

L'innovation numérique au service d'un changement de perspectives dans les transports

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Séminaire GERI USACT Ifsttar 20 mai 2016

Innovation numérique

- **Une révolution technologique**
 - General Purpose Technologies Bresnahan T.F. - Trajtenberg M. (1995) "General purpose technologies: Engines of growth", *Journal of Econometrics*, vol. 65, p. 83-108.
 - Impacte l'économie mais aussi le droit, les relations sociales, les organisations, les institutions, les comportements....
- Raison : porte sur les interactions (réseaux, plateformes).
 - Effets sur la structure organisationnelle de l'économie, les relations sociales, la codification de ces relations
 - Conditionnés par des changements organisationnels, sociétaux, juridiques
 - Le temps de la technologie, le temps des changements organisationnels, juridiques, mentaux...
 - A time to reap, a time to sow

- Innovation radicale comme *destruction créatrice* (Joseph Schumpeter) *Capitalism, Socialism and Democracy* (1942)
 - Destruction des industries (produits, techniques, compétences, firmes installées...)
 - Résistance des firmes existantes (statu quo)
 - Du à la rapidité du progrès technique et à la concurrence entre les firmes (spécificité du numérique)
 - Situations instables, transitoires (remise en cause des acteurs dominants, modèles économiques ? économie des promesses). Grande incertitude.
 - On voit la destruction et encore peu la création. Processus long (10, 20, 30, 40 ans...)

La mobilité rendue *smart* par le numérique, avec des angles d'attaque différents

- Les systèmes de transport intelligents
 - Régulation de trafic, coordination multi-modale, déplacements/stationnement, tarification...
 - Fournir des infos prescriptives permettant une optimisation du système
- Les applis user centric
 - accès à de nouveaux services : co-voiturage, navigation plus rusée, outils de divertissement (voiture connectée)..
 - Plateformes de coordination pour usages spécifiques
- L'équipement numérique des lieux physiques de la mobilité
 - Mobiles : bus, trams, voitures...
 - Immobilières : gares, hubs, espaces co-working, tiers lieux...

Des attentes fortes et multiples, des craintes

- Maîtriser les coûts associés à la croissance métropolitaine
- De nouveaux entrants, par exemple dans la voiture connectée, dans les services de navigation (Waze), le co-voiturage...
- Les acteurs historiques pris de revers (constructeurs automobiles, opérateurs de transport, autorité organisatrice des transports...)
- **Uberisation** : nom donné à la destruction créatrice



Smart Cities et nouveaux services de mobilité urbaine

- Les 3 composantes de l'innovation numérique :
 - Capteurs, mobiles, internet des objets
 - Communication : réseaux de télécoms, plateformes
 - Big Data
- Challenge pour les métropoles et régions urbaines :
 - Continuer à croître : métropolisation, cadre du développement économique
 - Minimiser coûts urbains (externalités négatives)
- "Intelligence" d'une ville : capacité à tenir les 2 objectifs (mobilité durable)

Mais deux visions des smart cities

- **smart cities**
 - Utiliser les opportunités créées par l'innovation numérique dans le cadre de la conception traditionnelle de la gestion urbaine
- **Smart citizens**
 - Utiliser ces opportunités pour développer des innovations sociétales dans le cadre d'une nouvelle représentation des problèmes de déplacements : *smart citizens*
- Comment aller des *smart cities* aux *smart citizens* ?

Smart Cities

- Traditional understanding of cities by planners and transport operators /
 - a technical-economic system, ie a complex set of flows that must be optimized.
 - System-centric view : we called it "systemic optimization" Kingdom of urban engineering.
- Smart Cities :
 - Integrate new technological inputs (geolocation and individualized recommendations for traveling in real time) to systemic optimization of urban flows
 - Orwellian view of cities



- Generalized and automated monitoring of urban moves sending informational signals to individuals in order to :
 - guide their real-time mobility behavior
 - ensure optimization of the traffic system.
- Extension of the previous techno-urban utopia : ITS (Intelligent Transport System) to human behavior
 - Intelligence is moving from transport infrastructure (road/vehicle) to automated prescription of human behavior
- Individuals don't play any active role
 - Information on their trips is extracted, processed and sent back in the form of mobility recommendations that guarantees dynamic optimization of flows

Smart Cities : difficulties

- Sponsored by big players : IBM, Cisco, urban planners, transport operators
- Solving urban issues with technological solutions
- Intelligence given by information system that acts as a behavioral prescriber
- Huge obstacles :
 - Who is able to organize the urban ecosystem (data providers, infrastructure owners, service providers, public authorities, transport users...)
 - Holdup risks
 - No cooperative behavior (nobody wants to share mobility data)
 - A lot of experiments, very few tangible achievements with regard to technological potentialities

Smart Citizens : a collaborative economy approach

- Smart Citizens :
 - **Bottom-up** approach : collective services (decreasing urban costs) based on changes of individual behavior and coordination between individuals
 - Exploiting opportunities opened by platforms and participative Web
 - **Intelligence** : new ways for individuals to be able to coordinate themselves (auto-organization) without any central agent (authority)
 - Usually in economics, coordination issues solved by price (market) or hierarchy (organization)
 - Nowadays, a third means provided by technology (platforms)
 - **User-centric** approach : smart **citizens**

From homo oeconomicus to homo socialis

HO

- Maximizing individual utility and creating negative externalities
 - *Popular version* : drivers as stupid and narrow-minded people
 - Individuals = source of problems
- Solution : individuals must be disciplined and controlled by taxes and/or restrictions, prohibitions

HS

- people able to adopt pro-social behavior (positive externalities)
- They would solve collective issues because want to improve they quality of live and they way of living (including revenue)
- But collective powerlessness : difficult to transform individual goodwill into collective action

- People would like to improve their daily trips but they don't know how to do it :
 - Collective failure issue
 - Rationale explanation (prisoners dilemma) :
 - I would like to share my car but others don't want (if they wanted, they should have shared their car before)
 - Because I expect they don't want, I don't share my car
 - Others people follow the same argument
 - Stupid collective outcome : one person in each car /congestion costs
- Coordination issue : how to solve it ?

4 conditions to solve collective action failure

- **Changing the frame :**
 - Deep coherence between how a problem is represented and the way you can act to solve it
 - Make no sense to rely on people within a frame where they are treated as a source of problems.
 - Inefficiency of campaigns such as "be reasonable, don't take your car") because no sense in a system of disempowerment of individuals.
 - **To make possible individual actions**, the frame must be changed (Goffman)
 - For instance, no central authority must be introduced in smart citizen configuration
 - Because people are used to delegate their action to authorities : *"I am not able to change anything, it's the job of urban planners or transport operators to do that"*

Second condition : measuring collective value created

- able to show the collective value created by individual actions.
- Very low value of each individual good practice (shifting its daily schedules, taking someone in his car, using today public transport instead of private car...)
- But when aggregated, high collective value (4 billions € of congestion and pollution costs for Ile de France region/year)
- Necessary to make visible this collective value as feedback effect encouraging and reinforcing individual good practices
- How to make it visible ?
- By measuring it ? Things are not visible if not measured

From Quantified Self to Quantified Commons

QS

- Self-measure by connected objects :
 - incentive to improve your health, electric consumption...
- Relation between you and you :
 - QS supposed to change your behavior
 - Because measures the impact of a specific action on your own utility
 - Individual gain

QC

- Measure the collective value created by small individual actions
- that do not have a high individual value
 - Very difficult to set a price
 - Disproportion between the scale of individual action and collective result
 - Difficult to establish a link between action and result
- Relation between individual and a collective
 - Give information on result of cooperative game
 - Some changed their behavior and this led to collective value measured
 - Feedback of the measure encourage me to change my behavior

Third condition : small worlds

- Possible to transform individual practices into collective action when limited to localized small communities.
 - Lack of central authority raises a problem of trust between individuals (not easy to accept to share your car or to be driven by a stranger)
 - Difficulty partly solved when exchanges embedded in interpersonal relationships within small communities
- General rule for most of social networks : Facebook, AirBnB, crowdfunding platforms...
 - BlaBlaCar has 10 million members but :
 - prior to become a large commercial platform, BlaBlaCar experienced a long period (2004-2011) almost militant, based on mutual assistance and small groups.

- Strategical mistake often made by start-ups developing apps in the field of mobility
- Want to reach asap a large audience due to network effects and audience revenue expected
- a trap because familiar ties do not have the time to develop.

4th condition : finding the good incentives

- A lot of new urban services exist : different forms of carsharing, dynamic navigation services, telework or work schedules shifting...
- But very few are adopted.
 - 5% of workers decide to switch to ridesharing after a company mobility plan
 - 7% of teleworkers in France
- Need for incentives but which ones ?
 - Monetary versus non monetary
 - Individuals incentives versus group effects

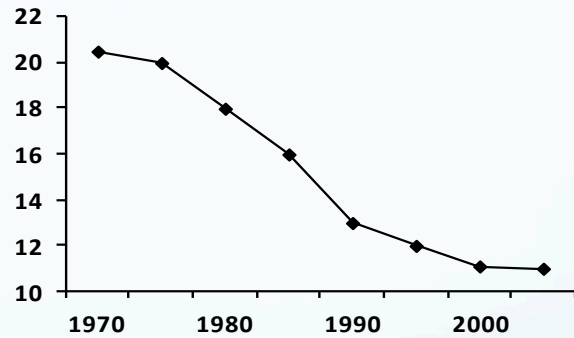
Applications : short distance car sharing, field experiment on the Plateau de Saclay



Why studying ridesharing ?

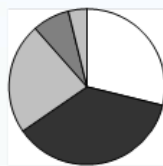
- Can improve urban transport :
 - New public transportation : high investment, takes time, can't go everywhere.
 - 60 to 70% of cars in urban area don't have any passenger.
- Lots of data and studies
- Studies shows a mix of private (economic) and social motivation
- Some success (long distance and hot lanes) and repeated failures (daily ridesharing)

Ridesharing

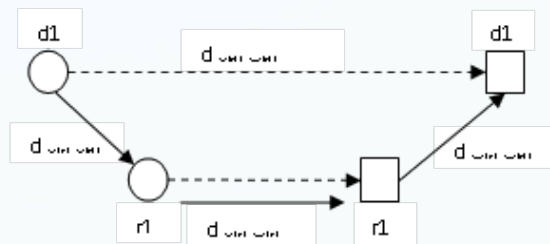


«Ridesharing died in the 1980's»
Pisarski (1997)

Difference between daily and long distance ridesharing



Prix Essence Voiture/loyer
 Age/éducation Style de vie



Daily ridesharing :

- More complex coordination
 - Max 5 min delay accepted by drivers
 - Critical mass difficult to get
- Monetary motivation insufficient
- Social issues : trust, gender, confort

	complexity	motivation	Social value
Long distance	no	economic	small
Daily	very	social	high
HOV	medium	convenience	medium

Why a Field Experiment ?

Lab versus Field

Laboratory experiment issues

- Based on Vernon Smith's works
- Laboratory experiments are made to test market related subjects (Croson 2005), not suited to test behavior / cognitives issues :
 1. Controlled behavior (limited social interaction)
 2. Monetary motivation only
 3. No deception
 4. No context
 5. Students as subject pool is no problem
- Note : Behavioral economics also in labs but uses different set of rules (experimental psychology)

Field experiment issues

- « into the wild »
 - Outside of the lab, see John A. List (+ Harrison, Charness..)
 - Deception
- Rules are a mix between sociology (context matter, pool selection bias, insider/outsider) and psychology (deception mandatory).
- Some issues to solve :
 - Diversity of the subject pool (Selection bias) ; the « good subject » problem
 - What motivation if not monetary
 - What deception (natural or decoy) and deception vs ethical issues
 - Following the subjects 'into the wild' (time & different spaces/contexts)
 - Users privacy vs experiment validity (controlled data)
 - Taking into account unwanted event (strike, meteo...)

Mobidix : 3 experiments

RITM, Orange Labs, Michelin

1. Framing the subject :
 - Change in presentation speech (video)
 2. Exploring feedback
 - Proposed representation
 3. Dynamics and motivations
 - Social effects
 - Collective feedback
 - Rewards
- Where : Paris Saclay area : IUT Orsay, IOGS, INRIA, Thales, CEA, Polytechnique.
 - 368 participants

The field : Saclay Campus



South of Paris (20km), pop 25000 : academies, research entities

AIMED TO BE

- pop 75000
- 20% of french research
- In top 8 of WW research clusters
- top 20 of Shangai ranking



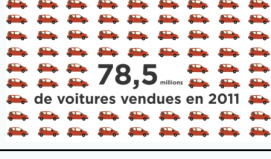
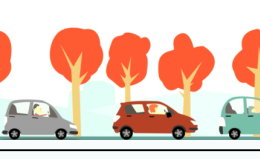


- Too wide (15km) , in the middle of 'nowhere'
- Congestion of PT and roads access morning and evening
- Lack of intra campus transportation during work hours
- Should get worse as pop increase by fact of 3 before new PT (metro 2023)

UN TERRITOIRE EXCEPTIONNEL

> Le sud du plateau



XP 1 : Framing

	Vidéo 1	Vidéo 2
Human representation		
Scale of data		
Proximity of situations		

112 participants
2 groups

Video + survey about daily transportation

Video 1 : usual « smart cities » speech : big picture, techno oriented

Video 2 : daily, individual representation of transportation

Willing to support alternative transportation initiatives

	Vidéo 1	Vidéo 2	différence
Je participerais bien	17,2%	27,6%	+10,4%

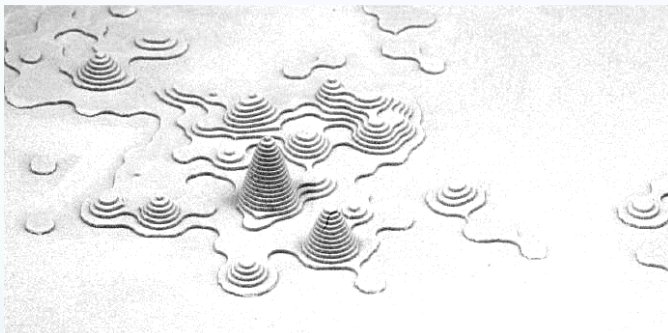
Individual have a responsibility in transportations issues

	Vidéo 1	Vidéo 2	différence
Individus	33,9%	41,38%	+7,48%

XP2: Mobility footprint

Use of the device "mobility footprint"

- Capture the locations of subjects using antennas triangulation (no GPS) accumulated data over a week



70 subjects
For 2 weeks

Before and after surveys (within) with same 2 questions

Willing to support alternative transportation initiatives

	Pré-enquête	Post-enquête	différence
Je participerais bien	17,9%	29,9%	+11,95

Individual have a responsibility in transportations issues

	Pré-enquête	Post-enquête	différence
Individus	25,37%	34,33%	+8,96

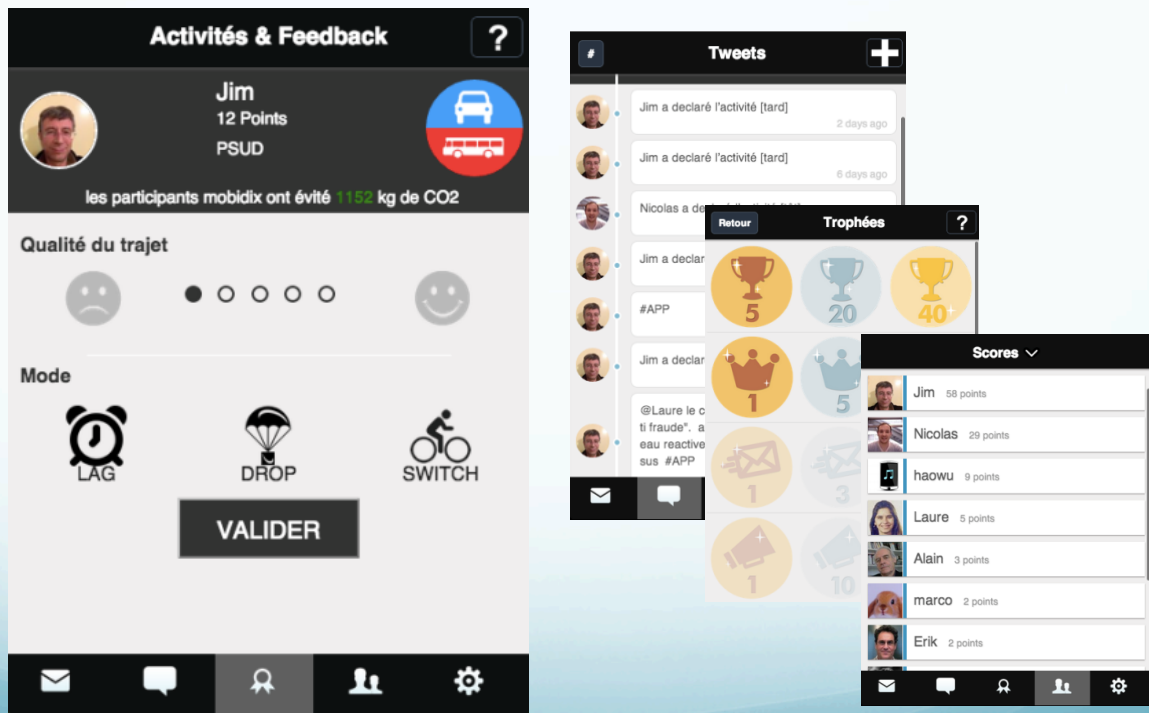
XP3 Hypotheses tested

- Individual :
 - Quantified self / Self measurement
 - Participants earn points by declaring mobility behaviors (1)
 - Participants earn badges by regular use of the application (2)
 - Representation of collective effect (Quantified Common)
 - traffic indicator of quality based on the feedbacks of participants (4)
 - calculation result of CO 2 collectively saved (5) (8)
- Social incentives
 - Group identity
 - Half of the participants were informed that the institution to which they belong has a remarkable activity level, to be confirmed over 3 days (6)
 - Competition -
 - ranking that compares the activity of participants (3)
- Monetary incentive
 - Vouchers A monetary incentive competition with vouchers is announced for last week (7)

Mobidix app : a portable labs

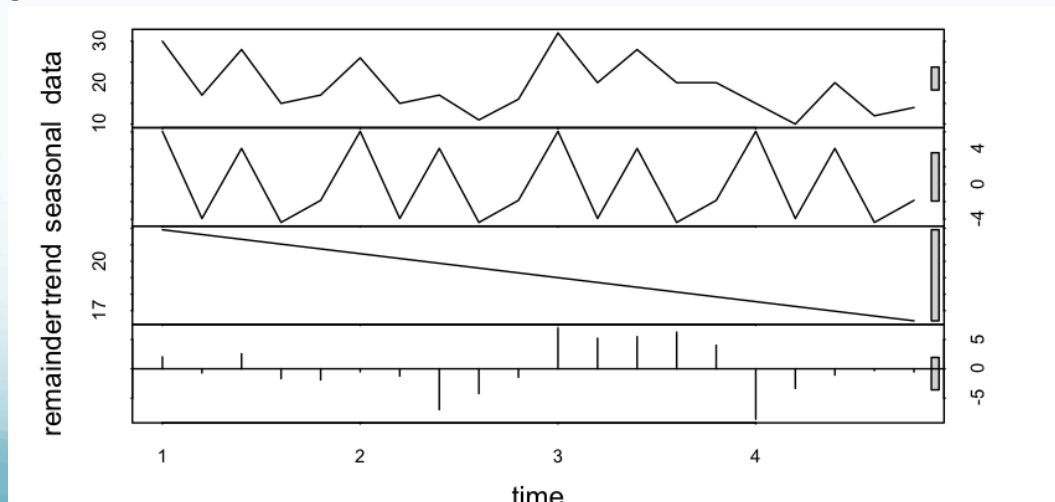
- Promoting responsible commuting
 - Ridesharing, cycling, avoiding peak hours/telecommuting
 - Giving feedback on transport conditions (road congestion, train incident...)
- Avoid selection bias
 - Not only for android / 4G+ power users : HTML5
 - No geoloc
 - 43,42% mobile usage, 56,58 on the web.
- A social application
 - Twitter like functionality :
 - Simple coordination
 - Community / Imitation effect
 - Social control
- A portable laboratory
 - Collecting results
 - Provide incitations introduced as « new functionalities / enhancement »

Screenshots

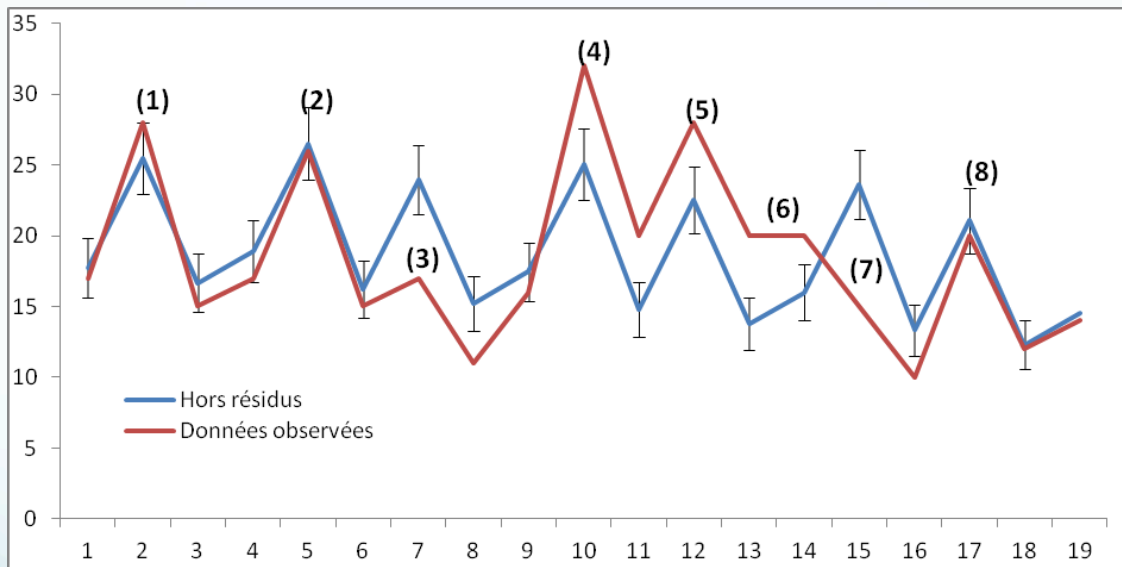


Test protocol and results

- 180 people recruited, 65 active participants
- 4 weeks, 20 days, 3 mails per week, 2 with incitation (Monday / Wednesday) one thank-you on Fridays
- Periodic serie with repited growth on Monday (36,06%) Wednesday (51,56%) Friday (13,39%)
- Negative trend $-0,3887x$

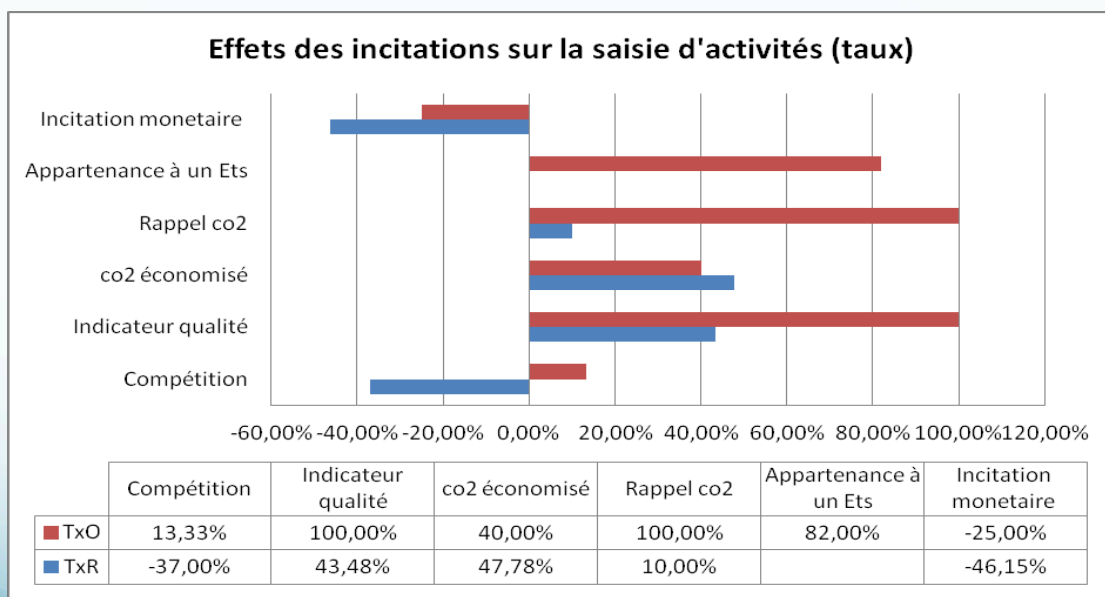


Mail effect vs incitations

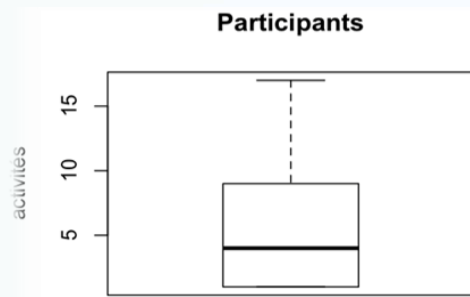


1	Points	3	Ranking	5	CO2 calculation	7	Monetary
2	Badges	4	Quality Indicator	6	Group identity	8	1t CO2 saving

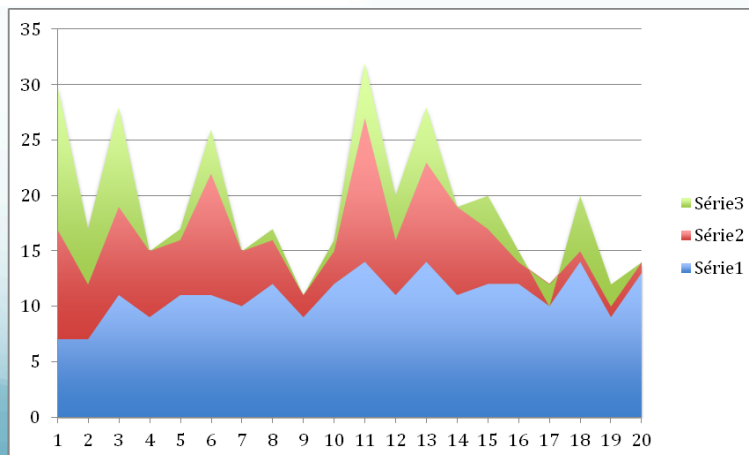
Compared growth rates



Participants distribution



- 75% of the values are in the box
- The distribution is asymmetric
- 3 groups according to Q1, Q2 and Q3.
- If we graphically represent the activity of these three groups with the observed data, the following curves are obtained :



Summary / conclusion

- In a context of voluntary cooperation :
 - Representation and social identity are powerful motivators
 - Positive impact of collective feedback with barometer transport or CO2 savings performed by users,
 - Positive impact of social identity (group membership)
 - Competition and monetary incentives drives crowding-out
 - Negative impact of incentives involving individual competition with symbolic award (ranking) and monetary reward