Attentional Inefficiency and Driving Distraction:

Limits of

Alertness &

Vigilance,

Orienting and

Executive Control

Sustained ANTI-TasK ?

Castro, C., Roca, J, Lopez-Ramon, M.F., & Lupianez, J.

New ANTI-Task

30 minutes

3 attentional networks measurement

+ a measure of vigilance

ATTENTIONAL NETWORKS:

1. ORIENTING

2. EXECUTIVE CONTROL

3. ALERTING

4. VIGILANCE

Safe driving relies on the Attentional Networks functioning correctly.

To measure….
ATTENTIONAL NETWORKS:

ORIENTING

EXCECUTIVE CONTROL

ALERTING

VIGILANCE

1. ORIENTING

Orienting is manipulated by

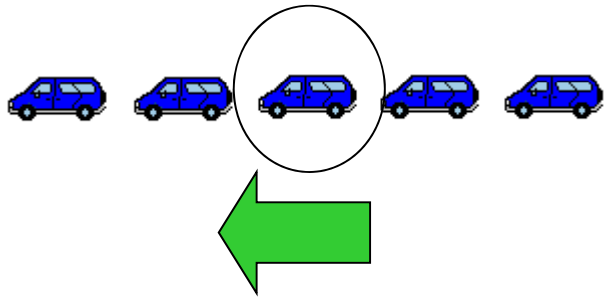
presenting a cue indicating

where in space a person should focus attention

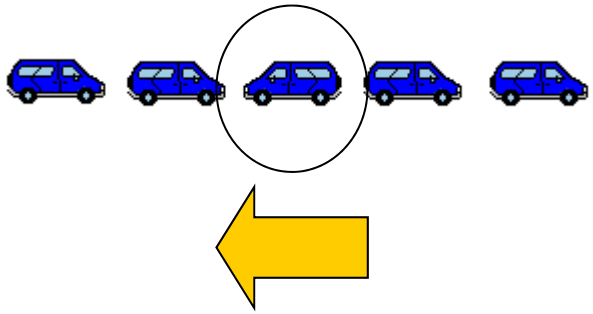
*

*

2. EXECUTIVE CONTROL



i.e. TASKS dealing with: CONFLICT



3. ALERTING

can be considered as…

Phasic alertness

Non-specific activation occurs when a warning signal is presented prior to the target.

+

*

3b ? VIGILANCE

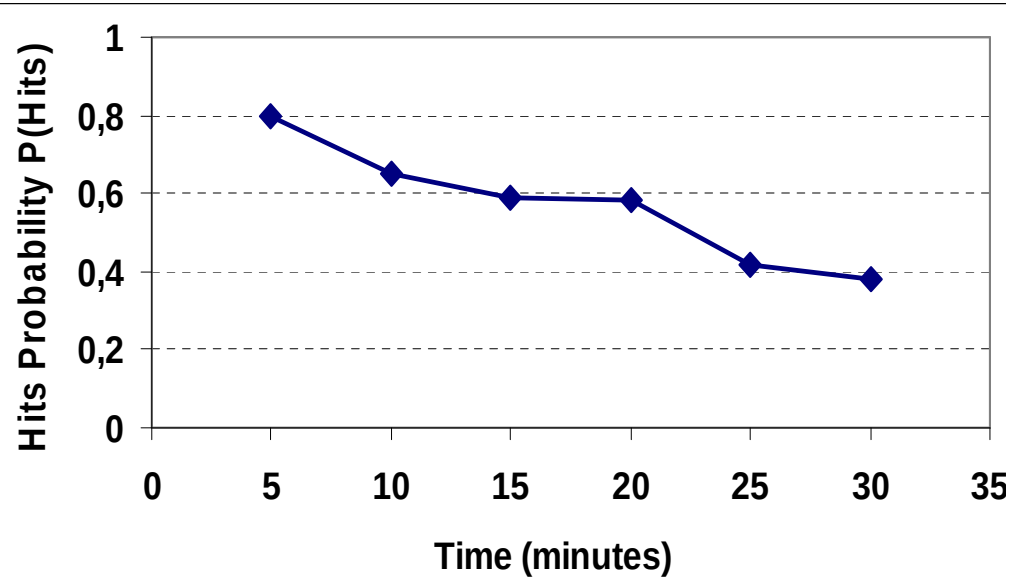
Alerting

ATTENTIONAL NETWORK

Tonic alertness or vigilance

Sustained activation over a period of time

Participants have to attend to a location over a period of time and detect infrequent targets.



The Vigilance Decrement

Grier, R.A., Warm, J.S. Dember, G.M., Galinsky, T., Szalma, J.L., and Parasuraman, R.

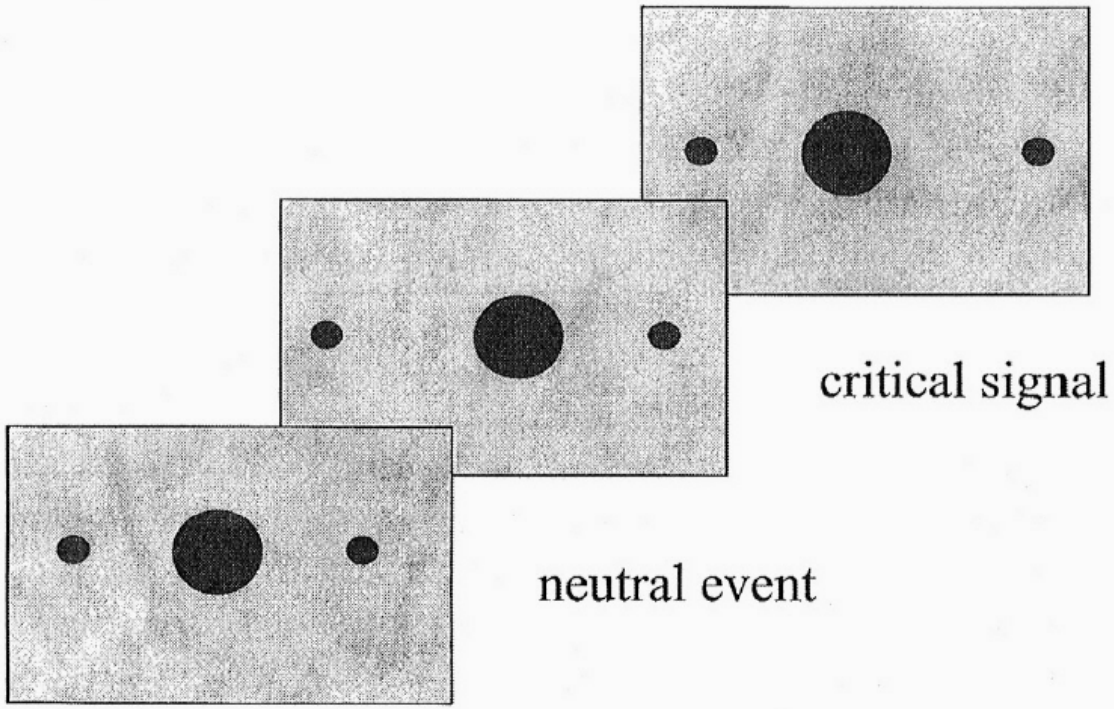


Figure 1. An illustration of the display showing acceptable (neutral events) and unacceptable (critical signals) parts.

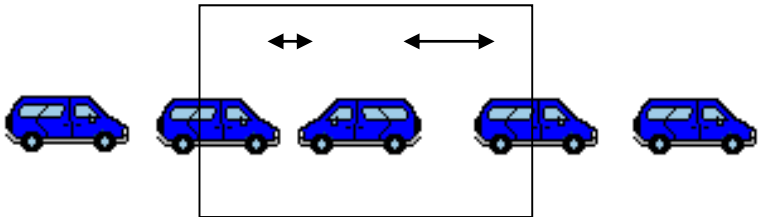
Stimuli

to manipulate

VIGILANCE

Sustained ANTI-TasK ?

Roca, J, Lopez-Ramon, M.F. Castro & Lupianez…



Aim

- Can be added to the ANTI-Task a new measure of sustained attention?

- Can the ANTI task be useful to explore driving behaviour?

INSTRUCTIONS

Imagine that you are working in a Centre for Traffic Management and you are studying the drivers' parking habits.

A row of five cars will be shown on the screen either just above or below a fixation cross
Your task consists on deciding whether the car in the centre of the row (the third car) is facing Left or Right.

Your answer should be:
"C" if the centre car is pointing to the left and
"M" if the center car is pointing to the right.

For instace, you should press "C" in this case:

and you should press "M" in this other case:

< Press the SPACE BAR to carry on >

Sometimes the centre car is wrongly parked and is pointing to the opposite direction to the other cars in the row.

Remember:
Your answer will be determined by the direction of the car of the middle.

For instance:

In this case you should press "C".

< Press the SPACE BAR to carry on >

Sometimes the car in the middle will be shown slightly closer to the next vehicle to the left or to the right leaving a gap in the row of cars.
In other words: The flanking cars will not be equidistant from the centering car.

When that happens you should press the SPACE BAR. In these cases the car is moving and will be excluded from the study.

Such trials will occur very infrequently, which is why you KEEP A HIGH LEVEL OF VIGILANCE thoroughout the experiment.

For instance here:

and here too:

In these examples you should press "SPACE BAR".

< Press the SPACE BAR to carry on >

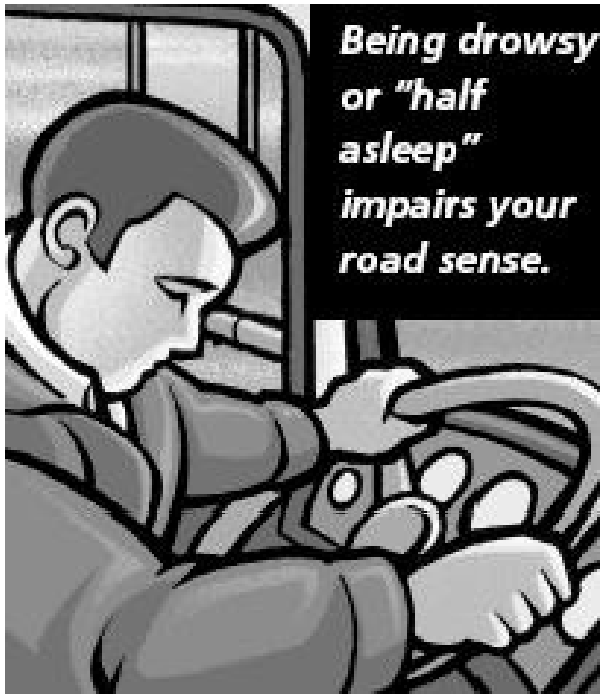
Preliminary results…

Participants

16 participants from the ugr Universidad de Granada

New ANTI-sustained.

- 6 blocks without breaks
- Infrequent trials added



Results

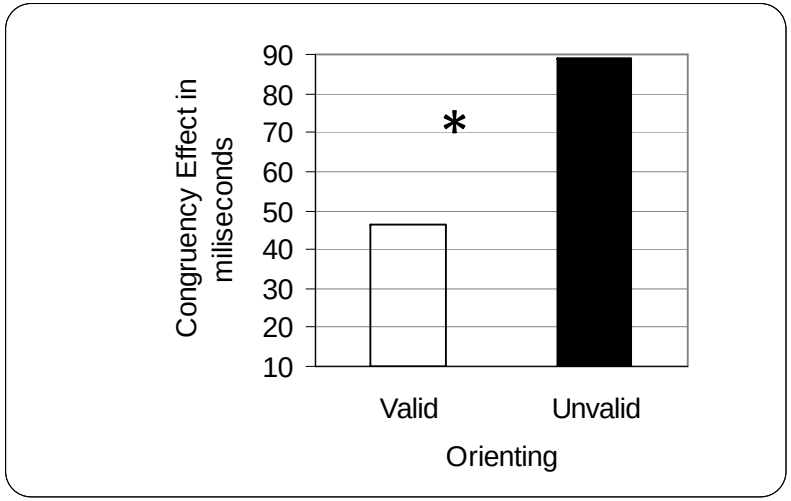
RT for each experimental condition

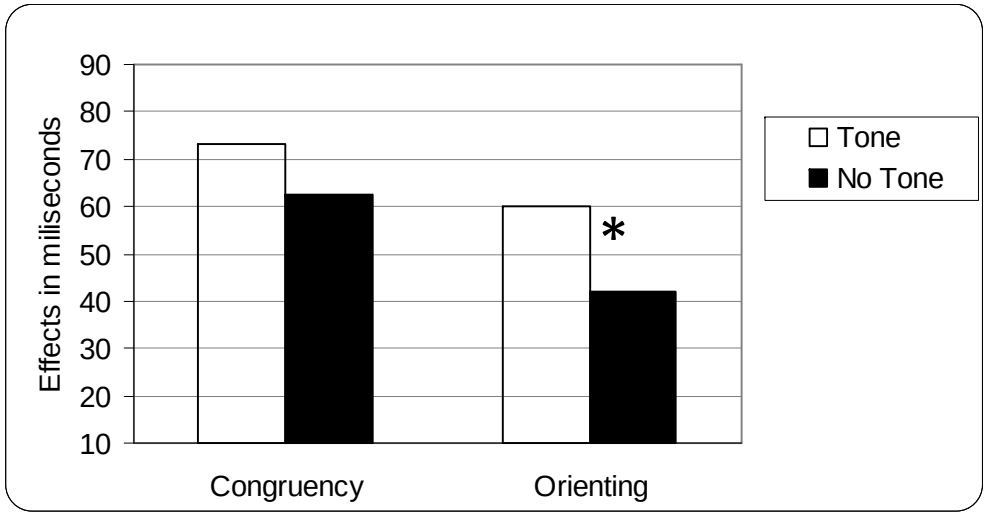
	No Tone		Tone		
	Congruent	Incongruent	Congruent	Incongruent	
Invalid	584,97	665,96	570,76	668,14	622,45
Neutral	602,22	657,46	557,24	607,6	606,13
Valid	561,46	605,16	534,64	583,95	571,30
	582,88	642,86	554,21	619,89	

Results

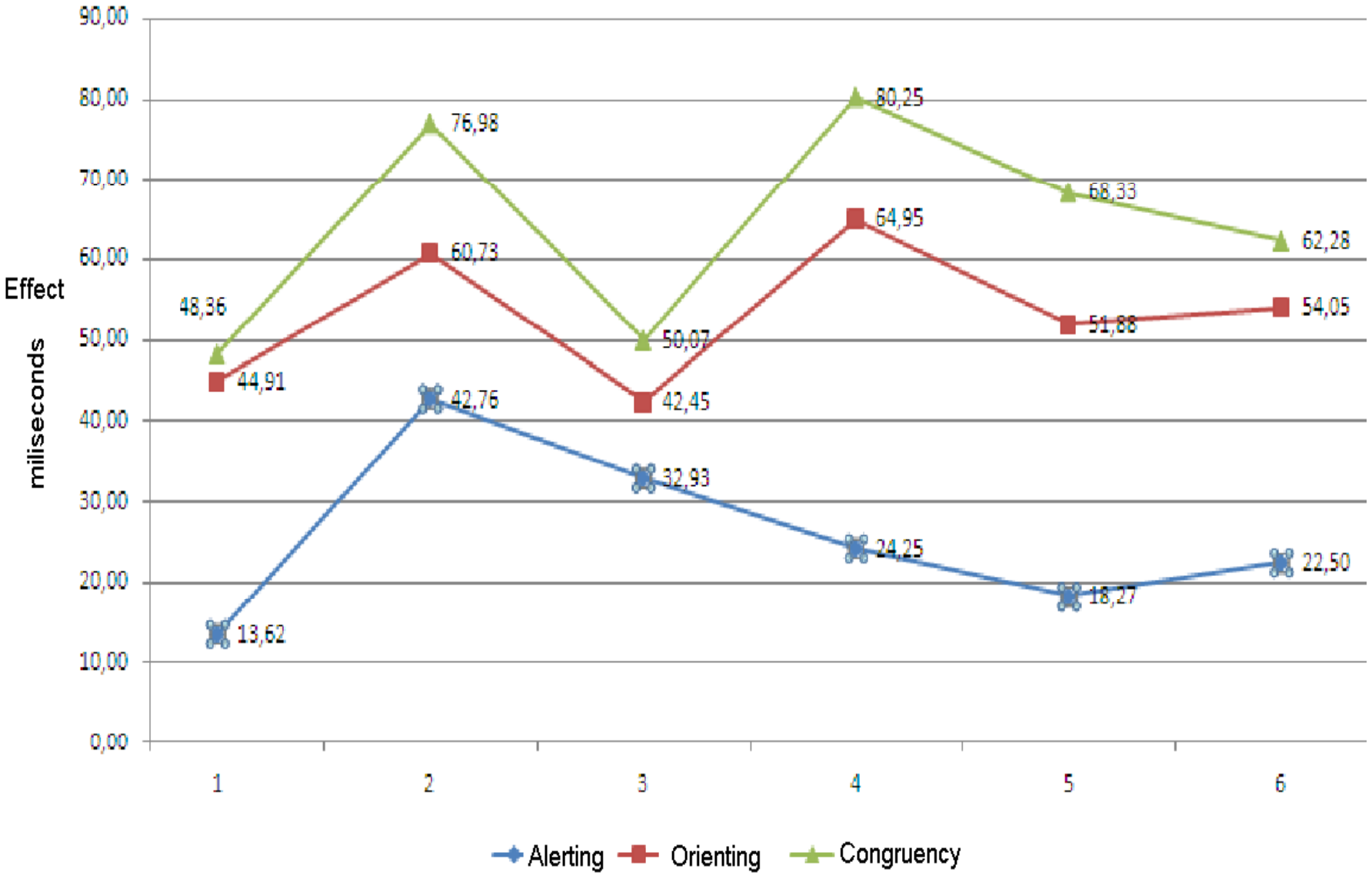
* significant effects

Alerting	F(1,15)= 17.42, p≤ .001
Orienting	F(2,14)= 53.42, p≤ .0001
Congruency	F(1,15)= 56.36, p≤ .0001
Alerting X Orienting	F(1,15)= 20.22, p≤ .0001
Orienting X Congruency	F(2,14)= 14.33, p≤ .001
~~Alerting X Congruency~~	Not significant





Alerting, Orienting and Congruency Effects X Blocks



Block 1

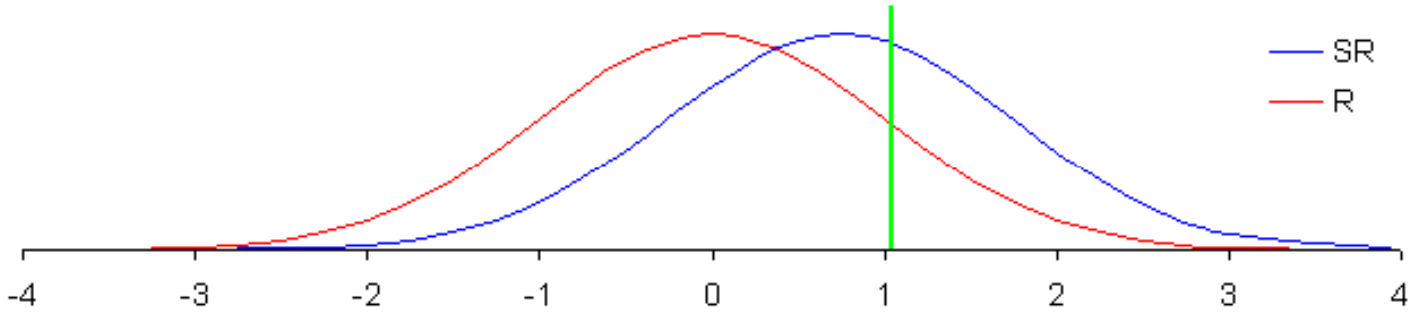
SDT *Signal Detection Theory*

.380 Hits

.148 False Alarms

d´ = 1.87

β =10.20



Block 2

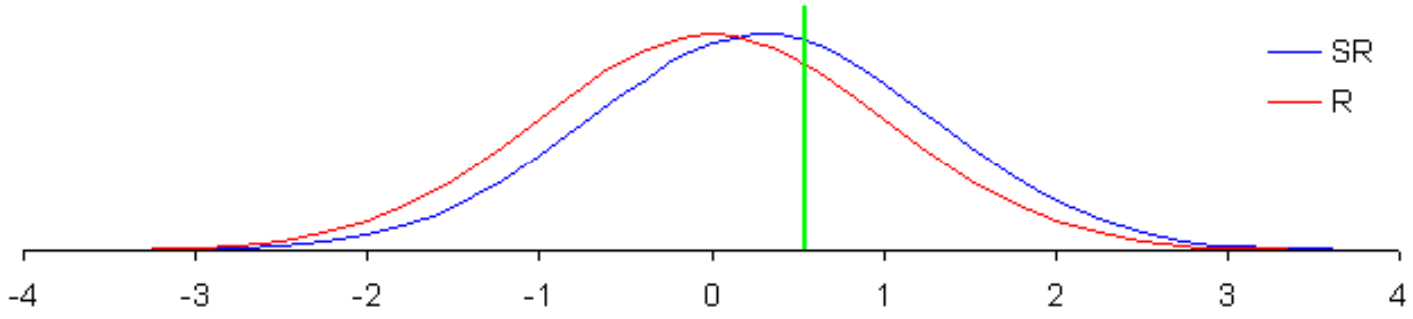
SDT *Signal Detection Theory*

. 40 Hits

. 295 False Alarms

d´ = 1.63

β = 5.76



Block 3

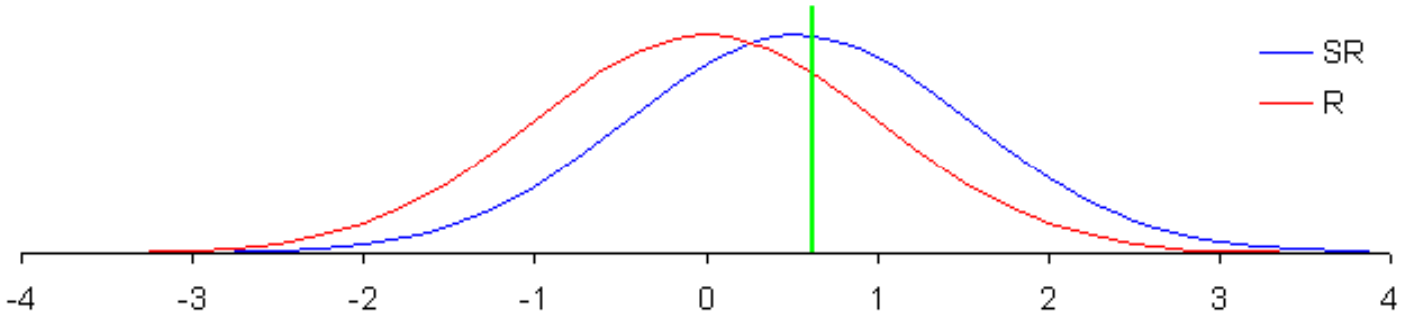
SDT *Signal Detection Theory*

. 465 Hits

. 266 False Alarms

d´ = 1.84

β = 6.42



Block 4

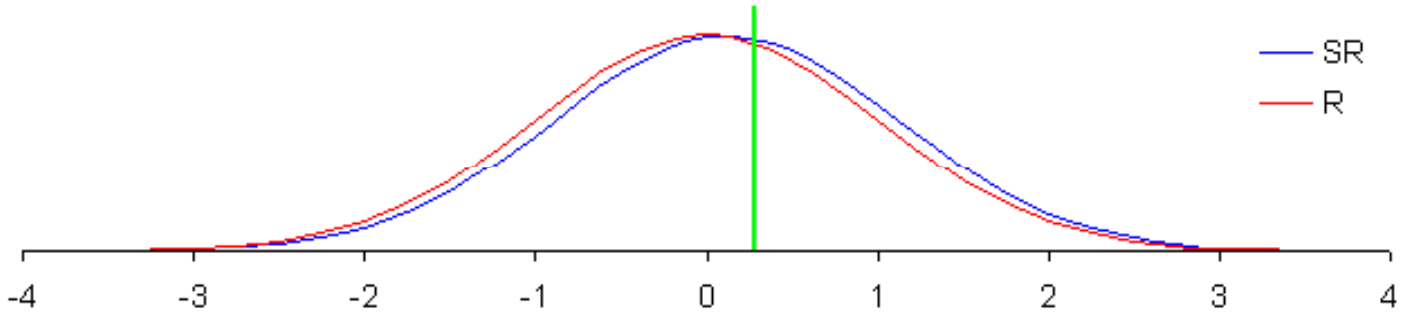
SDT *Signal Detection Theory*

. 42 Hits

. 387 False Alarms

d´ = 1.57

β = 4.67



Block 5

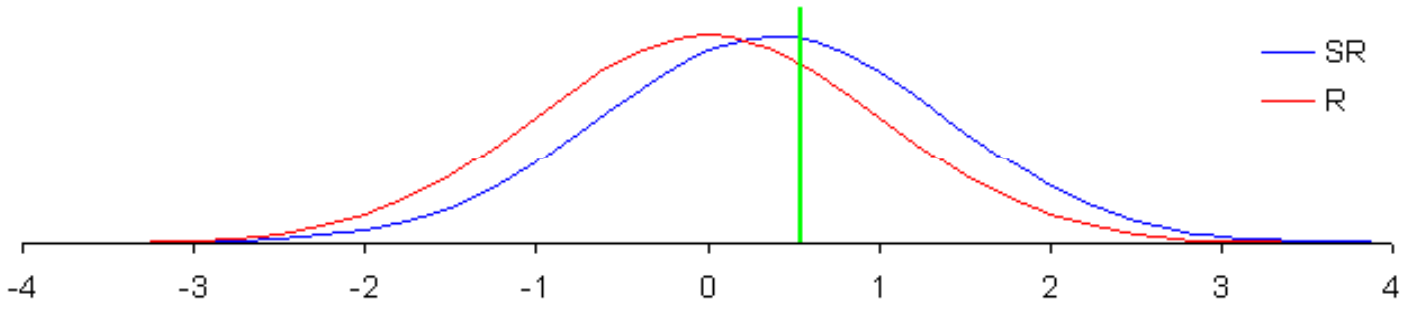
SDT *Signal Detection Theory*

. 438 Hits

. 295 False Alarms

d´ = 1.73

β = 5.86



Block 6

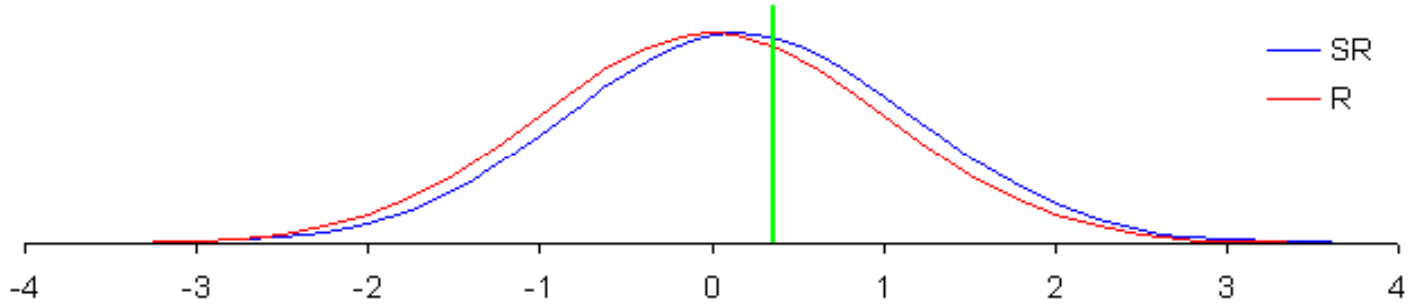
SDT *Signal Detection Theory*

. 42 Hits

. 359 False Alarms

d´ = 1.6

β = 4.95



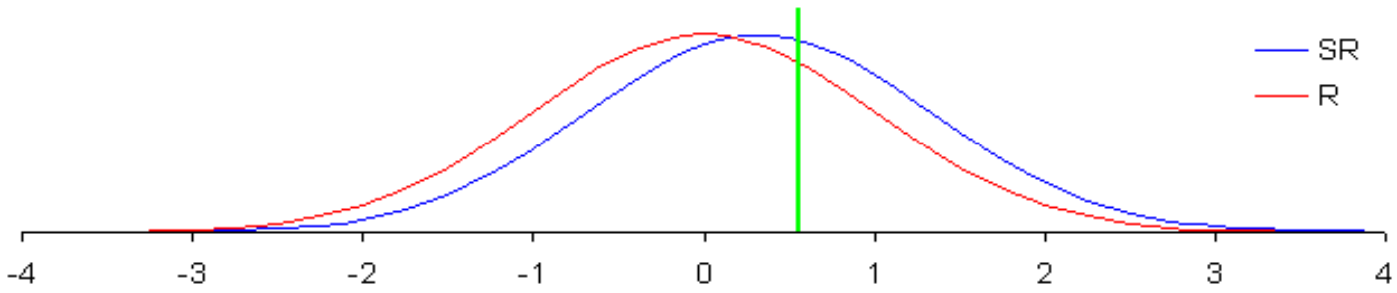
Average

SDT *Signal Detection*

Theory Measures

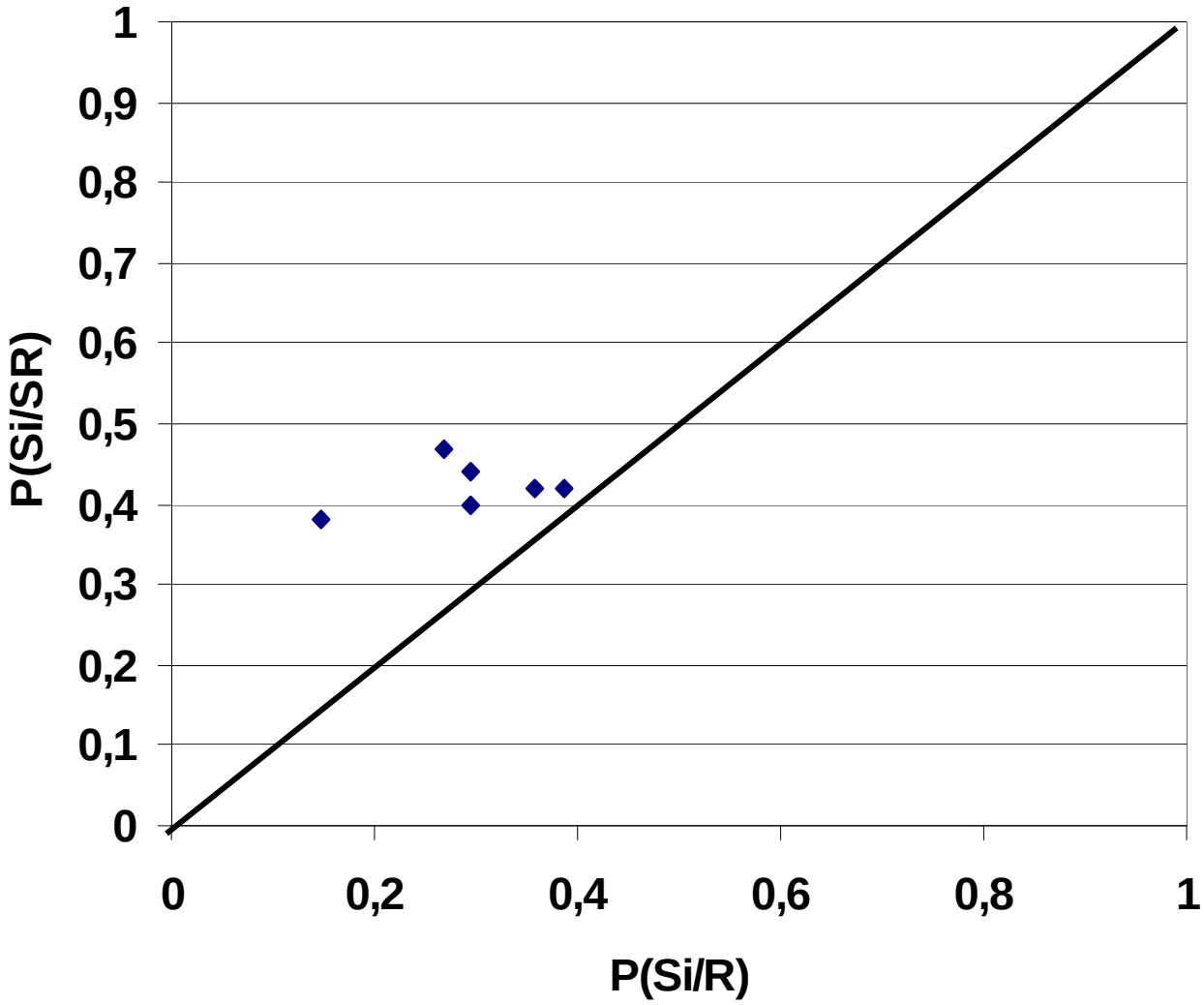
.418 Hits d´ = 1.71

.292 False Alarms β = 6.31

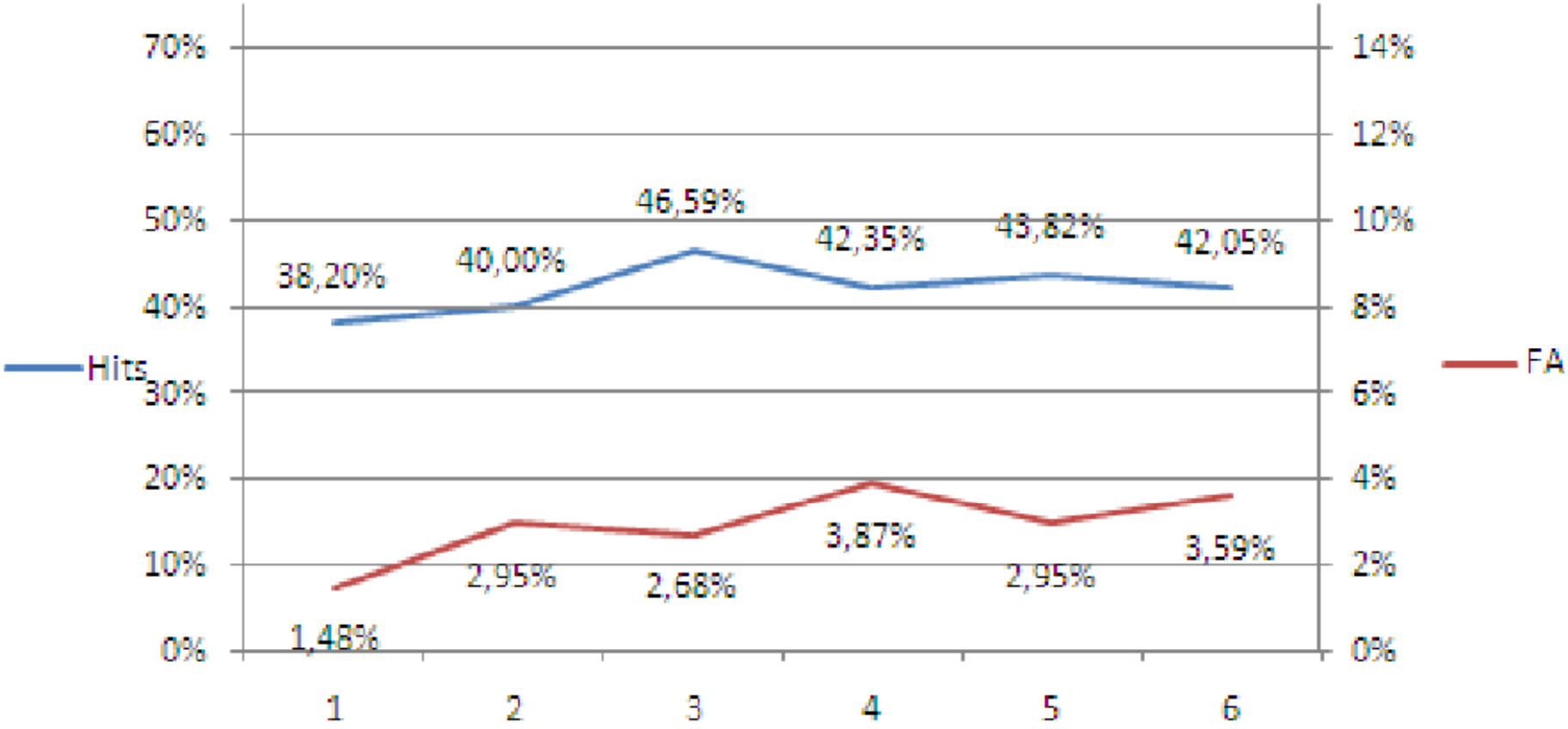


?

ROC Curve



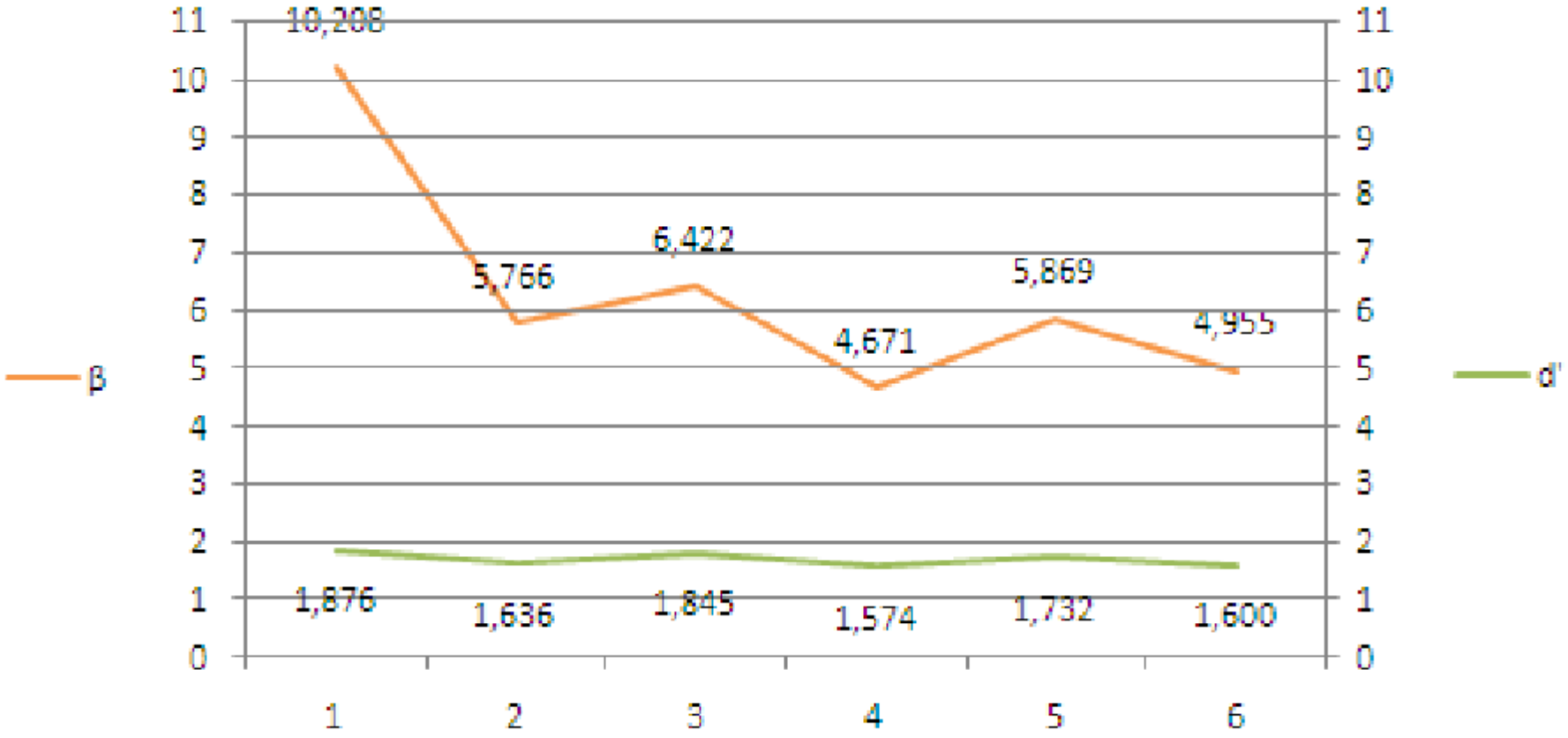
Hits and False Alarms between blocks



d' and β

sensitivity and

decision variable criterion



Anti-sustained task

Conclusions

Only partially replicated Callejas' *et al* (2004) results:

ORIENTING X ALERTING ***Tone enhancing effect….***

The effect of an Orienting Cue was larger under Alerting conditions than in those trials in which no alerting sound was presented.

CONGRUENCY X ORIENTING

Larger Congruency effect when the participant viewed a cue

in the location opposite to that of the target.

When the asterisk appeared in the same position as the target arrow,

it helped focus the attention.

~~**ALERTNESS x CONGRUENCY**~~

~~Alerting produces an inhibitory effect on the Executive Function~~

~~To enhance fast responses to sensory input in order to detect an infrequent target and prevent the system from focusing on feelings~~

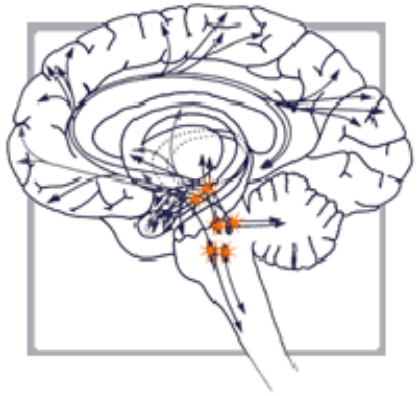
~~or thoughts or on further processing of the stimulus.~~

Discussion

d’ and criterion β

- These parameters do not vary between blocks…
- However, the infrequent trials…and the vigilance task… alter the functioning of the Alerting Network.

To be continued...



THANK YOU FOR YOUR

even more than “triple” ATTENTION

References

- Callejas, A. Lupianez, J. and Tudela, P. (2004). The three attentional networks: On their independence and interactions. *Brain and Cognition, 54*, 225-227.
- Callejas, A., Lupianez, J., Funes, M.J., Tudela, P. (2005). Modulations among the alerting, orienting and executive control networks. *Experimental Brain Research, 167,* 27-37.
- *Grier, R.A., Warm, J.S. Dember, G.M., Galinsky, T., Szalma, J.L., and Parasuraman, R () The Vigilance Decrement Reflects Limitations in Effortful Attention, Not Mindlessnesss Human Factors; 45, 3;* 349-358.
- Fan, J., McCandliss, B.D., Sommer, T., Raz, A., and Posner, M.I. (2002). Testing the efficiency and independence of attentional networks. *Journal of Cognitive Neuroscience, 14(3),* 340/347.
- Posner, M.I. (1978). *Chronometric explorations of mind*. Hillsdale, NJ: Erlbaum.
- Posner, M.I. (1980). Orienting of attention. *Quarterly Journal of Experimental Psychology*, *32*, 23-25.
- Posner, M.I., and DiGirolamo, F.J. (1996). Executive attention: conflict, target detection and cognitive control. In: R. Parasuraman (Ed.). *The attentive brain*. M.I.T. Press: Cambridge, MA.
- Posner, M.I., and Fan, J. (2005). Attention as an organ system. In: J. Pomeranz (Ed.). Neurobiology of perception and communication: from synapse to society. The IVth de Lange conference. Cambridge University Press, Cambridge, UK (press)
- *Schneider*, W., Eschman, A. and Zuccolotto, A. (2002). *E-Prime User's guide.* Pittsburgh, P.A.., U.S.A.: Psychology Software Tools Inc.
- Underwood, G, Chapman, P, Brocklehurst, N, Underwood, J, Crundall, D (2003). Visual attention while driving: sequences of eye fixations made by Experienced and Novice drivers. *Ergonomics, 46(6), 629-46*
- Underwood, G., Crundall, D. and Chapman, P. (2008). Experience and Visual Attention in Driving. In: C. Castro, and L. Hartley (Ed.). *Human Factors of Visual and Cognitive Performance in driving*. Boca Raton, FL.: CRC Press.
- Weaver, B., Bédard, M., McAuliffe, J. and Parkkari, M. (In press, 2008) Using the Attention Network Test to predict driving test scores. *Accident Analysis and prevention*. doi: 10.1016/j.aap.2008.09.006


candida@ugr.es