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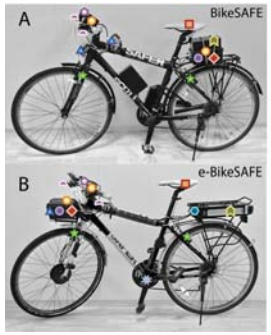
Naturalistic Cycling Studies: What Are They, and How Do They Relate to Naturalistic Driving Research?

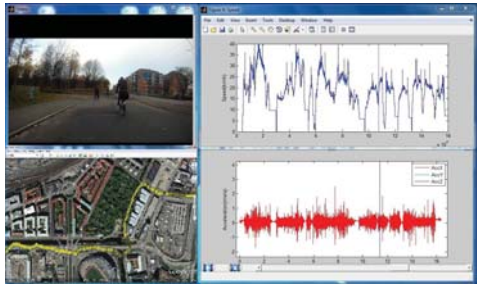
Aim of this paper/poster is to analyse the naturalistic cycling methodology, based on experience gathered in studies at TU Chemnitz (Germany) and Chalmers University of Technology (Sweden), and highlight the major differences to naturalistic driving studies (NDS). This analysis is structured according to the figure on the right, which we adapted from the FESTA (Field opErational teSt supporT Action) handbook (FESTA Consortium & FOT-Net, 2014). Input from the First Workshop on Naturalistic Cycling Analysis, Göteborg, Sept 3rd, 2013 was also included.

Heat map displaying cycling speed out of the Swedish NCS.

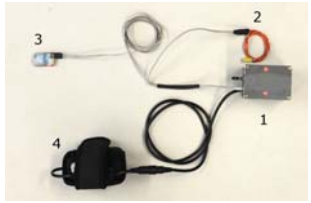


Installation Components:
- Data Logger
- GPS
- Inertial Measurement Unit
- Camera
- Brake Sensor
- Brake Switch
- Pedal Sensor
- Current Sensor
- Push Button
- Logging Switch
- Battery

Swedish NCS data acquisition system.



Analysis tool view out of the Swedish NCS. Top left: front view (video); bottom left: map view (GPS); top right: speed (speed sensor); bottom right: acceleration (IMU).



German NCS data acquisition system. (1) box with cameras and LEDs; (2) speed sensor; (3) GPS sensor; (4) battery package.

Video views out of the German NCS.

New research questions / new research focus
- mobility behaviour / mode choice
(e.g. "Which trips are made by bike? Why?")
- infrastructure use
(e.g. "Which infrastructure (road / cycling path / pavement) do cyclists use? Why?")
- increased relevance of physical fitness

Fewer knowledge from experimental studies - highly explorative

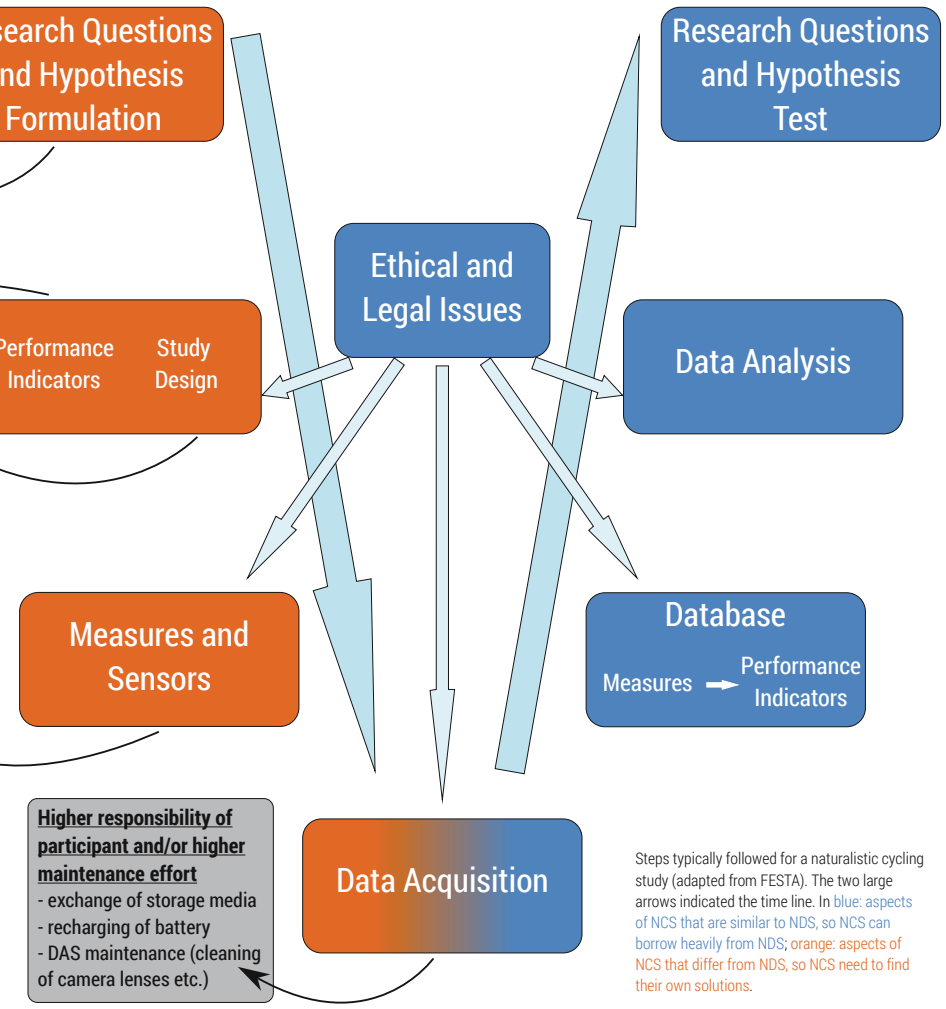
New defintions of criticality and conflicts required
- lower speed in general
- lots of interaction with other slow road users
- "eclectic" use of infrastructure

More constraints for research design due to technical limitations
- main issue: duration of data acquisition - see "Measures and Sensors"

Severe limitations
- weight / size
- battery life
- start / stop mechanism
- no on-board network
- conspicuity

Specific requirements
- weatherproof
- shock resistant

Higher responsibility of participant and/or higher maintenance effort
- exchange of storage media
- recharging of battery
- DAS maintenance (cleaning of camera lenses etc.)



Steps typically followed for a naturalistic cycling study (adapted from FESTA). The two large arrows indicated the time line. In blue: aspects of NCS that are similar to NDS, so NCS can borrow heavily from NDS; orange: aspects of NCS that differ from NDS, so NCS need to find their own solutions.

FESTA Consortium & FOT-Net (2014). FESTA Handbook. Version 5.

for the Swedish NCS:

Dozza, M., & Fernandez, A. (2014). Understanding bicycle dynamics and cyclist behavior from naturalistic field data. IEEE transactions on intelligent transportation systems, 15, 376-384.

Dozza, M., & Werneke, J. (2014). Introducing naturalistic cycling data: What factors influence bicyclists' safety in the real world? Transportation Research Part F: Traffic Psychology and Behaviour, 24, 83–91.

for the German NCS:

Gehlert, T., Kühn, M., Schleinitz, K., Petzoldt, T., Schwanitz, S., & Gerike, R. (2012). The German Pedelec Naturalistic Cycling Study – Study Design and First Experiences. In Proceedings of the International Cycling Safety Conference 2012, 7-8 November 2012, Helmond, The Netherlands.

Schleinitz, K., Franke-Bartholdt, L., Petzoldt, T., Schwanitz, S., Kühn, M., & Gehlert, T. (2014). Pedelec-Naturalistic Cycling Study. Forschungsbericht Nr. 27. Unfallforschung der Versicherer. Gesamtverband der Deutschen Versicherungswirtschaft e.V., Berlin.