

*Design et évaluation de  
politiques de transport : les  
leçons de l'expérimentation  
économique en laboratoire*

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# Plan de la présentation

- 1. Pourquoi l'expérimentation économique en laboratoire ?
- 2. Deux applications aux politiques de transport : DAP pour éviter les nuisances et impact de l'information routière sur la congestion

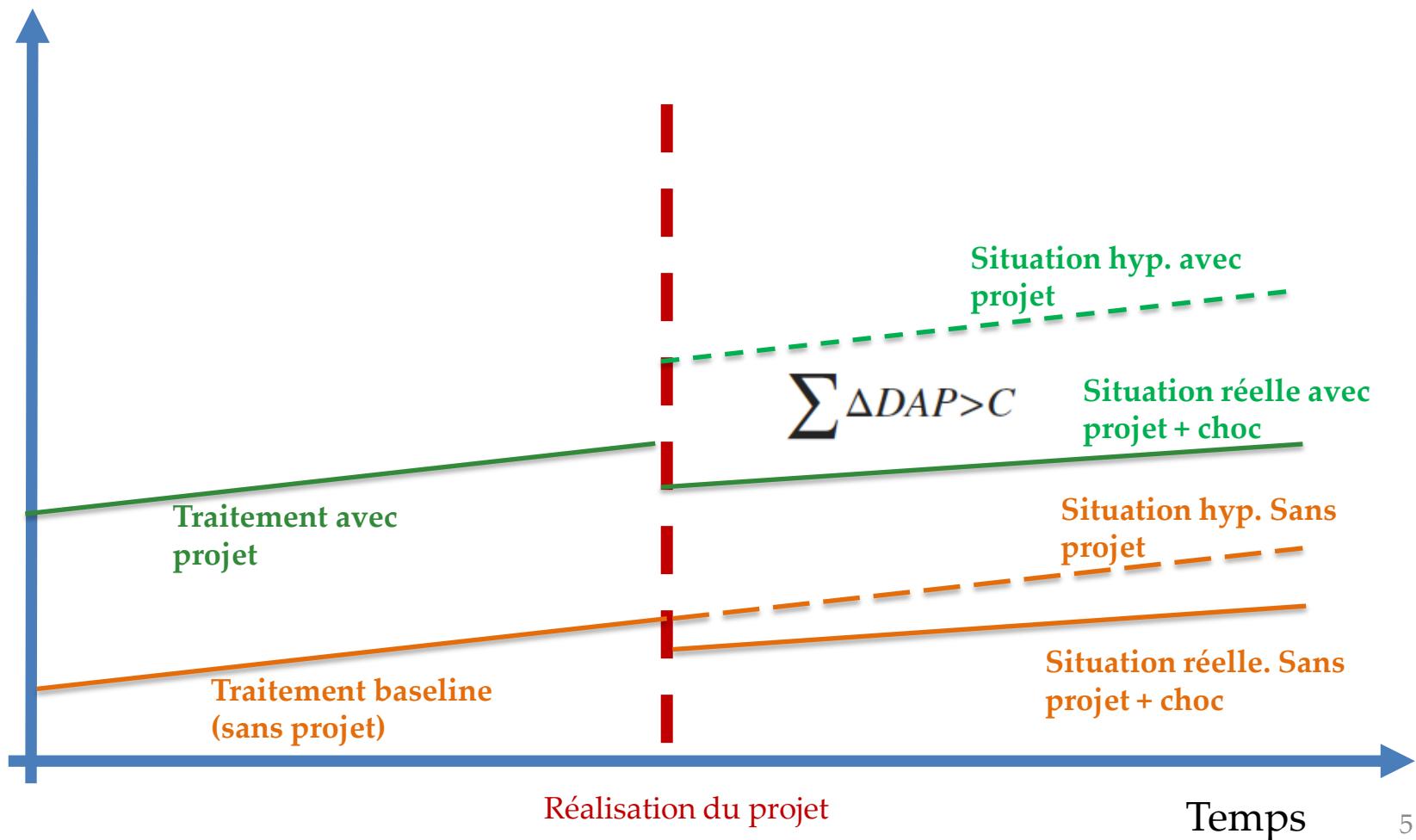
# *1. Pourquoi l'expérimentation économique pour évaluer les politiques publiques ?*

# Pourquoi l'expérimentation économique pour évaluer les PP ?

- Econométrie des données de terrain (préférences révélées ou préférences déclarées)
- Enquêtes (données qualitatives ou quantitatives)
- Méthodes expérimentales (expérimentations de terrain ou expérimentations de laboratoire)

# La méthode expérimentale et le problème du contrefactuel en évaluation

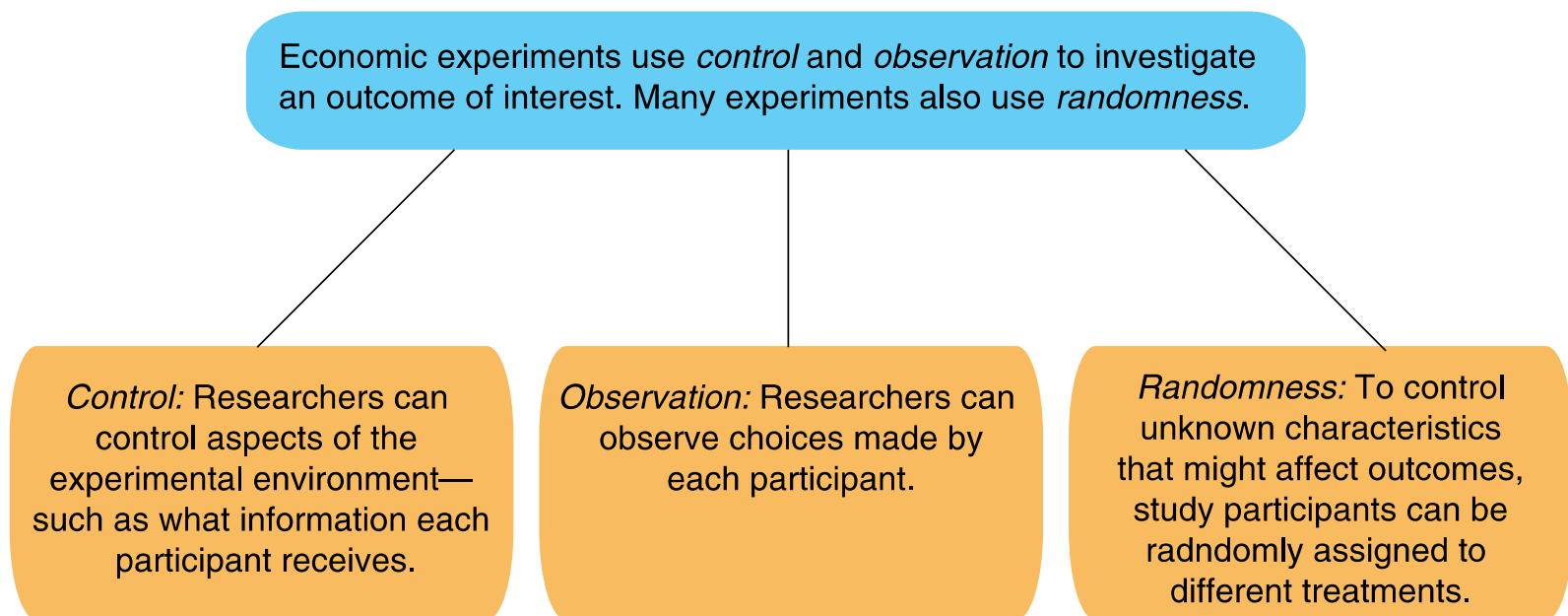
Variable observée  
(ex: DAP pour le transport public)



# Préambule : qu'appelle-t-on expérimentation ? (USDA, 2017)

Figure 1

## Control, observation, and randomness in economic experiments



Source: USDA, Economic Research Service.

# Quelques laboratoires expérimentaux



USA Harvard Decision Science Laboratory



USA Caltech Social Science Laboratory



USA Princeton Laboratory for Experimental Social Science



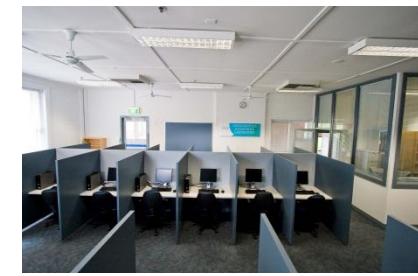
New Zealand  
ChristchurchNEEL



Kenya Université de Nairobi Busara  
Center of Behavioral Economics



Canada Université de Montréal CIRANO



Australia University of Melbourne



France Université Lyon II-GATE



France Université Rennes I-  
CREM LABEX



Espagne Valencia Lineex



Allemagne University of  
Goettingen

# Validité interne et externe des expériences de laboratoire en sciences sociales

- « *Validity will be evaluated in terms of two major criteria. First, and as a basic minimum, is what can be called **internal validity**: did in fact the experimental stimulus make some significant difference in this specific instance? The second criterion is that of **external validity**, representativeness, or generalizability: to what populations, settings, and variables can this effect be generalized.* » (Campbell, 1957, p.297, emphasis in the original)

## **Charles Plott (1987). Dimensions of parallelism: Some policy applications of experimental methods.**

- « The engineers (of CalTech) were attempting to determine the flow of effluents that might result from a change in release in the ocean near Los Angeles. They were studying currents in a large pool constructed in the basement of a building on the campus. Of course, their pool looked nothing at all like the Pacific; yet it taught them something about their models, and it was the models that helped them learn something about the Pacific. »

# Building an airplane (or a new policy)

(Murphy, 2006)

- 1. Engineers develop design
- 1. Economic theory & econometrics
- 2. **Test in windtunnel**
- 2. **Experimental Economics**
- 3. Flight Tests
- 3. Field Pilots
- 4. Use Plane
- 4. Implement policy

# **Les expérimentations économiques en laboratoire : Valeurs induites ou élicitation des valeurs individuelles**

- **L'élicitation (révélation) des valeurs individuelles (Lab or Field)** : conçues pour mesurer les valeurs individuelles endogènes et « intrinsèques » (homegrown values) pour les biens ou services non-marchands,
- **Les expérimentations sur la base de valeurs induites (Lab)**: les valeurs économiques sont déterminées de manière exogène par l'expérimentateur, et l'objectif est de savoir comment une règle ou une institution spécifique affecte la révélation des préférences,

## *2. Deux études expérimentales*

# *Une expérimentation d'élicitation de DAP pour la réduction des nuisances du transport routier de marchandises*

Avec Javier Faulin (U. de Navarre),  
Sabrina Hammiche (U. de Rennes 1) et  
Adrian Serrano (U. de Navarre)

# Le biais hypothétique (Whitehead 2008 in Cherry et al 2008)

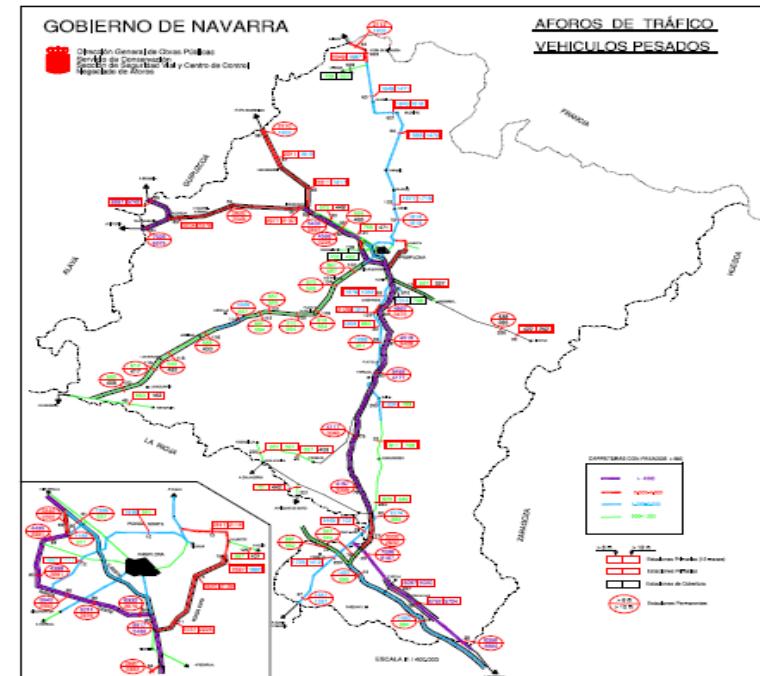
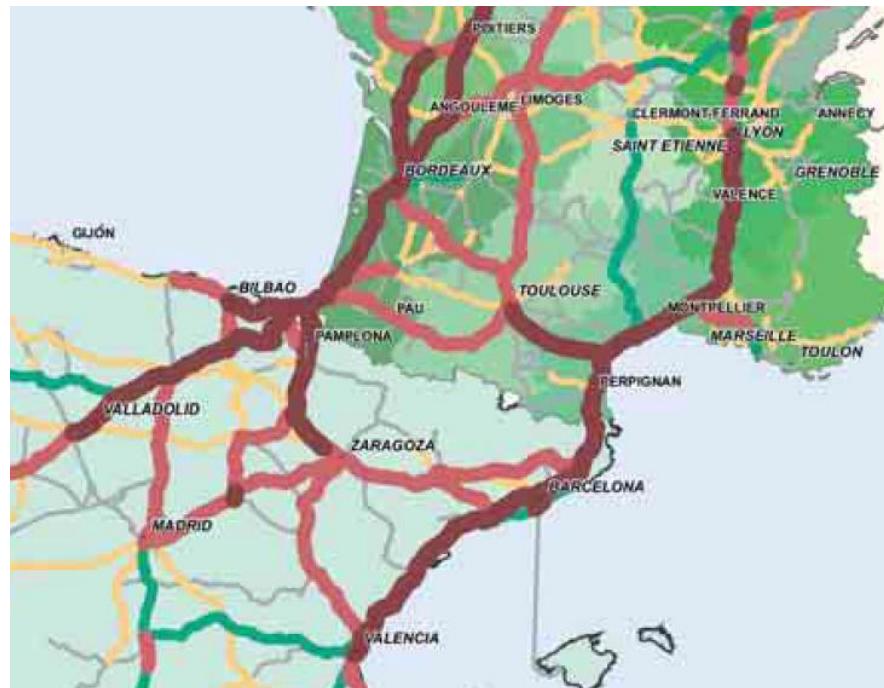
- Méthode d'Evaluation Contingente pose certains problèmes en économie de l'environnement :
  - *Incentive compatibility* pb: Une question évaluative est dite compatible en incitations si les répondants ont des raisons suffisamment fortes de dire la vérité sur leurs préférences,
  - *Biais hypothétique* : Les méthodes de préférences déclarées échouent à révéler les préférences individuelles ou à prendre en considération les contraintes de revenu.
- Littérature empirique : limité ou non sign. Pour les valeurs d'usage non-marchandes (par ex., loisirs, santé) mais importants et sign. Pour les valeurs d'usage marchandes ou pour les biens et S. non marchands environnementaux,
  - Murphy et al (2005) meta-analysis (28 studies, 83 obs.) : HB moyen 2.6, HB médian 1.35, 71% obs. HB>1.1

$$I < \frac{WTP_h}{WTP_r} < 25$$

# **Biais hypothétique et DAP pour la réduction des nuisances sonores et de pollution atmosphérique dans les Pyrénées (Denant-Boemont, Faulin, Hammiche and Serrano, 2016)**

- WTP in the context of freight transport in the Pyrenees' valley from France to Spain
- Noise and Pollution reduction elicited at the individual level
- Within-subject design: CVM + WTP with 'real incentives'

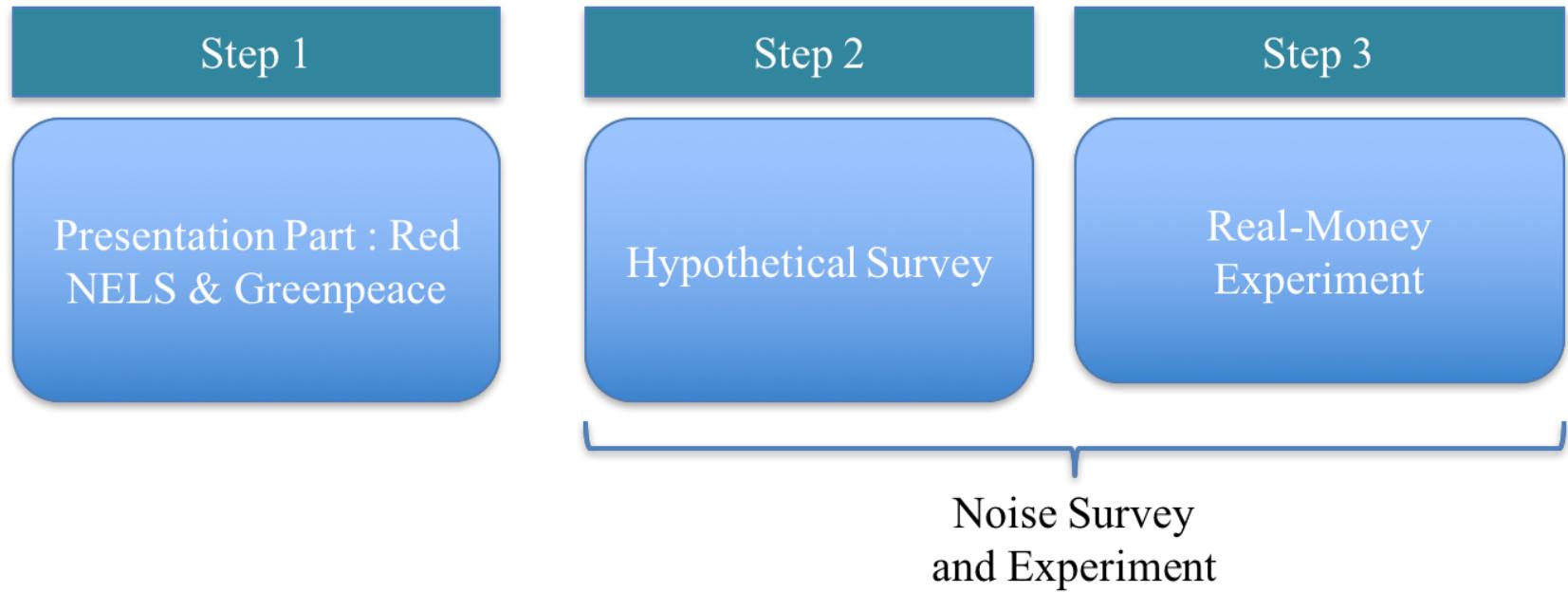
# Geographical scope for the experimental survey (Pamplona area, Spain)



# Survey design

- Combines a hypothetical CVM and a real-money experiment in order to measure WTP for noise and air pollution reduction (due to road freight)
- For the incentive compatible mechanism, group presentation format (Horowitz, 2006)
- 50 participants, 2 sessions, 90 mn per session, University of Navarra

# Experimental procedure



# Extrait des présentations des associations écologiques à but non lucratif



*"Queremos la paz y queremos que sea verde"*

## ¿Qué es Greenpeace?

Somos una organización ecologista y pacifista internacional, económica y políticamente independiente, que no acepta donaciones ni presiones de gobiernos, partidos políticos o empresas.

## ¿Qué objetivos tiene esta organización?

- ⌚ Detener el cambio climático.
- ⌚ Proteger la biodiversidad.
- ⌚ Acabar con el uso de la energía nuclear y de las armas.
- ⌚ Fomentar la paz.

## ¿Cómo trabaja Greenpeace?

- ⌚ Selecciona y estudia en profundidad los problemas / recursos limitados / Univ. Exeter
- ⌚ Informa públicamente de los descubrimientos y riesgos detectados.
- ⌚ Plantea soluciones y alternativas / Recaba respaldo / Lobby político.
- ⌚ Reivindicación mediática de alto impacto cuando otros recursos fallan.

GREENPEACE

Figure 2.a. An example for a slide within the presentation of Greenpeace

## ¿En qué se gastaría la Red NELS el dinero recibido?

1. Contaminación acústica. Cursos de conducción eficiente. Pamplona.



2. Contaminación del aire. Vía Amable que une Noáin con Pamplona

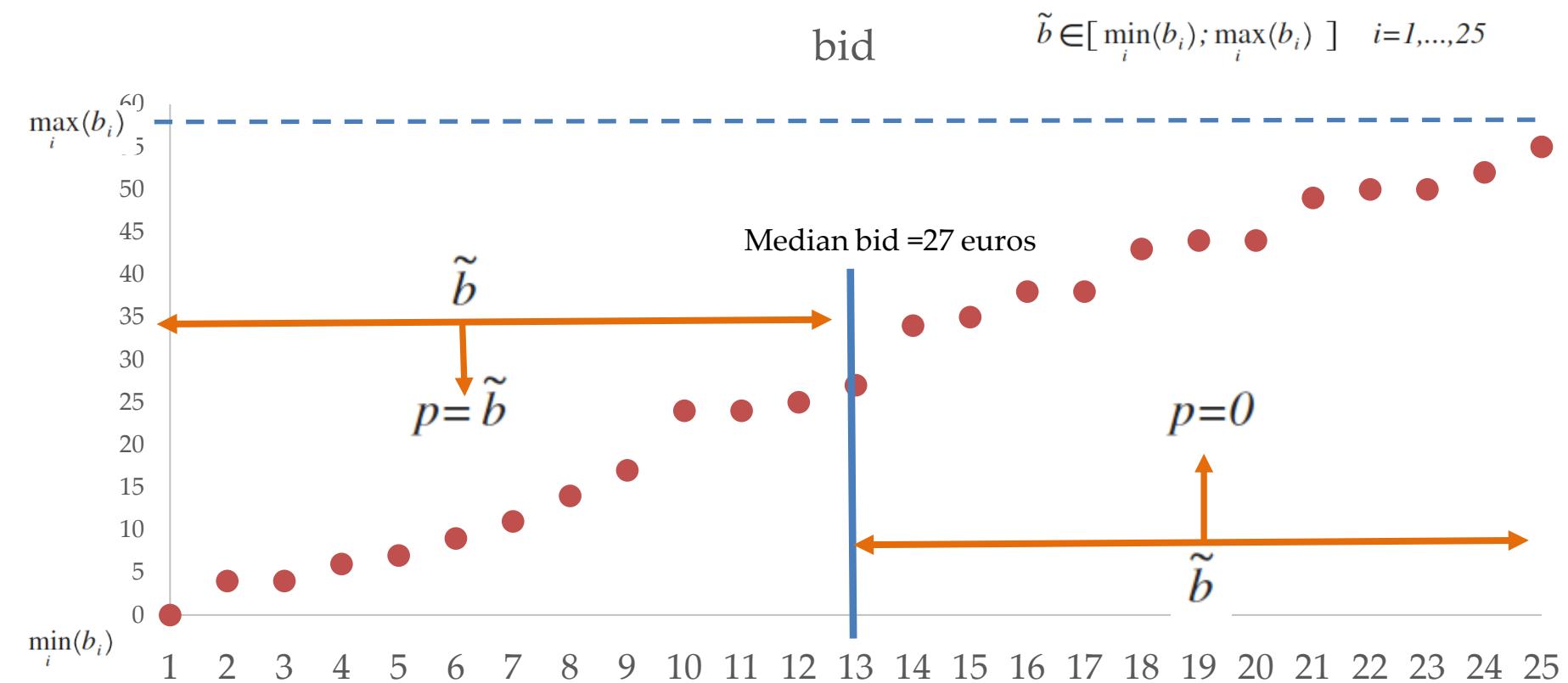


Figure 2.b. An example for a slide within the presentation of Red NELS

# The noise exposure scenario and the real-incentivized experiment

- Participants were exposed to successive levels of 70 dB(A) and 50 dB(A)
  - Then, should state how much they were willing to pay for a noise reduction from 70 dB(A) to 50 dB(A)
    - A lot of controls about their individual socio-demographic characteristics, habits and tastes as well as ecological sensitivity and awareness
- The same question for WTP for noise level reduction at the same magnitude but with real-incentives and an incentive compatible auction format,
  - 60 Euros Endowment: *How much would you give to one of the non-profit organization there?*

# L'élicitation des DAP par le format de présentation en groupe (Horowitz, 2008)



# Statistiques descriptives

	Full sample		Without zero protesters	
	WTP for noise reduction, Hypothetical	WTP for noise reduction, Real-Money	WTP for noise reduction, Hypothetical	WTP for noise reduction, Real-Money
Median	7.50	5.00	10.00	5.00
Mean	24.02	9.54	27.29	10.25
s.d.	40.61	13.31	50.63	13.80
Number of obs.	50	50	44	44

## *Example 2. Real-Time Traffic Information and Road Congestion*

With Kasun Wijayaratna, Vinayak Dixit  
and Travis Weller, UNSW

# Road Traffic Congestion and ITS

- Traffic congestion cost – time and fuel wasted -- for 1,064 cities around the world (38 countries): INRIX Global Traffic Scorecard
  - <http://inrix.com/scorecard/>
- US: \$300 billion in 2016, i.e., 1.6% of the GDP,
- US + UK + Germany: \$450 billion (on average, \$1,500 per year and driver, \$971 per inhabitant),
- Policies to tackle traffic congestion: Increasing Road capacities, Congestion Pricing and Real-Time Traffic Information

# The Online Traffic Information Paradox

- On a given network where users should choose between alternative routes,
- Travel costs may be sensitive to hazards that could occur (incident, accident), as travel time increases when incident occur,
- *What could be the impact of online information about existing incidents on the network efficiency?*
  - (some similarity with the Braess Paradox, where additional capacity could be detrimental for network efficiency)

# Online Information Paradox

Probability of Incident on C-B = 0.2

Probability of No Incident on C-B = 0.8

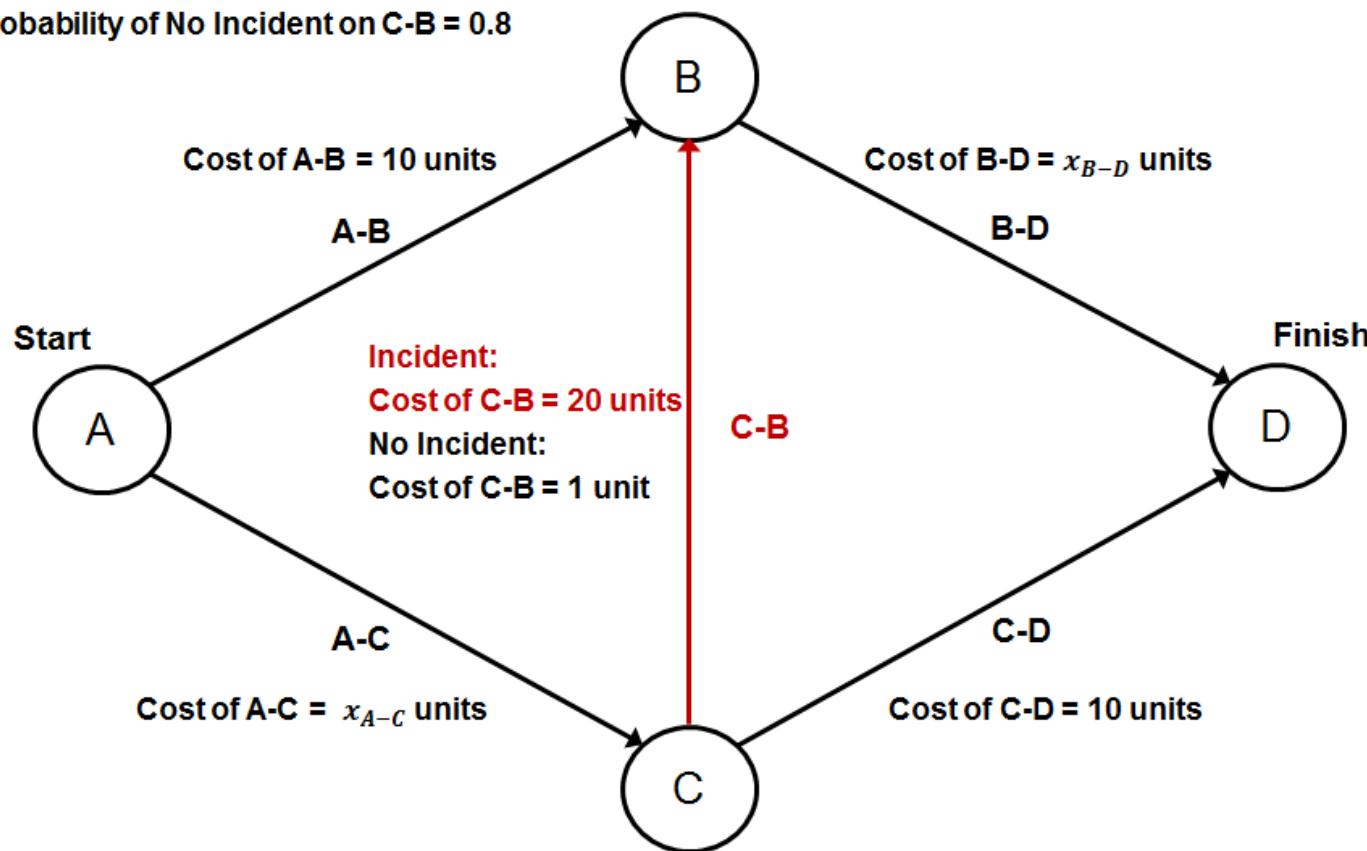


Figure 1 - Traffic Network of Game 1

# Game 2 : Online Information

Probability of Incident on C-B = 0.2

Probability of No Incident on C-B = 0.8

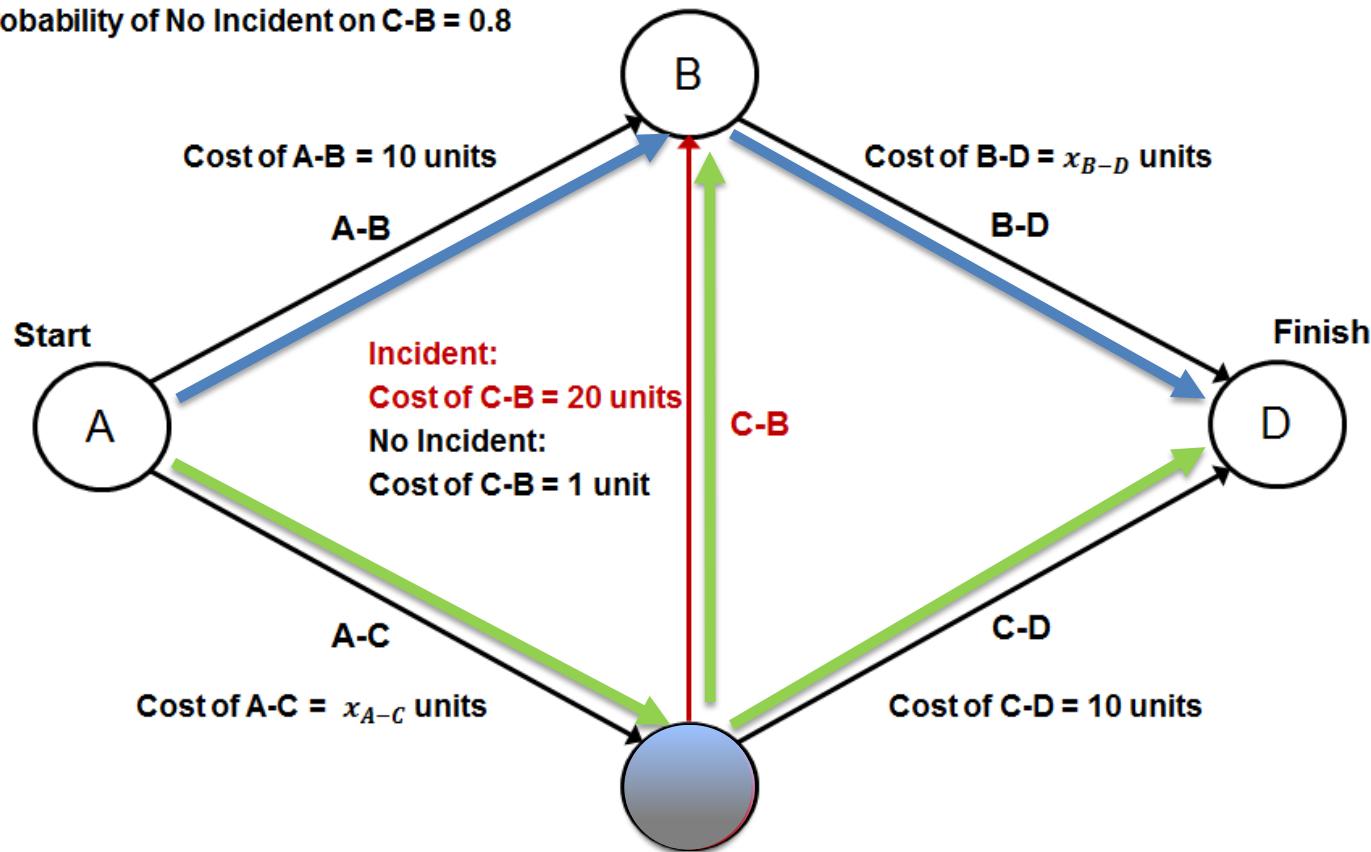


Figure 1 - Traffic Network of Game 1

# Experimental design

- Groups of 12 participants, 6 sessions of 24 participants each (144 subjects),
- 2 treatments : No Information, Full Information
- 20 periods for each treatment, within-subject design, partners matching, randomized treatment order for each session (6),
- UNSW Australian School of Business.

# Experimental instructions

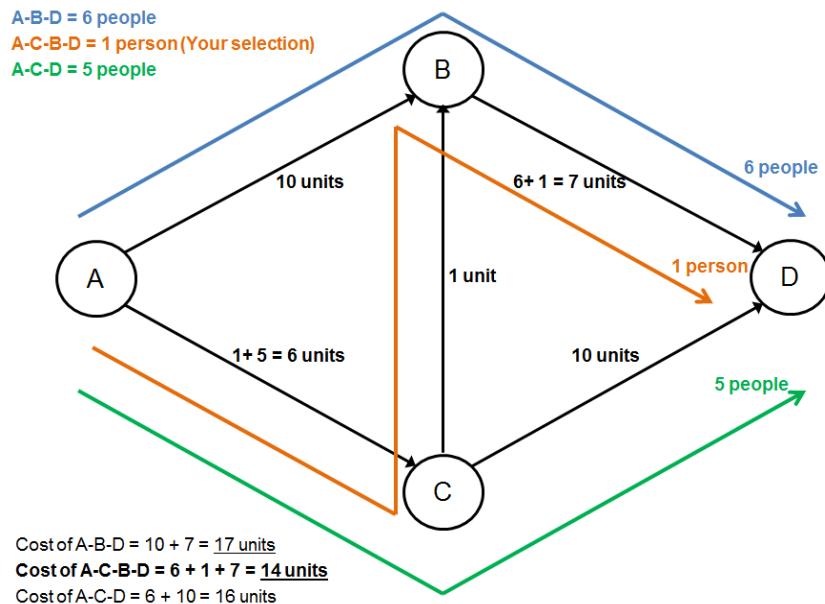


Figure 2 - Costs of Routes (No Incident on C-B), Round 1

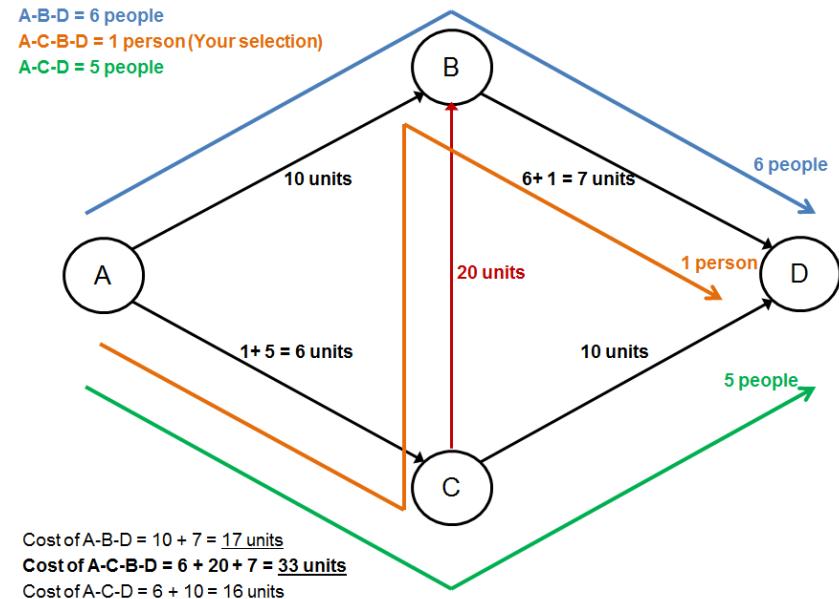


Figure 3 - Costs of Routes (Incident on C-B), Round 1

# Nash Equilibrium

	No Information		Full Information		
	n	EC	n		EC
			S1	S2	
A-B-D	6	16	4	4	18
A-C-D	0	--	8	3	18
A-C-(B)-D	6	16	0	5	18
Total expected travel cost		192			216

# Some results

**Table 4.** Comparison of empirical and theoretical path utilization.

Treatment 1: No Information					Treatment 2: Information provided at Node C				
	State	A-B-D	A-C-B-D	A-C-D		State	A-B-D	A-C-B-D	A-C-D
EUE Solution	E(S1,S2)	6	0	6		S1	4	0	8
Observed Mean Path Flow	S1	4.896	2.188	4.917	UER Solution	S2	4	5	3
	S2	5.130	1.688	5.182		S1	4.292	0.146	7.563
	Overall	5.083	1.788	5.129		S2	4.286	4.828	2.885

**Table 5.** Comparison of mean travel costs between treatments.

	Treatment 1: No Information	Treatment 2: Information Provided at Node C	
State	E(S1,S2)	S1	S2
Cost of A-B-D	16.871	14.438	19.115
Cost of A-C-B-D	18.588	32.146	17.828
Cost of A-C-D	16.917	17.708	17.714
Observed TSTC	210.629	219.163	
$\sigma_{TSTC}$	24.948	15.470	
Theoretical TSTC	192	216	

# Discussion

- US GAO – US Gov. Accountability Office - (2009):
  - « To establish the Real-Time System Management Information Program, DOT's Federal Highway Administration (FHWA) issued a proposed rule in January 2009 that, when finalized, could improve the coverage, quality, and sharing of traffic information »,
  - « State and local government officials GAO interviewed said that these improvements would allow the public to better select the most efficient route to reach their final destination, which could reduce congestion and yield other benefits »
    - <http://www.gao.gov/products/GAO-10-121R>

# Conclusion

- Promoting Lab economic experiments where economist compares to an engineer in order to improve *ex ante* policy evaluation,
  - By eliciting economic values for goods & services for which it is difficult to use direct market prices (distorted prices) or indirect market prices (no clear substitutes, etc.),
  - By simulating policy effects on individual decisions and relevant costs and benefits.