A CPM-GOMS-model of lane changes on highways

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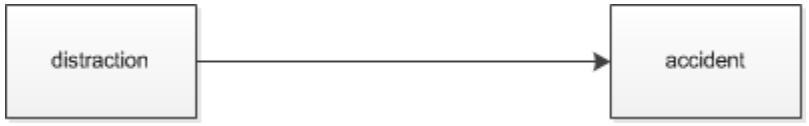
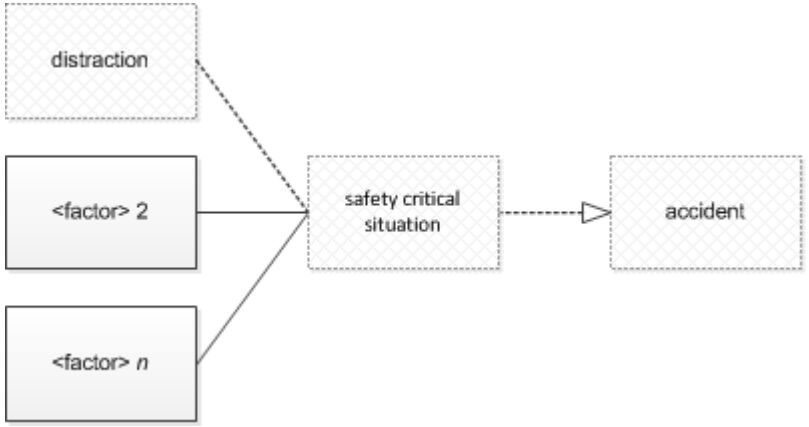
Agenda

1. Modelling of driver behaviour and distraction
2. A modelling workflow
3. Drive-GOMS
4. Empirical study
5. Motor operators
6. Outlook

Modelling of driver behaviour and distraction

Why do we study driver distraction?





"diversion of attention from the primary driving task"

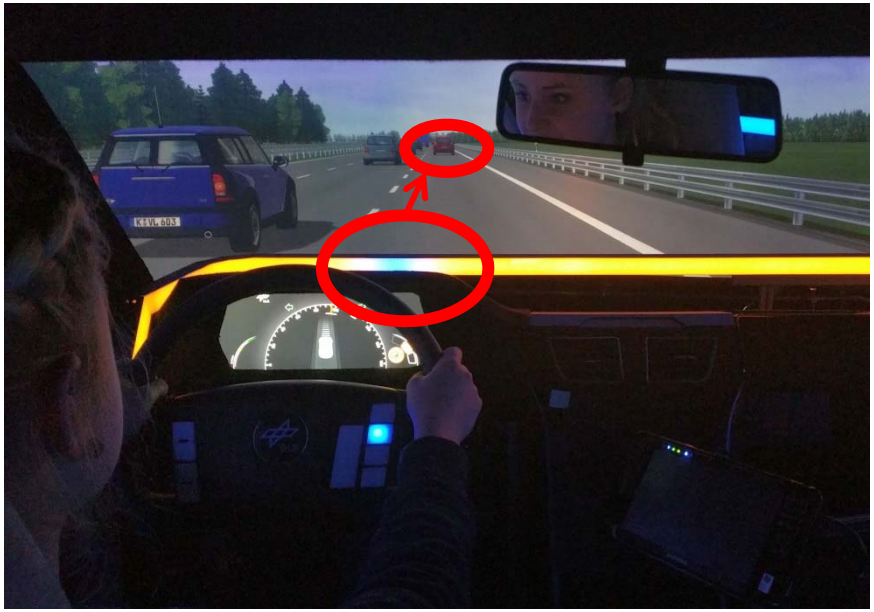
- due to an additional task
- reduction of situation awareness, decision making

Trezise et al. (2006)

Modelling of driver behaviour and distraction

Mitigating distraction

"Continental's concept vehicle recognizes **driver distraction** and is able to direct the driver's attention towards a dangerous situation."
Quelle



Ambient Light, Projekt "AdaptIVe", DLR 2016

Modelling of driver behaviour and distraction

Requirements

quantitative predictions

- computational
- functional

usability

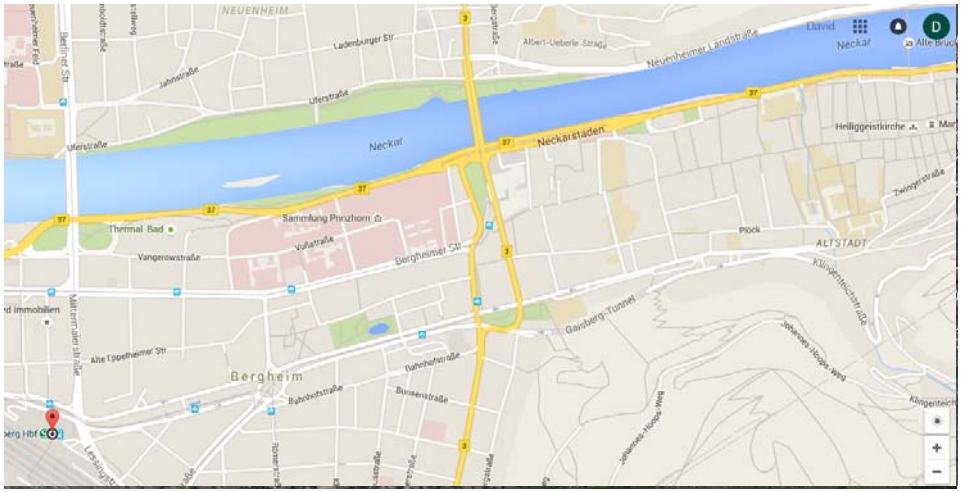
- effective
- efficient
- you can learn it on your own

specific support for design of

- driver information systems
- vehicle automation
- infrastructure

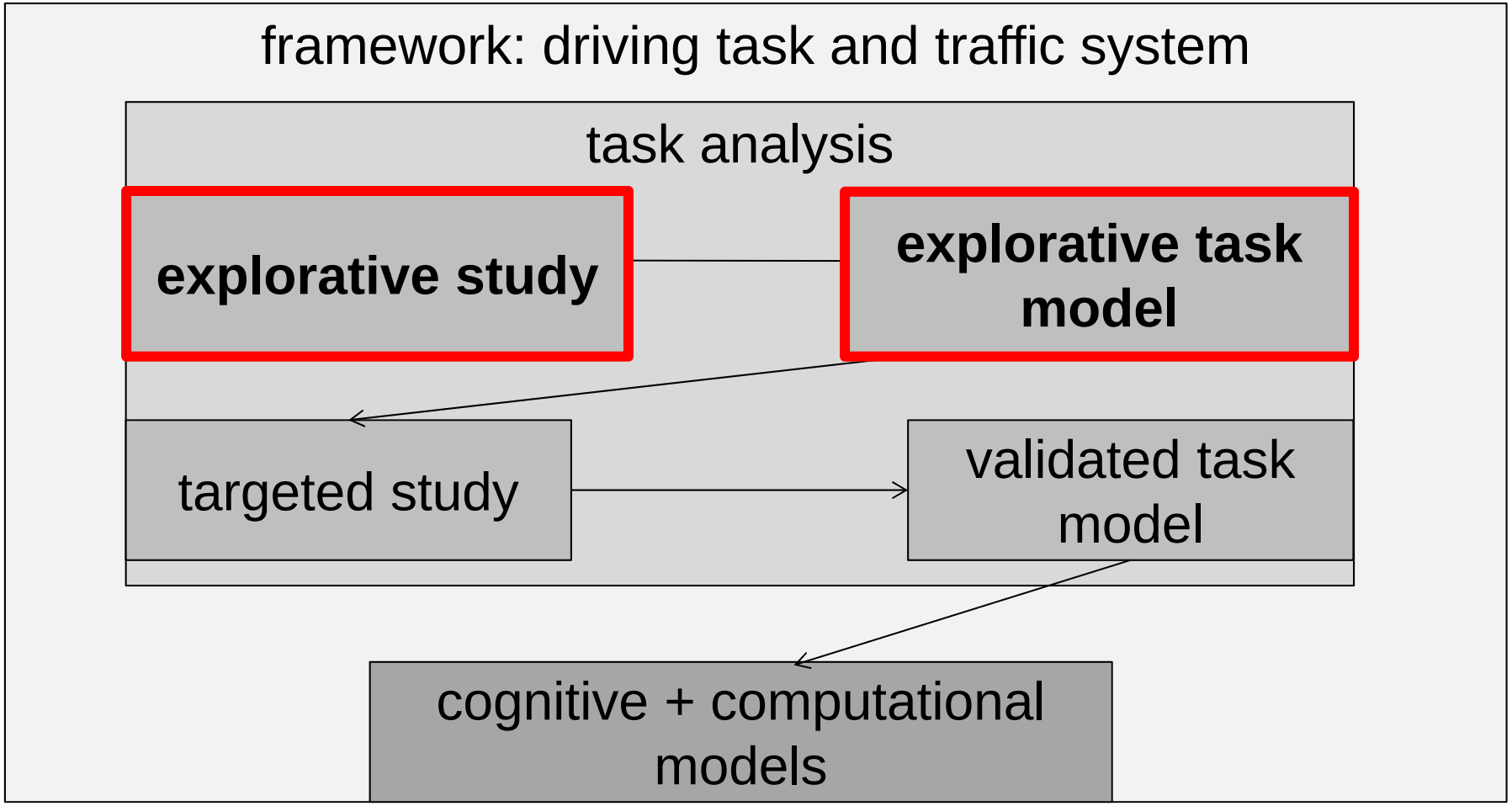
The appropriate level of abstraction

"Find the way from the main station to the TEAP."



There are no right or wrong models. Only useful / usable ones.

Modelling workflow

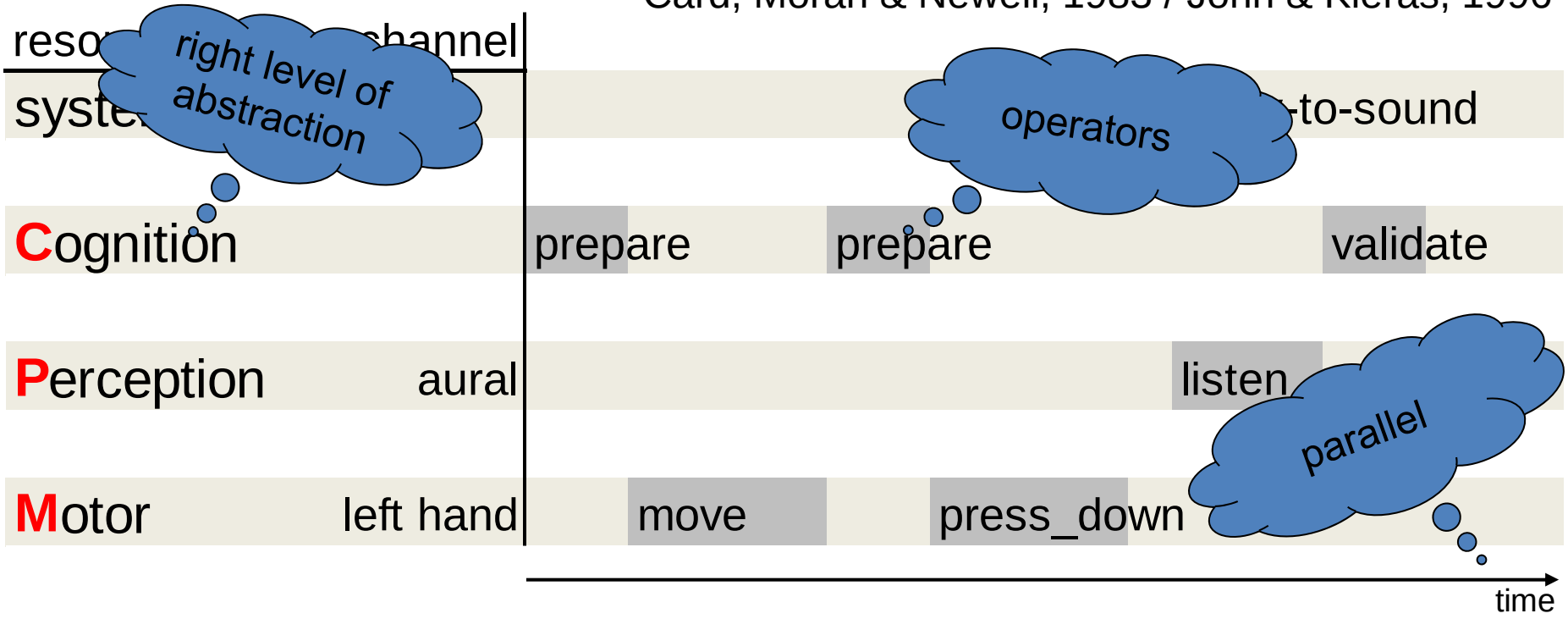


An example task

CPM-GOMS

Basic approach: CPM-GOMS

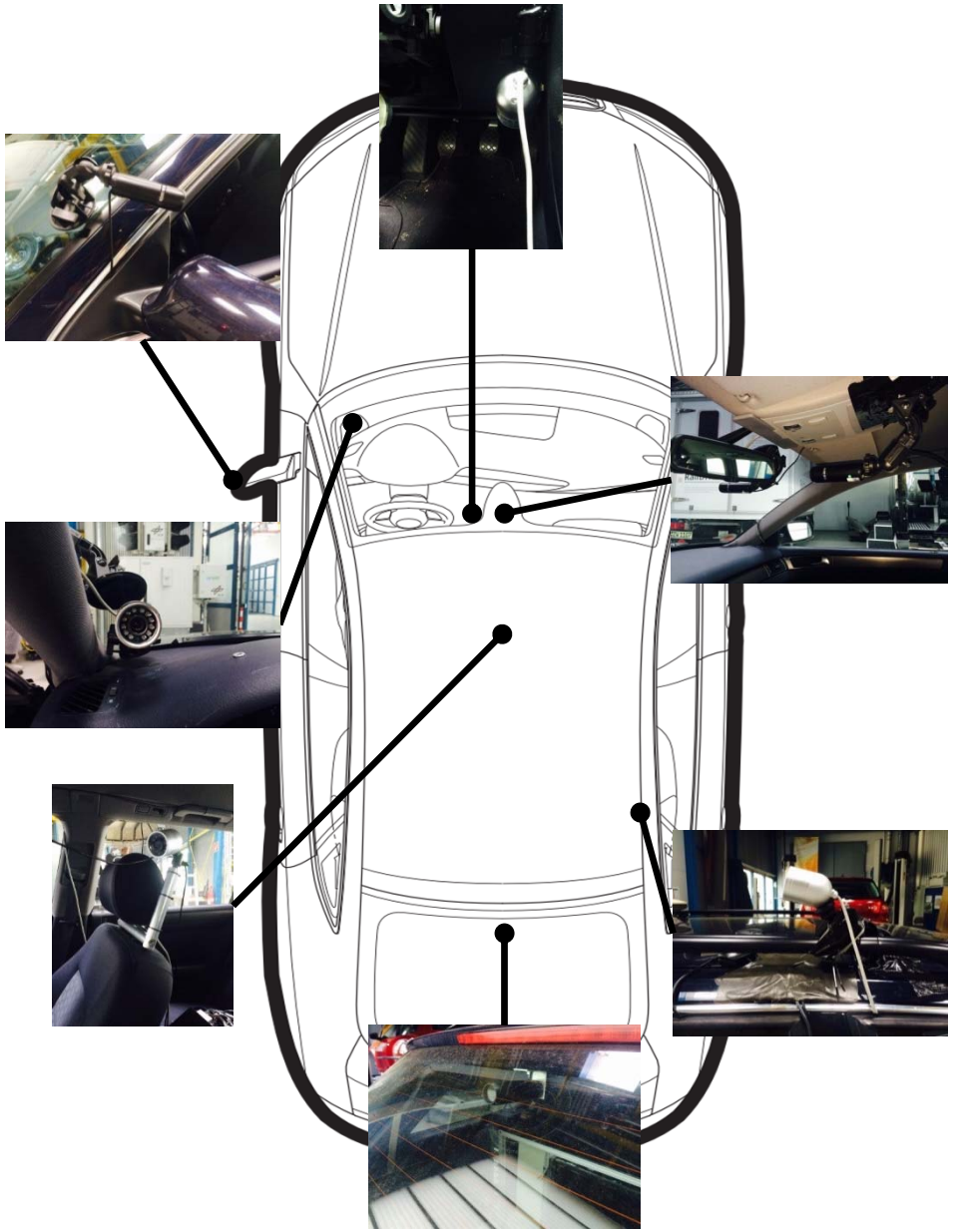
Card, Moran & Newell, 1983 / John & Kieras, 1996



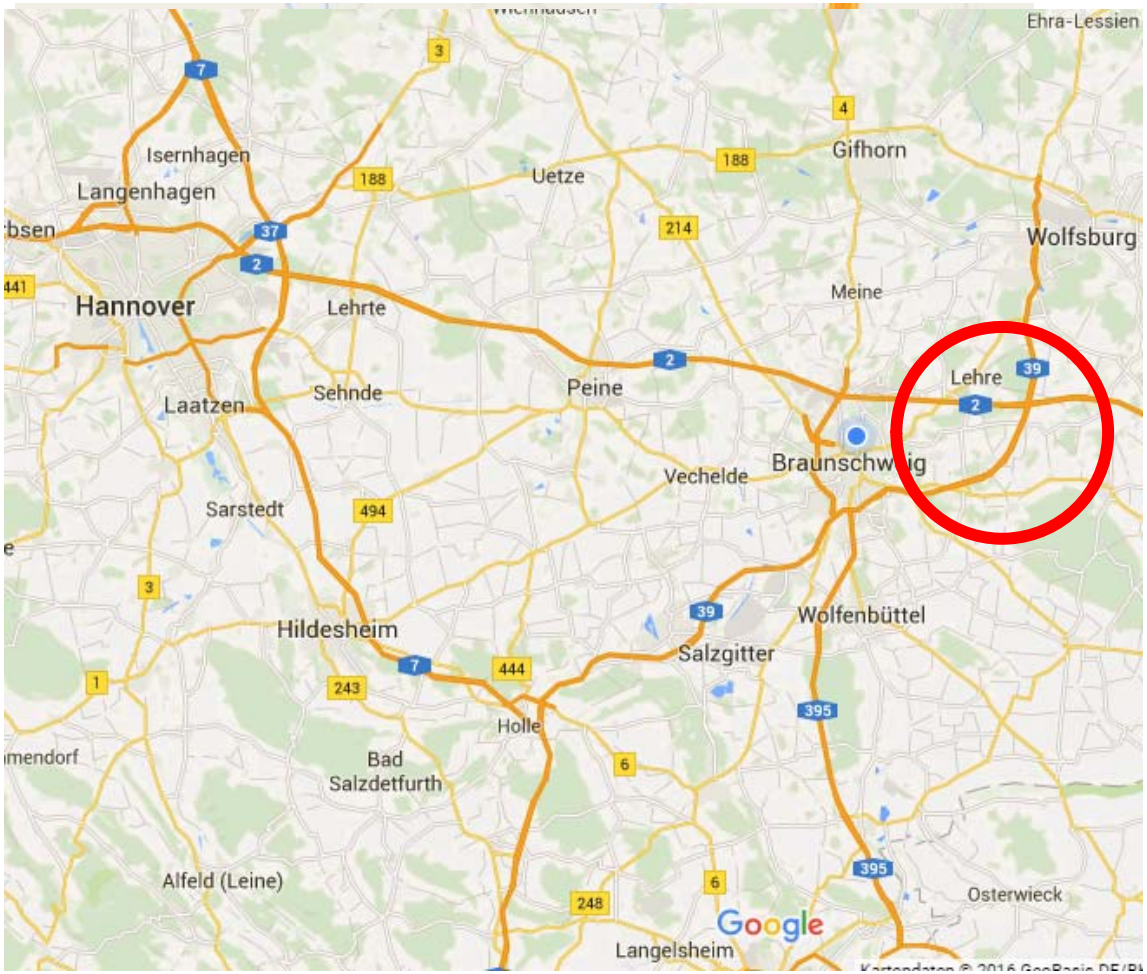
Empirical study

measuring vehicle "ViewCar"

- recording of all vehicle data
- 8 video cameras
- eye- and headtracking with Smart Eye Pro 6.1



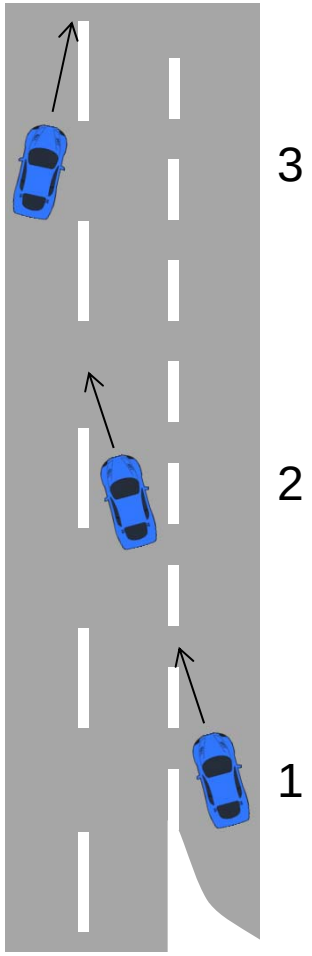
Empirical study



convenience sample:

- me, my colleague, and a student
- 33 / 31 / 22 years
- all sufficiently experienced drivers

Empirical study



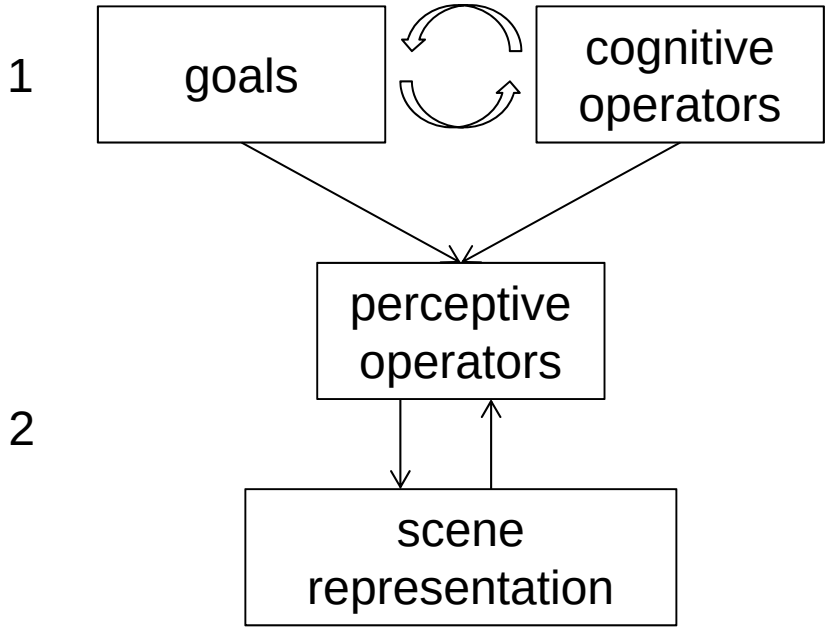
Motor operators: Template

resource	system unit	operator
right_foot	throttle	rest
		hold
		press_down
		release
	brake	rest
		hold
		press_down
		release
	floor	rest
	<from>:<to>	move
left_hand	non_functional_unit	rest
	steering_wheel	turn_left
		turn_right
		hold
	indicator_lever	prepare / be ready
		lift
		press
		tap_up
		tap_down
	<from>:<to>	move

Outlook: Drive-GOMS

automation and extension

- simulator study with fixed situations
- automated motor operator coding

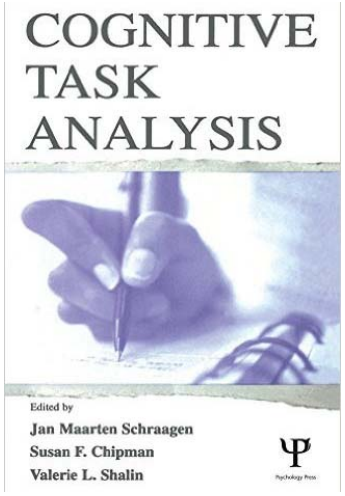


validation

What if you could *see* what your model does?

Will it work? We have to try!

"[To do] predictive human perfomance modeling (...), the real bottleneck is in the task analysis process. (...) What is missing, and badly needed, is a demonstration that one can start with a conventional task analysis (...) and then proceed systematically to a usefully accurate computational cognitive model, with no 'hand-waving' in between."



David Kieras & David Meyer
authors of the EPIC cognitive architecture

Thank you for your attention!

Drive-GOMS

Requirements

domain specific GOMS
- measurements for operators
- systematic relation to system elements
- integration of goals
- methods and selection rules

usability
- documented procedure for modelling of goals, cognitive and perceptual operators
- suitable statistical procedures to identify operator sequences

validation
- procedures for validation
- metrics for validation