Modeling startegies in Stroop with a general architecture of executive control

Tomasz Smoleń Adam Chuderski

Jagiellonian University, Krakow

Features of DuCCA

The architecture:

- explains effects related to interference control with an appeal only to general mechanisms
- integrates two approaches to goal influence into the unitary, general mechanism of top-down control
- monitoring procedure evaluates conflict between processes which need not lead directly to any response
- is aimed at taking into account the individual differences in control

Features of DuCCA

The architecture:

- explains effects related to interference control with an appeal only to general mechanisms
- integrates two approaches to goal influence into the unitary, general mechanism of top-down control
- monitoring procedure evaluates conflict between processes which need not lead directly to any response
- is aimed at taking into account the individual differences in control

Features of DuCCA

The architecture:

- explains effects related to interference control with an appeal only to general mechanisms
- integrates two approaches to goal influence into the unitary, general mechanism of top-down control
- monitoring procedure evaluates conflict between processes which need not lead directly to any response
- is aimed at taking into account the individual differences in control

Features of DuCCA

The architecture:

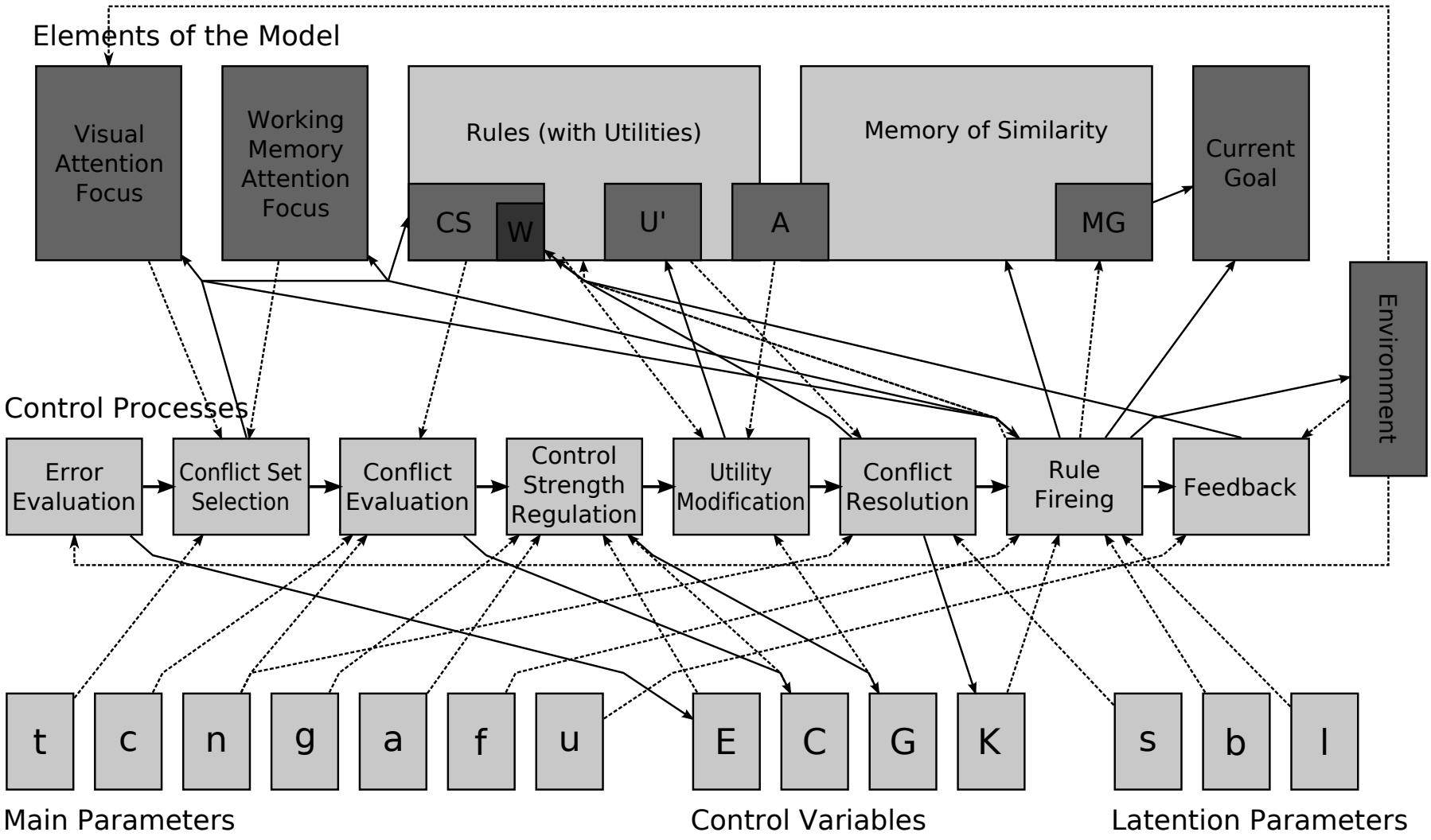
- explains effects related to interference control with an appeal only to general mechanisms
- integrates two approaches to goal influence into the unitary, general mechanism of top-down control
- monitoring procedure evaluates conflict between processes which need not lead directly to any response
- is aimed at taking into account the individual differences in control

Features of DuCCA

The architecture:

- explains effects related to interference control with an appeal only to general mechanisms
- integrates two approaches to goal influence into the unitary, general mechanism of top-down control
- monitoring procedure evaluates conflict between processes which need not lead directly to any response
- is aimed at taking into account the individual differences in control

Structure of DuCCA



Conflict

Conflict estimation

$$C_i = \left(\frac{\sum_{j \neq i} e^{U'_j / n}}{\sum_k e^{U'_k / n}} \right)^c$$

U' — modified utility

n — noise

c — parameter of sensibility to conflict

Utility

Modified utility

$$U_i' = \frac{U_i}{e^{G(1-A_{ij})}}$$

U — base utility
G — control strength
A_{ij} — association between rule i and current goal j

Example — utility

Rule	U	A
"Trained"	1	.2
"Target"	.6	1
"Others"	.1	.01

Example — utility

Rule	U	A	U' — low control
"Trained"	1	.2	.85
"Target"	.6	1	.6
"Others"	.1	.01	.08

Example — utility

Rule	U	A	U' — low control	U' — high control
"Trained"	1	.2	.85	.53
"Target"	.6	1	.6	.6
"Others"	.1	.01	.08	.05

Example — conflict

Congruent, low control

$$\frac{\text{Others (low)}}{\text{Trained (high)} + \text{Target (medium)} + \text{Others (low)}} = \text{low}$$

Example — conflict

Congruent, low control

$$\frac{\text{Others (low)}}{\text{Trained (high)} + \text{Target (medium)} + \text{Others (low)}} = \text{low}$$

Congruent, high control

$$\frac{\text{Others (low)}}{\text{Trained (low)} + \text{Target (medium)} + \text{Others (low)}} = \text{medium}$$

Example — conflict

Incongruent, low control

$$\frac{\text{Trained (high)} + \text{Others (low)}}{\text{Trained (high)} + \text{Target (medium)} + \text{Others (low)}} = \text{high}$$

Example — conflict

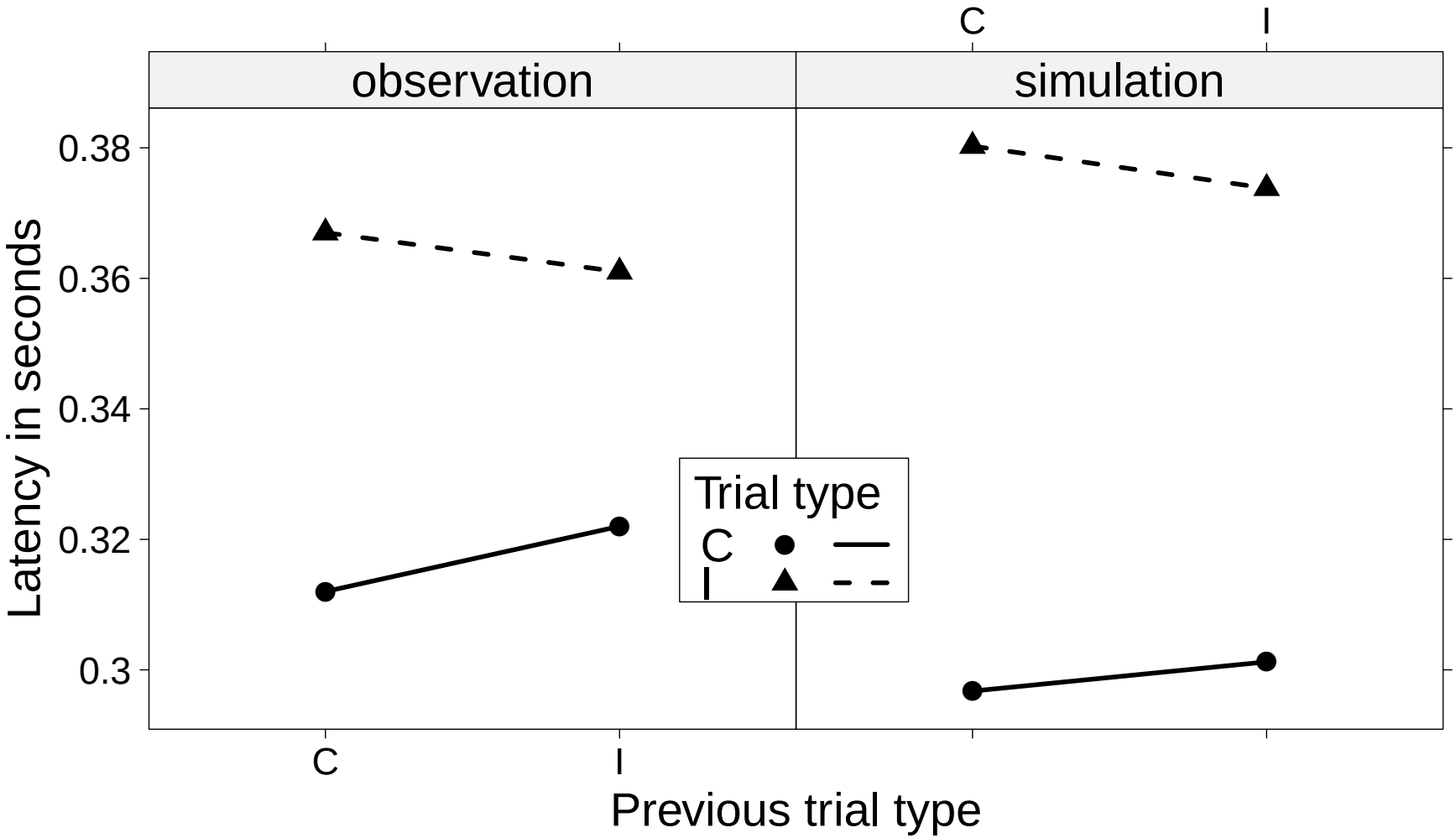
Incongruent, low control

$$\frac{\text{Trained (high)} + \text{Others (low)}}{\text{Trained (high)} + \text{Target (medium)} + \text{Others (low)}} = \text{high}$$

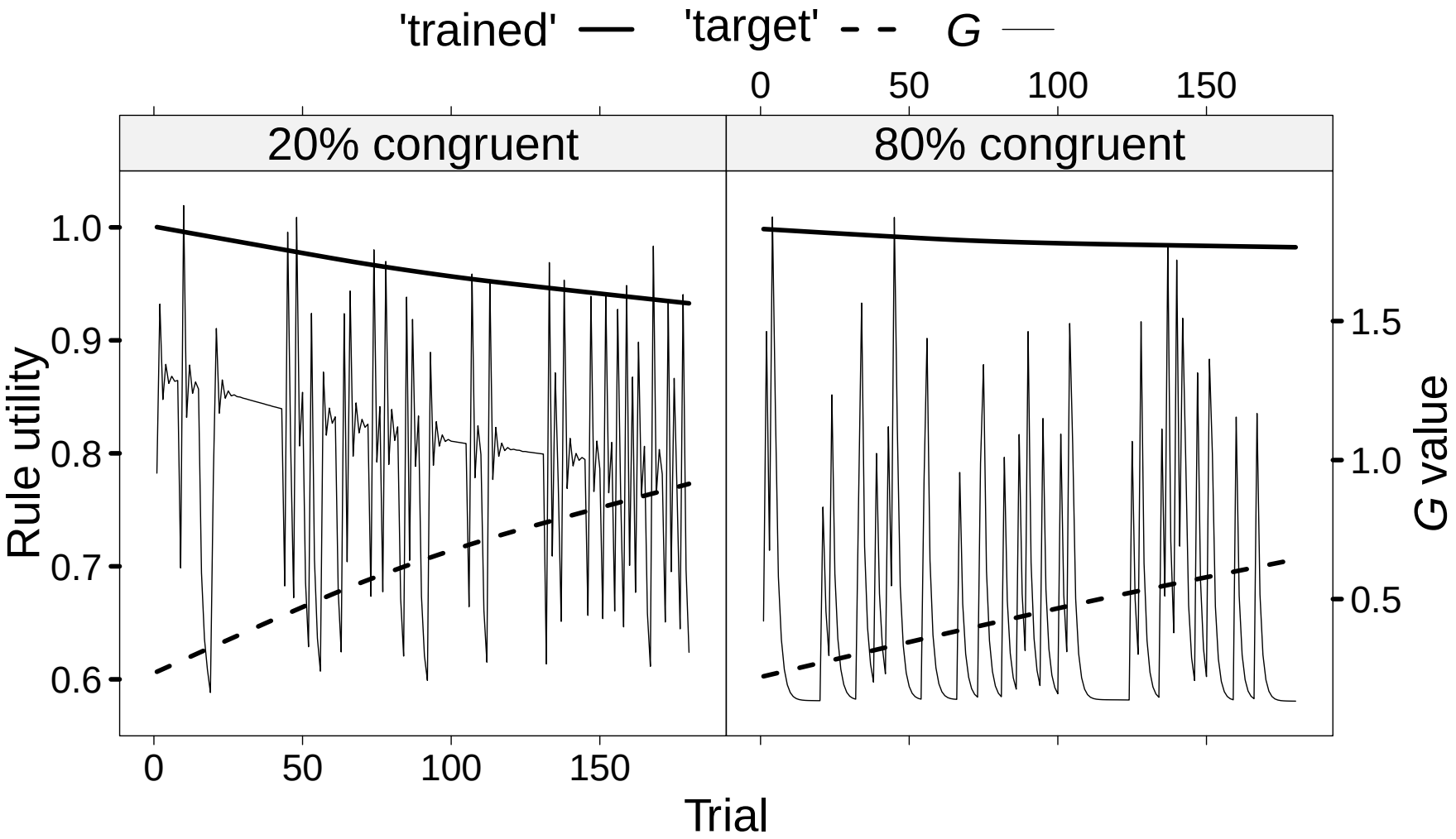
Incongruent, high control

$$\frac{\text{Trained (low)} + \text{Others (low)}}{\text{Trained (low)} + \text{Target (medium)} + \text{Others (low)}} = \text{medium}$$

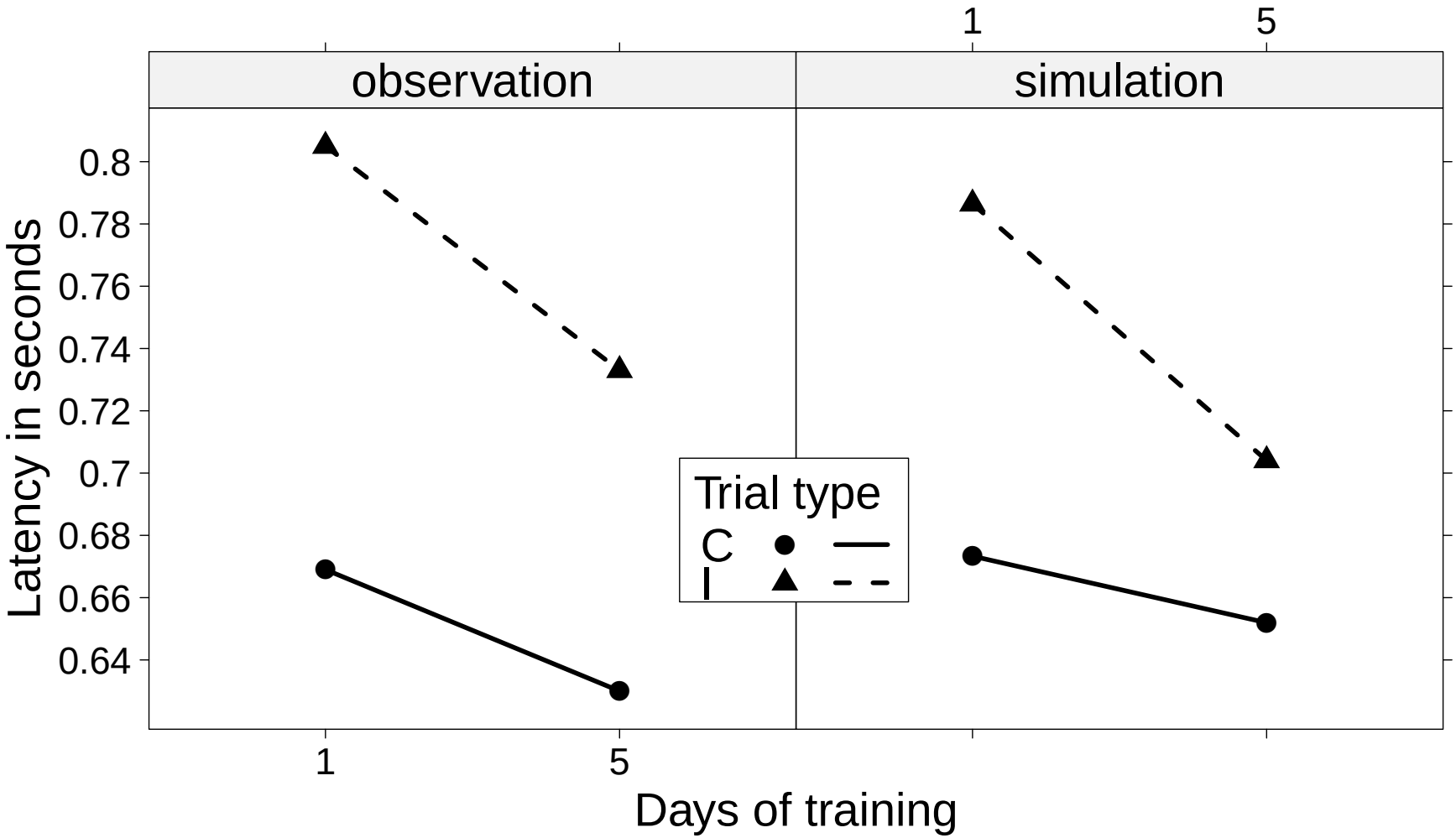
Gratton, Coles, & Donchin, 1992



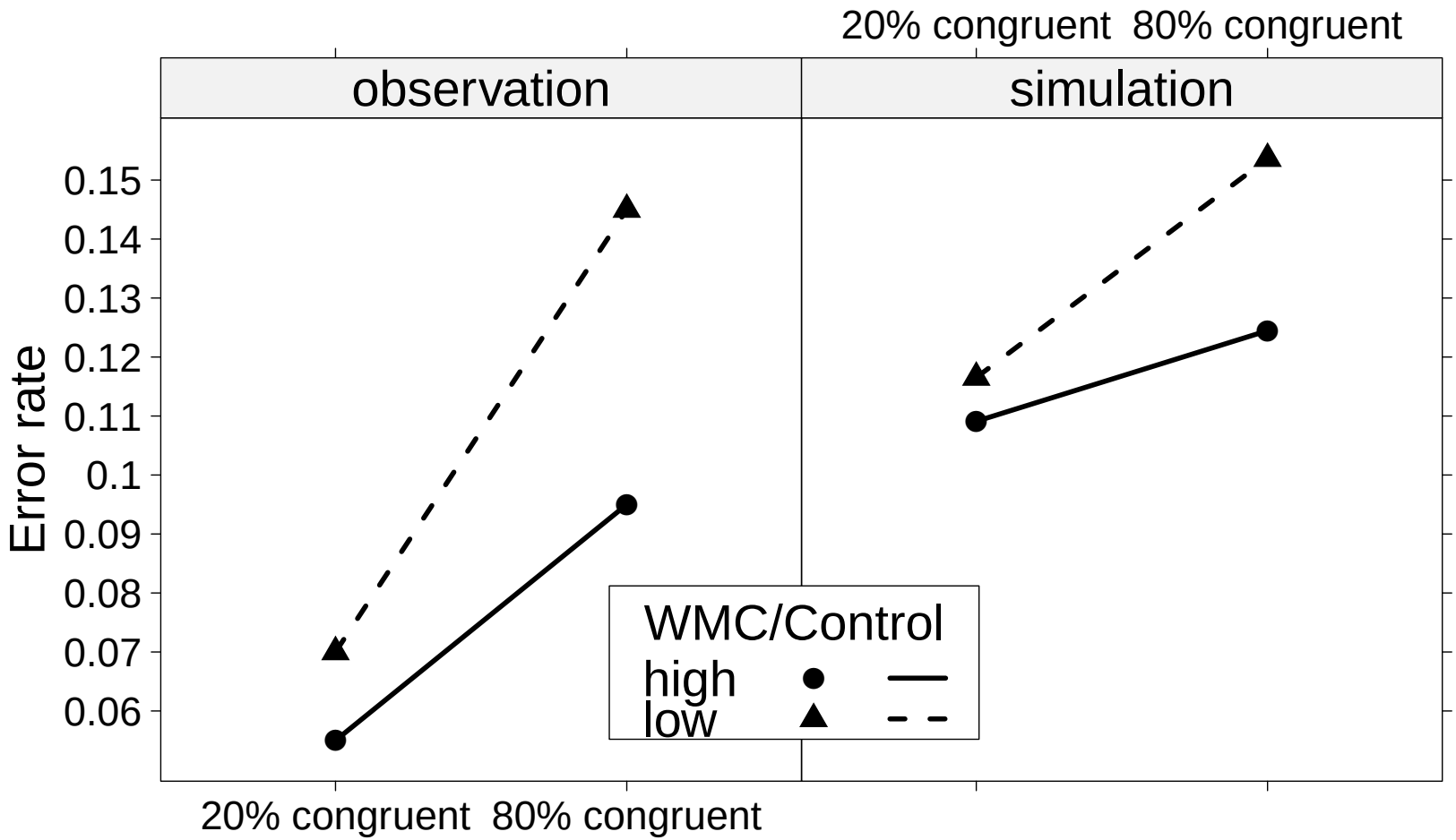
Utility and control dynamics



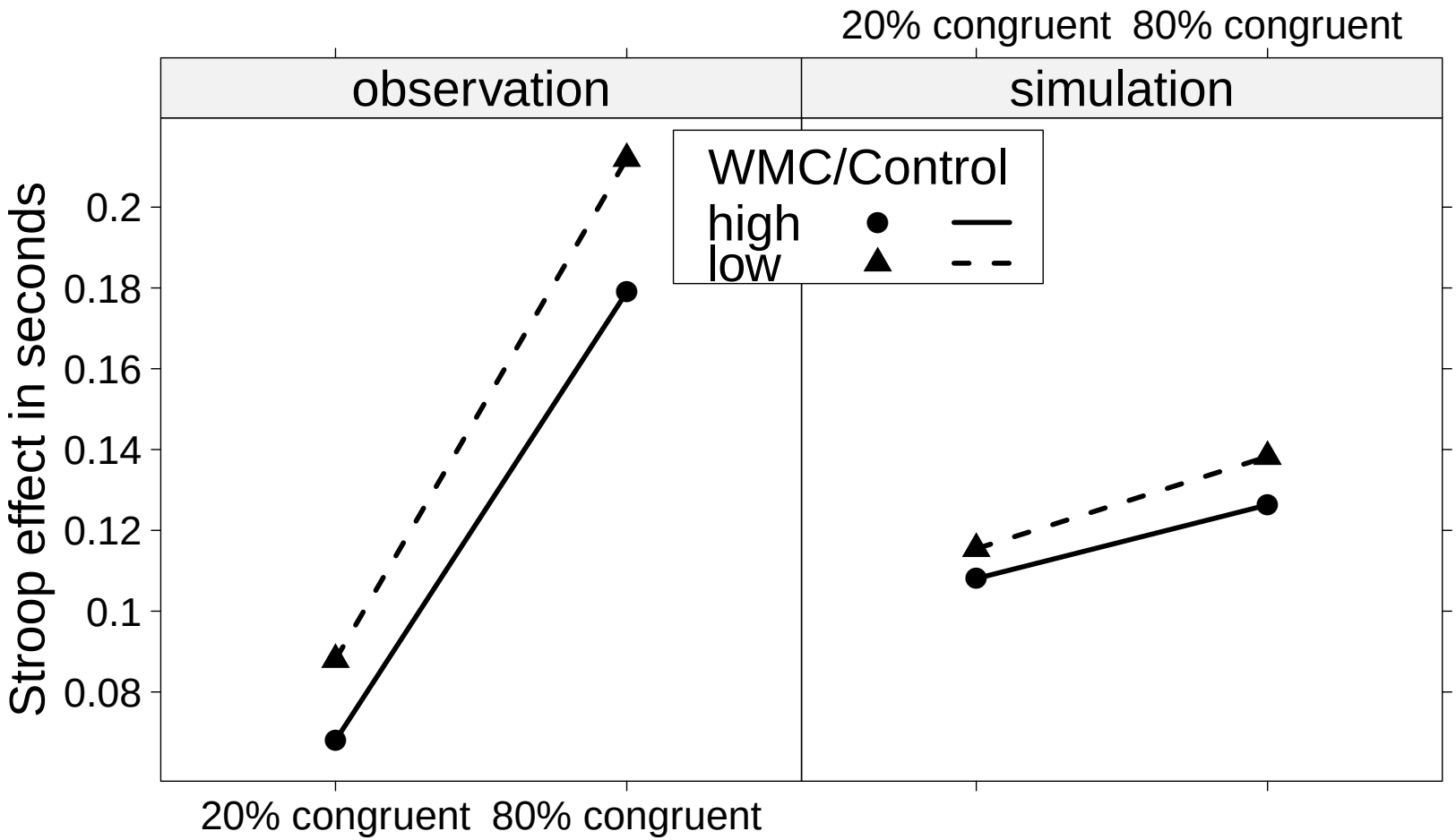
MacLeod & Dunbar, 1988



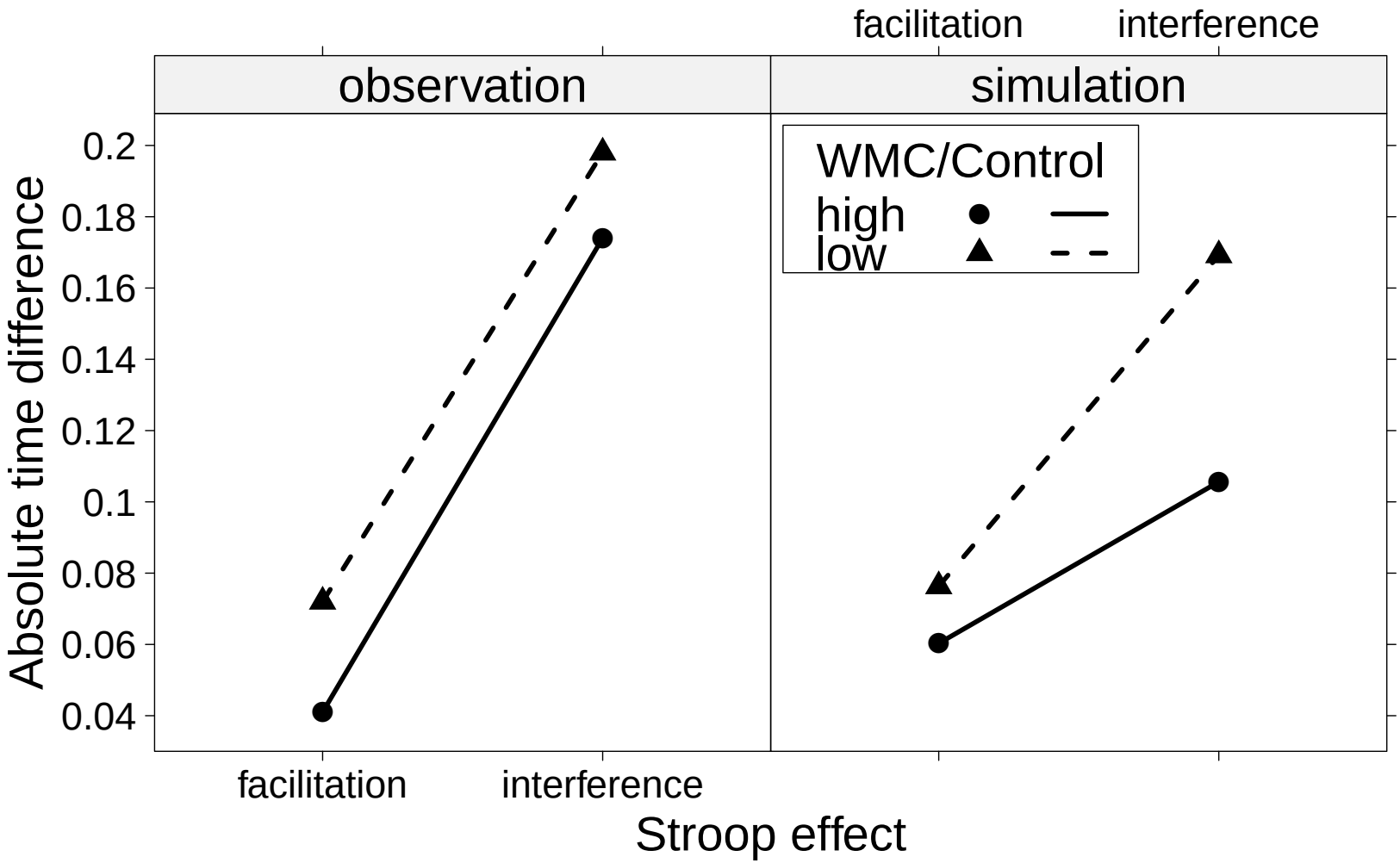
Kane & Engle, 2003



Kane & Engle, 2003



Kane & Engle, 2003



Thank You for Your attention

Tomasz Smoleń
tomasz.smolen@mailplus.pl
Adam Chuderski
a.chuderski@emapa.pl
Executive Control and Fluid Intelligence Research Group
http://ecfi-group.eu