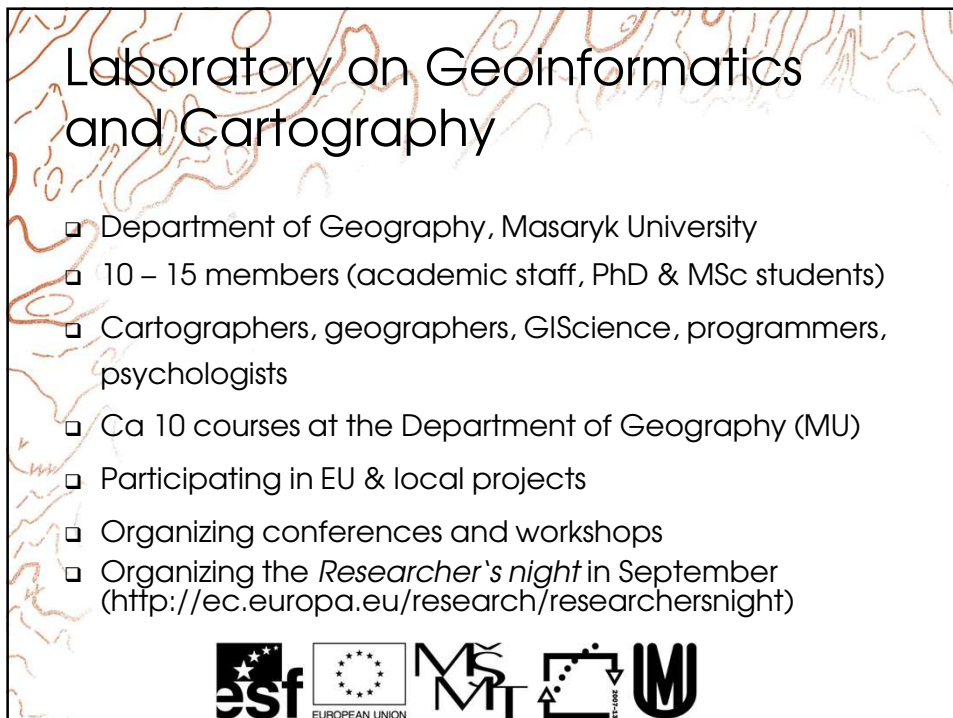




**Research on usability testing and cognitive issues of cartographic visualizations in the context of different groups of users**


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**Laboratory on Geoinformatics and Cartography**

- Department of Geography, Masaryk University
- 10 – 15 members (academic staff, PhD & MSc students)
- Cartographers, geographers, GIScience, programmers, psychologists
- Ca 10 courses at the Department of Geography (MU)
- Participating in EU & local projects
- Organizing conferences and workshops
- Organizing the *Researcher's night* in September (<http://ec.europa.eu/research/researchersnight>)



## Maps for crisis management

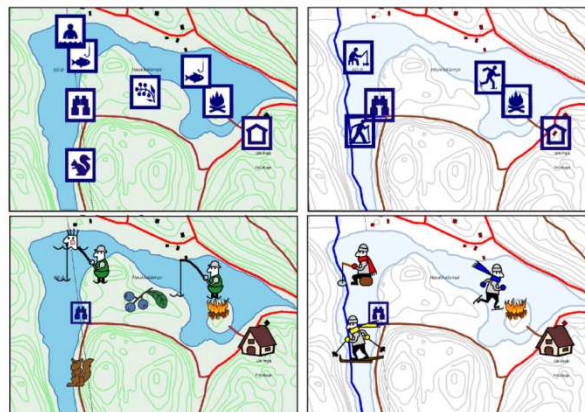
- Integrated rescue system (Fire brigade, Police, Emergency) uses different GIS and data from different sources (both public and private data)
- Maps for crisis management must be intelligible and enable quick and effective decision making
- It is obvious that different situations require corresponding (and different) cartographic visualizations ->
  - solved by **context cartography**: map content is changed dynamically, according to the situation and user's demands



## Context visualization

summer

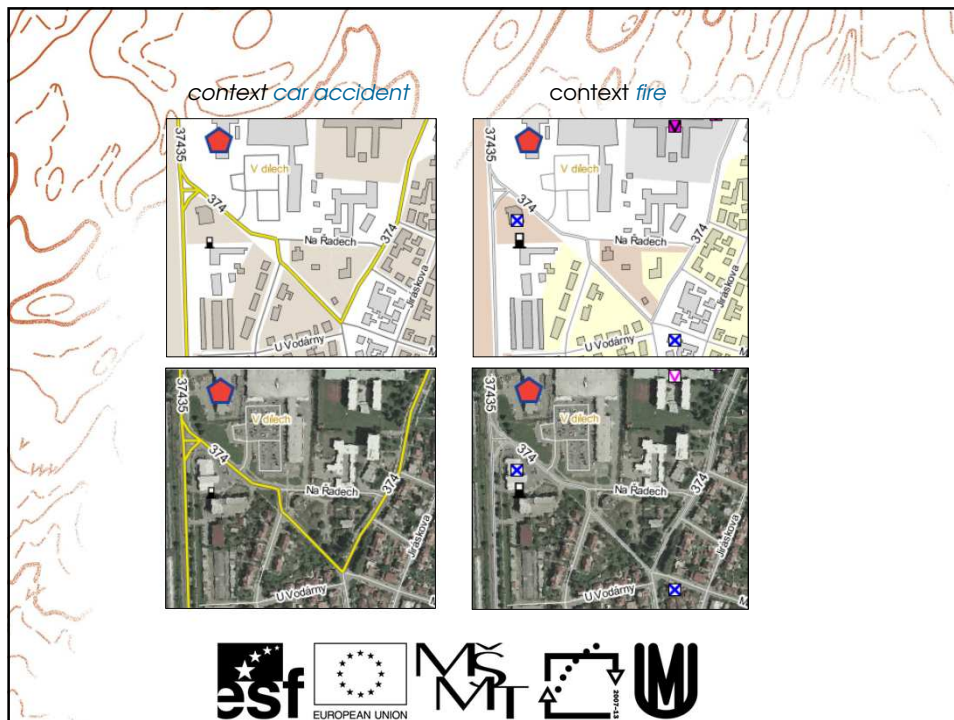
winter



adults

children





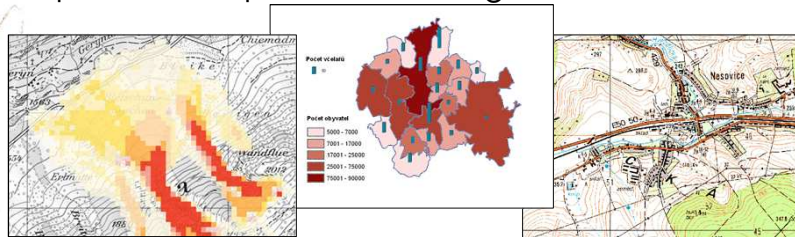
## Maps for emergency operators

- ❑ Most relevant symbols (crisis objects) → **figure**
  - ❑ Points symbols – high level of associativeness, intensive colours (high saturation, low lightness)
- ❑ Other symbols → **background information**
  - ❑ Mostly topographic information
  - ❑ Legibility should be suppressed
- ❑ User has better possibility to switch concentration between figure and background
- ❑ Relevancy of particular symbol could change according to a context
- ❑ Main idea from *Gestalt theory*



## Cartographic material

- ❑ Very complex stimulus
- ❑ Need of specific evaluation procedures
- ❑ Validity?
- ❑ Careful interpretation
- ❑ Emphasis on experimental design



## Usability testing

- ❑ Maps should be intelligible and enable quick and effective decision making
- ❑ Different situations require corresponding (and different) cartographic visualizations
- ❑ Context visualization
- ❑ Map creation -> evaluation -> Finalization
- ❑ Usability evaluation as an integral part of the map-making process



## Usability testing

- ❑ Proposal of a specific tool **Hypothesis** (based on previous version *MUTEP*)
  - ❑ Web-based application used for several experiments
  - ❑ Hypothesis is an application for test processing and their administration, as well as testing itself and results interpretation
  - ❑ Hypothesis offers also implementation of other tests, such as psychological tests etc.
  - ❑ The application has been developed with modern dynamic web solutions. Common internet explorers (IE, Mozilla etc.) can be used as user interface



## Usability testing

- ❑ Inspiration by psychological methodology and procedures
  - ❑ Combination of quantitative and qualitative methods
  - ❑ Dealing with the complexity issue in cartographic material
  - ❑ Adequate mixed research design could result in better understanding of cognitive strategies used by respondents
  - ❑ Mixed research design via combination of Hypothesis application + Eye-tracking analysis
- **more objective evaluation of cartographic visualizations**



## Objective evaluation?

- ❑ Improved map designs could be only achieved through the improvement of map creation processes
- ❑ Evaluation as a valuable feedback
- ❑ Evaluation results are affected by the used methodology
- ❑ Objectivity of the traditional evaluation methods?
- ❑ Interdisciplinary cooperation
- ❑ Interactive testing environment
- ❑ Combination of research approaches



## Mixed research design

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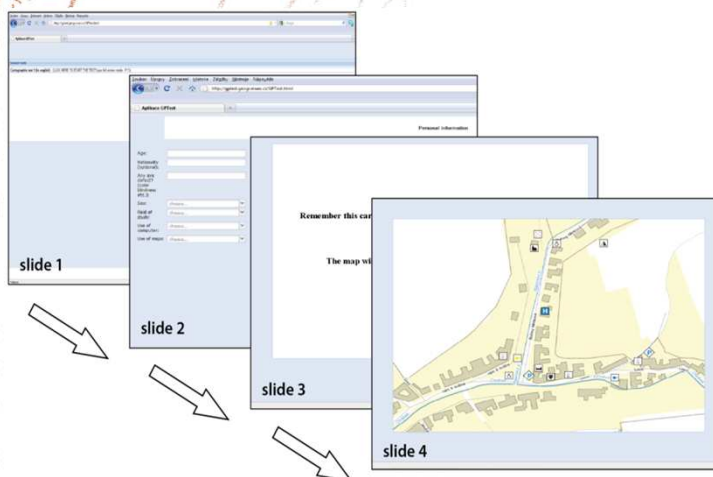
# Quantitative approach

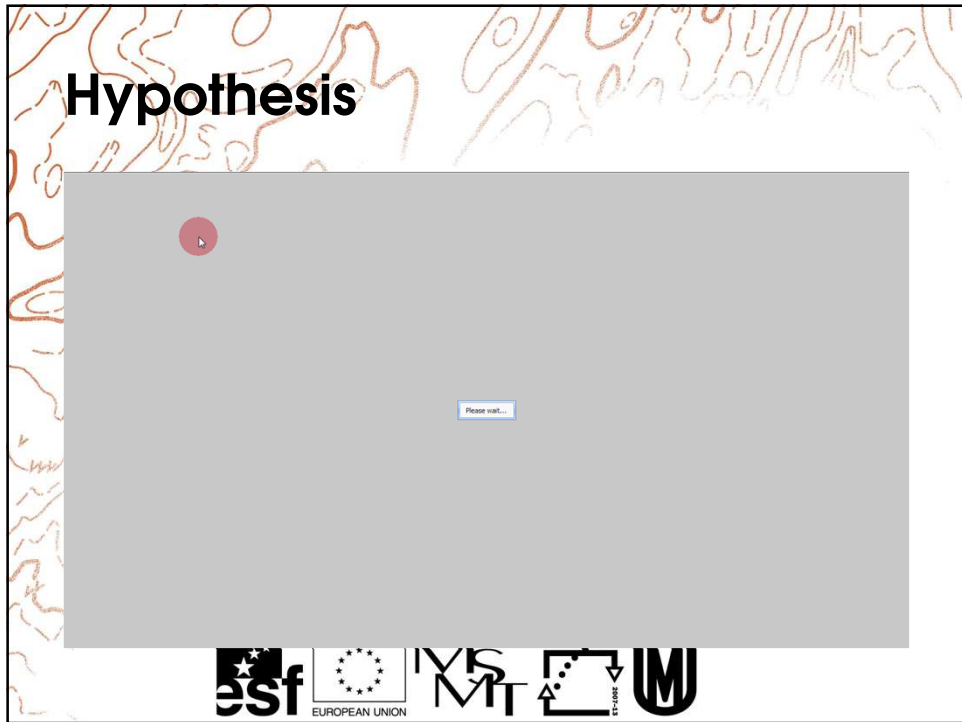
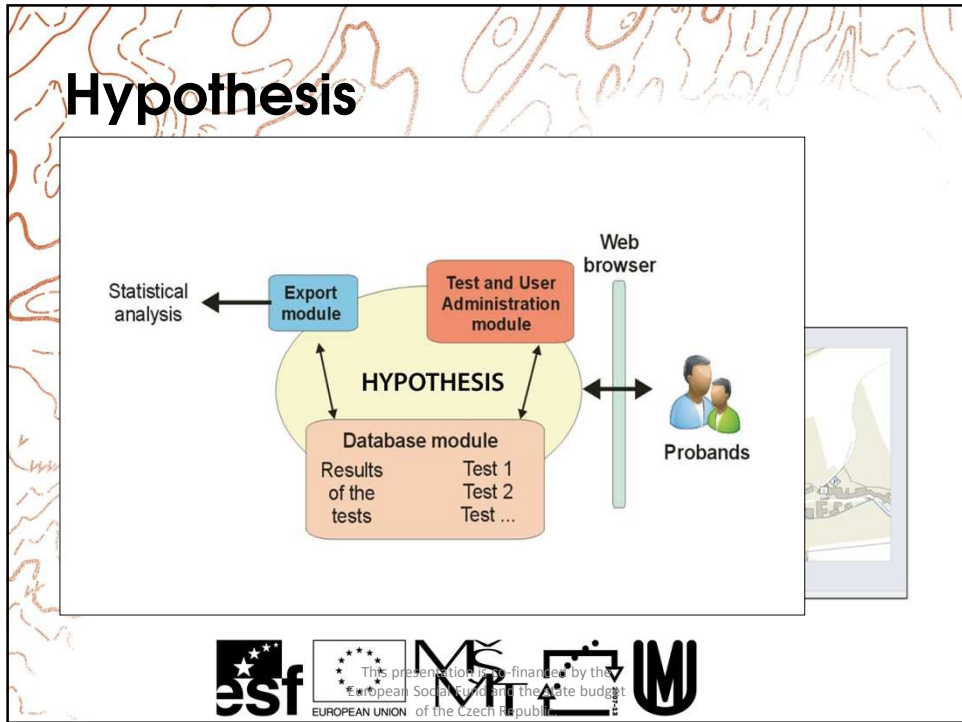
- ❑ Maximizing the objectivity of the evaluation through the exact quantification of the selected variables
- ❑ Quantitative data collection
  - ❑ online experiment builders
  - ❑ Hypothesis
- ❑ Observation of the user's performance
  - ❑ response time
  - ❑ accuracy
- ❑ Psychological testing
- ❑ Subsequent statistical analysis



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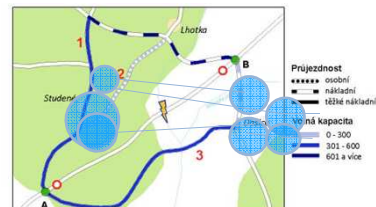
## Qualitative approach

- ❑ Helping with the interpretation of the quantitative analysis results (exploratory data analysis)
- ❑ Observation of cognitive strategies
- ❑ Exploration methods revealing previously unnoticed patterns and associations.



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- ❑ Helping with the interpretation of the quantitative analysis results (exploratory data analysis)
- ❑ Observation of cognitive strategies
- ❑ Exploration methods revealing previously unnoticed patterns and associations.
- ❑ Use of Eye-tracking system



## Conclusion and outlook

- ❑ Incomplete results could lead to incorrect interpretation
- ❑ The combination of both approaches represent a partial objectification of the evaluation process
- ❑ Standardisation of the testing methodology
- ❑ Further development of the Hypothesis tool (better functionality):
  - ❑ interactive maps
  - ❑ real-time feedback to a respondent
  - ❑ test branching



## Conclusion and outlook

- ❑ ICA Commission on Cognitive Visualization
- ❑ ICA Commission on EW and CM
- ❑ Discussions with appropriate authorities about a possible improvement of the used visualizations
- ❑ Extension of the interdisciplinary research team
- ❑ Cognitive aspects of the usability aspects (cognitive styles of the users, intercultural differences)



