

# *Executive functions contribution to older drivers performance*

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## Purposes of the study

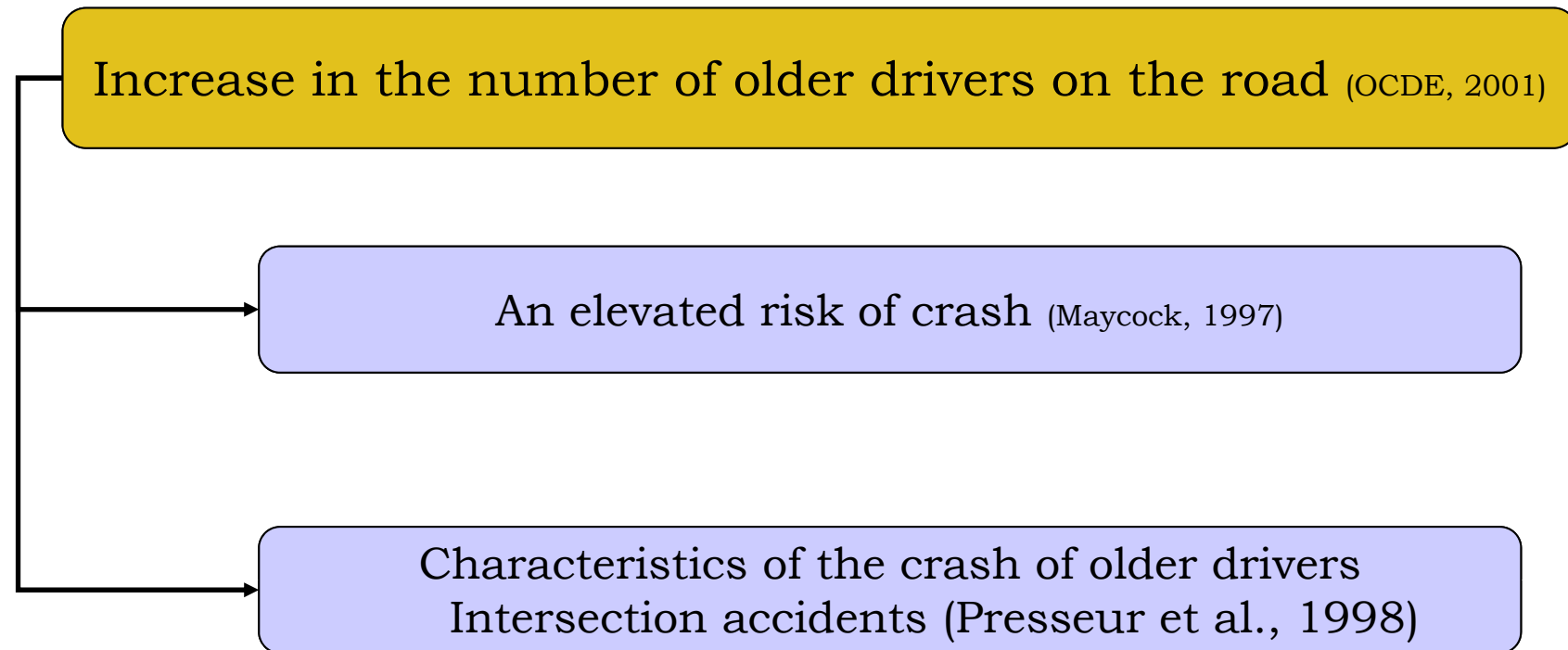
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**Evaluate the effect of aging on driving performance.**

**Evaluate the contribution of the executive functions to the driving performance in normal aging.**

## Specificity of the older drivers

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## What cognitive abilities affect driving among older people ?

### Divided attention

(De raedt & Ponjaert-Kristoffersen, 2001; Owsley et al., 1998 abilities )

### Selective attention

(De Raedt & Ponjaert-Kristoffersen, 2001;  
Richardson & Marottoli, 2003)

### Speed of processing

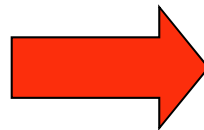
(Lundberg et al., 1998; Stutts et al., 1998)

### Visuospatial and constructional abilities

( Clark et al., 2000 ; Rizzo et al., 2001)

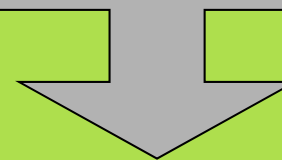
### Memory

(De Raedt et Ponjaert-Kristoffersen 2000; 2001)



### Limits

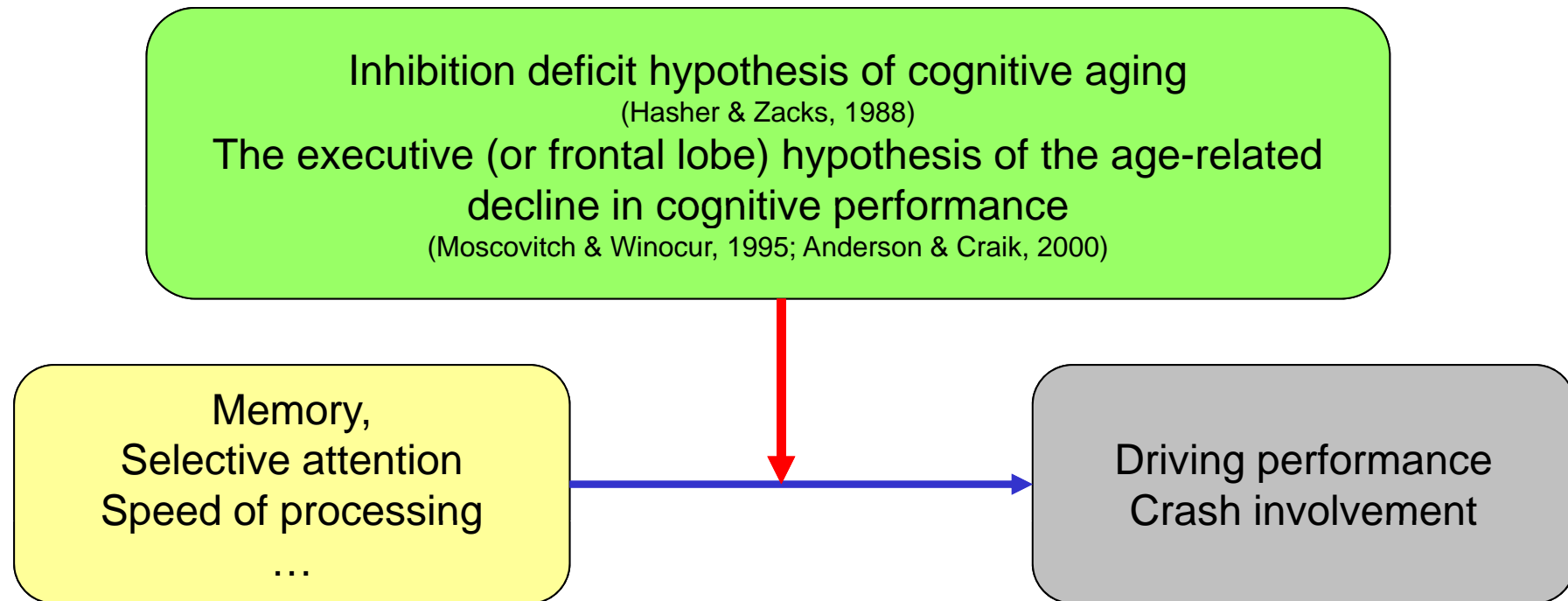
- Lack of distinction between normal and pathological aging
- Study undertaken to develop screening procedures for older drivers
- One test for assessing one cognitive function



### Lack of consensus

# Involvement of executive functions in driving performance ?

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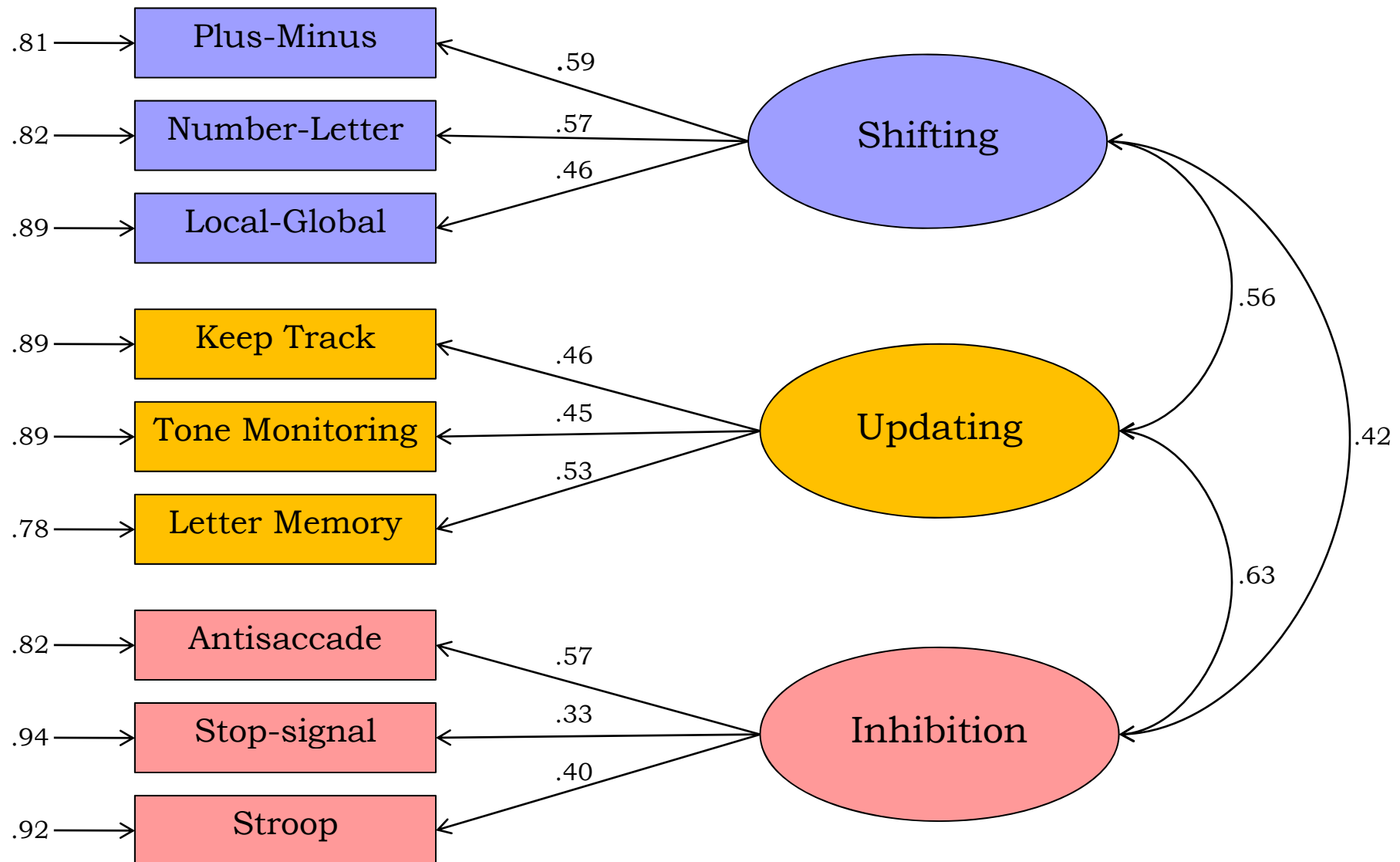
## Executive functions: definitions

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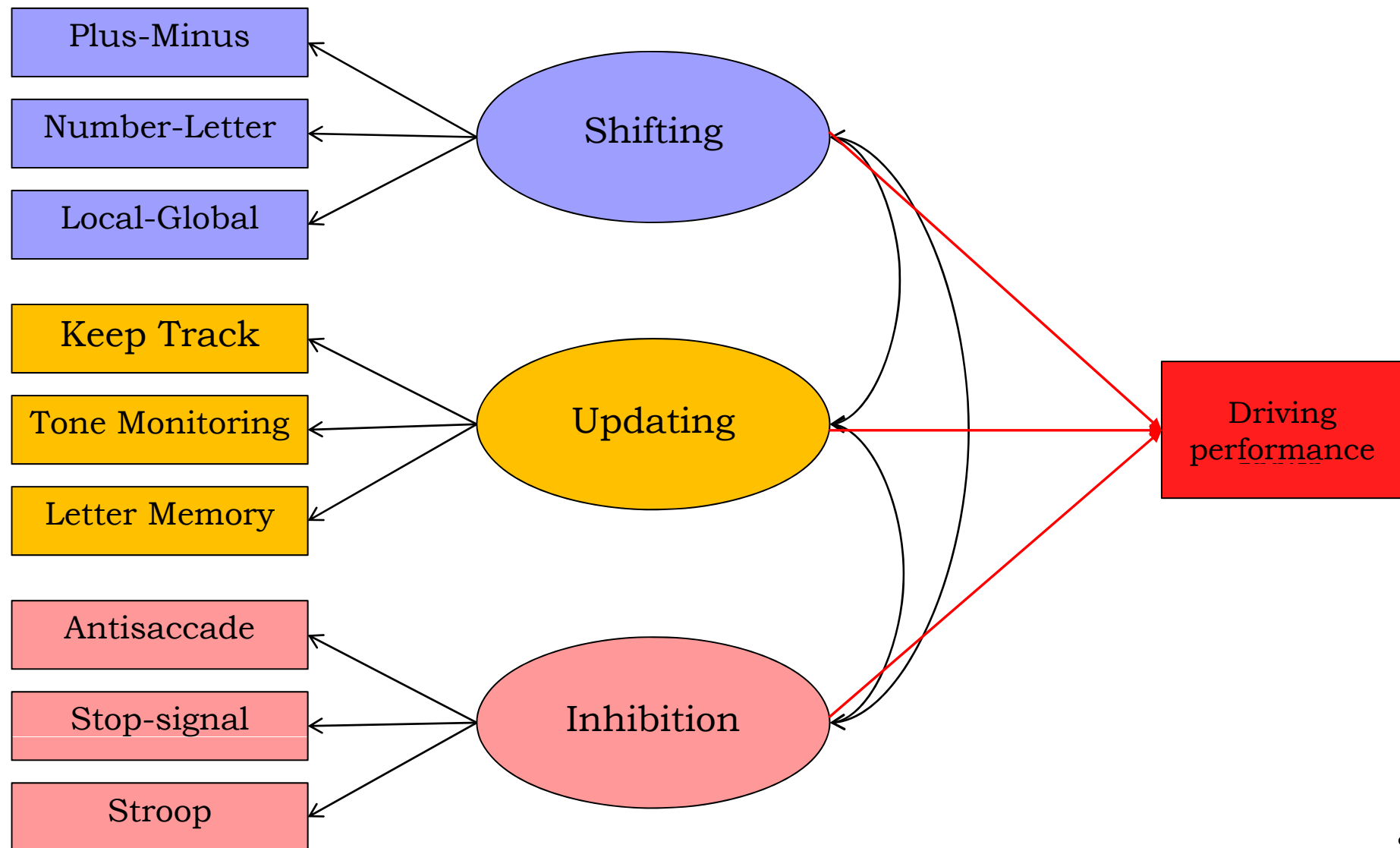
*« Executive functions are processes that control and regulate thought and action » (Friedman et al., 2006).*

*« Executive functioning encompasses a series of high-level processes, the main aim of which is to facilitate adaptation to new or complex situations, when highly practiced cognitive abilities no longer suffice » (collette et al., 2005).*

## The executive functioning model of Miyake et al. (2000)



# The executive functioning model of Miyake et al. (2000)





# Method

- ❑ Experiment on real road with an instrumented car
- ❑ 150 Miles
- ❑ Assessing driving performance with:  
test ride for investigating practical  
fitness to drive (TRIP)  
(De Raedt, 2000)



## Driving route and experimental phase



# Materials

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## **Simple executive tasks**

### **Inhibition tasks**

Stroop task (Stroop, 1935)

Incompatibility TEA (Zimmermann & Fimm, 1994)

Go/no-go TEA (Zimmermann & Fimm, 1994)

### **Shifting tasks**

Plus minus task (Jersild, 1927)

Number letter task (Roger & Monsell, 1995)

Flexibility TEA (Zimmermann & Fimm, 1994)

### **Updating tasks**

Letter memory task (Morris & Jones, 1990)

Operation span task (Turner & Engle, 1990)

Letter-number test (Weschler, 2000)

## Population

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- ❑ 126 drivers aged 20 to 82 years

Characteristics of the participants according to gender and age

| Age group | Young Drivers |       | Middle-aged drivers |       | Older drivers |       |
|-----------|---------------|-------|---------------------|-------|---------------|-------|
| Genre     | Men           | Women | Men                 | Women | Men           | Women |
| Number    | 20            | 20    | 22                  | 22    | 21            | 21    |
| Age       | 28,9          | 26,4  | 45,6                | 45,9  | 66,1          | 67,4  |

- ❑ ethics protocol
- ❑ non-pathological older adults
  - ❑ medico-psychological examination

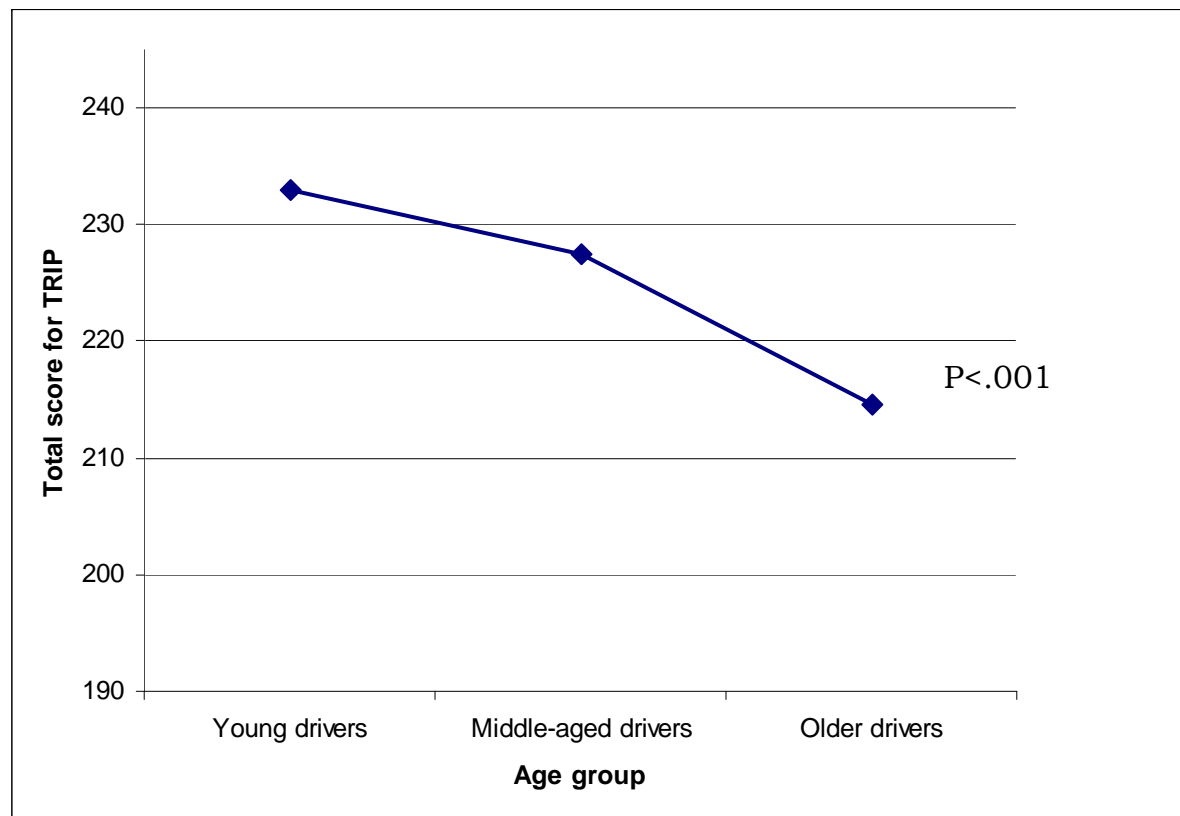
# Experiment 1

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**Driving Performance according to age.**

## Driving performance (TRIP)

Total score for TRIP according to age



## Experiment 2

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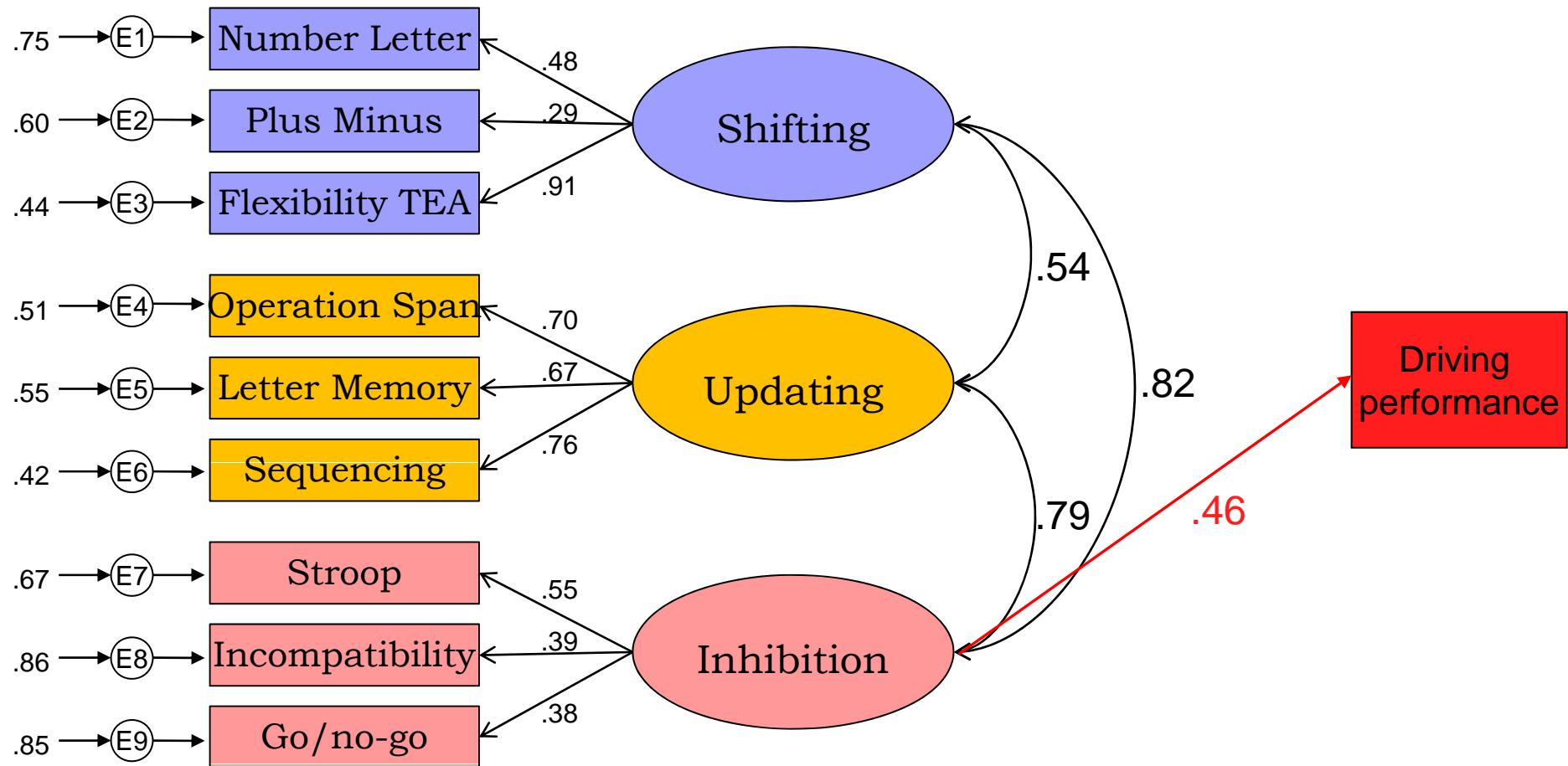
### **Contribution of the executive functions to driving performance with aging**

## Which Executive Function(s) contribute to the driving performance ?

### Fit Indices for Structural Equation Models with TRIP scores

| Model                                     | ddl | $\chi^2$ | AIC    | SRMR  | RMSEA | CFI  | GFI  |
|---|-----|----------|--------|-------|-------|------|------|
| 1. Full three paths                       | 30  | 26.16    | 76.16  | .0484 | .000  | 1.00 | .960 |
| 2. One path from Shifting                 | 32  | 31.5     | 77.49  | .0535 | .000  | 1.00 | .955 |
| 3. One path from Inhibition               | 32  | 27.13    | 73.13  | .0485 | .000  | 1.00 | .959 |
| 4. One path from Updating                 | 32  | 29.0     | 74.952 | .0532 | .000  | 1.00 | .955 |
| 5. Two paths from Shifting and Inhibition | 31  | 26.22    | 74.218 | .0484 | .000  | 1.00 | .960 |
| 6. Two paths from Shifting and Updating   | 31  | 27.39    | 75.39  | .0493 | .000  | 1.00 | .958 |
| 7. Two paths from Inhibition and Updating | 31  | 26.7     | 74.68  | .0484 | .000  | 1.00 | .959 |
| 8. No paths                               | 33  | 47.99    | 91.99  | .1088 | .060  | .930 | .935 |

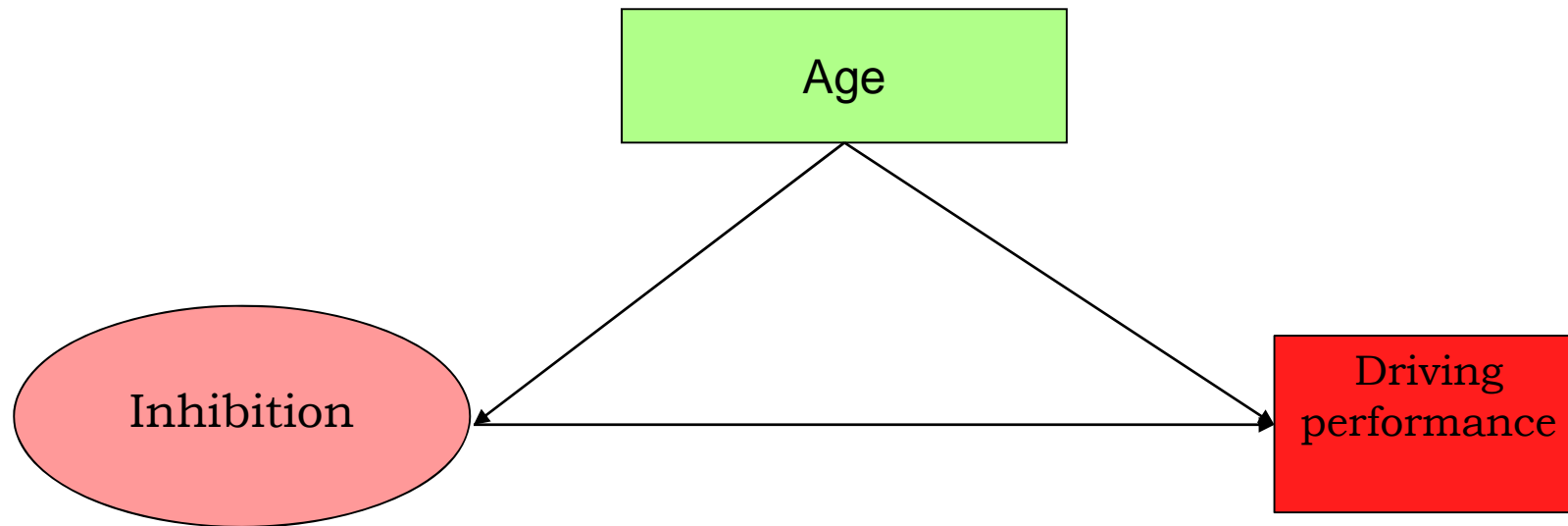
## Model of the executive functions contribution to the driving performance while aging





## The mediational models tested

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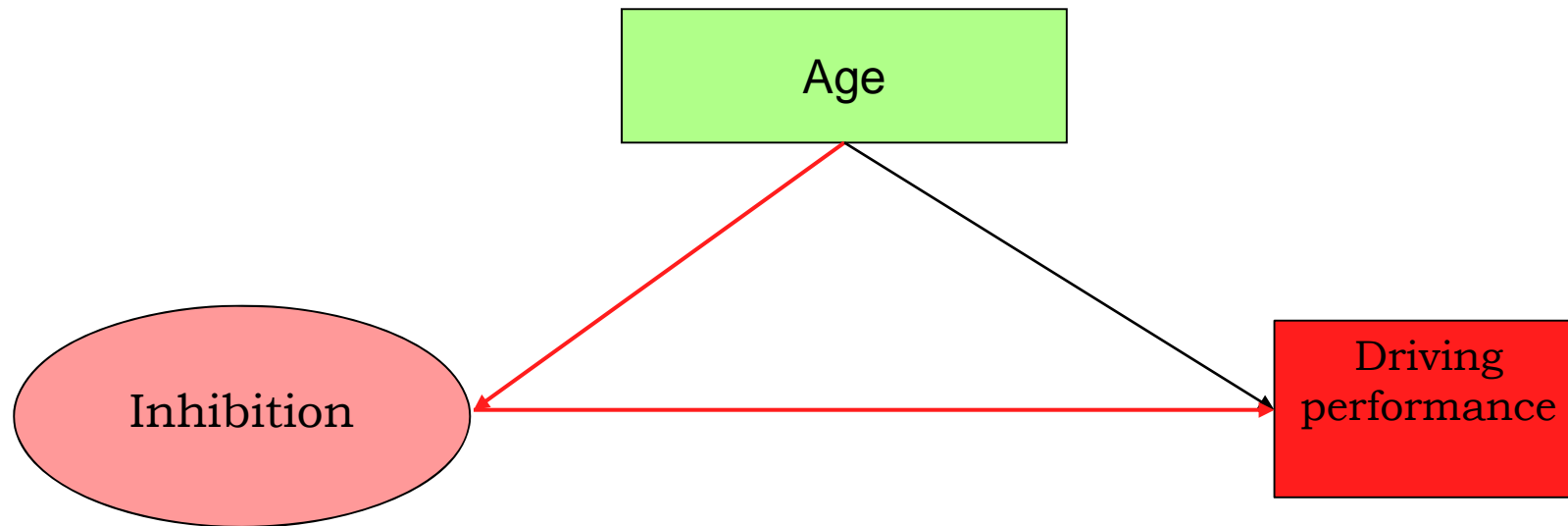
## Is inhibition mediated the relation between age and driving performance ?

Fit Indices for Structural Equation Models assessing the mediated role of inhibition between age and driving performance

| Model                         | ddl | $\chi^2$ | AIC    | SRMR  | RMSEA | CFI  | GFI  |
|-------------------------------|-----|----------|--------|-------|-------|------|------|
| 1. Model of independance      | 5   | 40.88    | 60.88  | .1719 | .240  | .580 | .900 |
| 2. Model of total mediation   | 5   | 2.73     | 22.730 | .0320 | .000  | 1.00 | .992 |
| 3. Model of partial mediation | 4   | 2.37     | 24.37  | .0293 | .000  | 1.00 | .993 |

# inhibition mediated the relation between age and driving performance

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## Inhibition: an important function while driving

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- ❑ Driving performance is altered while aging
- ❑ Inhibition ability contributes to driving performance
  - ❑ Reponse-distractor inhibition (Friedman & Miyake, 2004)
- ❑ Inhibition mediates the relationship between age and driving performance

## Inhibition: an important function while driving

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- ❑ Results are compatible with Hasher and Zacks' (1988) theory of distraction control
- ❑ How distraction can disturb driving performances among older drivers
  - ❑ Extracting the relevant informations
  - ❑ Update the informations
  - ❑ Time to react
- ❑ Recommendations

## Conclusions

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- ❑ latent variable analysis is a useful approach to studying the cognitive functions involved in driving performance among older drivers
- ❑ Inhibition is an important function for safe driving
- ❑ Findings support the view that functional performance is more important than age in determining driving abilities

**Thank you for your attention**

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