

# Personality & Performance in Working Dogs

## Reliability and Predictive Validity of Behavioral Tests



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National Science  
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# Talk Outline

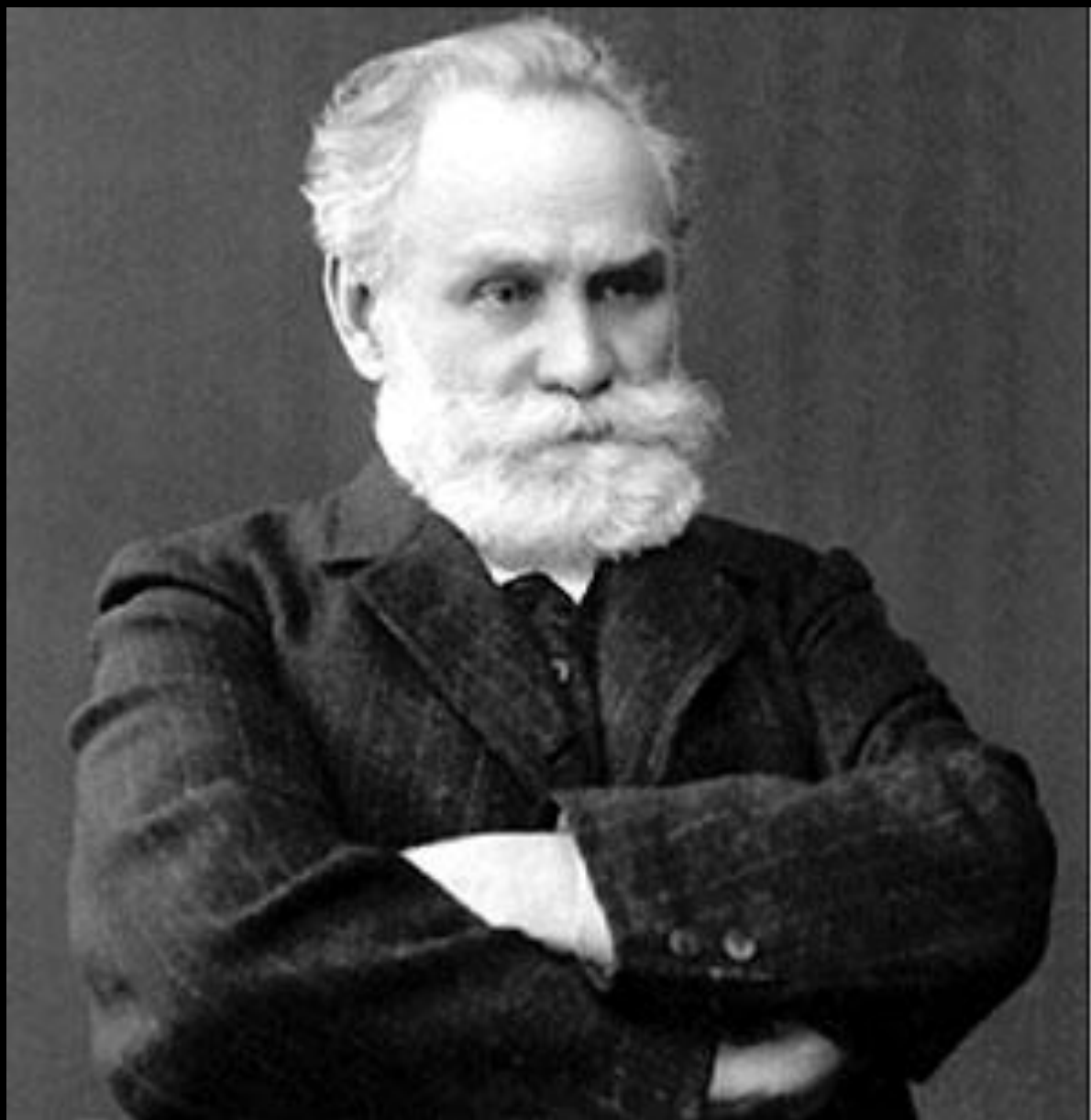
## I – Groundwork

- What is personality?
- Can we measure it?
- What are the basic dimensions?
- Does it predict behavior?

## II – Personality in Working Dogs

- Reliability
  - Interjudge
  - Test-retest
- Validity

## III – Remaining Questions



“Trascible, irritable, manipulative, and grumpy.”

Suzy June



# Terminology

Temperament

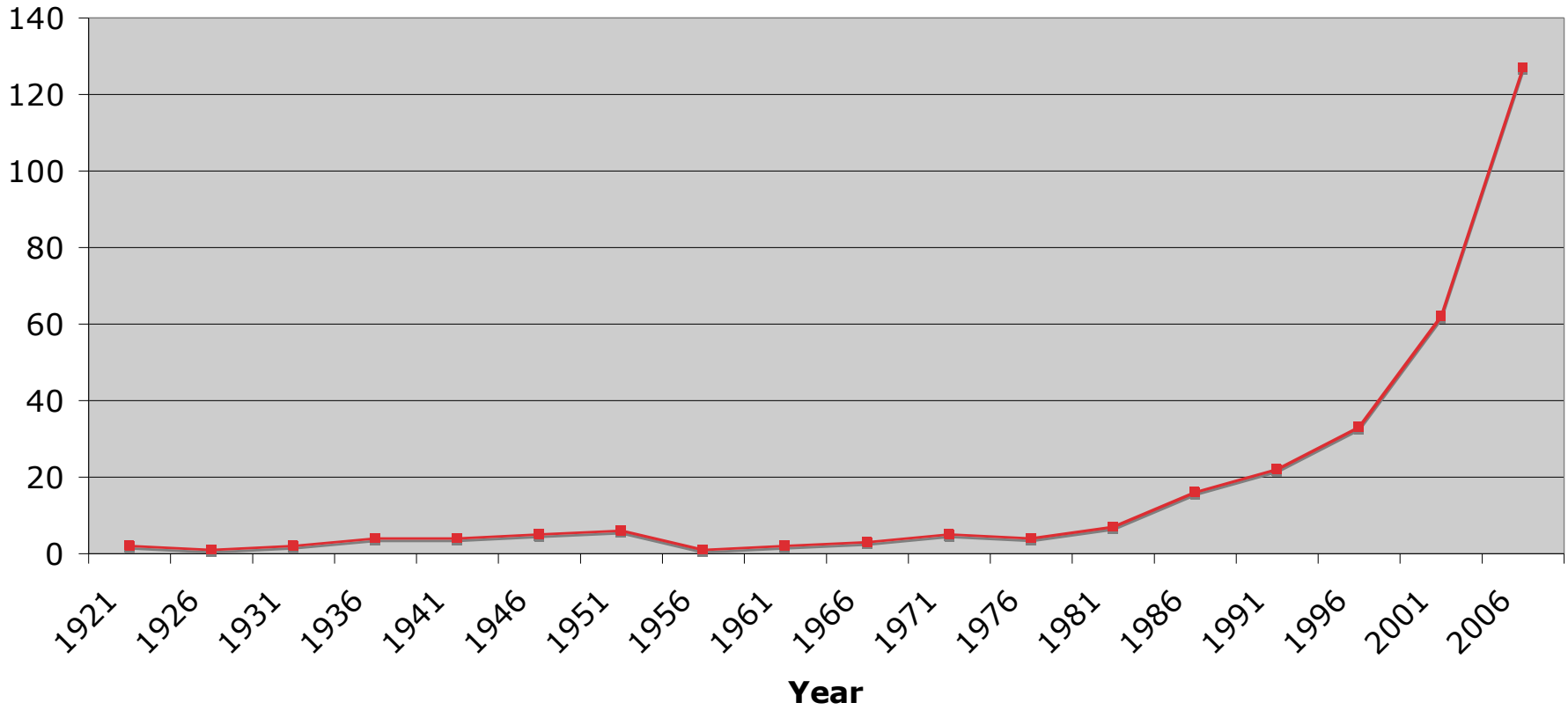
vs.

Personality

vs.

Behavioral Syndromes

*Figure 2: Animal Personality Keywords*



(Gosling, 2008)

## LETTERS

# Life-history trade-offs favour the evolution of animal personalities

Max Wolf<sup>1</sup>, G. Sander van Doorn<sup>1,†</sup>, Olof Leimar<sup>2</sup> & Franz J. Weissing<sup>1</sup>

In recent years evidence has been accumulating that personalities are not only found in humans<sup>1</sup> but also in a wide range of other animal species<sup>2–8</sup>. Individuals differ consistently in their behavioural tendencies and the behaviour in one context is correlated with the behaviour in multiple other contexts. From an adaptive perspective, the evolution of animal personalities is still a mystery, because a more flexible structure of behaviour should provide a selective advantage<sup>9–11</sup>. Accordingly, many researchers view personalities as resulting from constraints imposed by the architec-

birds<sup>8</sup> and rodents<sup>5</sup>. Individuals should adjust reproductive value<sup>1</sup> to match the environment, and individuals with relative advantages in one context should have relative disadvantages in other contexts. By the same reason, individuals should be relatively flexible in their behaviour. Consequently, when

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be pivotal to solving the mystery of high-temperature superconductivity.

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PROCEEDINGS  
OF  
THE ROYAL  
SOCIETY

B

*Proc. R. Soc. B* (2007) 274, 1685–1691  
doi:10.1098/rspb.2007.0332  
Published online 1 May 2007

## *Drd4* gene polymorphisms are associated with personality variation in a passerine bird

Andrew E. Fidler<sup>1,2,†</sup>, Kees van Oers<sup>1,3,†</sup>, Piet J. Drent<sup>3</sup>, Sylvia Kuhn<sup>1</sup>, Jakob C. Mueller<sup>1</sup> and Bart Kempenaers<sup>1,\*</sup>

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<sup>3</sup>Netherlands Institute of Ecology, PO Box 40, 6666 ZG Heteren, The Netherlands

Polymorphisms in several neurotransmitter-associated genes have been associated with variation in human personality traits. Among the more promising of such associations is that between the human dopamine receptor D4 gene (*Drd4*) variants and novelty-seeking behaviour. However, genetic epistasis, genotype-environment interactions and confounding environmental factors all act to obscure genotype-personality relationships. Such problems can be addressed by measuring personality under standardized conditions and by selection experiments, with both approaches only feasible with non-human animals. Looking for similar *Drd4* genotype-personality associations in a free-living bird, the great tit (*Parus major*), we detected 73 polymorphisms (66 SNPs, 7 indels) in the *P. major Drd4* orthologue. Two of the *P. major Drd4* gene polymorphisms were investigated for evidence of association with novelty-seeking behaviour: a coding region synonymous single nucleotide polymorphism (SNP830) and a 15 bp indel (ID15) located 5' to the putative transcription initiation site. Frequencies of the three *Drd4* SNP830 genotypes, but not the ID15 genotypes, differed significantly between two *P. major* lines selected over four generations for divergent

### EVOLUTIONARY BIOLOGY

## Animal personalities

Alison M. Bell

That different people differ in their readiness to take risks is an obvious feature of human personality. Theoretical advances now help in making sense of observations of analogous behaviour in animals.

Personality might seem to require a complexity and subtlety that is unique to humans. But evidence for individual variation in traits that we would recognize as personality, for example aggressiveness in fighting or boldness in the face of a predator, has cropped up in animals ranging from fish to monkeys to squid. Even an individual spider behaves differently from other spiders, through time and in different situations<sup>1</sup>. Wolf *et al.* (page 581 of this issue<sup>2</sup>) now show how such variation in behaviour can make evolutionary sense.

variation is puzzling, because natural selection will favour individuals with characteristics that perform the best, and less 'fit' individuals will be removed from the population. If a trait is heritable and linked to survival or reproductive success, then evolutionary theory tells us that variation will eventually disappear from the population. But, empirically, we know that personality traits are heritable<sup>3</sup>, are linked to fitness<sup>4</sup> and are quite variable.

So how is all this behavioural variation maintained? One way is if the fitness of one strategy



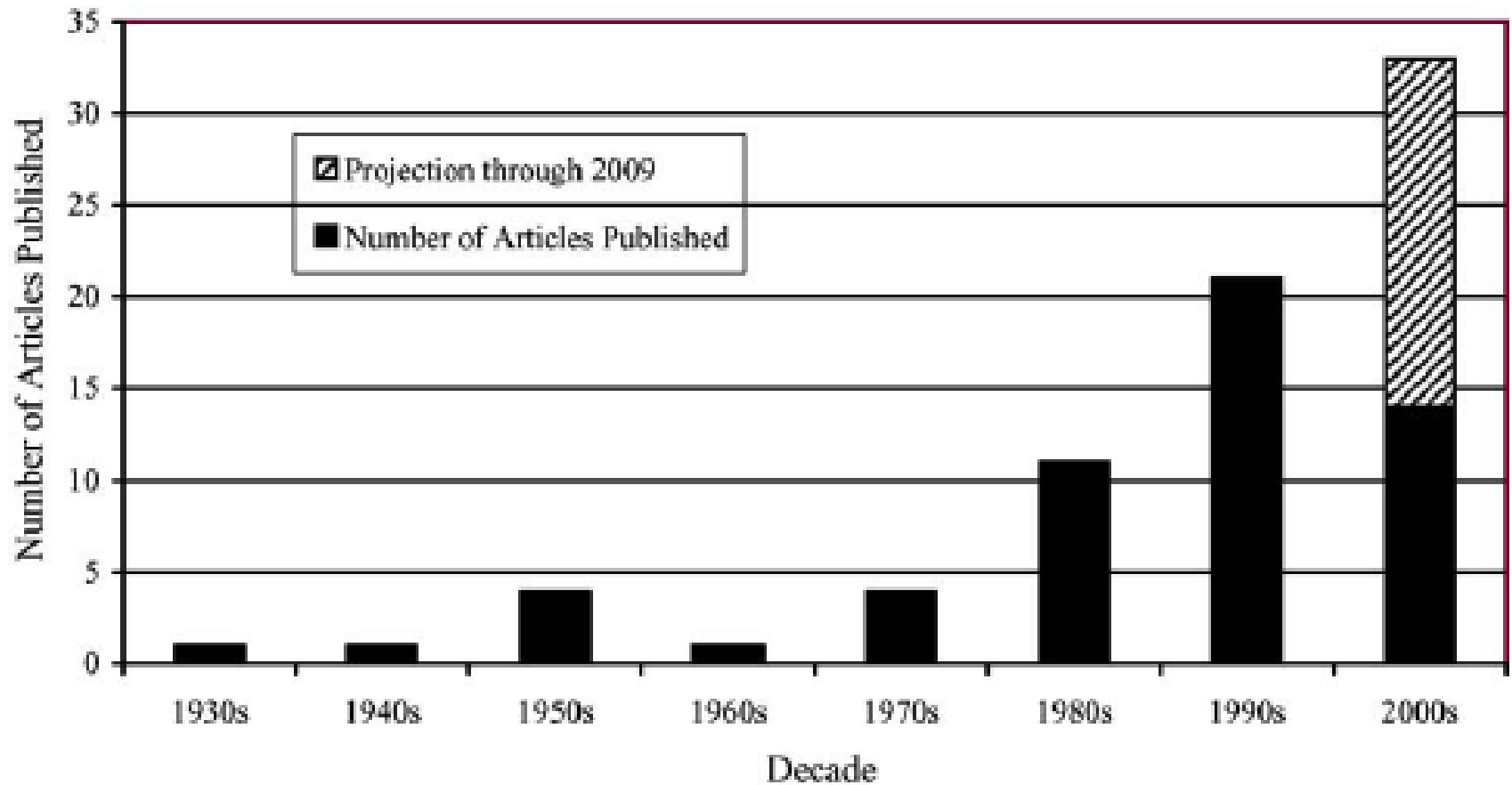
### 50 YEARS

A "Incorporation of amino-acids in the synthesis of bull spermata widely held that is directly involved in the synthesis, and several recent of the necessity of ribonucleic synthesis of proteins, it seemed to examine the mature, ejaculated which appeared only traces of. The absence of bull semen has in the present. It is possible that deoxyribonucleic involved in the proteins... The would be to require synthesis in spermatic enzymatic production of nucleic acid. From *Nature* 1957.

### 100 YEARS

Mr. Walter W.

# Research on Dog Personality & Temperament

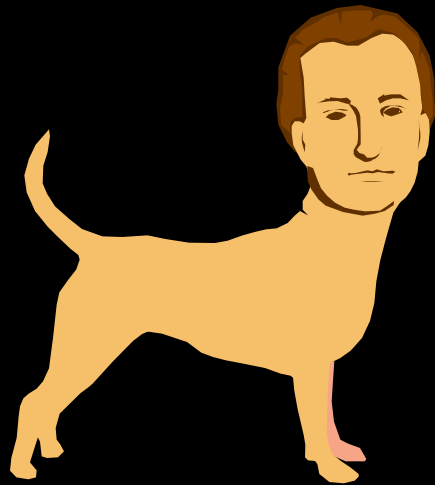


(Jones & Gosling, 2005)

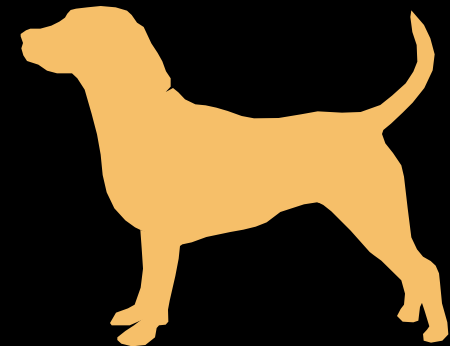
# Two Views

Personality descriptions of animals reflect...

Anthropomorphic  
projections



Real characteristics  
of the target



# Criteria to establish viability of personality in animals

1. Assessments by independent observers must agree
2. Personality dimensions must reflect reality not projections
3. Assessments must predict real-world outcomes

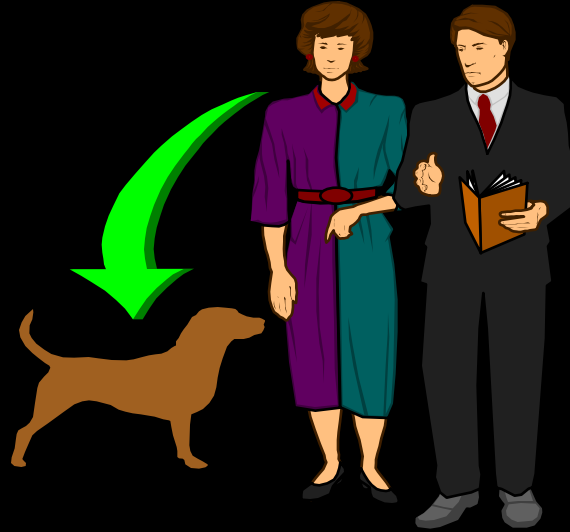
Spotted hyena (*Crocuta crocuta*)



# Criteria to establish viability of personality in animals

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# 15 Most Frequently Generated Attributes in Free Descriptions of Dogs

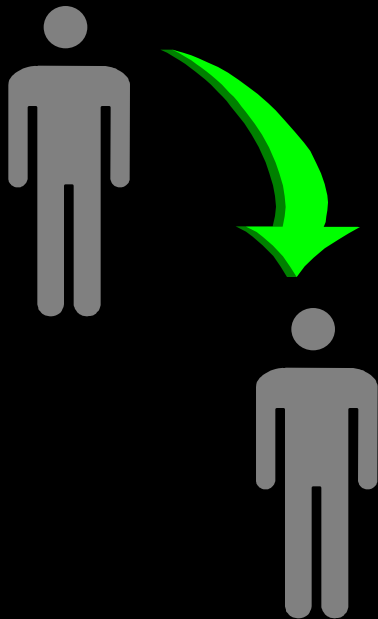


- Affectionate
- Cuddly
- Cute
- Energetic
- Friendly
- Happy
- Intelligent
- Lazy
- Loving
- Loud
- Loyal
- Obedient
- Playful
- Protective
- Stupid

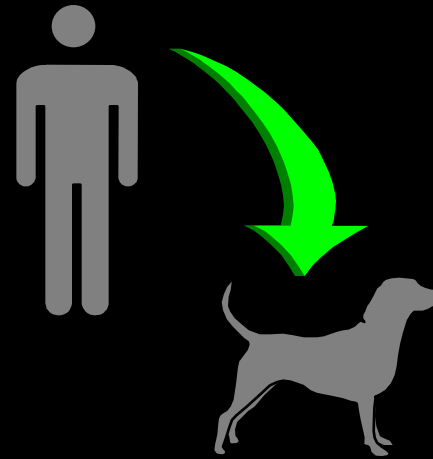
# Method

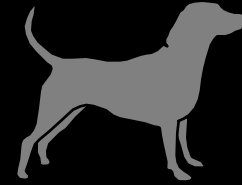
Using dog AND human instruments:

Sample A – 300 humans  
describe a person they know



Sample B – 300 humans  
describe a dog they know





Human  
instrument

5 Factors

4 Factors

Dog  
instrument

5 Factors

4 Factors

# Marker Traits for the Empirical Dog Factors

## ENERGY

- Energetic
- Loud
- Hyperactive

## AFFILIATION

- Affectionate
- Loving
- Cuddly

## EMOTIONAL

## REACTIVITY

- Nervous
- Jealous
- Whiny

## COMPETENCE

- Smart
- Obedient
- Clean



## Hyena Personality: Five Principal Components

### **I - Assertiveness**

Assertive  
Argumentative  
Aggressive  
Dominant  
Confident

### **II - Excitability**

Excitable  
High Strung  
Calm  
Slow  
Active

### **III – Human-directed**

**Agreeableness**  
Sociable - H  
Tame - H  
Warm - H  
Obedient - H  
Deceitful - H

### **IV – Sociability**

Warm  
Affiliative  
Sociable  
Cold

### **V - Curiosity**

Exploratory  
Impulsive  
Curious  
Imaginative  
Playful

# Big Five personality dimensions

## Openness to Experience

*(intellect, imagination, curiosity, creativity)*



## Conscientiousness

*(order, duty, deliberation, self-discipline)*



## Extraversion

*(sociability, assertiveness, activity, positive emotions)*



## Agreeableness

*(trust, nurturance, kindness, cooperation)*

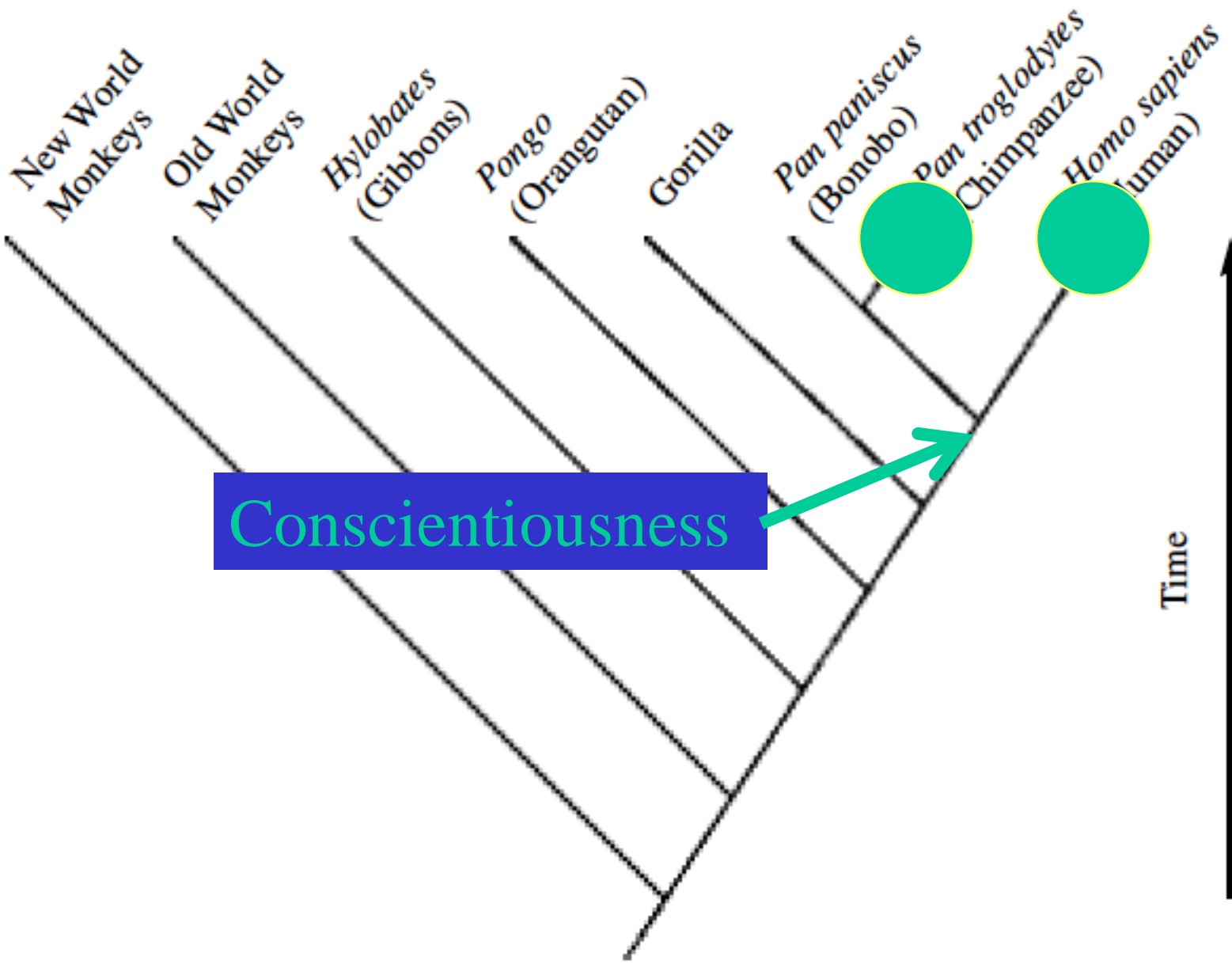


## Neuroticism

*(anxiety, depression, moodiness, vulnerability to stress)*



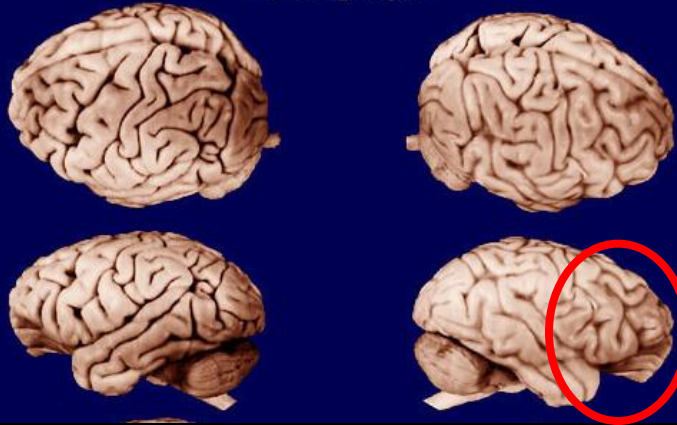
Species	N	A	E	O	C	Dom.	Activ.
Chimpanzee	✓ ✓ ✓	✓ ✓	✓ ✓ ✓	✓	✓ ✓	✓ ✓	✓
Gorilla	✓	✓	✓			✓	
Rhesus Monkey	✓ ✓ ✓	✓ ✓	✓ ✓ ✓	✓		✓	
Vervet Monkey		✓		✓		✓	
Hyena	✓	✓ ✓		✓		✓	
Dog	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓		✓ ✓	✓	
Cat	✓	✓	✓		✓		
Donkey		✓	✓				
Pig		✓	✓	✓			
Rat	✓	✓ ✓					
Guppy	✓		✓				
Octopus	✓		✓				✓



Consciousness

Time

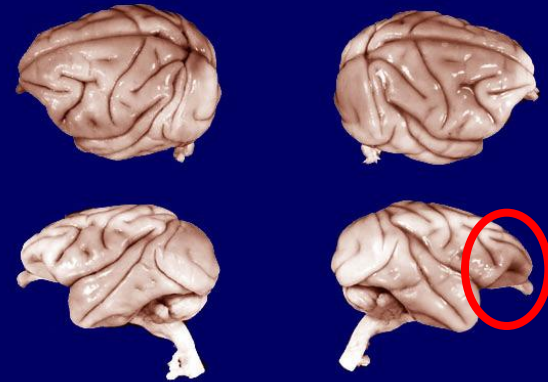
**Common Chimpanzee**  
*Pan troglodytes*



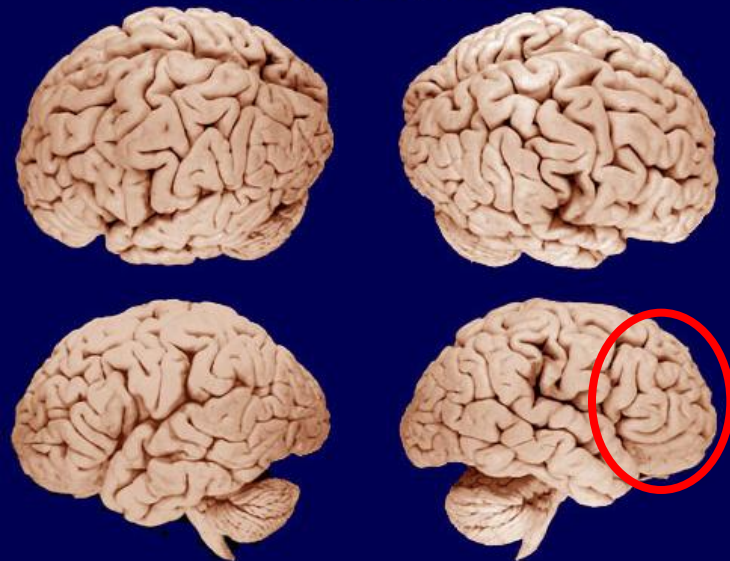
**Western Gorilla**  
*Gorilla gorilla*



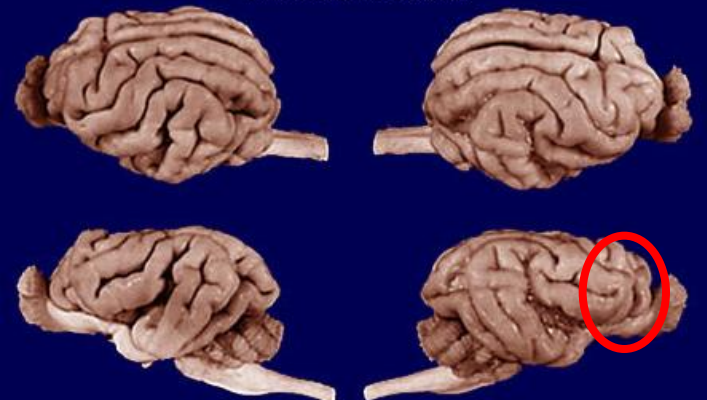
**Rhesus Monkey**  
*Macaca mulatta*



**Human**  
*Homo sapiens*



**Spotted Hyena**  
*Crocuta crocuta*



# Criteria to establish viability of personality in animals

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*I See X's Dog as an Individual Who . . .*

\_\_\_\_\_ Is talkative, vocal

\_\_\_\_\_ Is disagreeable, difficult to please

\_\_\_\_\_ Does things thoroughly

\_\_\_\_\_ Is down, depressed, blue

\_\_\_\_\_ Is original, comes up with new ways of doing things

\_\_\_\_\_ Is reserved

\_\_\_\_\_ Tends to be lazy

\_\_\_\_\_ Is emotionally stable, not easily upset

\_\_\_\_\_ Perseveres until the task is finished

# Do Ratings Predict Behavior?



# Predictive Validity

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Judgment-rating correlation

---

Dog

Human

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Extraversion



Agreeableness



Conscientiousness



Neuroticism



Openness



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(Gosling, Kwan, & John, 2003)

# Talk Outline

## I – Groundwork

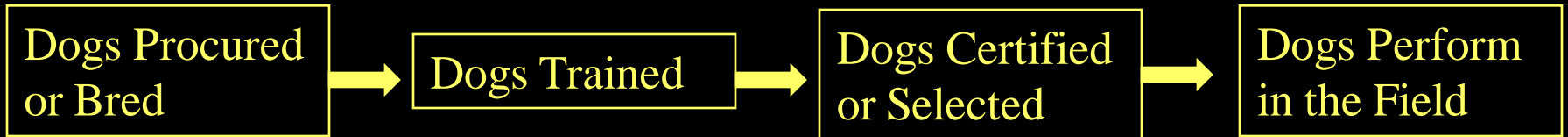
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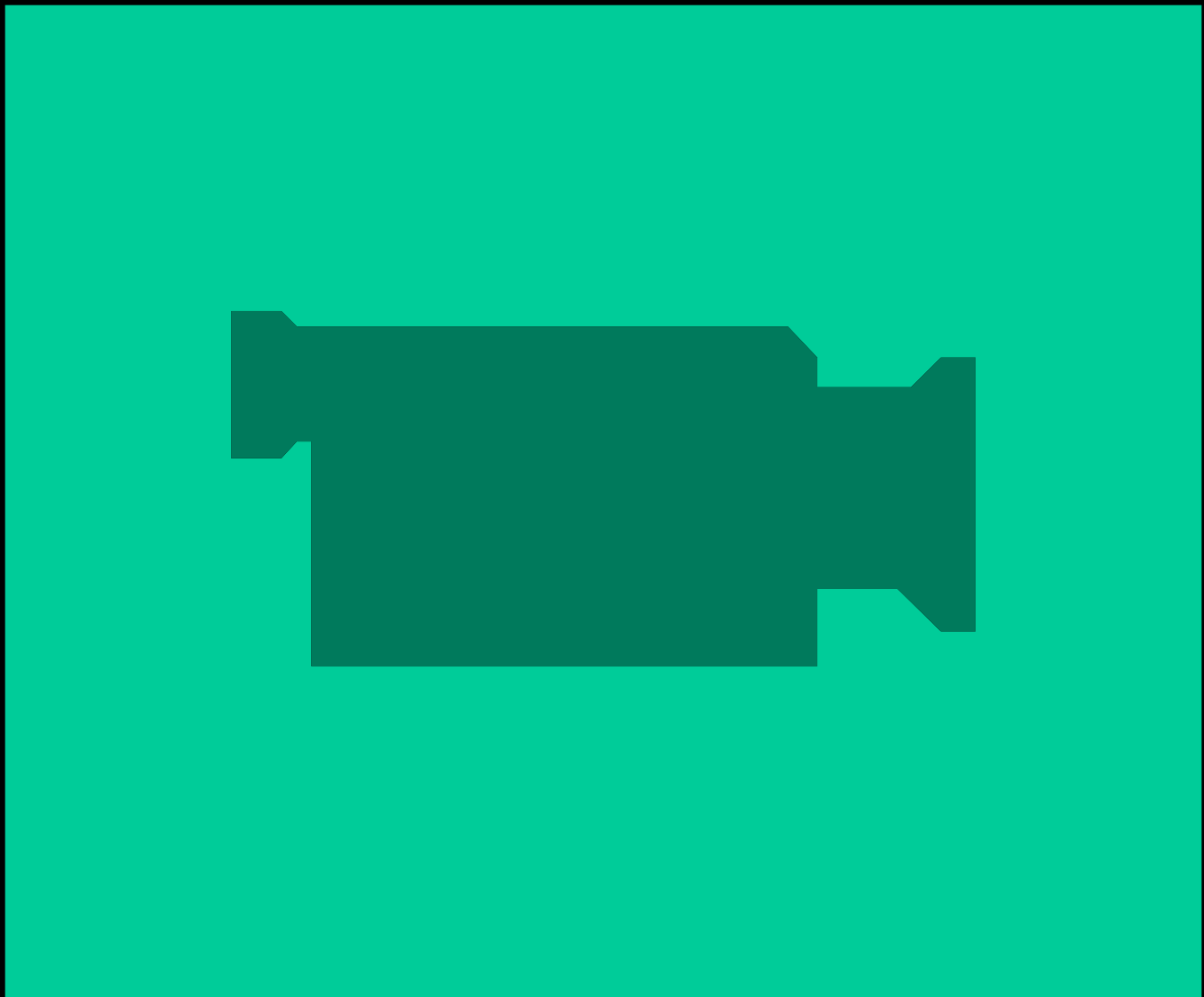
- Reliability
  - Interjudge
  - Test-retest
- Validity

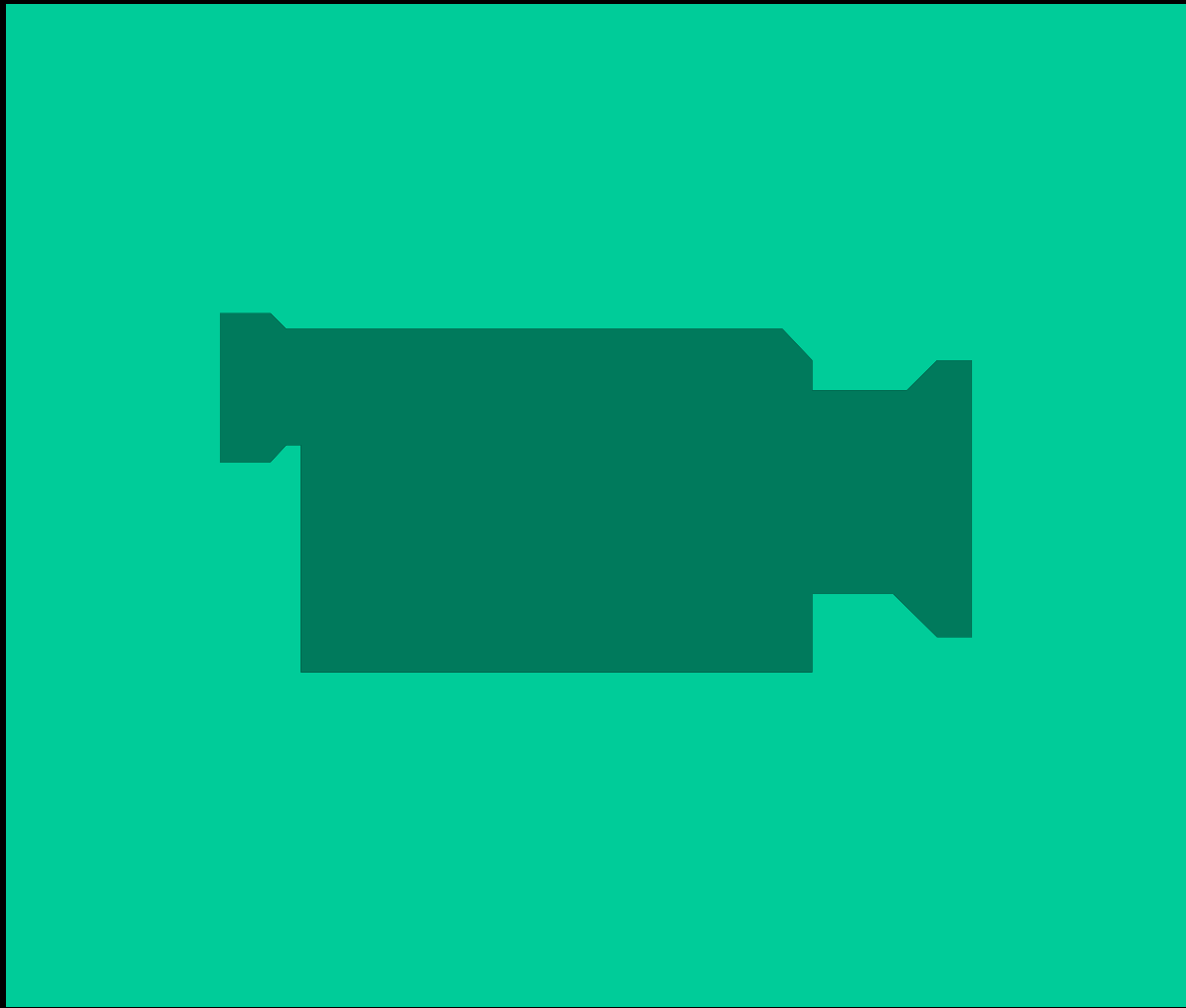
## III – Remaining Questions

# Prediction Paradigm



**Predictive ability**





# Factor analysis

Behavioral item	Object focus	Sharpness	Human focus	Search focus
Environmental sureness	<b>.62</b>	-.06	.12	-.17
Static object interest	<b>.73</b>	.02	.11	.09
Thrown object interest	<b>.68</b>	.12	-.08	.23
Possession	<b>.69</b>	.05	-.06	.17
Physical possession	<b>.39</b>	.23	-.11	.25
Search activity	.23	.09	.03	<b>.75</b>
Search stamina	.03	-.06	.12	<b>.79</b>
Defense	-.01	<b>.41</b>	<b>.55</b>	.01
Threat aggression	.20	.07	<b>.74</b>	.08
Non-threat bite quality	.16	<b>.88</b>	.08	-.06
Threat bite quality	-.01	<b>.87</b>	.00	.10
Attention transfer	-.13	-.12	<b>.72</b>	.05

Evaluated & procured in Europe



Evaluated then trained at Lackland AFB



Certified at Lackland AFB



Shipped to Field



.69



.77



.82

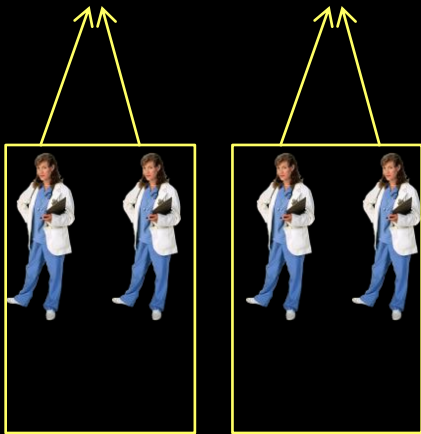
# Q1: Inter-rater Reliability

Evaluated & procured in Europe

Evaluated then trained at Lackland AFB

Certified at Lackland AFB

Shipped to Field



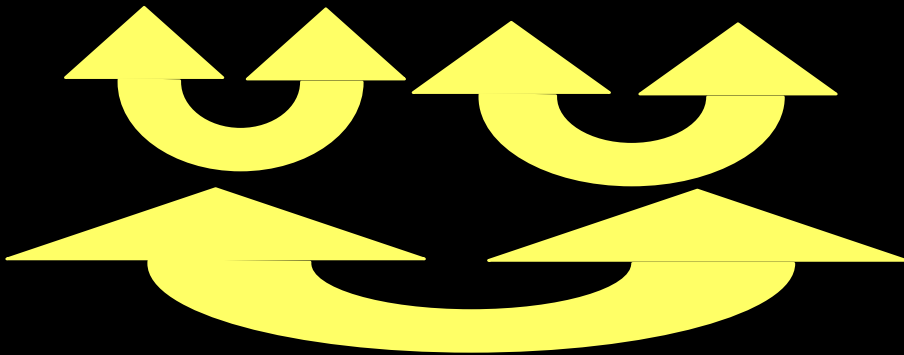
.5 to .6



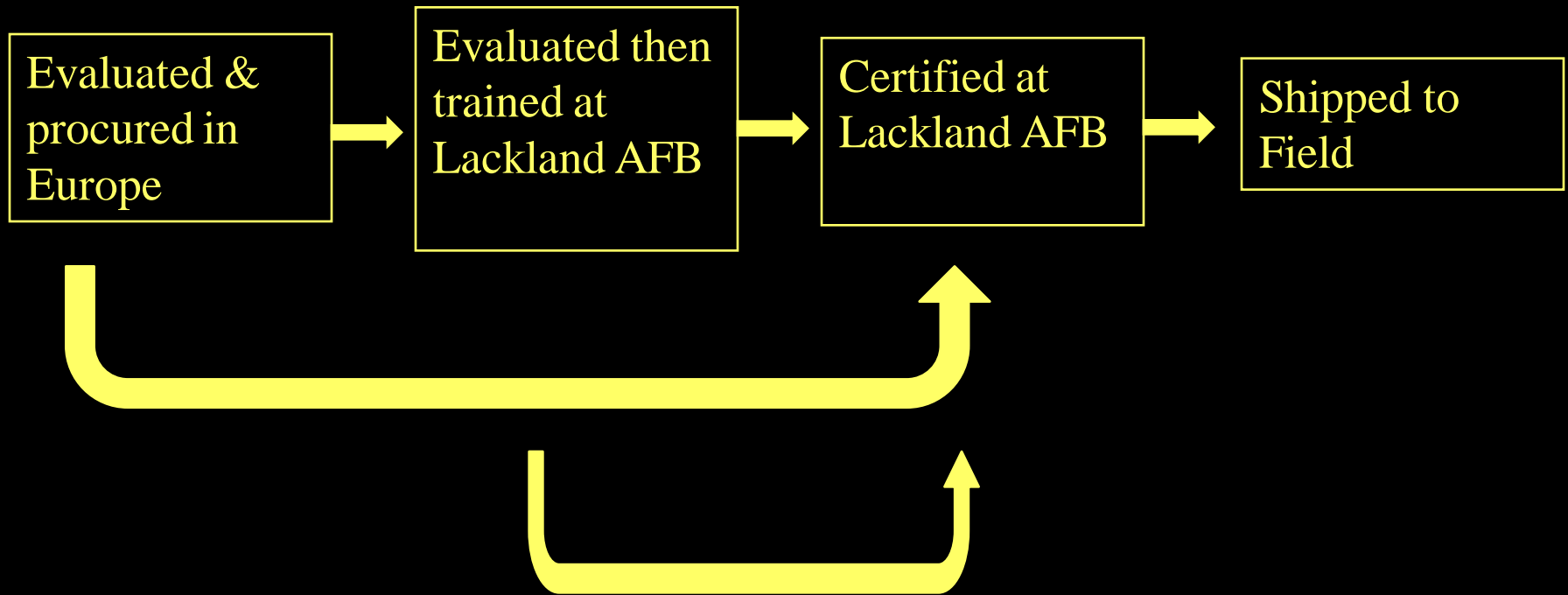
-.1 to .5

## Q2: Test-retest Reliability

Mean .2 to .4



.2 to .3

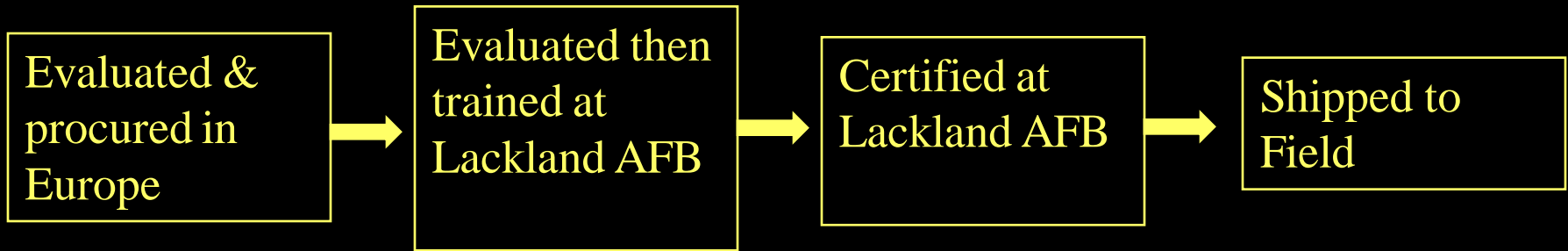


## Q3: Predictive validity

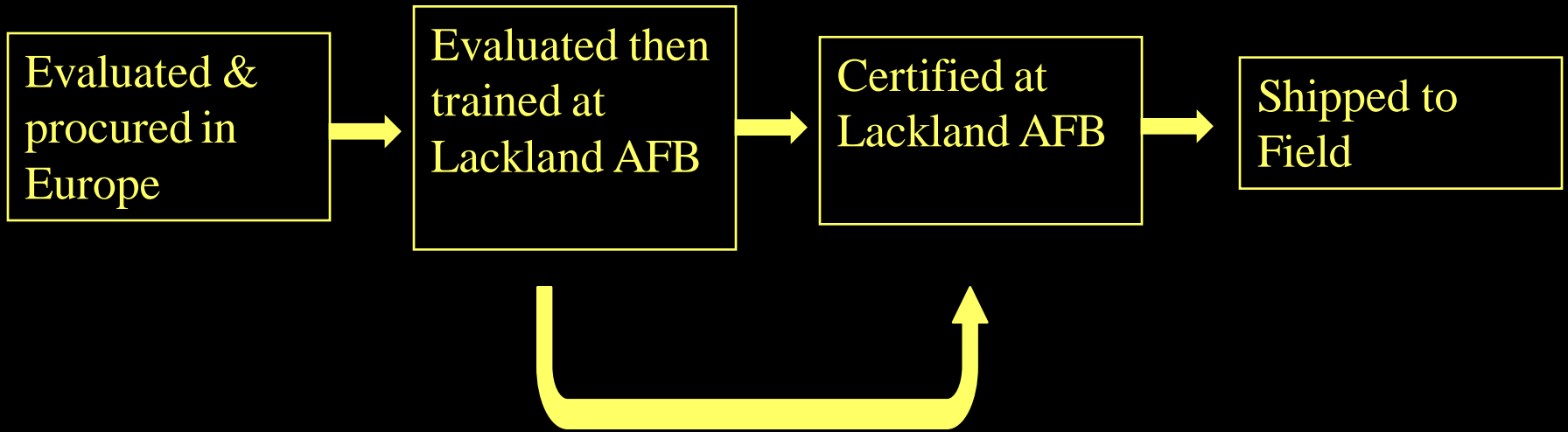
3 DVs: Dual-certification, Patrol-only, Detection only

6 IVs: Sex, Breed, and 4 Personality traits

Training and Test data sets



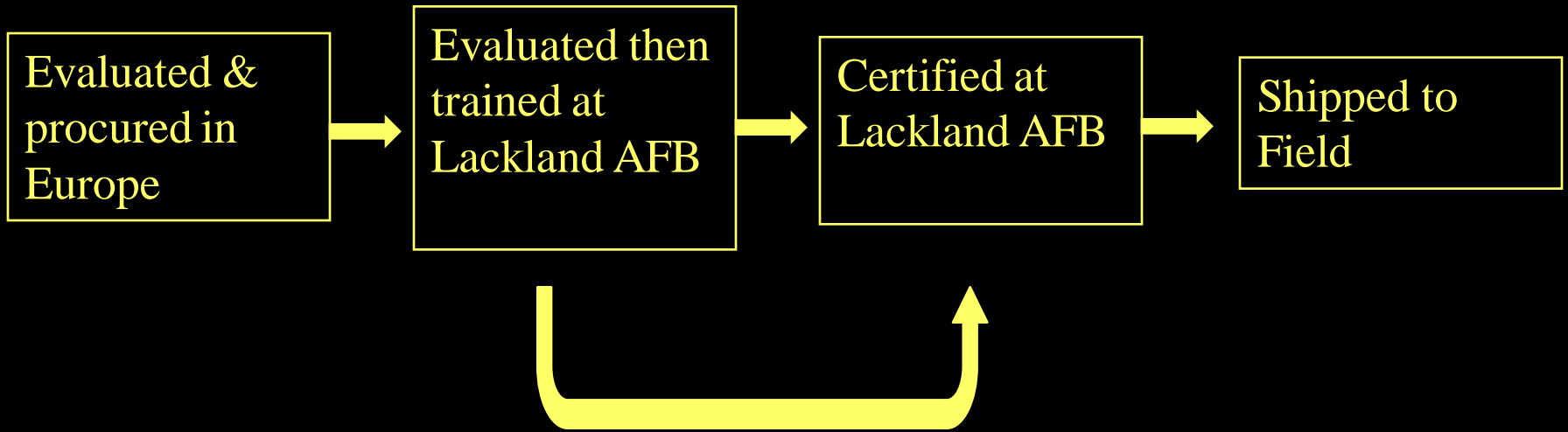
## Q3: Predictive validity



Dual certification: 66.3%

Search focus odds ratio 2.59 (P = 0.001)

**Q3: Predictive validity**



Patrol-only certification: 66.3%

Search focus odds ratio 2.47 (P = 0.003)

Sharpness odds ratio: 1.71 (P = 0.03)

## Q3: Predictive validity

# Predictive validity

- PE improvement 1.5 – 7%
  - Dual: 60.2%
  - Patrol-only: 63.9%
  - Detection-only: 76.5%
- Restriction of range issues
- ‘Right’ behaviors?
- \$97,200 – \$340,200 savings

# Conclusions

- Personality can be measured reliably
- Predictive validity is satisfied
- Consistency issues are complex and interesting!
- Further work on validity needed

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