Share of Strategic Alighting Passengers combining Automatic Passenger Counting and OpenStreeMap data

Rémi Coulaud[1,2], Valentine Mazon[2], Oded Cats[3]

[1]Laboratoire de Mathématiques d'Orsay
[2]SNCF Voyageurs Transilien
[3]Smart Public Transport Lab

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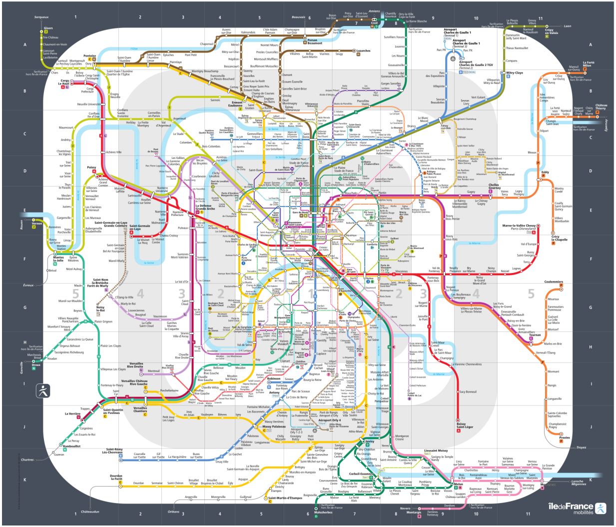
Transilien SNCF



3.4M passengers/day, more than 6 200 trains/day

Two complementary types of information to guide passenger choice

Real-time crowding information on IENA screen to maximize passenger confort

Paris-ci la Sortie du Métro app to minimize walking distance at destination

Platform position strategies

Departure station **Destination station**

Platform position strategies

Strategic boarding passengers (SBP)

Minimize walking distance at departure

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Strategic alighting passengers (SAP)
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Platform position strategies

Strategic boarding passengers (SBP)

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Strategic alighting passengers (SAP)

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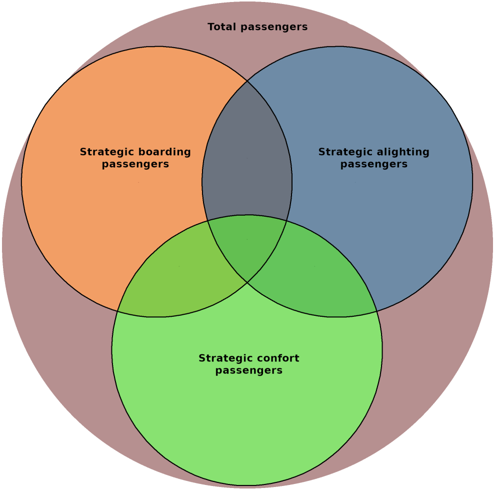
Departure station

Destination station

Strategic confort passengers (SCP)

Travel in the least crowded car

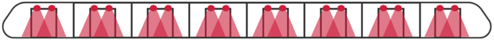
Diversity of strategies



Share of strategic alighting passengers (54% according to [2], [1])

High quality data → new research objectives

Openstreetmap high resolution geographic data

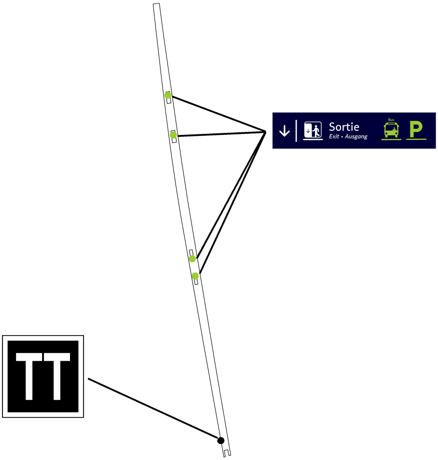


Door by door APC data

Objectives :

1. Going from a stated preference (SP) to a reveal preference (RP) method
2. Initiate a research project on passengers strategies at station platforms

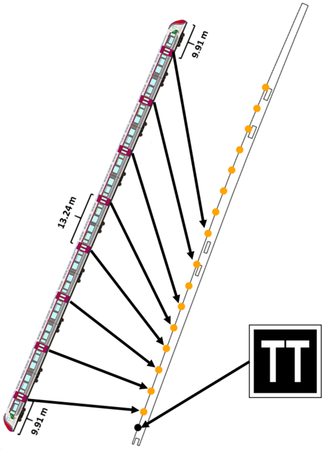
Platform main geographical elements



Geographical point : (2.345856, 48.9334)

1. Platform borders
2. J platform exits position, note $(E_{j,s})$
3. Train stop point

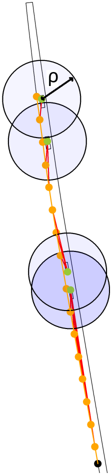
Train doors position



Space between doors : 13.24m or 9.91m

1. Deduce train doors position, note $V_{i,s}$ from train stop point
2. Make the hypothesis that train stop point is reliable

Exit attractiveness



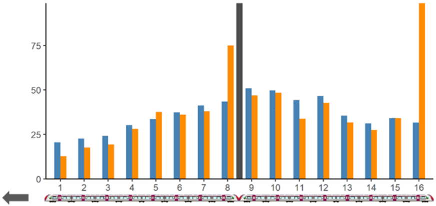
Exit attractiveness : ρ

1. Door i minimal distance to an exit :

$$d^*_{i,s} = \min_{j=1,\ldots,J} d(V_{i,s}, E_{j,s})$$

2. Door i belong to an exit attractiveness area of radius ρ if $d^*_{i,s} \leq \rho$
3. One same exit attractiveness for all exits

Share of strategic alighting passengers (SAP)



Alighting distribution $(a_1, \dots, a_I)$ and boarding distribution $(b_1, \dots, b_I)$

The share of strategic alighting passengers is :

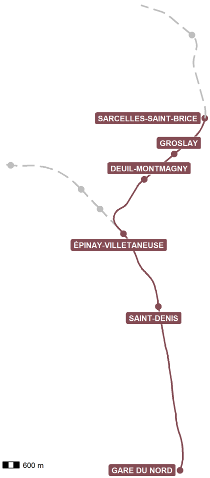
$$SAP_\rho = \frac{\sum_{i \in \mathcal{I}_\rho} a_i}{a_\bullet}, \qquad (1)$$

with $\mathcal{I}_\rho$ all the door's index less which belong to an exit attractiveness area.

In brief

1. Capture platform exit $E_{j,s}$, platform border and train stop point localization
2. Project trains doors on platform border using train stop point and rolling stock characteristics
3. Compute door minimal distance d^* to exit for all doors
4. Set a radius exit attractiveness ρ
5. Compute share of SAP_ρ

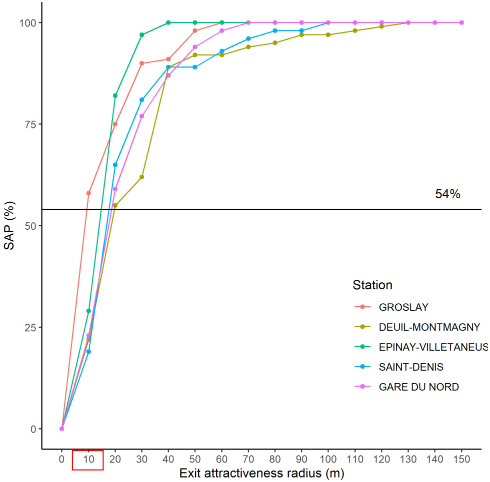
Case study: scope and data



- May to June 2019 on 6 stations
- Trains toward Paris with two units
- $>$ 30 000 observations

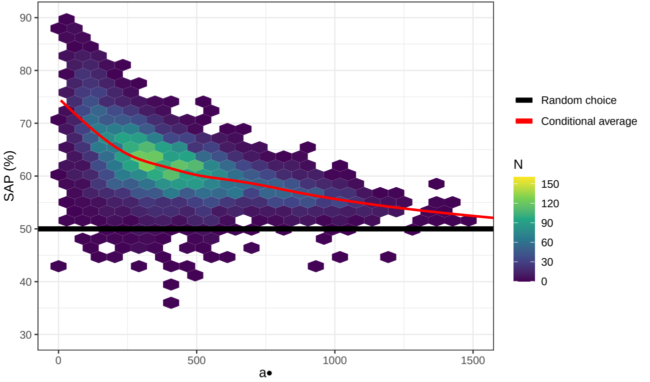
Exit platform localization

Exit attractiveness and *SAP*



Groslay share of *SAP* is greater than 54% with $\rho = 10m$ while for **Deuil** $\rho \geq 20m$ or $30m$

Number of alighting passengers impacts on *SAP* (ρ=20m)



$\nearrow$ number of alighting passengers $\Longrightarrow$ $\searrow$ of *SAP*

Conclusion and perspectives

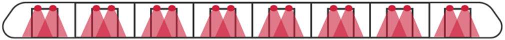
Conclusion :

- To obtain a 54% share of *SAP*, we need to change attractiveness radius depending on the platform design
- The number of alighting passengers reduced the opportunity to be strategic

Perspectives :

- Study the share of strategic boarding passengers (*SBP*) at origin and the strategic comfort passengers (*SCP*)
- Confirm these results on other stations/perimeters
- Develop a theoretical model to better understand *SAP*, *SBP* or *SCP*

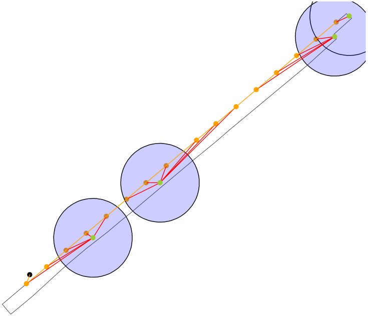
Thank you



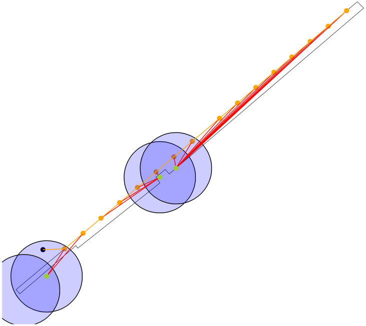
Bibliographie I

[1] Fatma Elleuch. *Transférabilité d'une modélisation-simulation multi-agents: le comportement inter-gares des voyageurs de la SNCF lors des échanges quai-train*. PhD thesis, Conservatoire national des arts et metiers-CNAM, 2019.

[2] Hyunmi Kim, Sohee Kwon, Seung Kook Wu, and Keemin Sohn. Why do passengers choose a specific car of a metro train during the morning peak hours? *Transportation research part A: policy and practice*, 61:249–258, 2014.



Groslay platform for trains toward Paris



Deuil platform for trains toward Paris