Turning off dogs' brains: roles for reactivity and exposure in problem solving behavior

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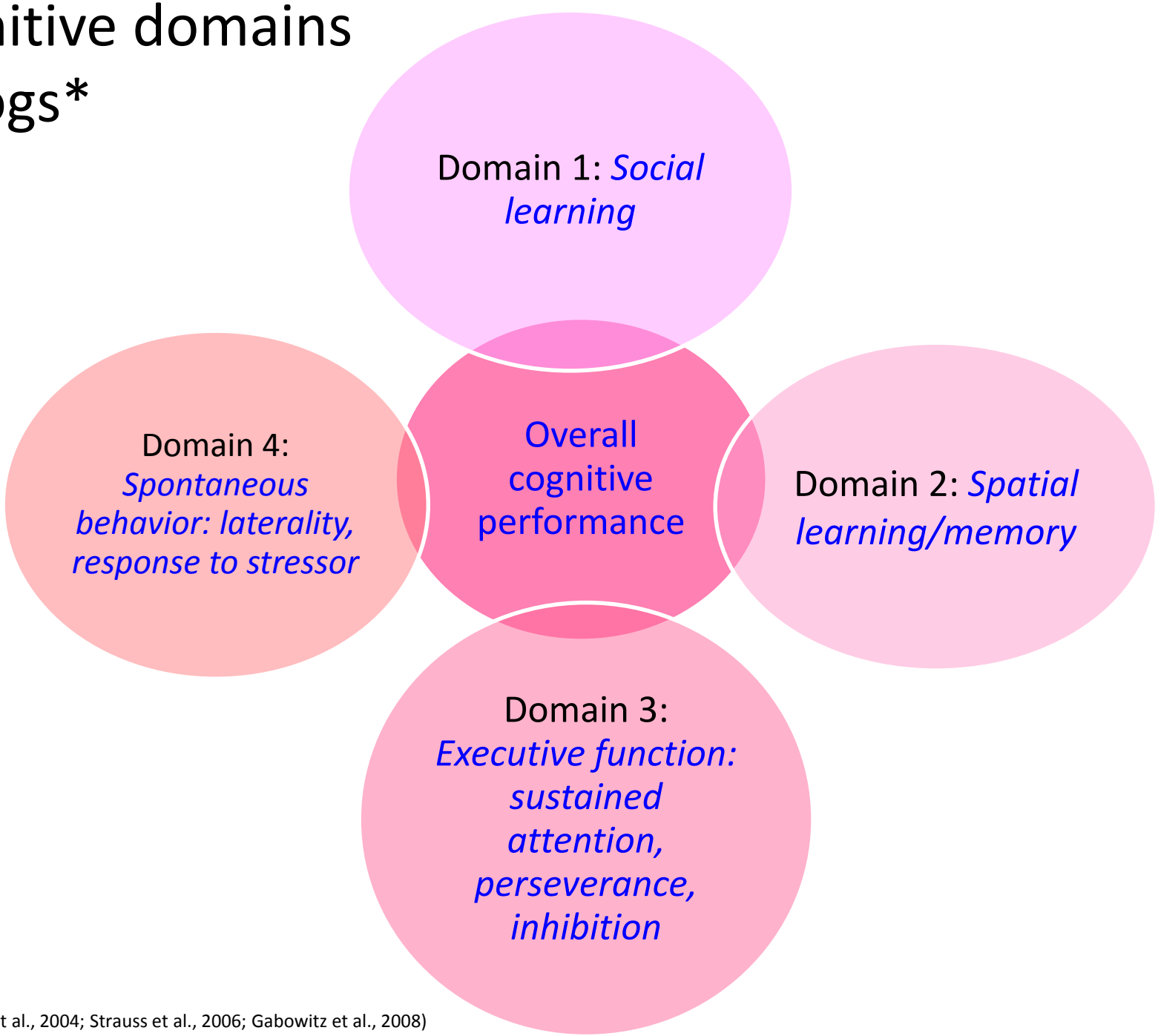
Problem-solving ability and ‘cognition’

- I: Assess K-9 problem-solving ability using novel tasks/techniques that differ from those used to select and train working dogs to develop an external referent about ability and skill set.

- II: Assess an “equivalent” population of pet dogs, and include an auditory assessment and further testing of young dogs, older dogs, test-retest, and testing over time (repeated measures).

Cognitive domains in dogs*



* (*sensu* Lezak et al., 2004; Strauss et al., 2006; Gabowitz et al., 2008)

THE CITP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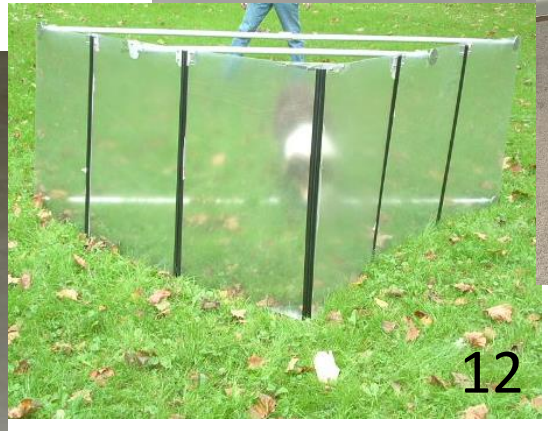
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Study features

- CITP (Canine Intelligence Test Protocol)
- WDQ-PET (includes AIR/SAIR scores)
- Awake auditory evaluation of a subgroup of noise reactive/phobic dogs
  - Of 35 dogs available for hearing tests over 6 weeks, 19 dogs were noise reactive/phobic, 16 were non-reactive.
- VOYCE band measurement of movement in 3 dimensions every second (custom firmware) and calculation of deviations and extremes

Primary auditory measures discussed (see Scheifele et al., 2016 for details)

Term	Abbreviation	Definition
Brainstem Auditory Evoked Response; aka Auditory Brainstem Response	BAER; ABR	Auditory evoked potential generated by the auditory nerve and brainstem in response to acoustic stimuli; commonly used to estimate hearing and auditory acuity and function; waveform peaks within first 10 msec following stimulus onset and are labeled as I, II, III, IV and V; peaks of wave V for the right and left ears = RE-V and LE-V
Auditory Middle Latency Response	AMLR	Event related potential generated by the thalamic, pre-cortical and cortical levels of the frontal and temporal lobes of the brain in response to acoustic stimuli; *commonly used to assess higher-order cognitive function*; waveform peaks occur within 12-80 msec following stimulus onset = N_0, P_0, N_a, P_a, N_b, and P_b.
Auditory Late Latency Response	ALLR	Event related potential generated by the primary and secondary auditory cortices of the temporal lobe, the mesencephalic reticular activating system and the planum temporale, in response to acoustic stimuli; commonly used to assess higher-order cognitive function; waveform peaks occur within 50-250 msec following stimulus onset and are labeled as N1, P1, N2, P2, and P3.
Mismatch Negativity	MMN	An auditory late latency response generated by the primary and secondary cortices of the temporal lobe with contributions from the frontal lobe; commonly used to assess sequential and fundamental brain processes, including pre-attentive analysis of sound features, cognitive processes, sensory memory and the continuous comparison and perception of acoustic stimuli; waveform peaks occur within the latency range of 100-300 msec

Term	Abbreviation	Definition
Auditory Middle Latency Response	AMLR	Event related potential generated by the thalamic, pre-cortical and cortical levels of the frontal and temporal lobes of the brain in response to acoustic stimuli; ***commonly used to assess higher-order cognitive function***; waveform peaks occur within 12-80 msec following stimulus onset = N_0, P_0, N_a, P_a, N_b, and P_b.

Pete ‘Skip’ Scheifele, MDr, Ph.D., LCDR USN

Kristine E. Sonstrom, Au.D., Ph.D.

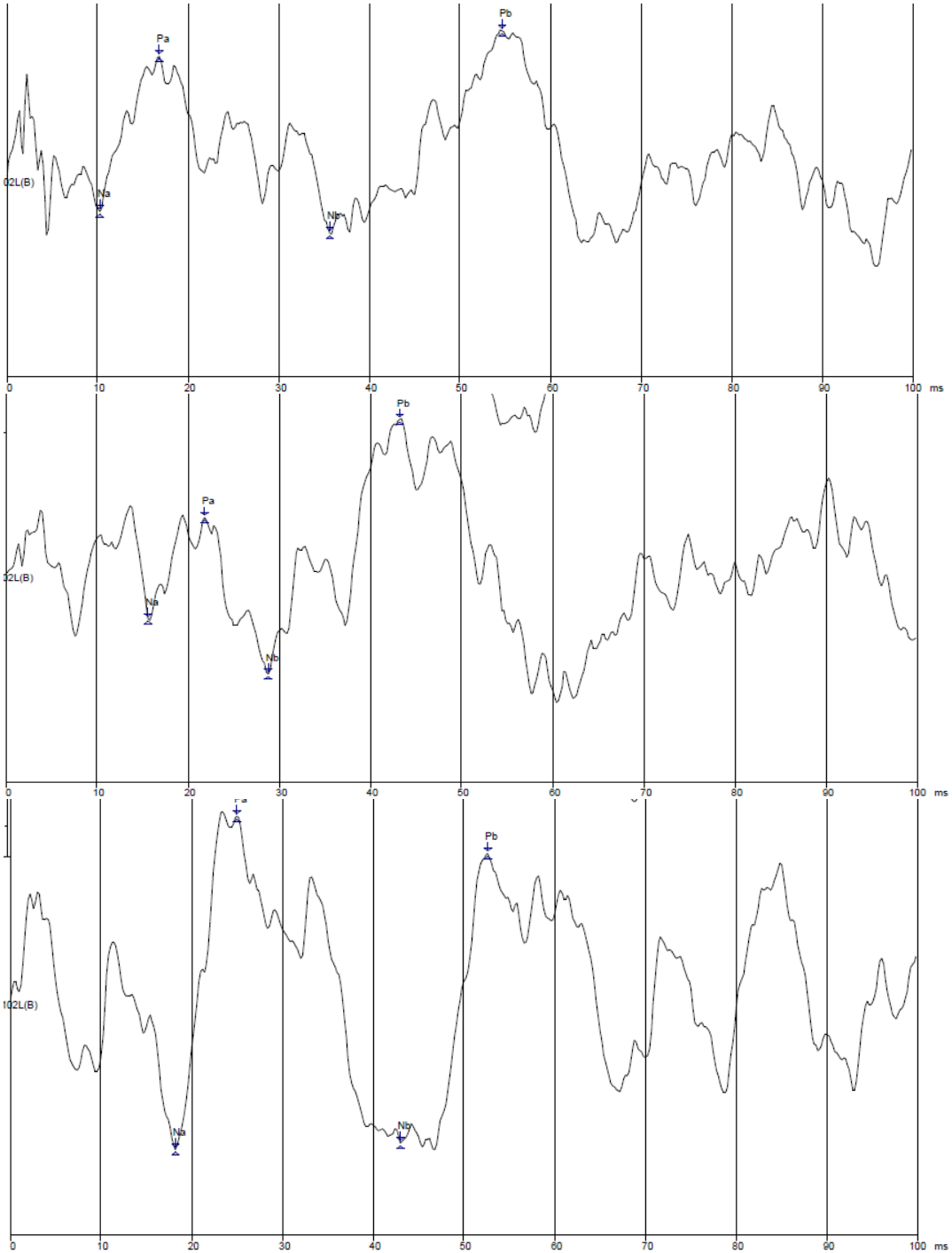
Jess Lydon, CVT, with “Chino”

Sample AMLR

14 yo FS Labrador retriever

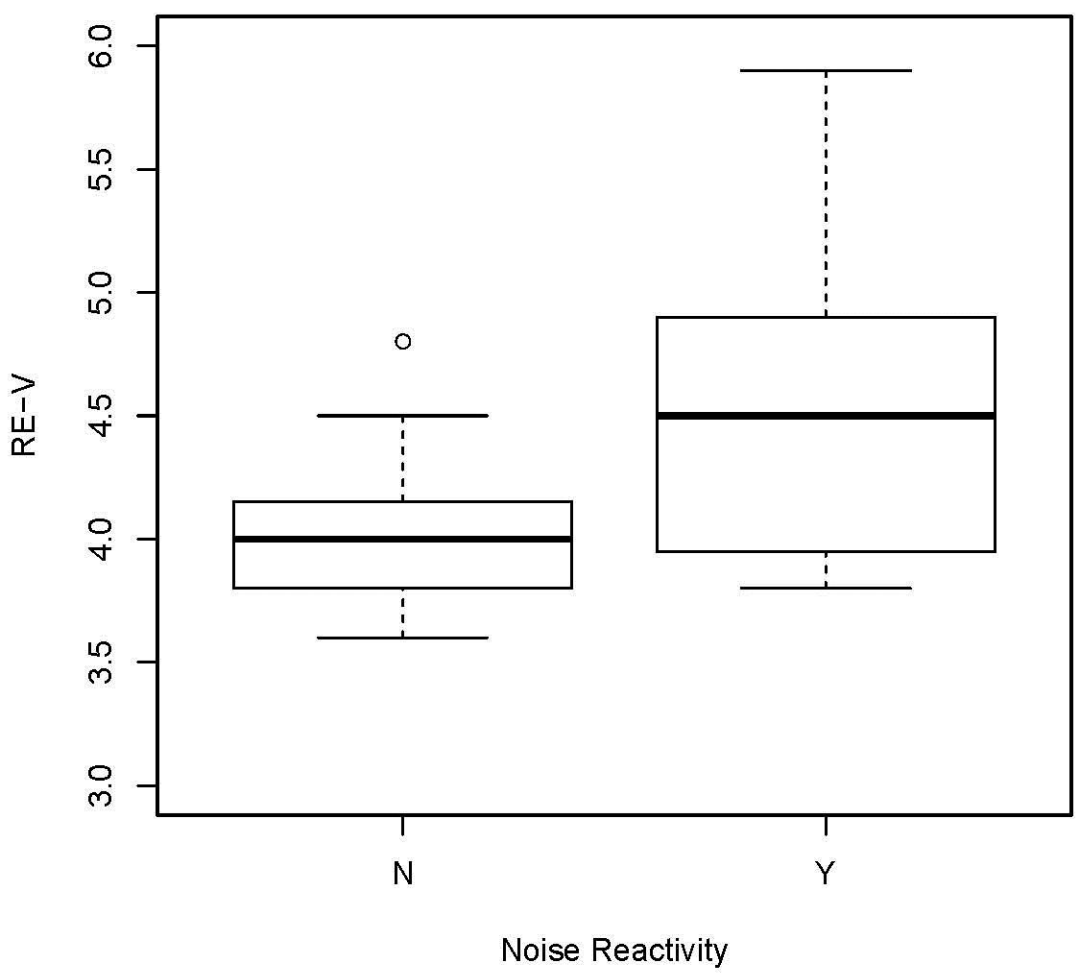
8 yo MC Australian shepherd

8 month old F German shepherd



Statistically significant ($P < 0.05$) Spearman rank correlations among major auditory variables, noise reactivity status, AIR and SAIR scores.

Variables	**R_s (P)**
LE-V - RE-V	r_s =0.62, (P = 0.001)
Noise Reactivity RE-V	**r_s = -0.40, (P = 0.001)**
Noise Reactivity - AIR	r_s =0.62, (P = 0.003)
N_a - P_a	r_s =0.44, (P = 0.03)
N_b - P_b	r_s =0.66, (P = 0.00)
N1 – P2S	r_s =0.46, (P = 0.02)
N1D – P2D	r_s =0.43, (P = 0.02)
P2D – P2MM	r_s =0.62, (P = 0.000)


RE.V by Noise Reactivity
RE-V
3.0
3.5
4.0
4.5
5.0
5.5
6.0
N
Y
Noise Reactivity

Findings – AIR scores x auditory assessment

- Affected dogs were relatively *mild*: mean AIR score = 17.65, max = 64 (max possible = 128); SD = 17.82.
- AIR scores for the two groups of dogs were highly significantly different (t = 4.34, df = 19.23, $P < 0.0004$).
- *There was no statistically significant association for AMLR and AIR score, but there was a highly significant (P<0.001)relationship between RE-V and noise reactivity.*
- But ….the auditory portion of this test should be expanded to a more severely affected population. The domain of generality here is limited.

Findings – global behavior x audiology

- 2 dogs in each group were lost to diseases like otitis media leaving 17 noise reactive and 14 non-reactive dogs.
- 5 of the final 17 noise reactive dogs were too reactive to undergo or complete the test but ***none*** of the final 14 non-reactive dogs were unable to undergo and complete testing (G test; $P<0.0294$).
- *The noise reactive dogs different significantly from non-reactive dogs in handling and testing ability.*

Conclusions

- Being affected with noise reactivity/phobia – at any level – impairs performance in a problem solving task.
- Being affected with noise reactivity/phobia – at any level – affects how you move when you use environmental and social information.
- Being affected with noise reactivity/phobia – at any level – likely affects many other aspects of your life that are seldom appreciated, but mentally and emotionally painful for the dog.
- Noise reactivity/phobia changes under-appreciated aspects of dogs' lives…. *it essentially functions to turn off the plastic, problem solving canine brain.*

Acknowledgments

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- The publication for this presentation is: Scheifele PM, Sonstrom KE, Dunham AE, Overall KL. Is noise reactivity reflected in auditory response variables, including those that measure cognition, in dogs? Initial findings. J Vet Behav: Clin Appl Res 2016;16:65-75.