Typology of Cyclist Accidents

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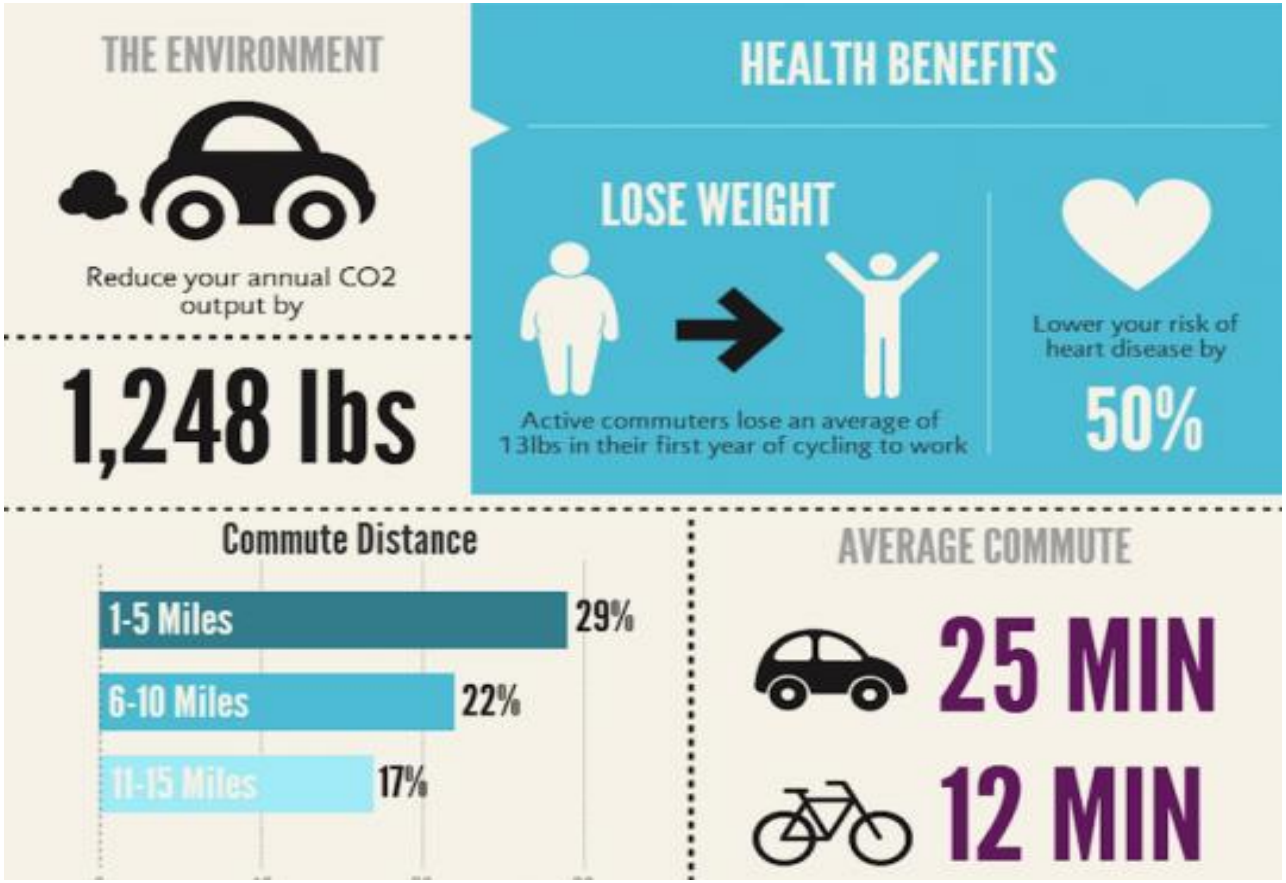
Cycling safety

Cycling is promoted because **of health benefits** & for **modal shift** on utilitarian trips.

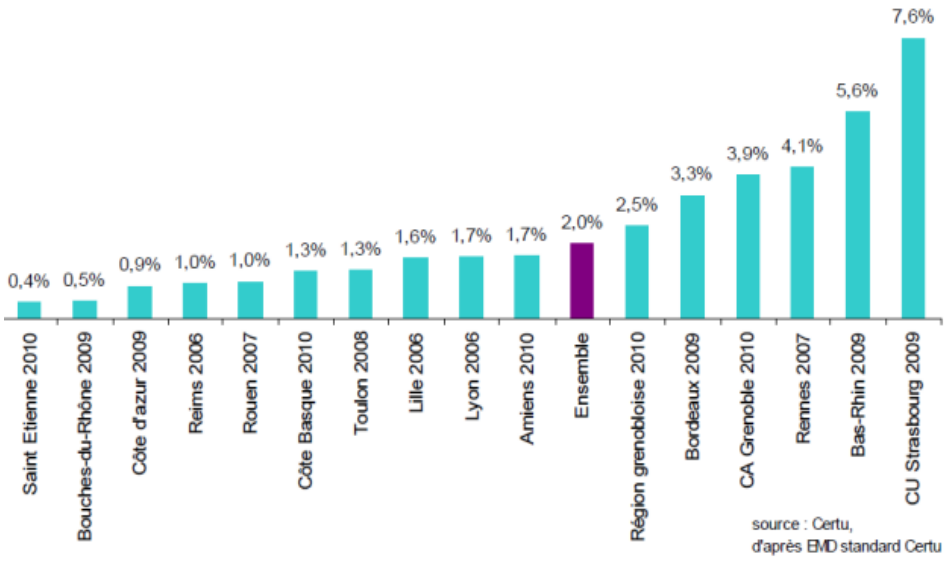


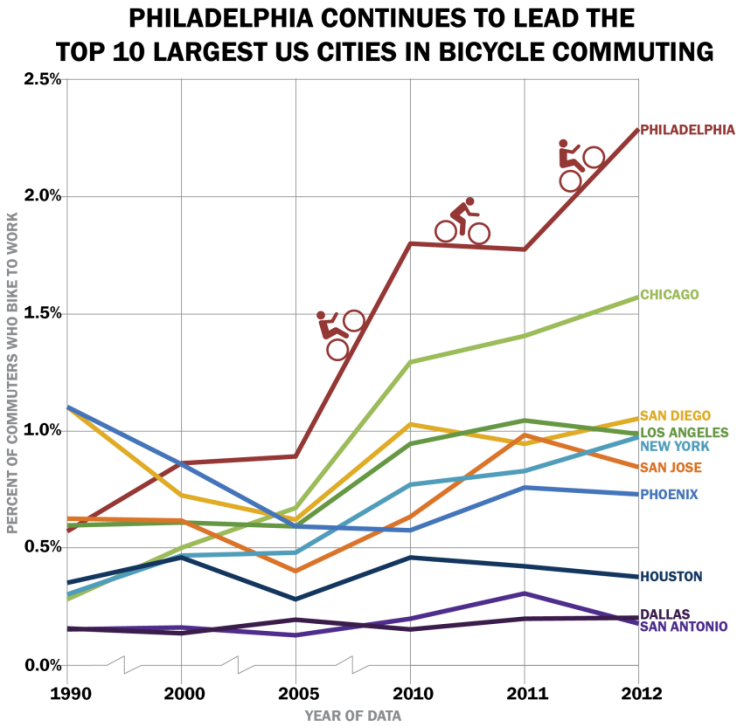
http://inhabitat.com/infographic-how-biking-to-work-can-help-you-save-money-lose-weight-and-reduce-co2/

Cycling safety

Safety is a concern for many stakeholders because of an increasing cycling modal share in many major cities.

Bicycle modal share in some French cities





https://phillymotu.files.wordpress.com/2013/11/bicyclecommuting-011.png?w=630&h=630

Cycling safety

Risk of accident:

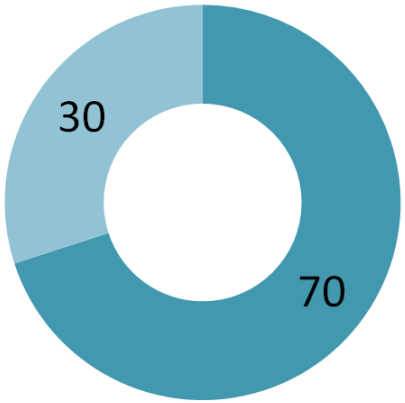
The risk to be injured is **8 times higher** for cyclists than for car occupants per hour (Blaizot et al., 2012).

Cycling safety

Cyclist-only accidents are up to 70% of all cases

but they are hard to analyze because most of **data come from police forces** (underreporting + biased on accident type)

Collisions



Cyclist-only accidents

More generally, only **a few typologies** of bicycle crashes exist.

Cycling accident

Accidents

(injuries)

Objectives

Improve knowledge on cyclist accidents thanks to a typology containing:

- Collisions and cyclist-only accidents;

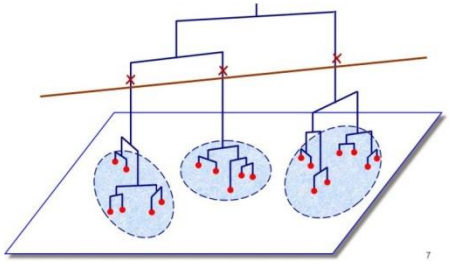
- All type of practises (utilitarian, sport, leisure).

Objectives

By :

- collecting data through a survey;

- constructing a typology using classification;



- identifying contribution of accidents factors to accidents types;
- understanding the impact of cyclist behaviours;

- analysing gender effects.

Available data in France

Études Détaillées d'Accident (EDA)

- About 30 cycling accidents out of 1000 EDA,
- Case studies collection

Official data from police forces (BAAC)

- Incomplete and many biases,
- 4500 cycling accidents per year in France and 150 in the Rhône department.

Rhône Trauma Registry

- 1300 cycling accidents per year in the Rhône department,
- 260 care services on this territory,
- almost exhaustive, biases on injuries severity ≥ AIS 1,
- design for collecting additional data.

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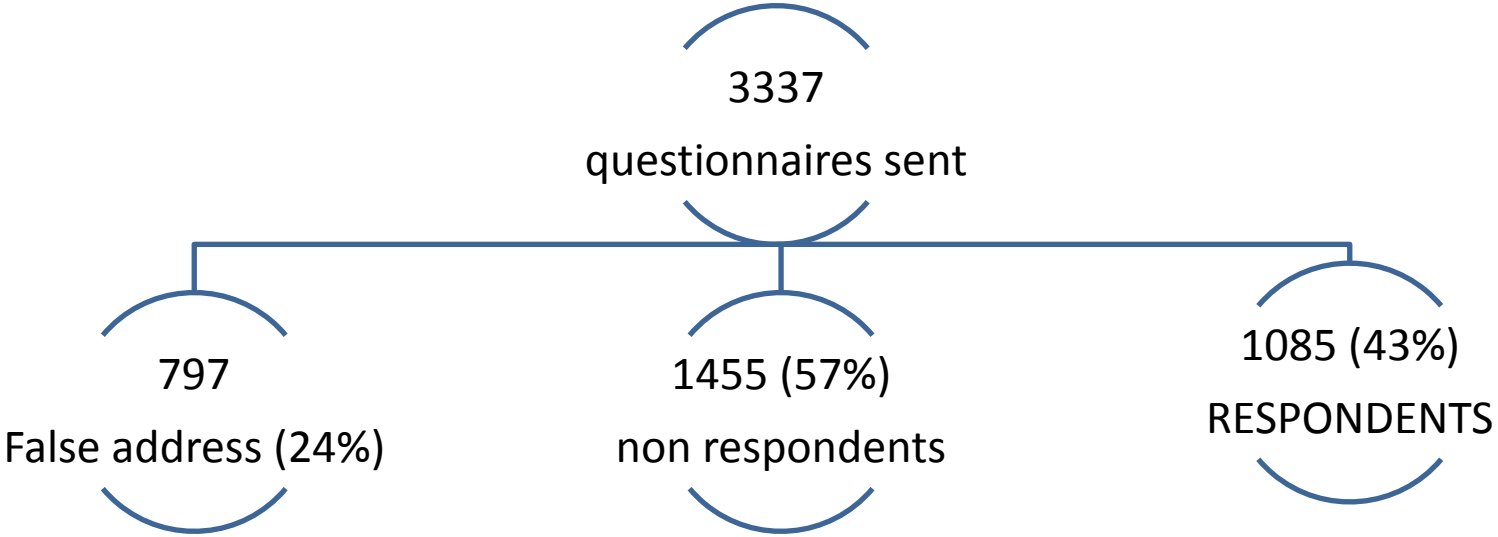
Material and methods

Postal **survey** sent to cyclists identified from the Rhône Road Trauma Registry (medical database) and injured in 2009-2011.
n=**1078 respondents**



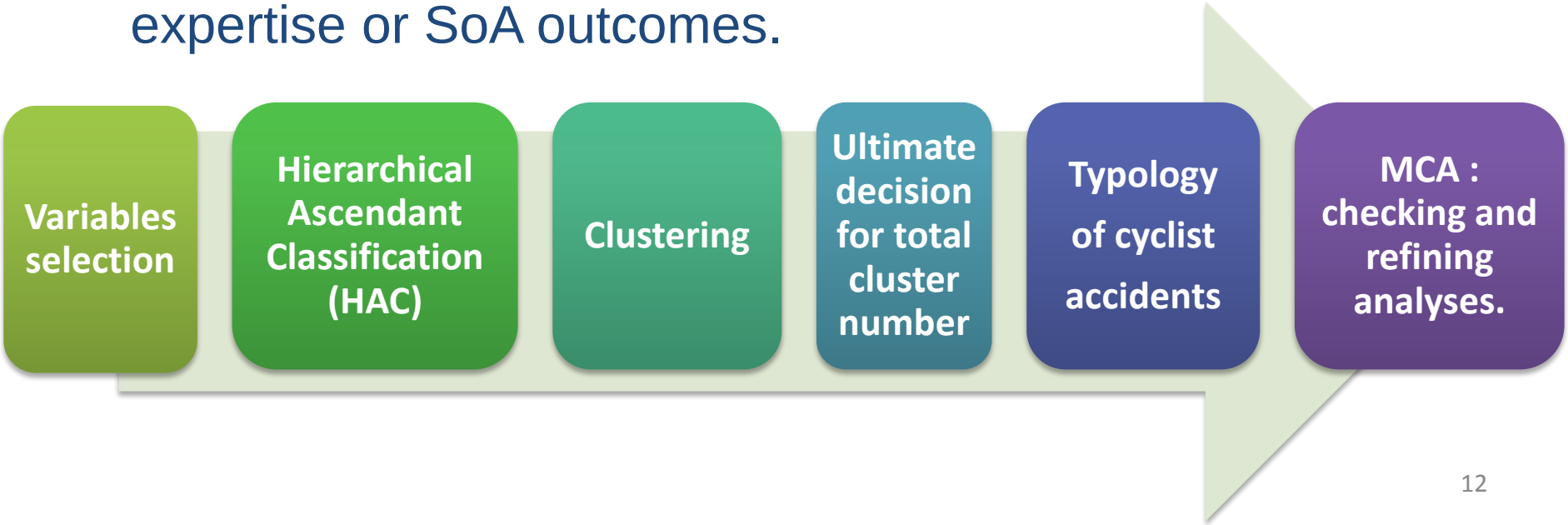
Respondents :

Older, more often women, more often cycling in urbanised area, more often involved in collisions and more often sustaining serious injuries; than non respondents.

Methods

Trade-off between automatic methods and experts' decisions:

- 35 relevant variables selected (state of art + descriptive statistic from the Registry),
- unsupervised classification (clustering to reveal data natural structure),
- ultimate decision for the total number of clusters made by expertise or SoA outcomes.

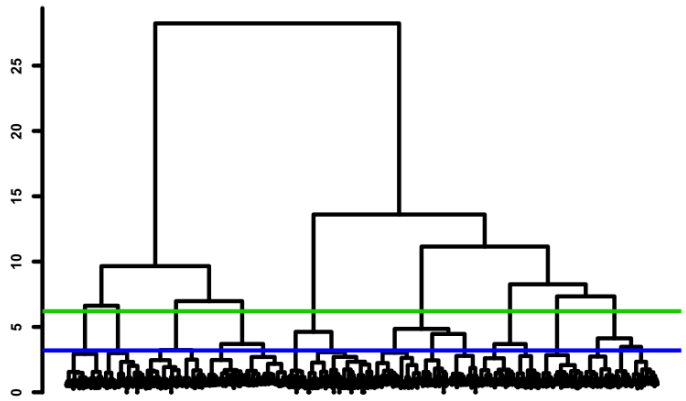


Statistical approach

Hierarchical Ascendant Classification (HAC)

Clustering individuals using a distance for binary variables,

to obtain a indicative number of clusters.



Dendrogram (Jaccard ; Ward)

Partionning Around Medoids (PAM)

Clustering individuals using the same distance.

As a result of a robust method we obtain a typology of 17 clusters.

***Clustering* (Jaccard)**

Typology of Cyclist Accidents

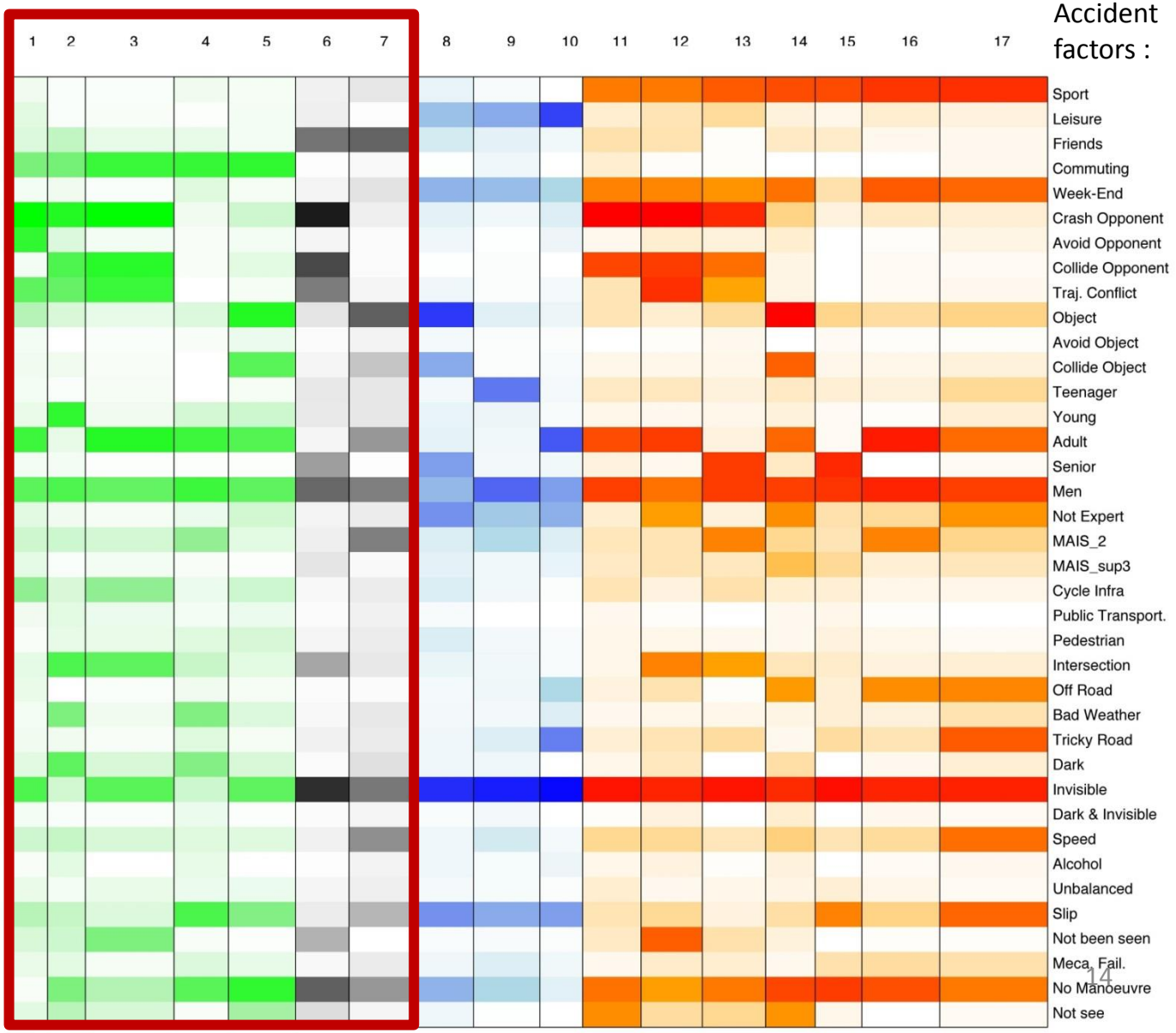
7 configurations
on utilitarian trips

Commuting

Utilitarian (except commuting)

Leisure

Sport

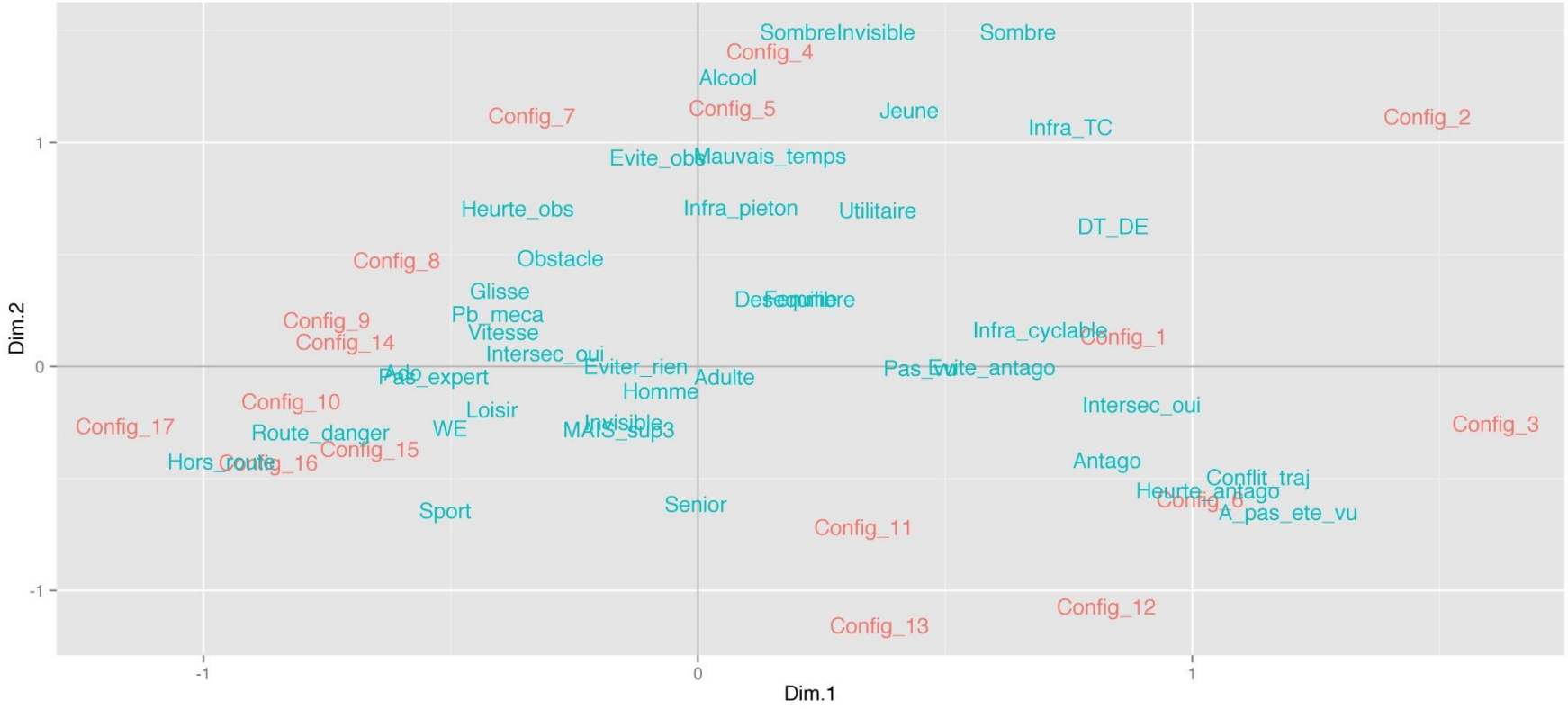


Example of an accident type

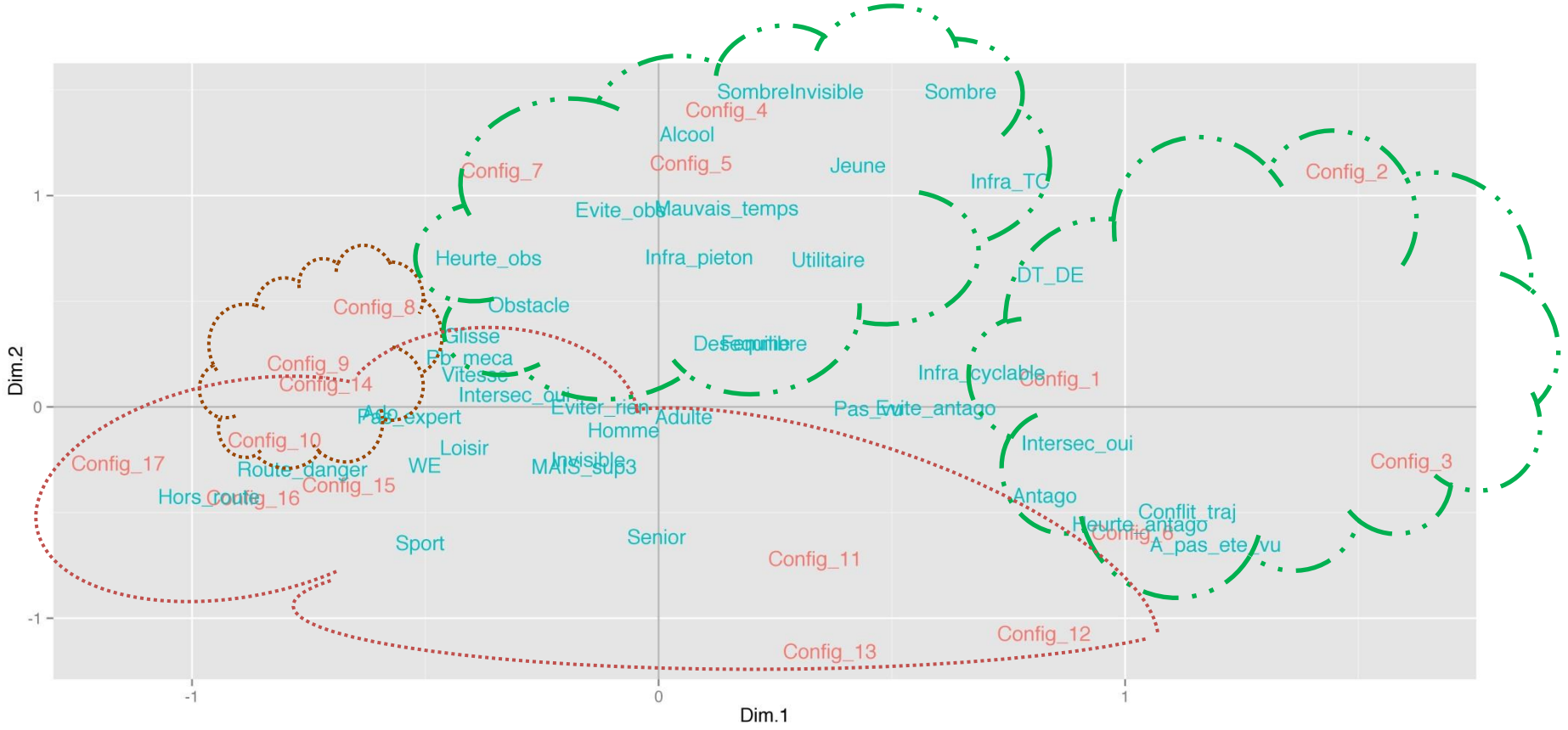
N°1 - Avoidance of another road user (n = 51)

Often, a cyclist avoiding another road user (82 vs. 10%) on a dedicated bicycle facility (49 vs. 16%). Usually, there is a trajectory conflict (67 vs. 27%), while commuting (57 vs. 23%). Most of the time on a straight road between intersections.

Multiple Correspondence Analysis (MCA)



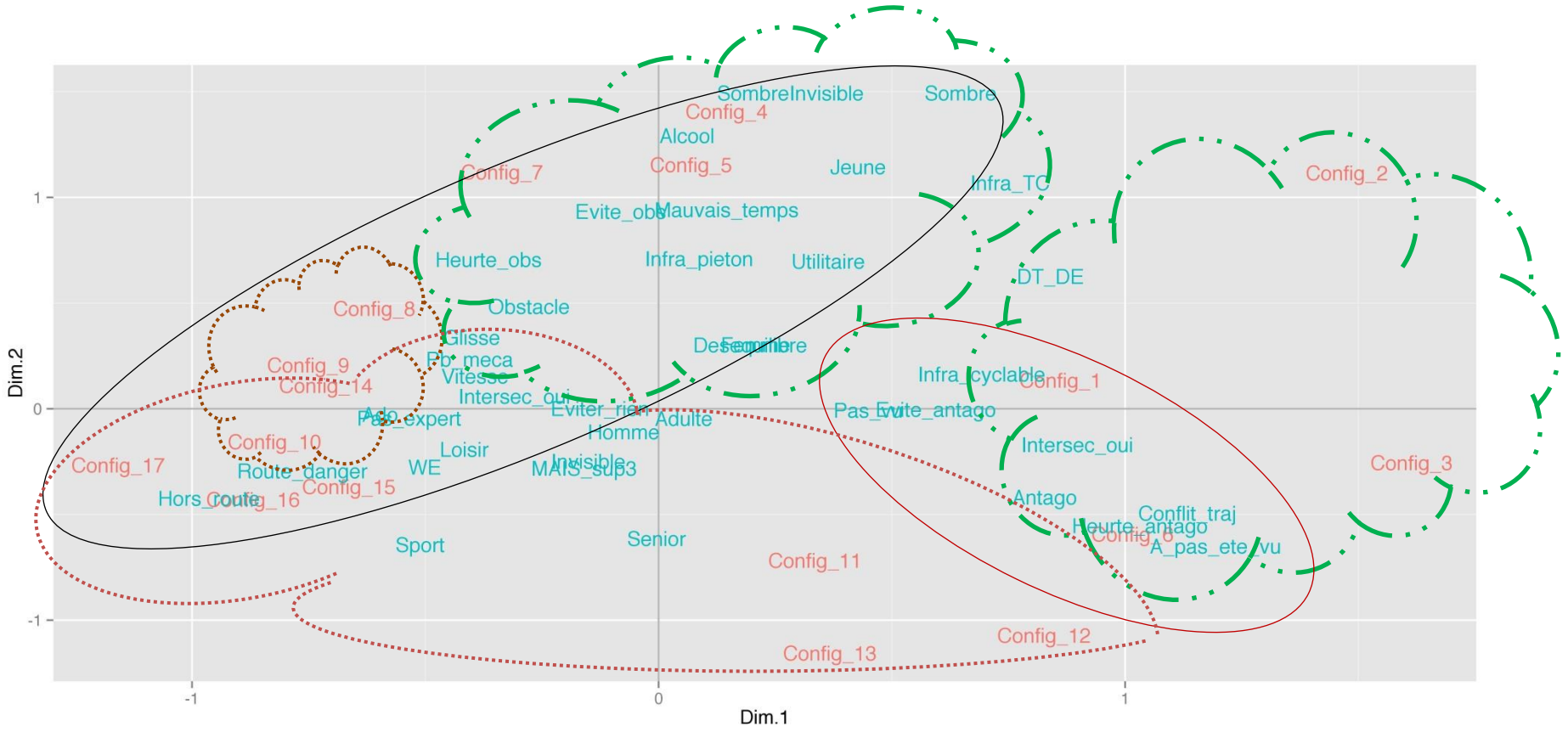
MCA (2)



Type of trip:

- utilitarian
- sport
- leisure

MCA (3)



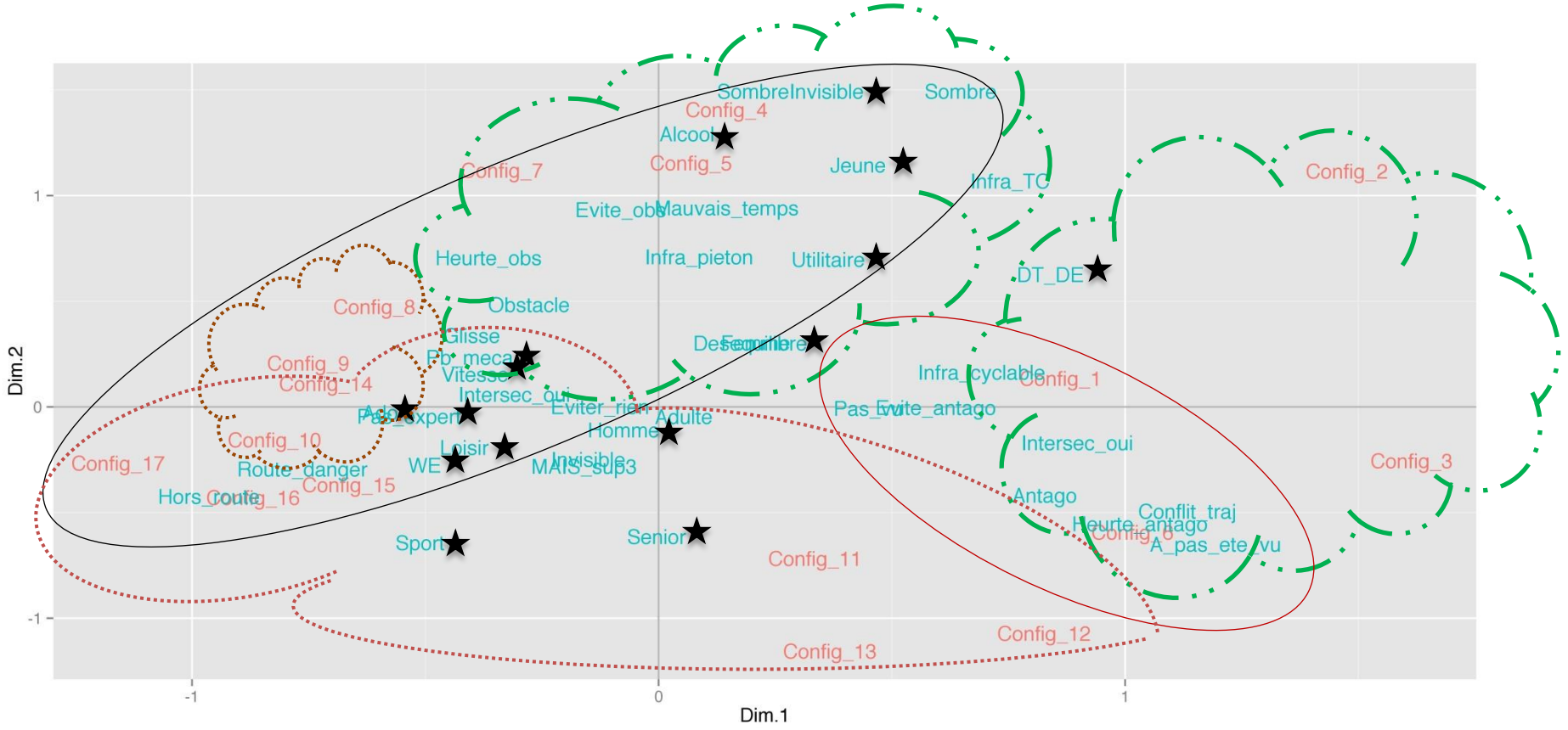
Type of trip:

- utilitarian
- sport
- leisure

Accident type:

- cyclist only
- collision

MCA (4)



Type of trip:
- utilitarian
- sport
- leisure

Accident type:
- cyclist only
- collision

★ Behavioral variables

Summary

- **Survey** :
  - rigorous methodology,
  - RR=43% (1078 respondents),
  - estimation of differences between respondents and non-respondents.

- **Typology of cyclists accidents** :
  - 17 configurations (7 on utilitarian trips, 10 sport and leisure),
  - identification of accidents factors for each configuration,
  - validation of the typology quality and connection between cyclist behaviours and cyclist only accidents.

Application

- **Proposals for action:**
  - preventing parking on bike path (conf. n°1) ,
  - improving obstacle conspicuity (conf. n°5 et 7) ,
  - increasing road facilities to make them convenient for cyclist, i.e. predictable trajectory, eye-contact with other road users (conf. n°3 et 6),
  - growing awarness of cyclist behavior impact among cyclistes themselves to encourage conspicuity clothing and bike devices, appropriate speed, alcool consumption (conf n°2 - 4 - 5 – 7).

- **Proposed approach:**
  - pinpoint key actors to diffuse prevention (cycling school instructor, association, medias…),

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IFSTTAR

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Contribution of variables

Table 2 Significance Level of the typology variables

	P-value
Crash.Opponent	1.12e-236
Collide.Opponent	8.40e-204
Commuting	2.62e-194
Senior	1.05e-168
Sport	1.47e-153
Traj..Conflict	5.07e-149
Adult	3.74e-116
Collide.Object	4.13e-105
Object	7.02e-99
Not.been.seen	6.22e-93
Leisure	1.77e-82
Off.Road	5.84e-78
Avoide.Opponent	1.43e-77
Week-End	3.87e-70
Tricky.Road	4.25e-70
Intersection	1.71e-65
Friends	3.89e-61
Invisible	1.14e-55
Not.Expert	3.45e-53
Slip	2.60e-48
Teenager	1.47e-47
Not.see	8.52e-44
Young	2.98e-42
Dark	1.05e-40
Speed	1.30e-34
Bad.Weather	3.09e-33
MAIS_2	2.05e-31
No.Manoeuvre	3.11e-31
Cycle.Infra	1.08e-28
MAIS_sup3	4.86e-07
Pedestrian	1.35e-04
Men	4.56e-04
Public.Transport.	1.85e-03
Alcohol	2.31e-03
Meca..Fail.	1.94e-02