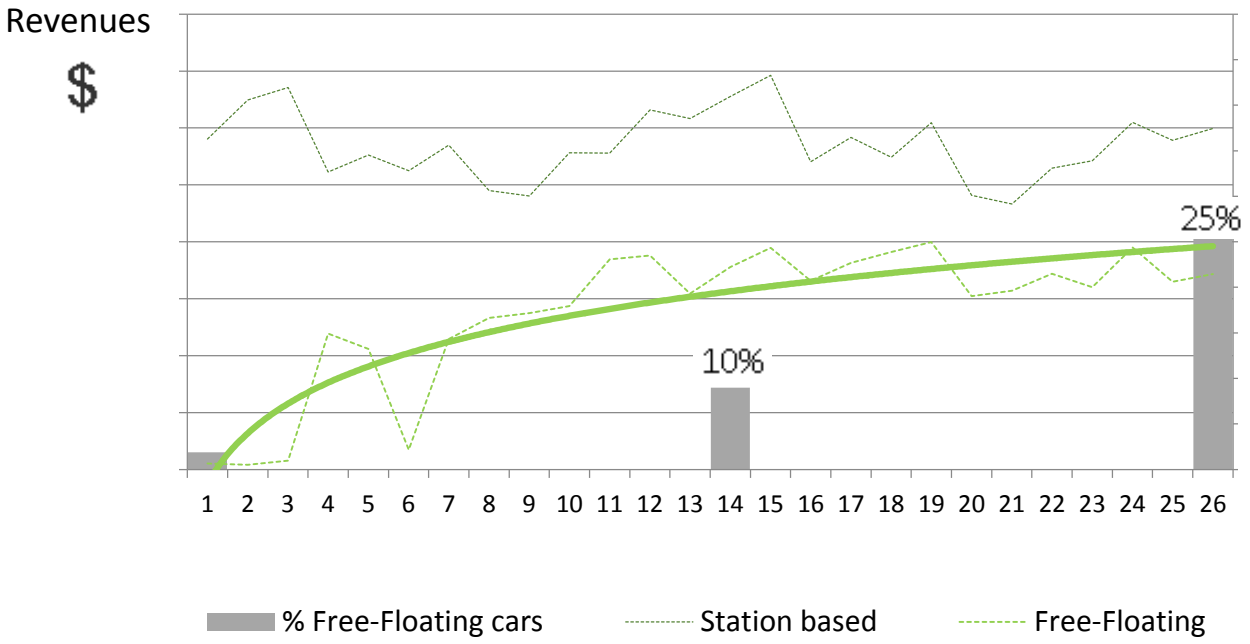
- Will this new service be profitable?



Case Study

The profitability issue

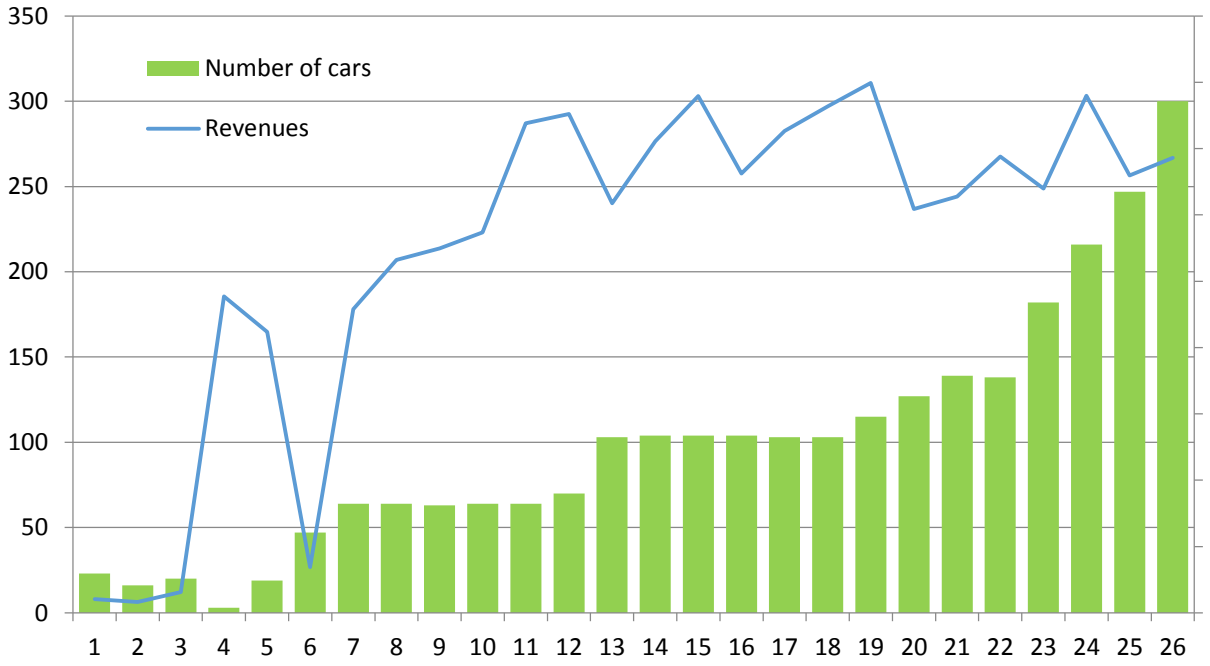
- What will the impact of this new offer be in terms of market cannibalization for our traditional offer?



Case Study

The profitability issue

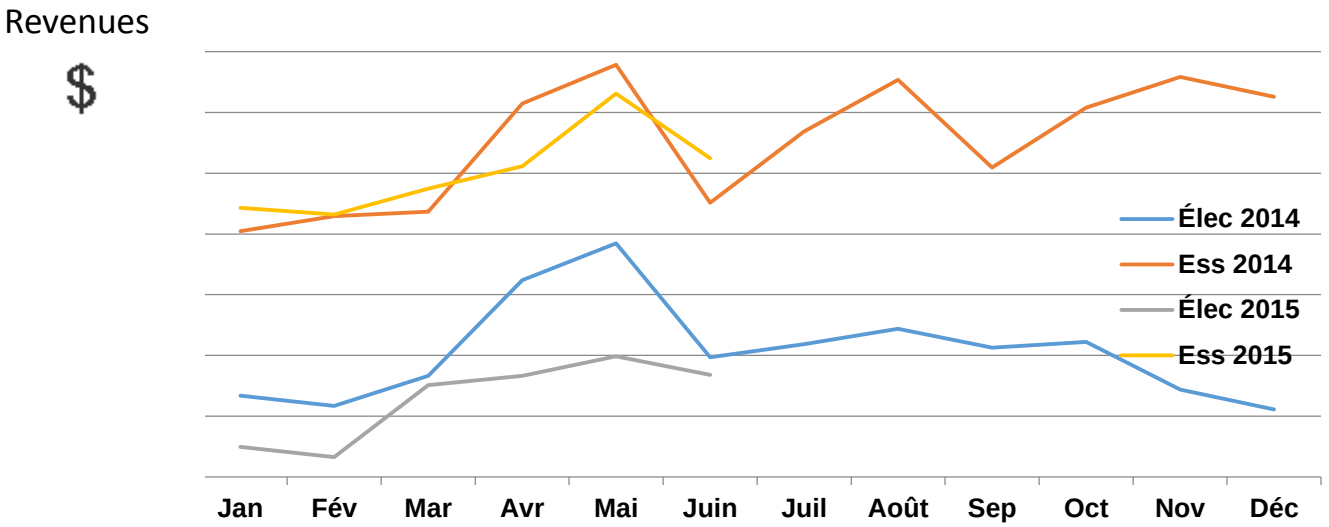
- How many vehicles can the market absorb, and how fast ?



Case Study

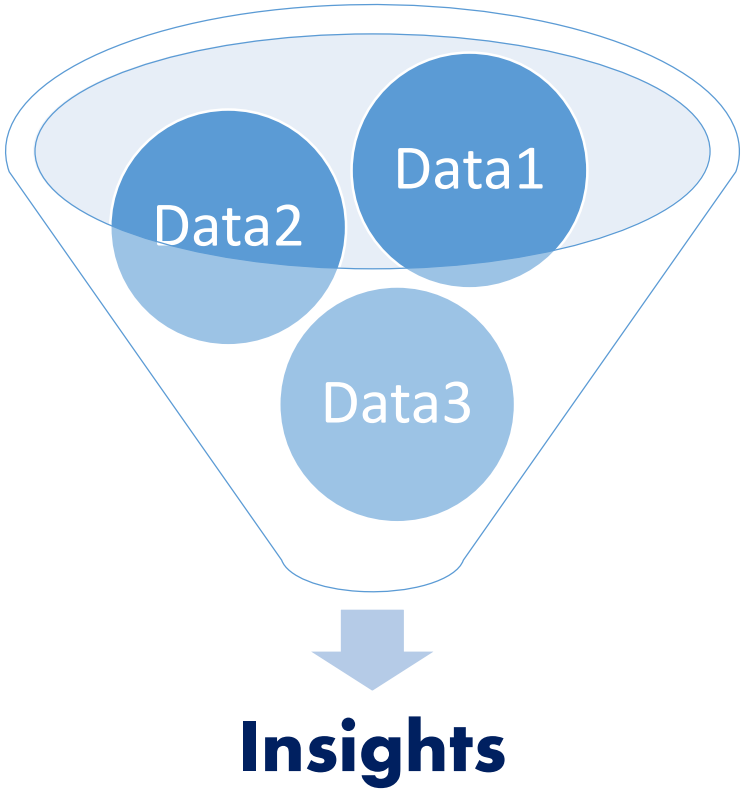
The profitability issue

- How to meet this challenge while integrating as many electric vehicles as possible?



Impact of the service on consumer behaviour

Methodology



> 100 000 transactions

- From June 2013 to April 2015
- Date/time, user id, car id, distance, time elapsed

> 5000 active users

- Gender, age, client type (Only AuM and/or both services), home location (postal code)

Car fleet of 165 vehicles

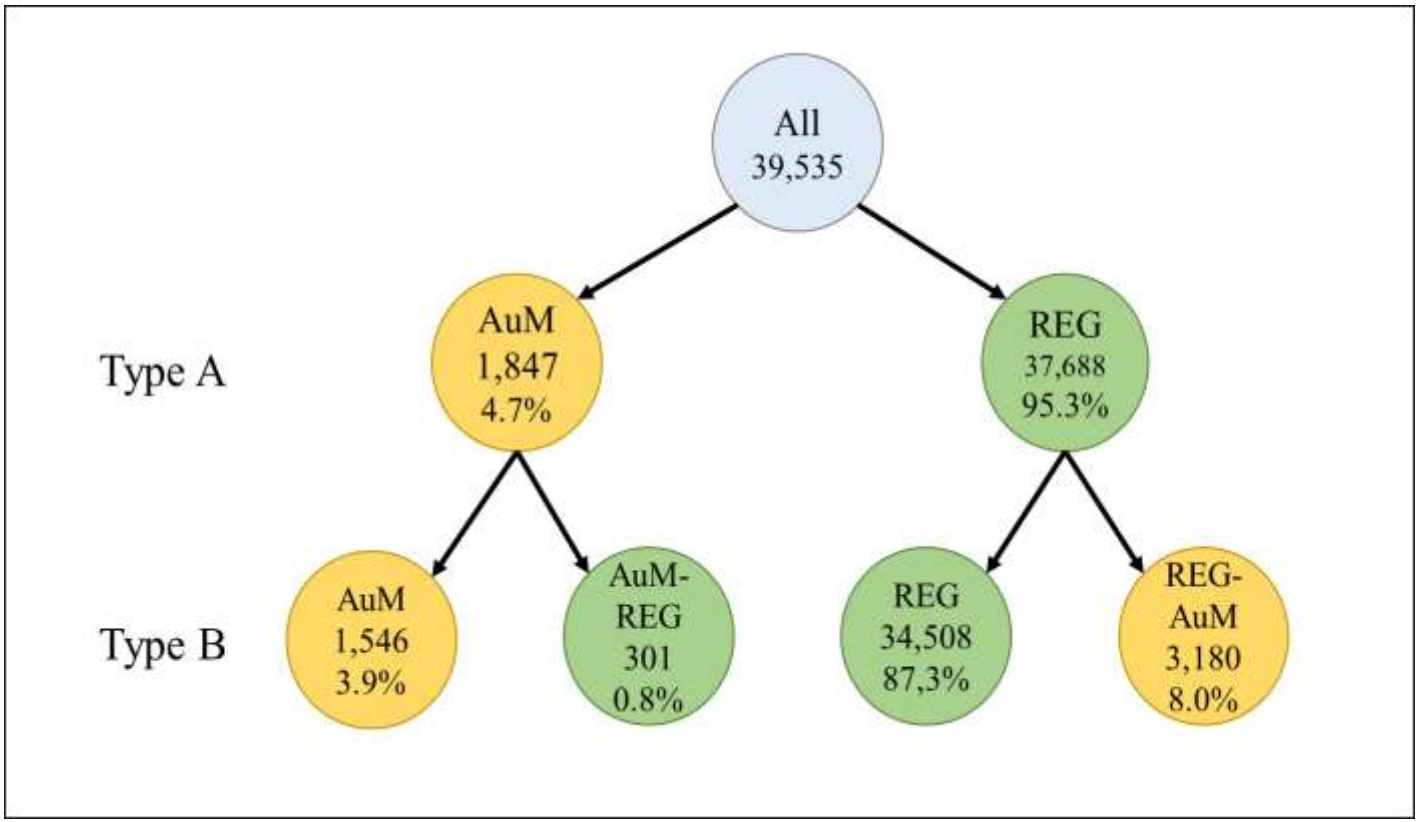
- 24 EV + 141 HV
- EV : Nissan Leaf HV: Toyota Prius-C

Complementary DBs

- GPS Locations (June 2013 to February 2014; >2 millions points)
- Weather conditions
- Traditional service booking

Methodology

Customer Type



AuM = Auto-mobile service REG = Station-based service

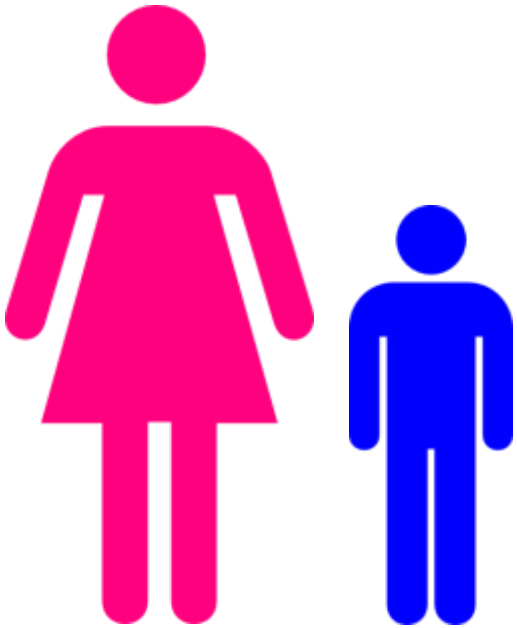
Results

Descriptive Analysis

Who's using Auto-mobile?

35 Median age

Average age **37**



61% 39%

85%

Live inside the service area

31%

Are exclusively Auto-mobile users

Descriptive Analysis

Behaviour according to the travelled distance.

Gender		Age		Customer Type		Time of the week		Temperature		Usage based	
M	F	35-55 years old	<> 35-55 y.o.	AuM Only	REG-AuM	Week days	Week ends	Above FP	Below FP	Frequent users	Casual users
10,2 ± 14,1	10,0 ± 13,9	9,4 ± 12,9	10,7 ± 15,0	11,4 ± 16,4	9,6 ± 13,4	9,2 ± 12,5	12,2 ± 16,6	10,6 ± 14,6	9,4 ± 13,2	9,1 ± 12,3	14,2 ± 18,5

Values in km

Descriptive Analysis

Behaviour according to the travelled distance.

Gender		Age		Customer Type		Time of the week		Temperature		Usage based	
M	F	35-55 years old	<> 35-55 y.o.	AuM Only	REG-AuM	Week days	Week ends	Above FP	Below FP	Frequent users	Casual users
—	—	16%	↗	↗	19%	33%	↗	↗	13%	56%	↗

↗ = distance augmentation

Descriptive Analysis

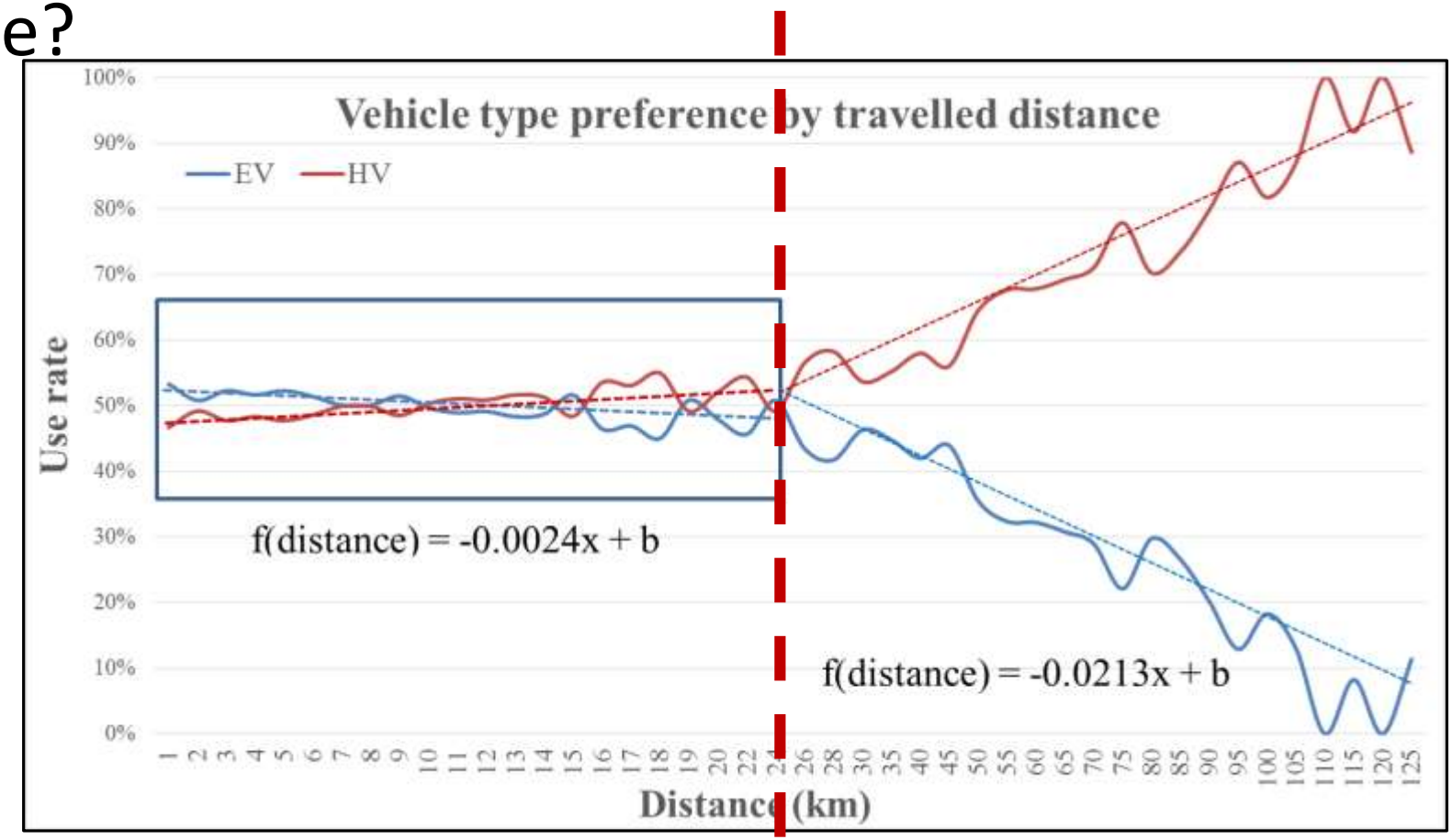
Difference of travelled distances for HV compared to EV.

Gender		Age		Customer Type		Time of the week		Temperature		Usage based	
M	F	35-55 years old	<> 35-55 y.o.	AuM Only	REG-AuM	Week days	Week ends	Above FP	Below FP	Frequent users	Casual users
				28%	16%	18%	25%	16%	29%	18%	26%

% = distance augmentation for a HV over a EV

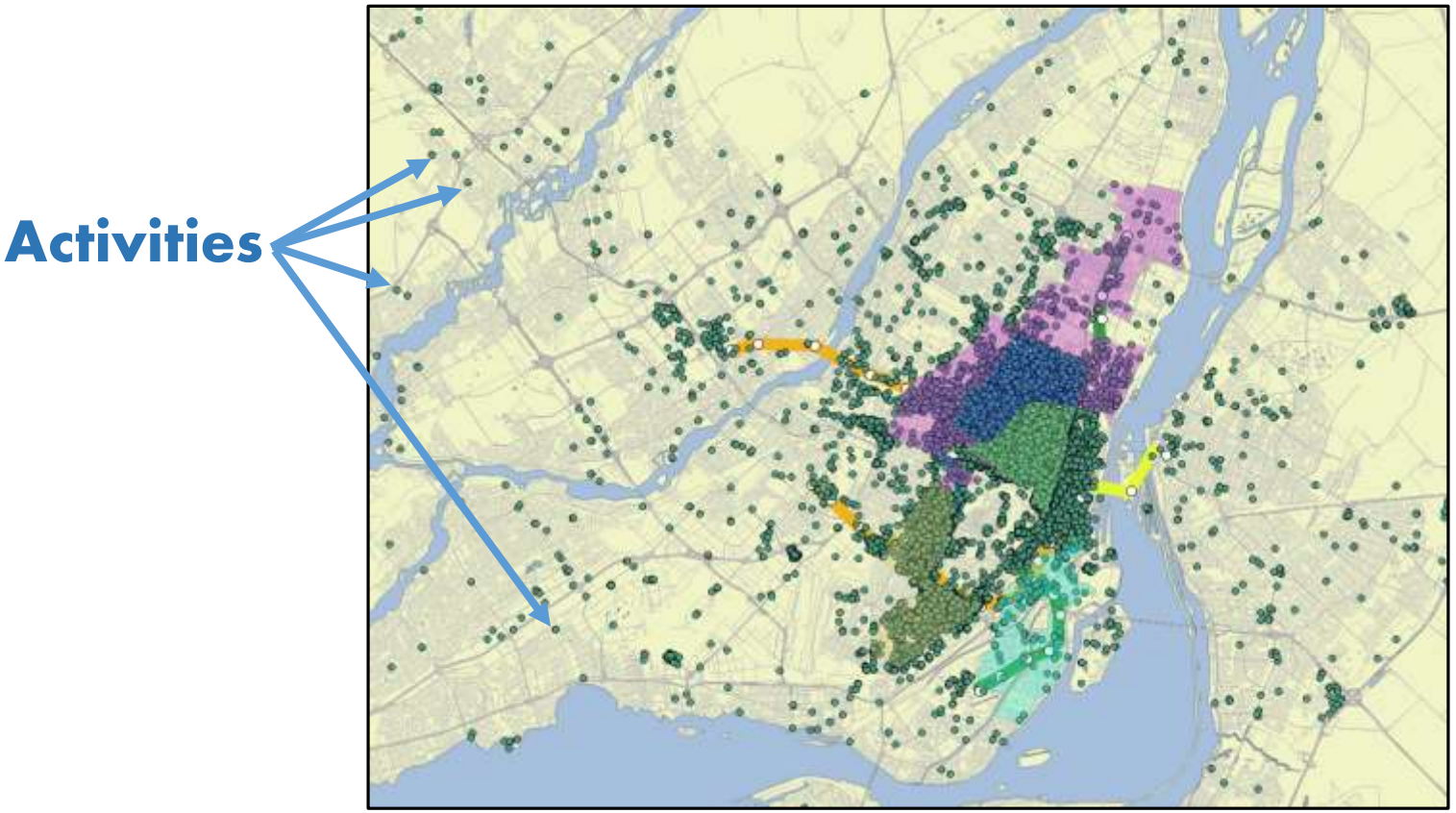
Travel distances

What's the user behaviour according to each car type?

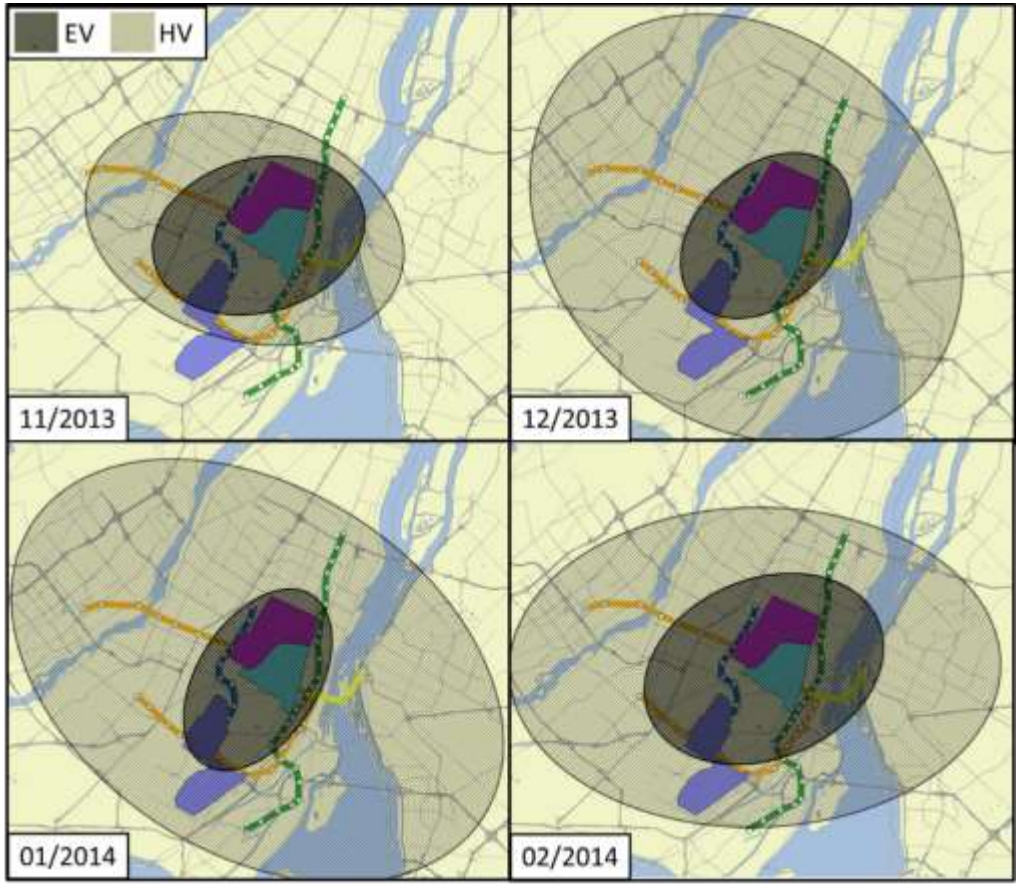


Travel locations

Localisation of all stops made by users:



Travel locations



- We wanted to know if EV users are less inclined to go outside of the service area, and to what extend.
- 46,5% of EV stops have been made outside the service area.
- 53,9% of HV stops have been made outside the SA.
- HV stops are much more spatially dispersed that EV stops.

Model

Model to predict the car type attribution

Outcome variable

User related

Environment related

Id	Variable	Variable Type	Definition
1	CarType	Nominal	0 if HV, 1 if EV
2	Distance	Continuous	Travelled distance in km
3	Gender	Dichotomous	1 if Female, 2 if Male
4	Age	Continuous	Age of the user
5	Age_Cat	Ordinal	Age by category (1= 18-24;2=25-34;3=35-44…)
6	Service subscription	Continuous	Time (months) since the user joined Communauto
7	TypeOnTime	Nominal	User type when borrowing the car (1=AuM-AuM;2=AuM-REG;3=REG-AuM)
8	TypeA	Nominal	User type when first accessing Communauto (1 = AuM; 2 = REG)
9	TimeOfWeek	Nominal	1 = Weekday; 2 = Weekend
10	Borough	Nominal	Borough in Mtl (1=PLMT; 2 = RSMT; 3=CDN-NDG…)
11	Snow (Cm)	Continuous	Quantity of snow on ground
12	SnowOnGround	Dichotomous	1 if there's no snow on ground, else 2
13	Mean Temp(°C)	Continuous	Mean temperature of the day (°Celsius)
14	Freezing Point	Dichotomous	1 if below the freezing point, else 2
15	Surface	Nominal	Surface area development phase (1=Phase III; 2=Phase IV…)
16	ABC	Nominal	User ABC type (1 = A, 2 = B, 3 = C)
17	EV_Prop	Continuous	Proportion of EV in the car fleet
18	Dist_Threshold	Dichotomous	If distance <= 24 km then 1; else 0

Variables:

Model

Model to predict the car type attribution

Model:

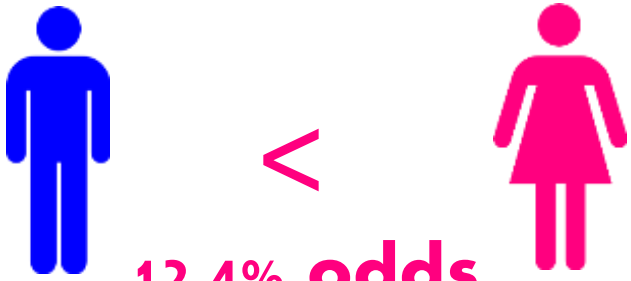
Table 2: Logit model output (60,157 observations)

Coefficient	Estimate	Std. Error	z value	Pr(>|z|)	Sig	Transf. coefficient
(Intercept)	-3.70635	0.05161	-71.816	< 2e-16	***	0.02456
Gender_Male	-0.13205	0.01961	-6.732	1.67E-11	***	0.87630
TypeA_Reg	-0.05604	0.0194	-2.889	0.00387	**	0.94550
TimeOfWeek_WE	0.05406	0.02	2.703	0.00686	**	1.05554
FP_Above	0.19647	0.021	9.354	< 2e-16	***	1.21709
PropEv	6.55031	0.11786	55.575	< 2e-16	***	1.92520*
Dist_Threshold_Below24	0.50593	0.03768	13.426	< 2e-16	***	1.65852

Model

Model to predict the car type attribution:

Far from perfect!!



Users coming from Communauto station-based have an odds ratio smaller than other users.

Weekends

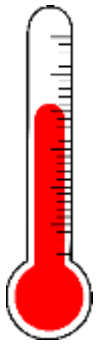
5,6%

Weekdays

Odds = odds to use an Electric car

Model

Model to predict the car type attribution:



Below FP

21,7%

Above FP

When the EV proportion is larger, the odds are also larger.

Distance <= 24 km

65,9%

Conclusion

Findings & Limitations

Main conclusions:

- Travel distance is greater for HV & there is a clear distinction at the 24 km mark
- Auto mobile user's vehicle type choice is greatly affected by three elements:
  - The desired travel distance
  - The cold weather (range goes ↓)
  - EV availability (naturally!)

Main limiting factors of the study:

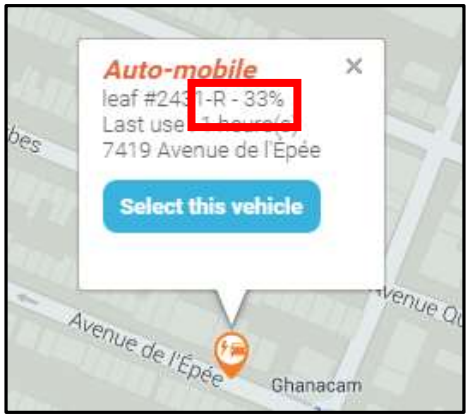
- The small proportion of electric vehicles
- The non-equal distribution of EV cars on the network

What's next?

1. How the EV charge level affects user's vehicle choice.

2. With GPS locations, study of user's habits depending of the structure of the service area.

3. How pricing affects user's behaviour.



Acknowledgement

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