Association between Lateralization & Guide Dog Success

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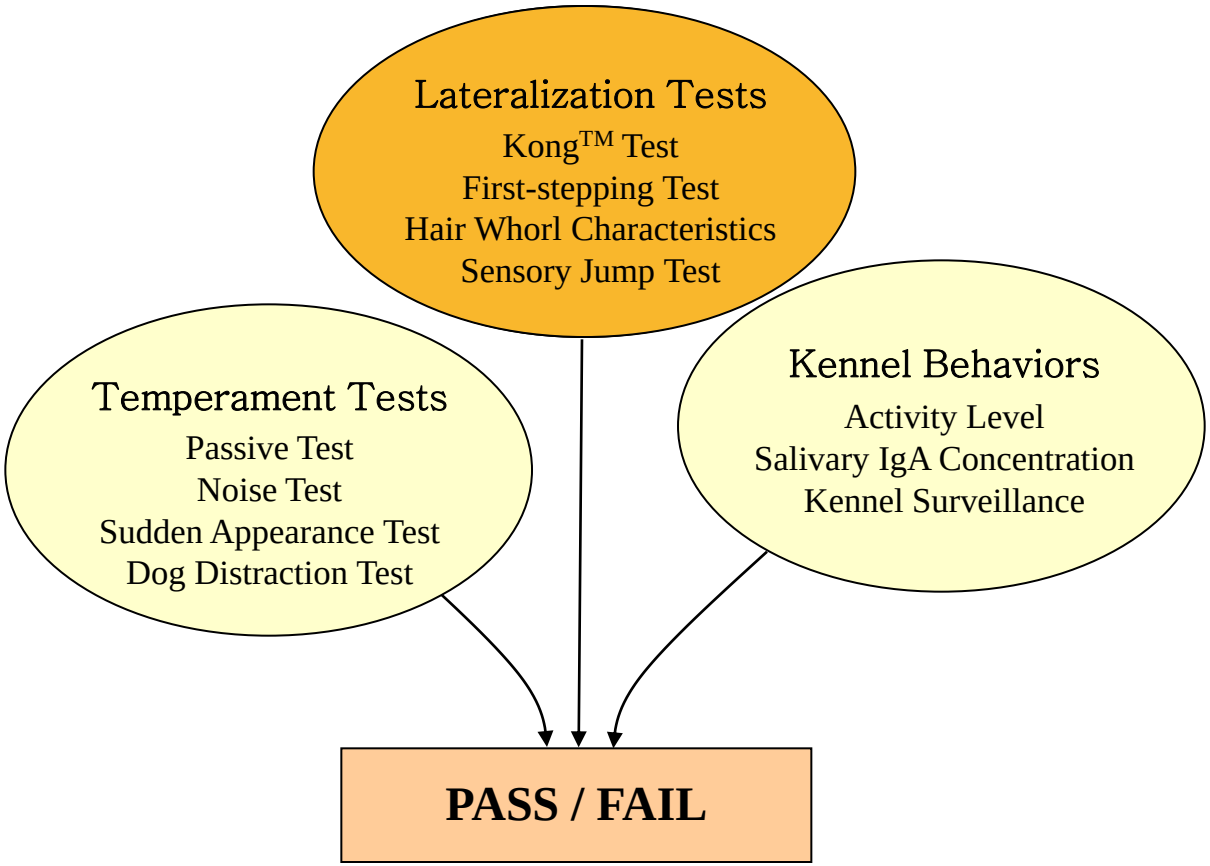
Guide Dogs™
Guide Dogs NSW/ACT

Guide Dogs

Training 1 Successful Guide Dog = AU$30,000 ≈ US$33,000

Success Rate for Dogs in Training ≈ 50%

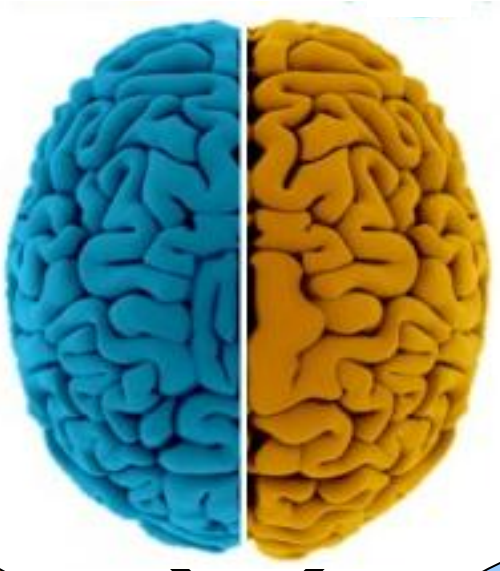
Identifying Early Predictors



Tomkins, L.M., Thomson, P.C. and McGreevy, P.D. (2011) Behavioral and physiological predictors of guide dog success. *Journal of Veterinary Behavior: Clinical Applications and Research.* Volume 6, Issue 3, Pages 178-187.

Lateralization

Left Hemisphere
Considered responses
Focused attention
Feeding & prey capture
Categorizing stimuli



Right Hemisphere
Rapid responses
Predator detection
Analyzing spatial info
Viewing novel stimuli

Left side of the body
Rapid responses
Aggressive responses
Avoidance

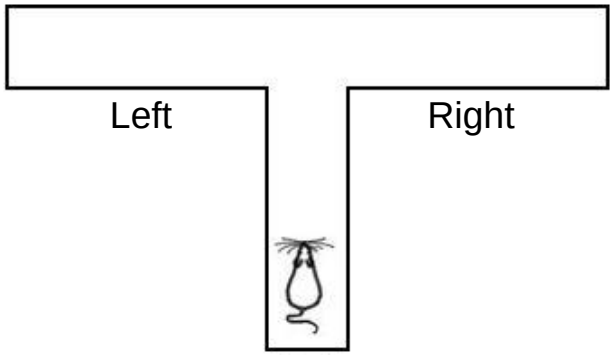
Right side of the body
Prey detection & feeding
Learned responses
Approach

Lateralization

- **Motor Laterality**
  - Hand, paw, flipper preferences
  - Coiling behaviors
  - Turning bias

Counter-clockwise

Clockwise

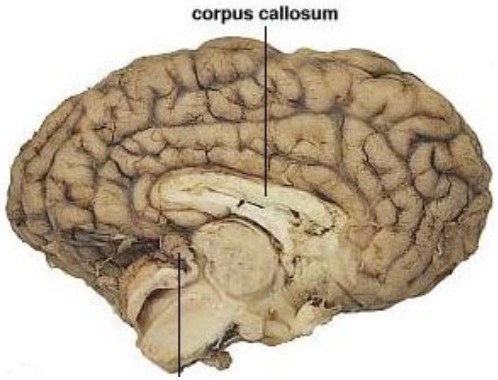


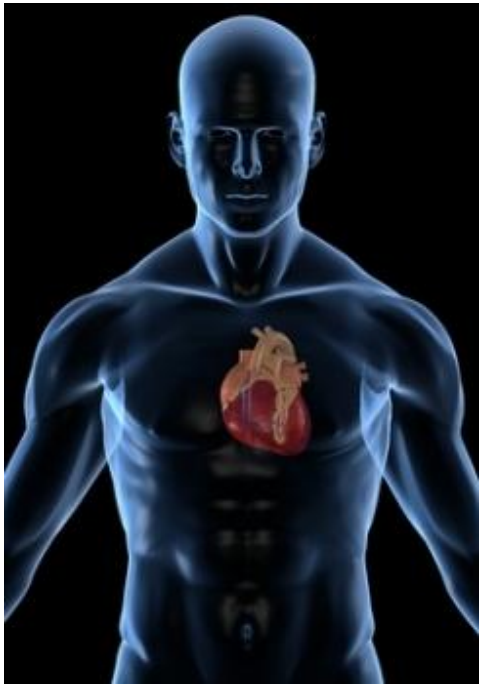
Lateralization

- **Sensory Laterality**
  - Visual
  - Auditory
  - Tactile
  - Olfactory

Lateralization

- **Structural Laterality**
  - Hair whorl direction
  - Position of heart in thorax
  - Corpus callosum





Lateralization Studies

Motor Laterality in the Dog

Task	Study
Removal of tape from the eyes or nose	Tan, 1987; Tan and Caliskan, 1987; Quaranta et al., 2004; Poyser et al., 2006; Quaranta et al., 2006; Batt et al., 2008; Batt et al., 2009
Removal of a blanket from the head	Wells, 2003
Paw to shake hands	Wells, 2003
Retrieval of food from a metal can or from a Kong™	Wells, 2003; Branson and Rogers, 2006; Batt et al., 2007; Batt et al., 2008; Siniscalchi et al., 2008; Batt et al., 2009; McGreevy et al., 2010; Tomkins et al., 2010
Reaching for, or manipulation of, food	Aydinlioğlu et al., 2000; Aydinlioğlu et al., 2006; Branson and Rogers, 2006; Poyser et al., 2006
Manipulation of a ball	Poyser et al., 2006
Paw used to step-off from a sit or stand position	van Alphen et al., 2005; Tomkins et al., 2010
Paw used preferentially during locomotion	Hackert et al., 2008
Head turning bias	Siniscalchi et al., 2010
Direction of tail wagging	Quaranta et al., 2007

Motor Laterality in the Dog

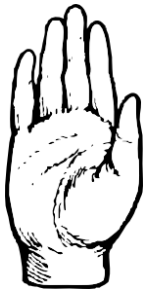
Table 1 Summary of the results of motor laterality studies in the dog (adapted from Branson, 2006)

Study	Sample size	Number of laterality scores recorded per dog	Ambilateral	Lateralized	Left	Right
Tan (1987)[a]	28	100	25%	75%	18%	57%
Tan and Caliskan (1987)[a]	24	100	NR	NR	NR	NR
Aydinlioğlu et al. (2000)[b]	21	NR	0%	100%	48%	52%
Wells (2003)						
Task 1[c]	53	100	6%	94%	39%	55%
Task 2[d]	53	100	15%	85%	34%	51%
Task 3[e]	53	100	19%	81%	41%	40%
Quaranta et al. (2004)[f]	76	12-72	25%	75%	NR	NR
van Alphen et al. (2005)[g]	36	3	NR	NR	NR	NR
Aydinlioğlu et al. (2006)[b]	20	NR	0%	100%	55%	45%
Branson and Rogers (2006)[h]	48	100	23%	77%	44%	33%
Poyser et al. (2006)						
Task 1[i]	59	NR	NR	NR	NR	NR
Task 2[e]	35	11-20	NR	NR	NR	NR
Task 3[j]	55	30-120	NR	NR	NR	NR
Quaranta et al. (2006)[e]	36	NR	NR	NR	NR	NR
Quaranta et al. (2007)[k]	30	NR	NR	NR	NR	NR
Batt et al. (2008)						
Task 1[f]	43	26	NR	NR	NR	NR
Task 2[h]	43	100	NR	NR	NR	NR
Hackert et al. (2008)[l]	5	69-125	0%	100%	60%	40%
Siniscalchi et al. (2008)[h]	14	50	21%	79%	43%	36%
Batt et al. (2009)						
Task 1[f]	43	26	NR	NR	NR	NR
Task 2[h]	43	50	NR	NR	NR	NR
Siniscalchi et al. (2010)[m]	30	10	NR	NR	NR	NR
McGreevy et al. (2010)[h]	183	100	63%	37%	17%	20%
Tomkins et al. (2010a)						
Task 1[h]	113	50	48%	52%	28%	24%
Task 2[n]	113	50	24%	76%	30%	46%

Tomkins, L.M., McGreevy, P.D. and Branson, N.J. (2010) Lack of standardization in reporting motor laterality in the domestic dog (*Canis familiaris*). *Journal of Veterinary Behavior: Clinical Applications and Research*, Volume 5, Issue 5, Pages 235-239.

Background - Motor Laterality

Right Preferent



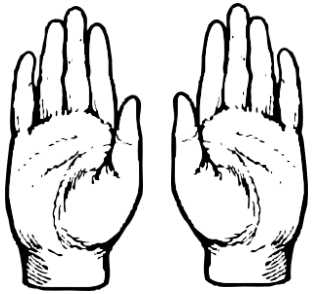
› Willing to approach novel objects & environments

Left Preferent

› Cautious & fearful of approaching novel objects & environments

Ambidextrous

(No Preference)



› Increased reactivity to loud noises; e.g. thunder, fireworks

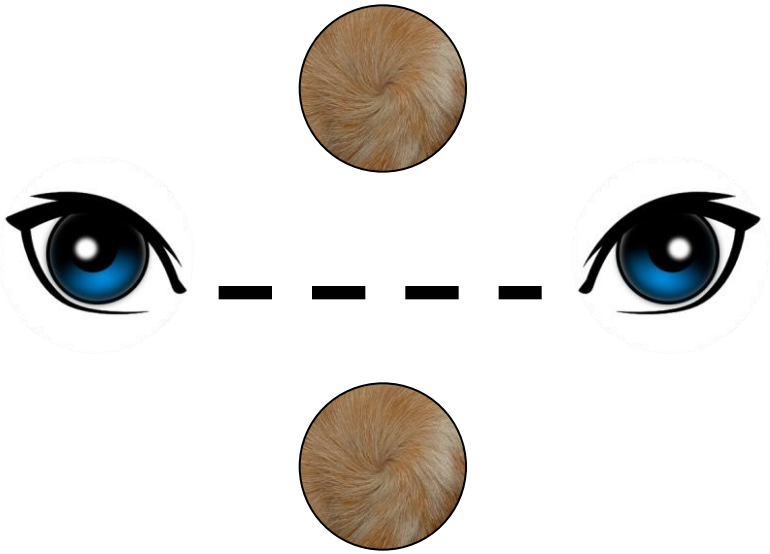
Background - Sensory Laterality

- Convention dictates that the dog walks on the handler's left side

Background - Structural Laterality

Highly reactive

Agitated



Lower reactivity

Calmer, Docile

Methodology

› Study Population

- **114 dogs**
  - 61 Females
  - 53 Males

› Motor Laterality

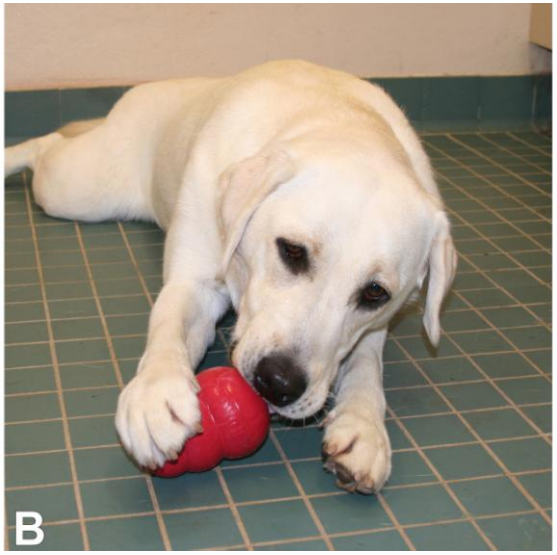
› Sensory Laterality

› Structural Laterality

Motor Laterality - Paw Preference

The Kong™ Test

Left paw-use



Right paw-use

Both paws used

The Kong™ Test

Motor Laterality - Paw Preference

The First-stepping Test

Forelegs level

prior to stepping-off

Right paw-use

Left paw-use

The First-stepping Test

Sensory Laterality – Visual Bias

Binocular vision

(n=10 jumps)

Right monocular vision

(n=10 jumps)

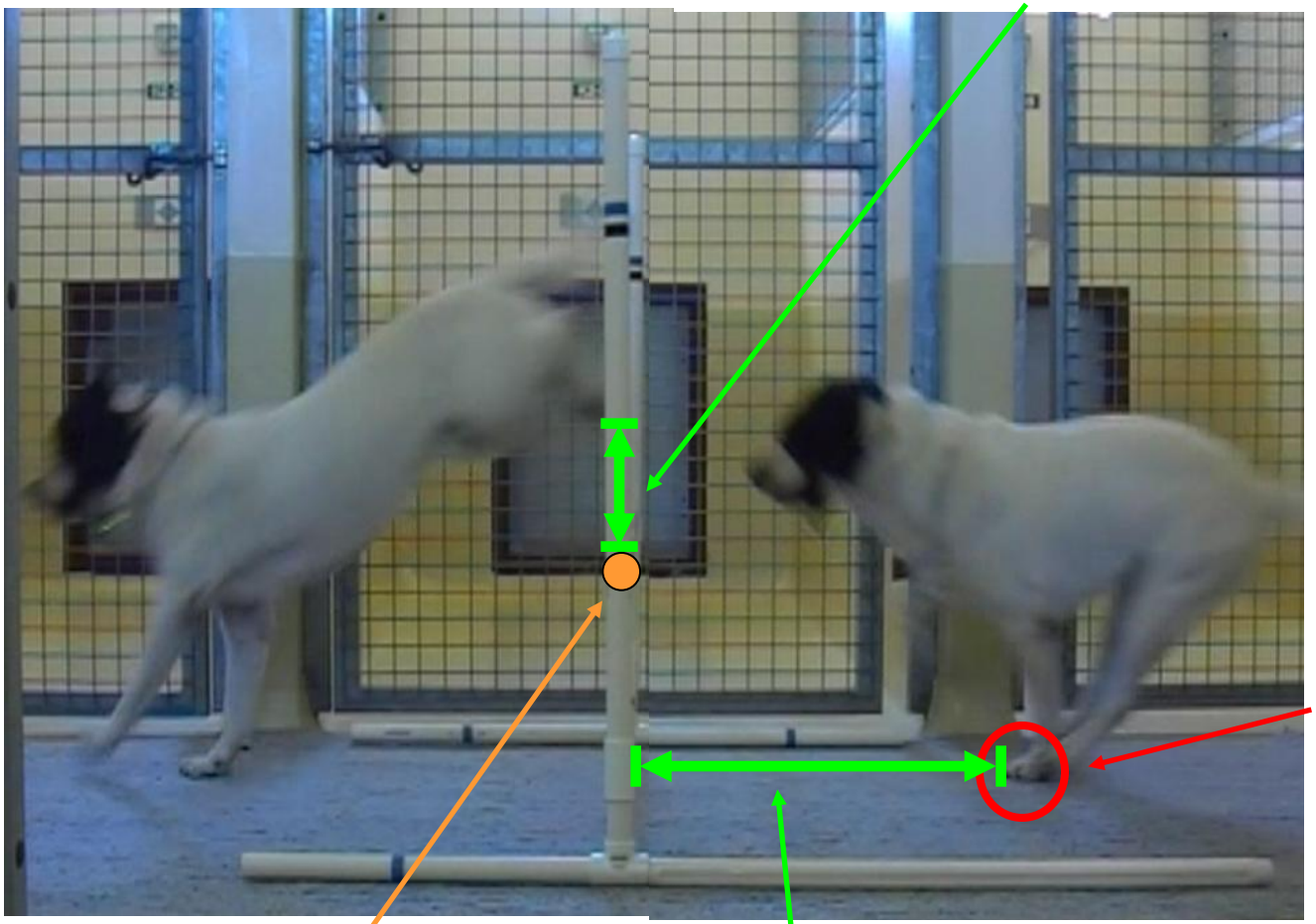
Left monocular vision

(n=10 jumps)

= 30 jumps per dog

Sensory Jump Test Measurements

Clearance height
(forepaw, hindpaw, lowest body part)



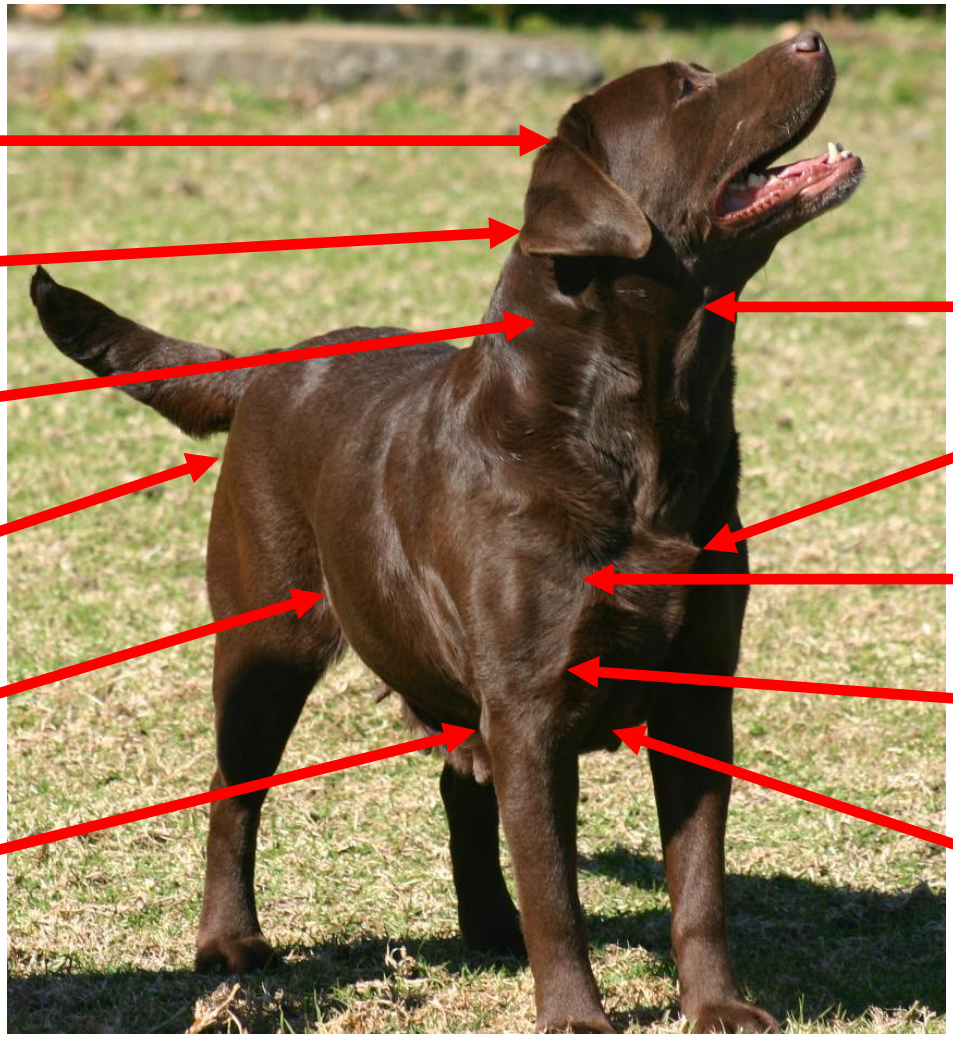
Launching paw

Jump bar

Approach distance

The Sensory Jump Test

Hair Whorl Locations



Cephalic

Cervical – Dorsal

Cervical – Lateral

Ischiatic

Abdominal

Elbow

Ventral Mandibular

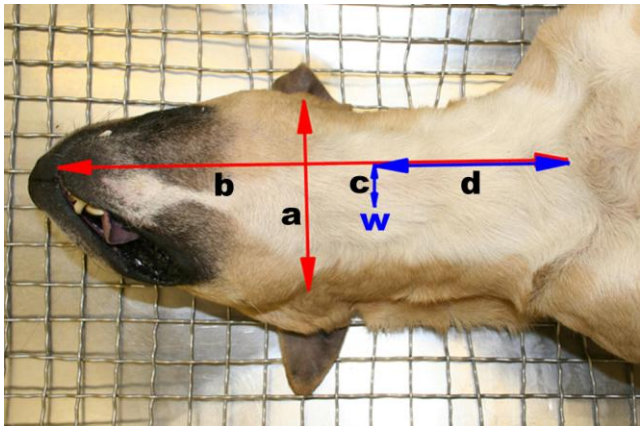
Chest

Shoulder

Brachial Axillae

Thoracic Axillae

Hair Whorl Characteristics



› Position

Simple

Tufted

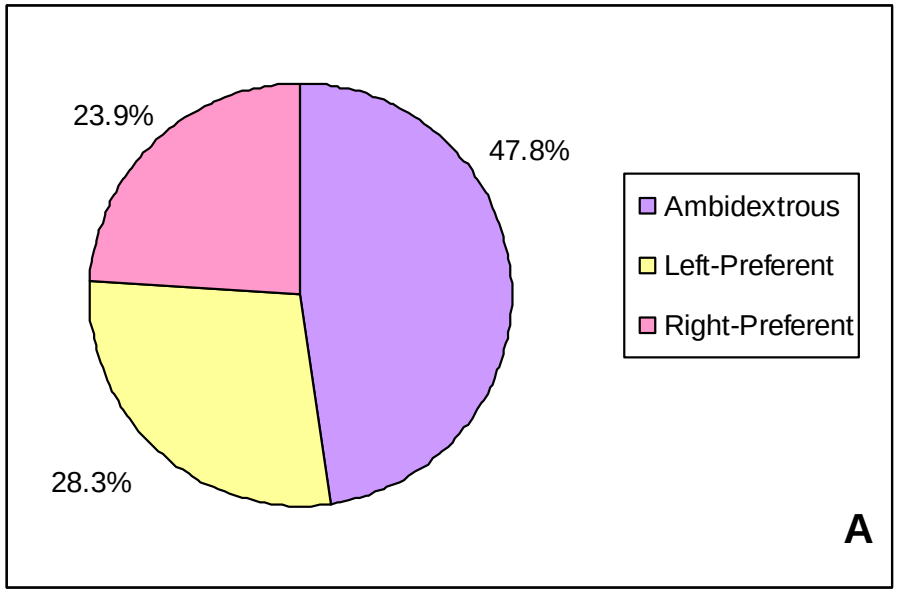
Clockwise

Counter-clockwise

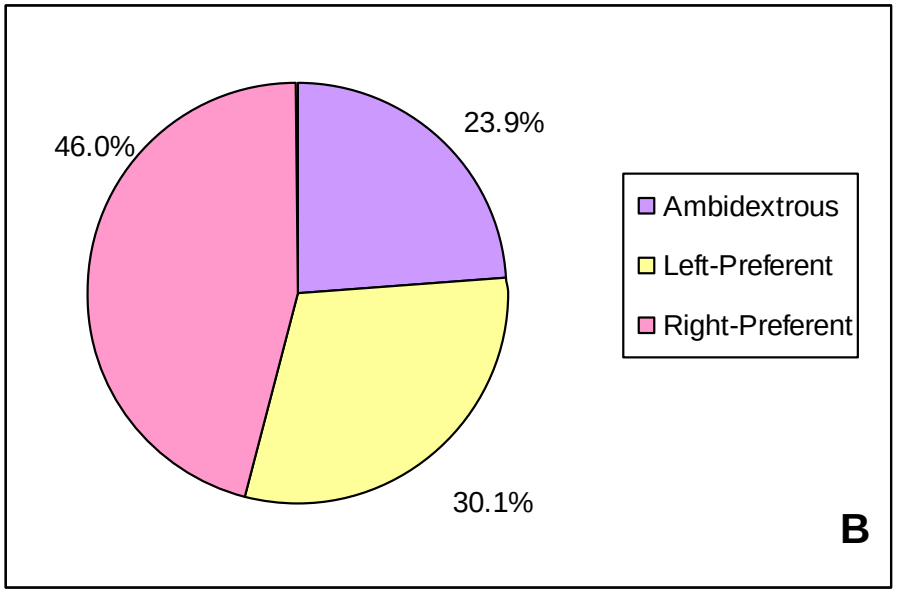
Results - Motor Laterality

› Classification of paw preferences based on the three paw categories; right-preferent, left-preferent, or ambidextrous.

Kong™ Test

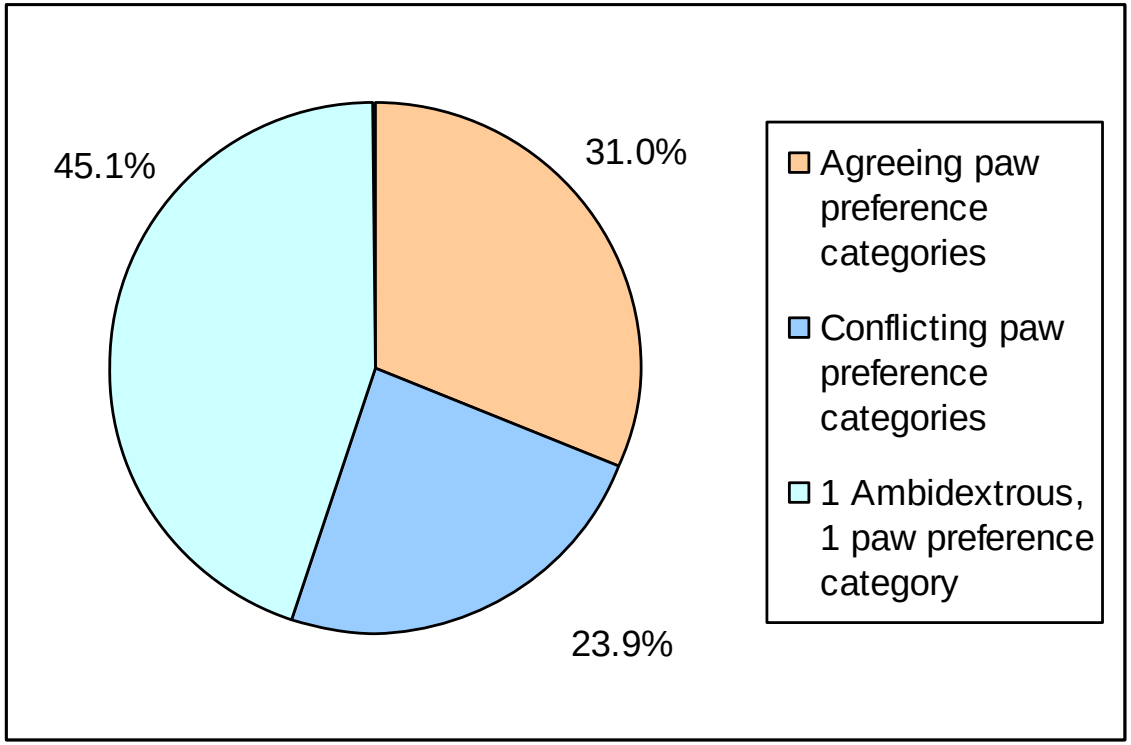


First-stepping Test



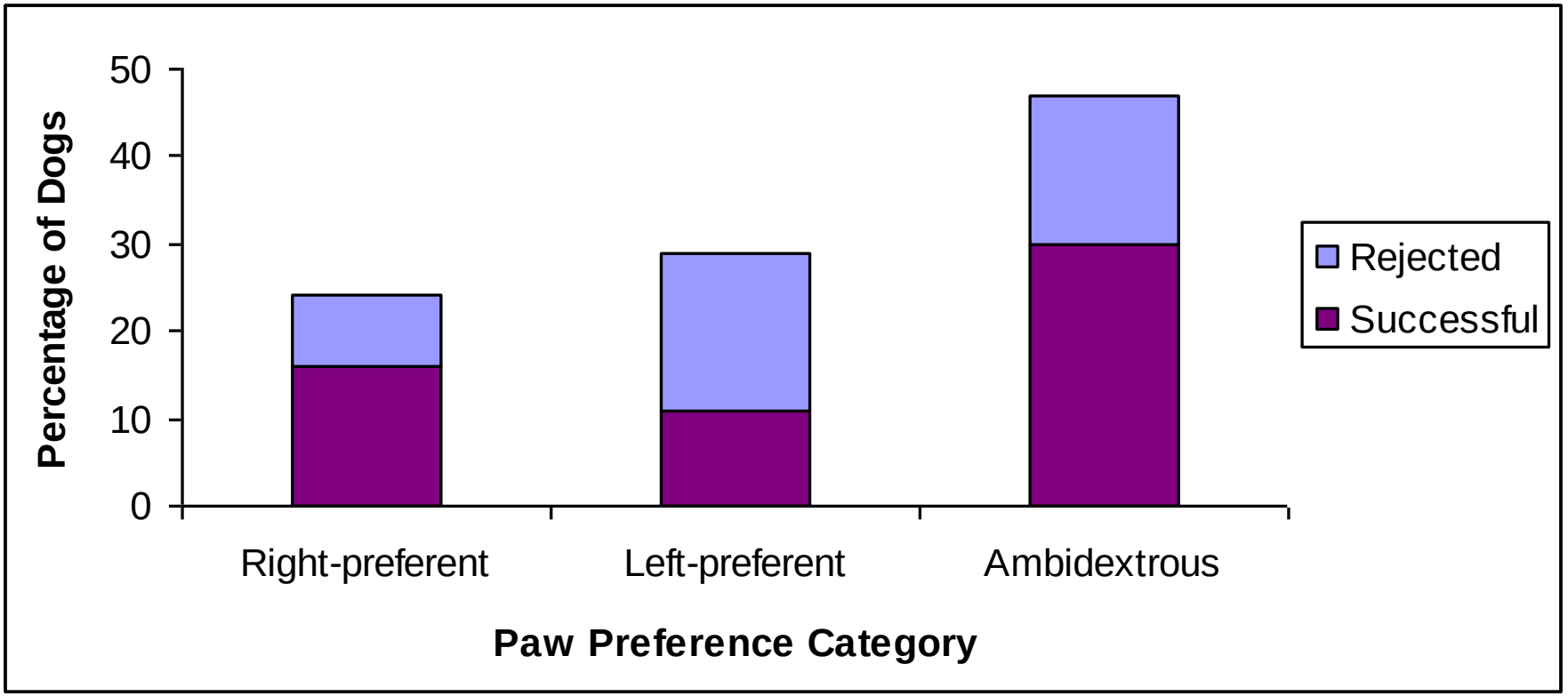
Results - Motor Laterality

› Relationship between paw preference categories as determined by the Kong™ and First-stepping Tests.



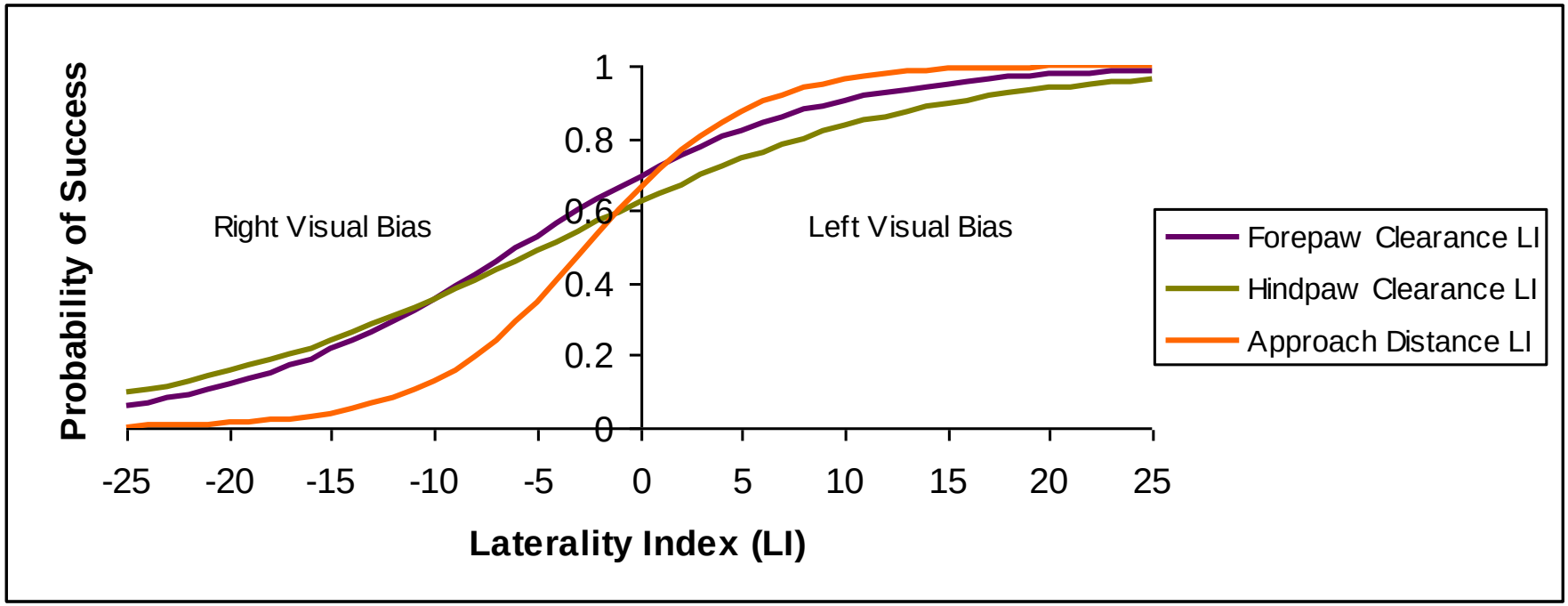
Results - Motor Laterality

› Distribution of paw preference (Kong™ Test) and their relative success rate in the Guide Dog Training Program



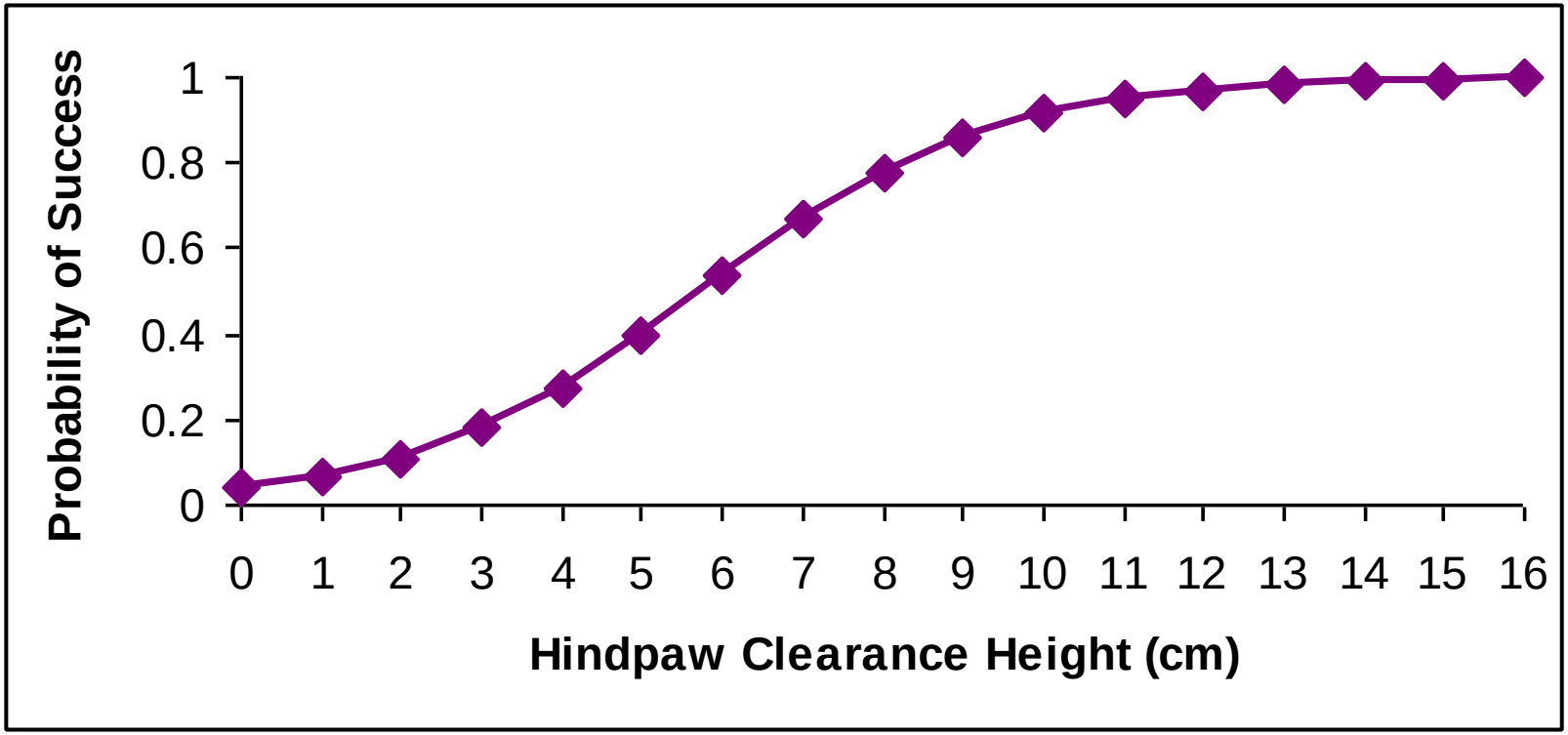
Results - Sensory Laterality

› Effect of Sensory Jump Test laterality indices (LI) on the probability of success in the Guide Dog Training Program



Results - Sensory Laterality

› Effect of hindpaw clearance height on the probability of success in the Guide Dog Training Program



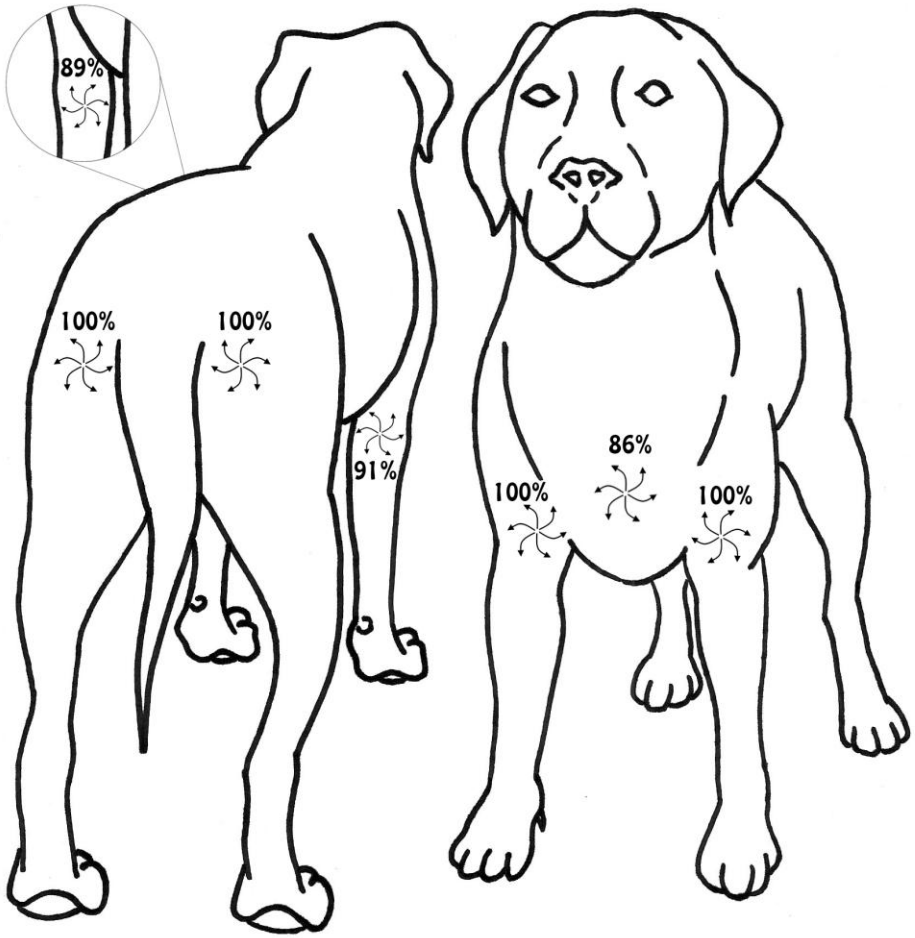
Results - Structural Laterality

Position	Presence		Classification
	Left	Right	
Cephalic^	0.9%	0.9%	Simple
Cervical – Dorsal	0.0%		-
Cervical – Lateral	0.9%	2.6%	Simple
Ventral Mandibular*#	11.1%		Simple
Chest*	92.1%		Tufted
Brachial Axillae	95.6%	98.3%	Simple
Thoracic Axillae+	10.8%	14.4%	Simple
Shoulder	7.0%	7.0%	Simple
Elbow	92.1%	92.1%	Tufted
Abdominal	1.8%	0.9%	Simple
Ischiatic	86.0%	87.7%	Simple

Based on *n* =114, with the exception of ^ *n* = 113, # *n* = 108, + *n* = 111. *Depicts whorls located centrally.

Results - Structural Laterality

- **Whorl Direction**



Results - Structural Laterality

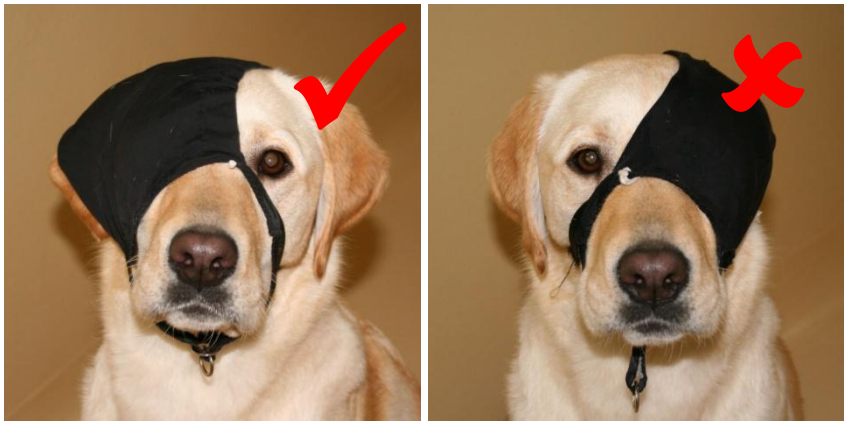
Counter-clockwise

Clockwise

Summary

- Motor Lateralization

- Sensory Lateralization



- Structural Lateralization

Practical Implications

Success rate of dogs in the Guide Dog Training Program (GDTP) based on the categorization of structural and motor laterality measures

Chest Whorl Direction	Paw Preference Category	Success Rate in the GDTP
Counter-clockwise (*n* = 77)	Ambidextrous (*n* = 39)	64.1%
	Right (*n* = 18)	72.2%
	Left (*n* = 20)	45.0%
Clockwise (*n* = 14)	Ambidextrous (*n* = 4)	50.0%
	Right (*n* = 3)	33.3%
	Left (*n* = 7)	14.3%

Note: Success rate is based on 91 dogs that had both a chest whorl present, and participated in the Kong™ Test.

Practical Implications

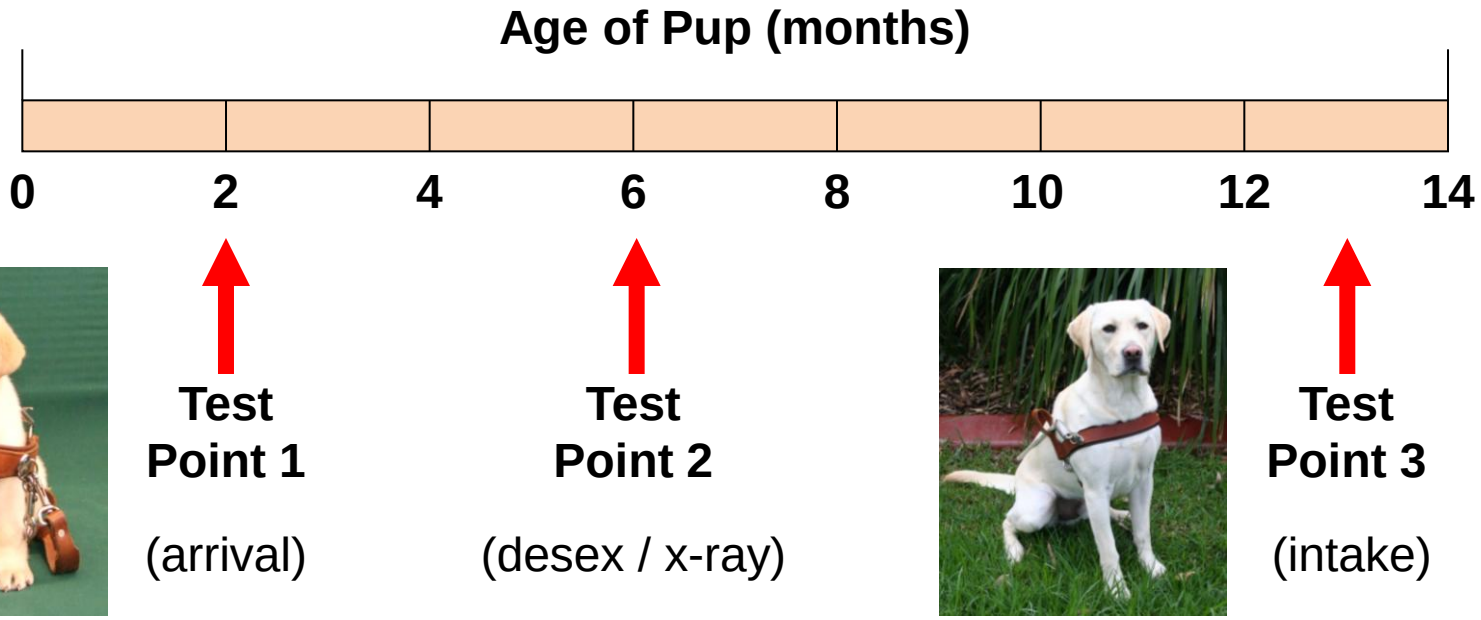
Success rate of dogs in the Guide Dog Training Program (GDTP) based on the categorization of structural and sensory laterality measures

Chest Whorl Direction	Hindpaw Clearance Height	Success Rate in the GDTP
Counter-clockwise (*n* = 55)	> 5 cm (*n* = 36)	72.2%
	≤ 5 cm (*n* = 19)	57.9%
Clockwise (*n* = 5)	> 5 cm (*n* = 4)	25.0%
	≤ 5 cm (*n* = 1)	0.0%

Note: Success rate is based on 60 dogs that had both a chest whorl present and participated in the Sensory Jump Test.

Laterality Studies at Guide Dogs

- Motor and Structural Lateralization
- Timeframe



Laterality Studies at Guide Dogs

Stay tuned for answers in 2012..

Acknowledgements

› PhD Support

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SCUZ TECHNOLOGIES

THE UNIVERSITY OF SYDNEY

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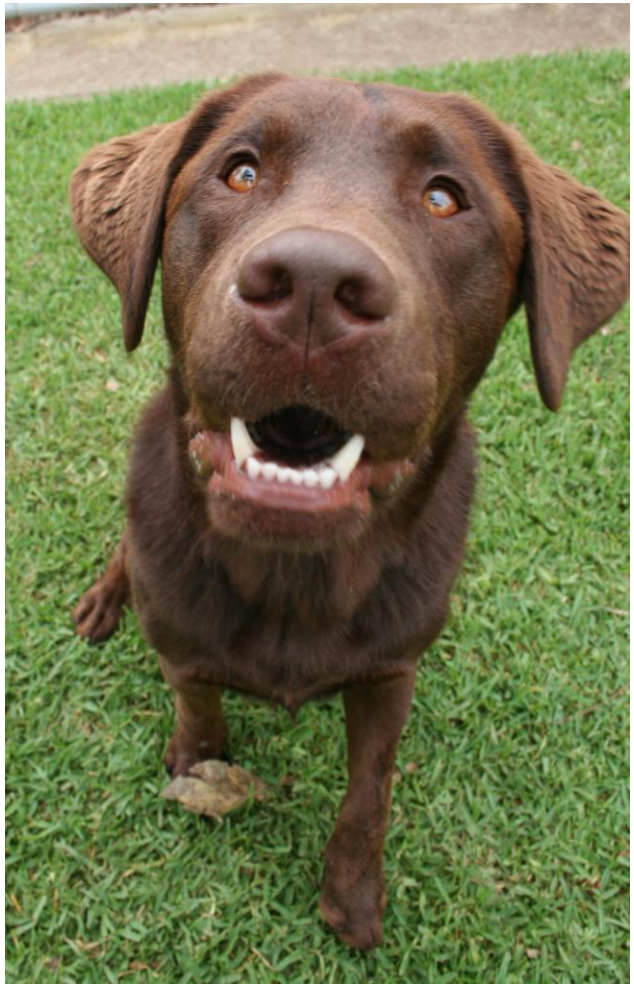
- Penn Vet Working Dog Centre



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