"Models of pedestrian behaviour and safety" - Overview of the PEDMOD research project

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Background

❖ A research project implemented within the framework of the Action «Supporting Postdoctoral Researchers» of the Operational Program "Education and Lifelong Learning" (Action's Beneficiary: General Secretariat for Research and Technology), and is co-financed by the European Social Fund (ESF) and the Greek State.

❖ Duration: 2012 –2015

❖ Co-supervised by NTUA & IFSTTAR

Objectives

The objective of this Post Doc research is the analysis of pedestrian crossing behaviour and safety along entire trips in urban road networks and the identification of related determinants.

❖ More specifically, this research aims to:

- develop models for estimating the probability to cross at each location along a pedestrian trip in relation to roadway, traffic and pedestrian characteristics,

- develop models for estimating the risk exposure of pedestrians as a result of their behaviour,

- incorporate the effects of human factors (pedestrians attitudes, perceptions etc.) on pedestrian behaviour and safety.

Work Programme

1. Review of pedestrian behaviour and safety models
2. Development of the methodology
3. Design of experiment and execution of pilot
4. Execution of experiment
5. Modelling pedestrian behaviour
6. Modelling pedestrian safety
7. Synthesis on pedestrian behaviour and safety
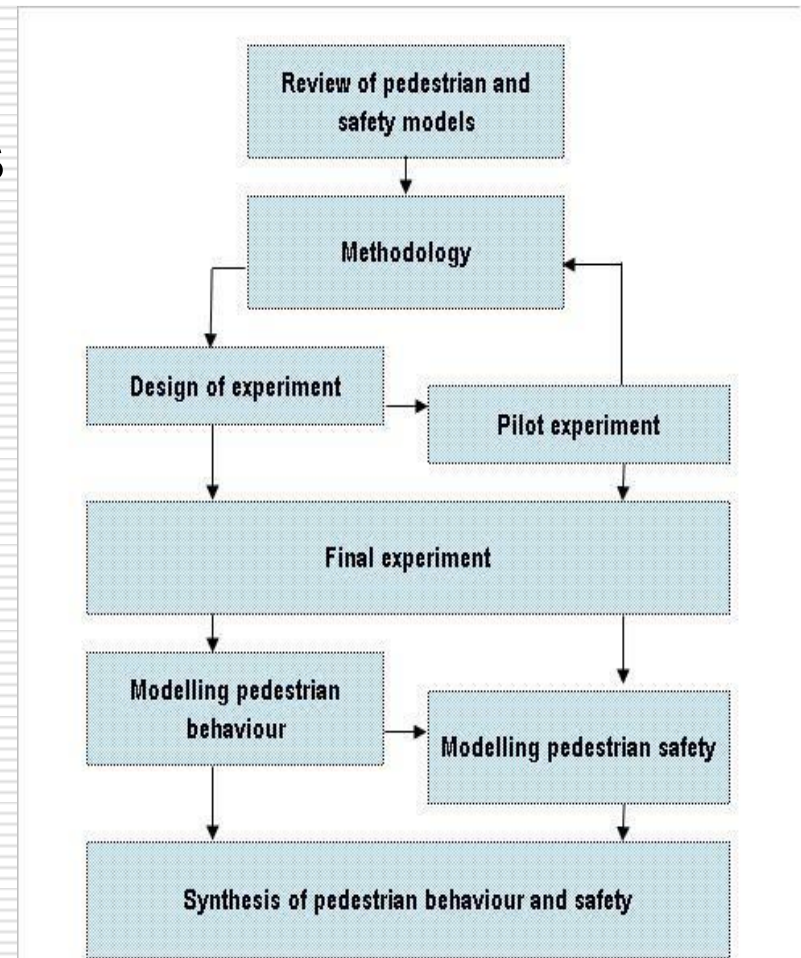
Methodology

❖ A methodological framework **building on previous research** carried out by the members of the research team.

❖ Literature review allowing to formulate the **research hypotheses**.

❖ A **dedicated data collection scheme**: observation of pedestrian behaviour combined with declared attitudes, perceptions, behaviour etc.

❖ **Explanatory models of pedestrian crossing behaviour** and risk exposure, based on different behavioural hypotheses.

Research hypotheses

❖ **Road and traffic factors of pedestrian behavior**

■ **Road type:**

❑ **Residential zones** (minor urban roads): pedestrians will choose the shortest path, due to lack of constraints and vehicle-pedestrian interaction.

❑ **Major urban arterials**: all pedestrians will opt for a protected crossing at junction.

❑ **Mixed urban area** (secondary roads): more variation is expected behavior.

■ **Traffic flow:**

❑ **No traffic**: pedestrians will choose the shortest path.

❑ **Low traffic**: increased probability of crossing at mid-block or diagonally,

❑ **High traffic**: increased probability of a protected crossing at junction.

❑ **Congestion**: pedestrians are likely to cross 'between' stopped vehicles.

Research hypotheses

❖ **Road and traffic factors of pedestrian behavior**

■ **Traffic control:**

❑ **Traffic signal**: leads to increased probability of crossing at junction.

■ **Infrastructure design**

❑ **Obstacles and barriers**: obstacles (illegally parked vehicles, roadside barriers), or **local design elements** may lead pedestrians to a deterministic choice**.**

Research hypotheses

❖ **Human factors of pedestrian crossing behavior**

■ **Demographics:**

❑ **Younger and male** pedestrians are more risk-taking and less compliant.

❑ **Low income**, perceived social inequality and the lack of alternatives to walking may lead pedestrians to more aggressive behavior.

■ **Travel motivations:**

❑ Positive relationship between **walking frequency / distance travelled** and crossing behavior is assumed.

❑ Pedestrians **walking for health / pleasure** are more safety conscious.

Research hypotheses

❖ **Human factors of pedestrian crossing behavior**

■ **Risk perception and value of time:** different types of pedestrians

❑ ones that **minimize the number of crossings** and increase the trip length to avoid vehicles

❑ others who maximize the number of crossings in order to **minimize the length of the trip**

■ **Interaction with other road users:**

❑ imitation and **leader / follower** effects

❑ **opinion towards drivers** : pedestrians with negative opinion on drivers are more likely to be careful and compliant

Survey design

- ❖ Pedestrians were followed along urban trips, and their crossing behavior was recorded, together with features of the road environment and the traffic conditions.
- ❖ They were also asked to fill in a questionnaire.

- ❖ The field survey site is located at the Athens central area, from Evangelismos metro station to Kolonaki square.
- ❖ The pilot survey (7 individuals) took place on July 2013
- ❖ The final survey took place on September – November 2013

Survey scenarios

❖ Eight crossing scenarios: fractional factorial design

*[road type * traffic flow * traffic control]*

❖ **Scenarios (i) and (viii)**: Crossing a main urban road with signal controlled and uncontrolled crosswalks

❖ **Scenarios (ii), (v), (vi) and (vii)**: Crossing a minor (residential) road with or without marked crosswalks:

❖ **Scenarios (iii) and (iv)**: Crossing a major urban arterial with signal controlled crosswalks

Survey questionnaire

- Section A: Demographics
- Section B: Mobility and travel motivations
- Section C: Attitudes, perceptions and preferences
- Section D: Self-assessment and identity
- Section E: Behavior, compliance and risk taking
- Section F: Opinion on drivers

- ***Details in presentations to follow***

Survey participants

- **75 participants** recruited among students and graduates of the National Technical University of Athens (NTUA)

- 53% of the survey participants were males.

- Age distribution: 50% were 18-24 years old, 27% were 25-34, 20% were 35-45 and 3% were >45 years old.

Behaviour and safety analyses

❖ **Choice modelling:**

- Classical choice models and beyond
- Integration of human factors

❖ **Behaviour and trajectory analysis**

- Trajectory classification beyond classical approaches
- Multiple correspondence analysis

- *Details in presentations to follow*

❖ **Risk exposure analysis**