Can Multimodal Real Time Information Systems Induce a More Sustainable Mobility?
The potential of ATIS to influence mobility behaviour has hitherto rarely been researched (Gotzenbrucker and Kohl, 2011; Chorus et al., 2006)

- Not easy to define and document ATIS impacts
- Quantifying ATIS benefits is difficult, lack of real-world environments.
  → surveys, field experiments or simulations and assignment methods (Williams et al., 2008)

The ATIS assessment is not only a technological, but also a social process
Objective

• Evaluate an ATIS from the travellers’ point of view, to understand their effect on travel behaviour.
  
  • OPTIMOD’LYON: multimodal real-time urban navigator on Smartphone.
    
    • tested in Lyon in October 2013 and launched in May 2015 → working on Android, Iphone, WindowsPhone
    
    • In 2017 the system is still active and has more than 10000 downloads
Lyon navigator: OPTIMOD’LYON

**Bike sharing (Vélo'v) and bikes**

**Public Transport (TCL, buses Rhône, Ain, Isère)**

**Trains**

**Planes**

**Road Traffic**

**Parking**

**ONE HOUR TRAFFIC PREVISION**
The innovation

MULTIMODAL CALCULATOR

All the solutions to go from A to B, according to the user profile
Leaving in 15’, 1h for the whole solutions
Detail of each solution with the stops, and leaving sooner or later
Possibility to define the departure or arrival time
Hypothesis

• Multimodal information can influence intention to change mode and later behaviour and disrupt past behaviour

• OPTIMOD’Lyon will be used to plan systematic trips
Theoretical behaviour framework

- Habit, Automatism, Past Behaviour (Godin, 1991; Triandis, 1977)

- Reasoned character of the behaviour
  - Theory of the Reasoned Action (Ajzen and Fishbein, 1975)
  - Theory of Planned Behaviour (Ajzen, 1985)

- Intention → Behaviour

- Attitude → Subjective Norms → Perceived behavioural control → Intention

- « break the scheme » of habits (Bamberg et al, 2003)

- Information if relevant and convincing can affect
Methodology

• 50 participants selected by a specialized agency (46 arrived to the end of the project)
• 5 month (June to October 2013)
• It was offered an S3-mini to all participants
• Asked to use OPTIMOD’Lyon as much as they could
Survey design

• **Quali-quantitative approach** based in two tools that worked in a integrated way:

  1. **Questionnaire**

     Similar questions on both before and after surveys divided in four sections:
     - Personal mobility habits,
     - Personal Attitudes related to mobility,
     - Familiarity and interest for technological tools,
     - OPTIMOD’Lyon application.

     Web-based using Google Drive platform

     5 points Linkert-scale

  2. **Focus group**

     • Similar pattern of the questionnaires
     • Investigates in depth the issues contained in the questionnaires and bring to light new ideas
     • 6 focus groups (7-9 participants) discussion about 3 hours each (2 times)
Sample

- Were selected according to a stratified sampling plan
  - Variables: gender, age, occupation, education, travel pattern

- 50 participants (selected by a specialized company)
  - Evenly gender balanced (25 males and 25 females)
  - Age ranged from 23 to 68 years-old
  - 37 of the most frequent trip was to work
  - 1/3 have a university diploma
  - 26 used the car daily
Data analysis

Statistical techniques using BMDP, SPSS and R:
- Descriptive Statistics
- Factor analysis to identify the TPB factors
- Logit regression to model intention based on the TPB factors
- Parametric and non parametric test to measure differences before and after the test

Cautions
- Small sample size
  - Ex-ante survey - 50 participants
  - Ex-post survey - 46 participants
- Normality assumption if:
  - Skewness and Kurtosis values range from -1.5 and +1.5
  - Z-score lower than absolute value of 1.96
- Many statistical technics require at least 100 cases
  - It was tried with our sample but gave unstable results
Results and Discussion

Before the test of the app
After the test of the app
Before the test of the app
Before the test

43 participants use the car at least one time per week

I would use more frequent the ... if I had real-time information

Increase the use of PT
No effects on Car and Bike-sharing use
Reasons for choosing the transport mode

Optimod’Lyon aims at inducing a modal shift, guaranteeing the rapidity and flexibility that participants are looking for.
### TPB - Behaviour constructs
(between the test)

<table>
<thead>
<tr>
<th>Items</th>
<th>Construction</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>I expect that my family and friends put me under pressure to reduce the environmental impacts of my travels</td>
<td>SN</td>
<td>.898</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I expect that my family and friends incite me to use OPTI MOD'LYON</td>
<td>SN</td>
<td>.762</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I expect that policy makers incite me to use OPTI MOD'LYON</td>
<td>SN</td>
<td>.754</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I expect that policy makers put pressure on me to reduce the environmental impacts of my travels</td>
<td>SN</td>
<td>.753</td>
<td>.346</td>
<td></td>
</tr>
<tr>
<td>I don't like driving for my most frequent trip</td>
<td>ATT</td>
<td>.883</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I don't like to travel by car</td>
<td>ATT</td>
<td>.882</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would use the PT more often if I had real-time information</td>
<td>PBC</td>
<td></td>
<td>.809</td>
<td></td>
</tr>
<tr>
<td>I would use more the Velov' if the real-time was available</td>
<td>PBC</td>
<td></td>
<td>.784</td>
<td></td>
</tr>
</tbody>
</table>

**Eigenvalues**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SN</td>
<td>2.713</td>
<td>1.795</td>
<td>1.286</td>
</tr>
<tr>
<td>ATT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Percentage variance explained**

- Principal Component Analysis
- Quartimax Rotation

16
Behavioral constructs and intention to change mobility habits before testing OPTIMOD’Lyon (before the test)

“I have the intention to change my travel habits”

Few participants declared the intention to change their travel habits

<table>
<thead>
<tr>
<th>Stated Intention</th>
<th>Constructs</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain transport habits (n=27)</td>
<td>ATT</td>
<td>3.259</td>
</tr>
<tr>
<td></td>
<td>SN</td>
<td>2.704</td>
</tr>
<tr>
<td></td>
<td>PBC</td>
<td>2.685</td>
</tr>
<tr>
<td>Change transport habits (n=9)</td>
<td>ATT</td>
<td>2.000</td>
</tr>
<tr>
<td></td>
<td>SN</td>
<td>2.750</td>
</tr>
<tr>
<td></td>
<td>PBC</td>
<td>3.278</td>
</tr>
</tbody>
</table>

PBC higher values for those who want to change are coherent with the theory
ATT lower value for those who want to change is consistent too
Ability of the TPB model to explain the intention to change travel habits (before the test)

A logistic regression → how TPB explains the intention of changing behaviour. Subjectives norms (SN), attitudes (ATT) and perceived behavioural control (PBC) have been included.

ATT and PBC significant

Forward stepwise method and backwise forward method

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Coefficient</th>
<th>SE</th>
<th>Coef/ S.E.</th>
<th>p-value</th>
<th>Exp(coef)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SN</td>
<td>-0.098</td>
<td>0.546</td>
<td>-0.179</td>
<td>0.858</td>
<td>0.907</td>
</tr>
<tr>
<td>ATT</td>
<td>1.100</td>
<td>0.433</td>
<td>2.54</td>
<td>0.000*</td>
<td>3.01</td>
</tr>
<tr>
<td>PBC</td>
<td>-1.021</td>
<td>0.549</td>
<td>-1.86</td>
<td>0.032*</td>
<td>0.360</td>
</tr>
<tr>
<td>Constant</td>
<td>1.597</td>
<td>2.19</td>
<td>0.730</td>
<td>0.466</td>
<td>4.94</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Coefficient</th>
<th>SE</th>
<th>Coef/ S.E.</th>
<th>p-value</th>
<th>Exp(coef)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATT</td>
<td>0.835</td>
<td>0.373</td>
<td>2.24</td>
<td>0.043</td>
<td>2.31</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.068</td>
<td>0.954</td>
<td>-1.12</td>
<td>0.302</td>
<td>0.344</td>
</tr>
</tbody>
</table>

\[
Pr[ Maintain] = \frac{e^{-1.068 + 0.835ATT}}{1 + e^{-1.068 + 0.835ATT}}
\]

Hosmer-Lemeshow test and C.C. Brown test

The model adequately fits the data (< 0.05)
Results before the test of the app

Introduction of OPTIMOD’LYON app under a **positive outlook**

- The participants stated they were able to use the technology
- When choosing a mode of transport the participants look for quickness and flexibility
- The majority of the participants were curious about this system
- The majority expected to save time thanks to the use of OPTIMOD’LYON
- The participants agreed that real-time information would increase PT ridership

**Expected impacts** of OPTIMOD’LYON on mobility were **relatively low**

- Few commuters intend to change transport mode
- OPTIMOD’LYON is perceived as helpful for occasional trips
- There is not willingness to pay for it
- They do not believe that OPTIMOD’LYON could favour a modal shift
Changes after the test
Changes in the use of the modes

Changes on the Most frequent trip

Mode use frequency

<table>
<thead>
<tr>
<th>Mode</th>
<th>Period</th>
<th>Wilcoxon test</th>
<th>p value</th>
<th>Changed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>Autumn/winter</td>
<td>.426</td>
<td>.670</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Summer/Spring</td>
<td>-.610</td>
<td>.542</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Weekend</td>
<td>-.832</td>
<td>.405</td>
<td>NO</td>
</tr>
<tr>
<td>PT</td>
<td>Autumn/winter</td>
<td>-1.604</td>
<td>.109</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Summer/Spring</td>
<td>-1.342</td>
<td>.180</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Weekend</td>
<td>-2.194</td>
<td>.028*</td>
<td>YES</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>Autumn/winter</td>
<td>-1.187</td>
<td>.235</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Summer/Spring</td>
<td>-.115</td>
<td>.909</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Weekend</td>
<td>-.816</td>
<td>.414</td>
<td>NO</td>
</tr>
<tr>
<td>Walking</td>
<td>Autumn/winter</td>
<td>2.543</td>
<td>.011*</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Summer/Spring</td>
<td>-2.614</td>
<td>.009*</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Weekend</td>
<td>-.818</td>
<td>.413</td>
<td>NO</td>
</tr>
</tbody>
</table>

Bicycle, Bike-sharing, Train and Kick scooter use did not significantly changed after the test.
**Behavioural constructs** (comparison before and after the test)

### TPB constructs

<table>
<thead>
<tr>
<th>Construct</th>
<th>ex_ante survey</th>
<th>ex_post survey</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Attitudes Towards Behaviour</td>
<td>3.00</td>
<td>1.234</td>
</tr>
<tr>
<td>Perceived Behaviour Control</td>
<td>2.98</td>
<td>1.197</td>
</tr>
<tr>
<td>Subjective Norms*</td>
<td>2.82</td>
<td>.957</td>
</tr>
</tbody>
</table>

*ex_ante and ex_post are significant

**ATT and PBC stable over time**
### Intention as behaviour predictor

**Intention to change before the experimentation**

<table>
<thead>
<tr>
<th>Intention</th>
<th>Observed change of most frequent mode</th>
<th>Percentage of Correct Prediction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Totally agree</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Agree</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Undecided</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Disagree</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Totally disagree</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Overall Percentage (without undecided)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Intentions were not a good predictor of actual behaviour**
### Use of OPTIMOD’LYON

<table>
<thead>
<tr>
<th>Participants claim that...</th>
<th>N</th>
<th>Participants report that...</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intend to use Optimod’ Lyon to plan occasional trips</td>
<td>45</td>
<td>Used Optimod’ Lyon plan for occasional trips</td>
<td>28</td>
</tr>
<tr>
<td>Intend to use Optimod’ Lyon to plan daily commuting</td>
<td>39</td>
<td>Used Optimod’ Lyon to plan for daily commuting</td>
<td>21</td>
</tr>
<tr>
<td>Used Optimod’ Lyon daily</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Differences between ex_ante and ex_post are significant

The use of OPTIMOD’LYON after the experimentation was lower than the expressed intention to use it

Used more for occasional trips rather for daily commute, in line Bonsall and Joint (1991)
Conclusions

- The **past behaviour** has induced the future behaviour
  - stability of modes use
  - the stability of attitudes and of perceived behavioural control can explain the stability of the observed behaviour
  - OPTIMOD’LYON has **not disrupted the routine behaviour** and it has **not induced a reasoned action**

- The results confirm previous studies: the application is mainly used for **occasional trips**

- Without **complementary measures** information can have little or no impact towards a more sustainable mobility [focus group suggestions]
  - **Environmental feedback**
  - **Gamification** that rewards sustainable behaviour
  - Policies that restricts car use
  - Investments in public transport
Follow-up

• “Positive” measures projects
  • GoEco!  
    - The project investigates if and how information feedback and social interactions (social comparison and peer pressure) can be effective in fostering changes in personal mobility behavior.
    - Preliminary results show weak but significate change ($p < .05$) in systematic trips of 33 gCO2/km and 0.14 Kwh/Km in the Ticino Canton. In the other Living Lab, Zurich no significant changes were observed.

• Bellidea
  - Co-creation with Bellinzona (capital of Ticino Canton) citizens of a tool to improve mobility alternatives to car.
    - An app with persuasive tools is under construction and is been tested with the citizens.
    - More information: http://www.bellidea.ch/
Thanks for your attention

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