If I Could Talk To The Animals

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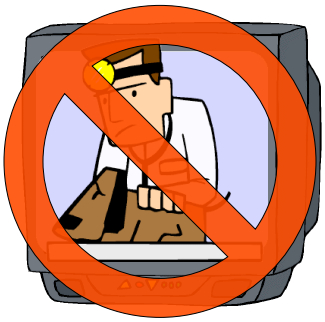
Northeastern University CCS
LISA 2001 Invited Talk

Itinerary

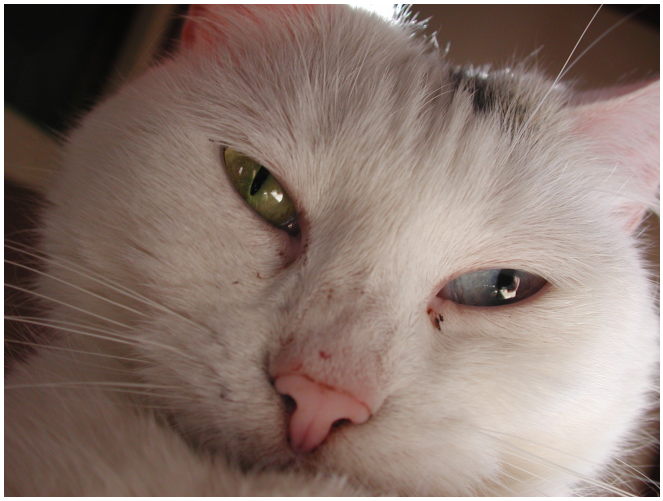
- Motivation
- Thesis
- Decision making
- Teaching the necessary skills
- Where/how they are found in the vet curricula
- Interesting things/ways they learn
- Applying this to our profession

Important Warning

I am not a veterinarian

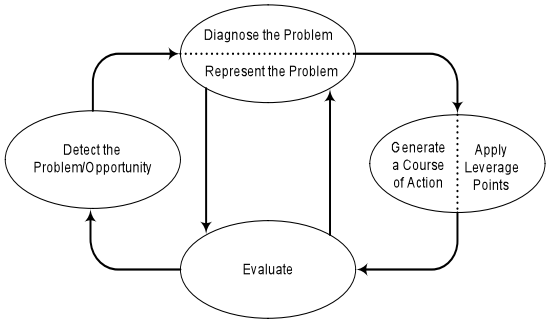


Nor do I play one on TV



Untangling the Topic

- Be sure to look at the moon in this talk
- Diagnosis, not prognosis
- Diagnosis, not diagnostic procedures
- Diagnosis, not synonymous w/problem solving



Motivation to Listen to Me Yammer

- Diagnosis is a core skill in our field
  - We do it all day long…
    - for our employer
    - for our friends, family, random strangers
- We need to procreate and mature
  - And the faster, the better
- So why aren't we thinking harder about this?
  - Some people are (e.g. Burgess, Limoncelli, et. al.)
- Can we bootstrap this process by looking at how another profession does this?
  - If so, which?

Should We Ask a Mechanic?

No.

- They can pull parts and put them back in again.
- Their world does not fluctuate as much.
- They have much better instrumentation than we do.

Should We Ask a Doctor?

Getting warmer, but no.

- Works on the same species.
- Largely has the luxury of communicating directly with the patient for diagnostic information.

Should We Ask a Veterinarian?

Yes.

- In common:
  - Large variety of different species
  - Can't easily replace parts and have patient live.
  - Diagnostic information comes from a third source.

Stay on Target, *Red Leader!*

- *Really, really* hard to avoid making as many analogies as possible
- Push this too far, it will break:
  - Anesthesia, euthanasia, restraint training, pain management, necropsy…
- Pushing it a little bit is ok, for example:
  - Potential flaw #1: scaling issues
  - Potential flaw #2: team issues

Let's take off our clothes and get abstract for a while…

decision making

Flavors of Decision Making

- Deductive logical thinking
  - classical approaches
  - what people are taught (more often than not)
- Naturalistic decision making
  - Some say this is what experts really do
  - Certain settings provoke it:
    - time pressure, high-stakes, experienced decision makers, inadequate information, ill-defined goals, poorly-defined procedures, cue learning, context, dynamic conditions

Classical Approaches

Rational choice strategy (P. Soelberg):

1. Identify the set of options
2. Identify ways of evaluating the options
3. Weight each evaluation dimension
4. Perform the rating
5. Pick the option with the highest score

Cool idea, but he found people didn't always use it when he expected them to.

Making Better RCS decisions

(I.L. Janis and M.L Mann)

- Thoroughly canvas a wide range of options
- Survey a full range of objectives
- Carefully weight the costs, risk and benefits of each option
- Intensively search for new information in evaluating options
- Assimilate all new information
- Reexamine the positive and negative consequences of each option
- Carefully plan to include contingencies if various risks occur

Stage Models (of Problem Solving)

(as characterized by Raanan Lipshitz and Orna Bar-Ilan)

- Two stages: idea getting and idea evaluation
- Three stages: problem finding, design of alternatives, and choice
- Four stages: understanding the problem, devising a plan, carrying out the plan, and evaluating it
- Five stages: identifying the problem, defining it, evaluating possible solutions, acting, and evaluating success

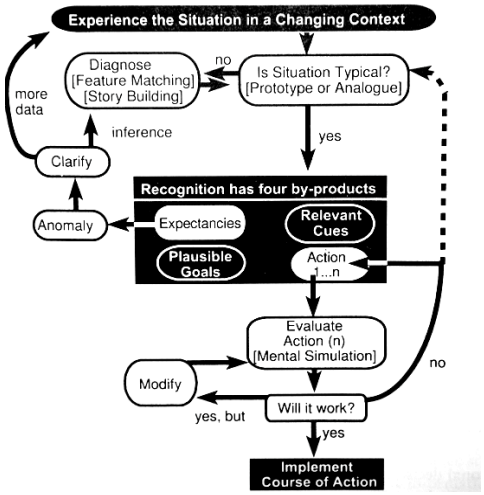
Stage Models (cont)

- Six stages: identifying the problem, obtaining necessary information to identify causes, generating possible solutions, evaluating various solutions, selecting a strategy for performance, performing and revising the solution
- Seven stages: problem sensing, problem definition, alternative generation, alternative evaluation, choice, action planning, and implementation.
- Eight stages:…

Interesting, but these are hard with ill-defined goals

Recognition-Primed Decision Model

(Klein 1998)



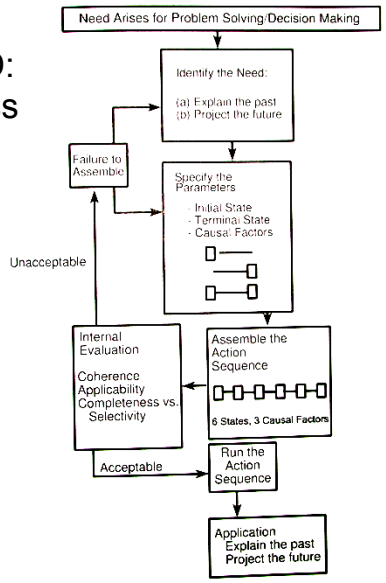
The 'R' in RPD

- Recognition allows for the identification of analogues and goals (and the linkage)
- Analogues generates expectancies and provide a structure for predictions
- Expectancies help us perceive:
  - Relevant cues
  - Fine distinctions, i.e. important and unimportant differences (zone of indifference)
  - Leverage points/choke points
  - Absence, anomaly, and counter-factuals

Mental Simulation

used in three places in RPD:

1. Forming situation awareness
2. Generating expectancies
3. Evaluating course of action



Problems with Mental Simulation

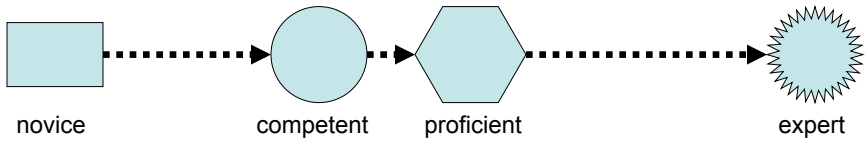
- Sometimes they lead you astray
  - C. Perrow described *de minimus* explanations
  - May cause overconfidence, especially if you become wedded to a particular one
  - A simulation is not situational awareness, but can be confused as such
- Humans are not very good at it when things become complicated
- Luckily, they can be self-correcting, e.g. M. Cohen's *snap-back* theory

How People Choose Between These Models

Task Conditions	RPD	RCS
Greater time pressure	☆	
Higher experience level	☆	
Dynamic conditions	☆	
Ill-defined goals	☆	
Need for justification		☆
Conflict resolution		☆
Optimization		☆
Greater computational complexity		☆

☆ = more likely to be used

Expertise Levels



Expertise and Decision Making

- Novices do better with Rational Choice Strategy, but that's not our end goal.
- Let's talk about experts.

Experts

- Perception is different
  - Fine discrimination, big picture, opportunity/cue/pattern (and anomaly/absence) detection skills
- See options, not decisions
  - Comparative vs. singular evaluation
  - Herbert Simon's term "satisficing"
    - Not optimization, that is too hard/takes too much time
    - How do you know you've got a good option? Mental simulation
- Handle time pressure better (perhaps because of RPD)
- Don't "fly behind the plane"
- Know their own limitation and when they are losing the big picture
- Can improvise (Lisa Di Bello)
- Problems: stereotypes and assumptions

Veterinary Diagnostic Experts

- How do you know one when you see one?
  - A person who, with a minimum of expense to owner, in the shortest time, with least number of tests, with the least invasive procedures, and the least patient morbidity and suffering, can bring a case to a satisfactory outcome. Outcome: optimal satisfaction to client, owner and vet. (Kleine)
  - Timing (Steward)
  - Quality of life vs. beat the disease focus (Steward)

Sysadmin Expert

- How do you know one when you see one?
- There will be a one-question quiz at the end of this talk. This will be that question.

Teaching These Skills

What Do You Need to Give to a Novice?

- Knowledge base
- Ways to gather diagnostic information and reduce diagnostic ambiguity (including communications skills)
- A way of organizing and representing this information (e.g. rules, patterns, schemes, an understanding of correlation, stories)
- Ability to apply general knowledge to specific situations and other methodological tools
- Experience (more on this in a moment)
- Training in ethics (dNb)

Experience Does Not Equal Expertise

- Twenty years of experience is different from one year twenty times (Kleine)
- Meaningful learning takes place when theory meets experience in real time (Kleine)
- Shanteau says translation doesn't occur as well when:
  - The stimuli is dynamic
  - Need to predict human behavior
  - Feedback unavailable
  - Not enough repetition
- Feedback is an important key
  - In the learning process and in the field
  - Learn how to distinguish valid feedback

How Do Experts Learn?

(Klein)

- Deliberate practice (with goals and evaluation criteria)
- Compile extensive experience bank
- Obtain feedback that is accurate, diagnostic, and reasonable timely
- Review prior experiences to derive new insights and lessons from mistakes

Half time video

Was Dr. Doolittle a sysadmin,
or did he just have latent
sysadmin tendencies?

493108359702850190027577767239076495728490777215020863208075018409792627885097658864557802013660073286795447341128317353678312015575359819785450548115719393458773300380099326195058764525023820408110189885042615176579941704250889037029119015870030479432826073821469541570330227987557681895601624030064111516900872879838194258271674564774816684347928464580929131531860070010043353189363193439129486044503709919800477094629215581807111691530318762884778783541575932891093295447350881882465495060005019006274705305381164278294267474853496525745368151170655028190555265622135314631042100866286797114446706366921982586158111251555650481342076867323407655054859108269562666930662367997021048123965625180068183236539593483956753575753246190234810647009877530279561868929253806933052042381499699454569457741383356899060058708321812704861133682026515905166351874029018197693937677852928722109550412925792573818660584501505525027499477188312931045769809091530461335941903025881320593227744438525504667790245186970626277888919795804230657506156698346956177978796592016440519399607169811126151956102762832339825791423321726961443744381056485529348876349210309887028787453233132532122678633283702792509974996948877593691591764458803271838474023593302037488850675570658791946113419323078148544364543751132070986063907464175641216350423880029678085586703703875094107698211837654992052043682558546422885024299633226853691246485500075591664024729240716450725319674499952944843474190210772960682055813092362683798795196619979828552588716109613656178074566159248866088981645685417213629208466562791314784667915509651543101135385862081968758368835955778939145453935681996098808540476590735897289898342504712891841626587896821853808795627903997862944939760546753482125675012151708273710764627071246753210248367815940008750545254353 7

How Are Vets Taught?

- 27 accredited schools in the US
- 4 in Canada
- Largely 4 year schools, last year is heavily clinical
- Extremely competitive, rigorous admission standards.
- They are *hard* work after you get in too.

My "Research"

- I reviewed all the available curricula listings from US schools (~70%)
- I followed up with question to representatives from ~⅓ of the schools
- Getting hold of veterinarians is hard, getting hold of veterinarians that teach is *very* hard.
- I asked at least these two questions:
  - Where/how do you explicitly teach diagnostic skills?
  - Where/how do you teach about acquisition of diagnostic information from an owner of an animal?

Example Answers

- Some standard answers:
  - Everywhere and nowhere (you fool)
  - Problem Based Learning
  - Clinical years (rounds, etc)
- Cornell university:
  - Entirely PBL in the 1st 2½ years
  - Clinics in the second year sometimes videotaped
  - Community practices service (see healthy animals)
- Iowa State:
  - PBL-hybrid class in 1st 4 semesters which includes fake patients with problems
  - Communications skills class taught by counselors, not vets

Example Answers 2

- University of Illinois-Urbana:
  - One faculty member thinks vets need to emulate our profession and be more logical in their behavior
- University of Minnesota:
  - Clinical skills class focuses on history taking
- Michigan State University:
  - Four phases in their curriculum: normality, abnormality, intervention/prevention (including diagnosis), clerkship
- Tufts:
  - Several standardized client interview with actors
- Virginia-Maryland Regional College:
  - Specific problems solving classes (SA, LA)

Clinical History Taking

(from Dr. Molgaard's class CVM6301/2 at University of Minnesota)

- Demonstrate effective medical interviewing techniques and communicate effectively with clients. The student will:
  - appropriately begin and end the interview
  - use open ended and directed questions appropriately
  - define and pursue problems
  - use language the client understands
  - communicate empathy and concern
  - use appropriate techniques that will put the client at ease
  - demonstrate appropriate professional behavior
- Elicit a complete medical history. The student will:
  - identify the chief complaint(s)
  - define and pursue major problem(s) and their chronology
  - follow a standard format for eliciting a history as outlined on the VTH history sheet

Clinical History 2

- perform a physical examination in a systematic and consistent manner
- demonstrate use of perceptual skills: inspection, palpation, and auscultation
- demonstrate correct use of selected instruments (e.g. stethoscope, otoscope)
- Organize and accurately record data from the history and physical examination using a standard format.
- Following review of the history and physical examination findings, define a patient's problem(s) and begin to generate a list of rule-outs based on previous knowledge, physiology, and anatomy. Present an oral case summary clearly and concisely (see example below).

Clinical History 3

Small Animal
This case is a _____ year old, _____ (gender, spayed/neutered/ intact), _____ (breed) dog/cat presented on _____ (date) for evaluation of _____ (chief complaint). Summarize history in 1-3 sentences including duration of problem and progression. On physical examination, the abnormal findings were _____ (describe). The problems identified so far are _____ (list).

Example: This case is a 3 year old female spayed German Shepherd presented on September 25 for evaluation of coughing. The coughing began 4 days ago after the dog was boarded and has worsened over the past 2 days. The cough is harsh and non-productive, and occurs in episodes 8-10 times per day. Appetite and attitude have not changed. On physical examination, the abnormal finding was increased tracheal sensitivity with tracheal palpation eliciting a harsh hacking cough. The problem identified so far is coughing. The primary rule out is kennel cough, although other causes of upper respiratory disease are still being considered.

UNIVERSITY OF MINNESOTA - VETERINARY TEACHING HOSPITALS • St. Paul, Minnesota • Phone 625-1919

ADMISSION	DATE 01/12/2000 15:00	PREV. ADMIT R
PRIMARY COMPLAINT	blood in urine	al
REFERRED BY	Dr. Smith	
ATTENDING CLINICIAN	Dr. X	
DISCHARGE DATE		

Blue Card Stamp

Animal Hosp.
(call to Rx)

	DIAGNOSIS/COMPLICATIONS	CODE
1st	~~[illegible]~~ - Bloody penile discharge [illegible]	
2nd	Enlarged prostate	
3rd		
4th		
5th		
6th		

	OPERATIONS AND TREATMENTS	CODE
1st	Rec prostate package Refer to Dr. Ross	
2nd		
3rd		
4th		
5th		
6th		

PROCEDURES	CONTACT WITH REFERRING VETERINARIAN	DISCHARGE STATUS
___ CLINICAL EXAM ONLY	DATE OF CONTACT ____	___ ALIVE
___ GROSS PATHOLOGY	TELEPHONE: No faxing	___ DIED - NECROPSY
___ HISTOPATHOLOGY	LETTER: ____	___ DIED - NO NECROPSY
___ SEROLOGY		___ EUTHANIZED - NECROPSY
___ MICROBIOLOGY		___ EUTHANIZED - NO NECROPSY
___ RADIOLOGY		___ ACCEPTED AS DONATION TO VTH
___ ELECTROPHYSIOLOGY		___ ADOPTED
___ HEMATOLOGY		___ SOLD
___ URINALYSIS		
___ CHEMISTRY		
___ PARASITOLOGY		
___ OTHER		

1/12/2000 — DATE
STUDENT
Signature — CLINICIAN

VTH 051

UNIVERSITY OF MINNESOTA
VETERINARY TEACHING HOSPITALS
HISTORY

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Date: 1/12/00 Student: Jones Clinician: Dr. X

REFERRING VETERINARIAN:

CHIEF COMPLAINT:

HISTORY FORMAT

I. History of Complaint(s)	II. Past History	III. Housing/Animal contact
A. Onset/Duration	A. Medical Illness	IV. Preventative medication/Vaccinations/Dates
B. Progression	B. Surgical	V. Systems Review
C. Prior Treatment	C. Reproductive	VI. Diet/Nutritional History
	D. Adverse Drug Reaction	VII. Behavioral Changes
	E. Trauma	

Oct 4 Nov 28th - noticed.
10th days - TMS - 480mg 1½ tabs BID blood
Nov 28 - blood + bacteria - tx c̄ TMS for 3 weeks

Dec 10th - blood + bacteria TMS for 3wks.
blood started again last 3 days of treatment
no dysuria - normal urine stream.
Eating well - active. drinking normally.
II. none
b. Intact.
d. no.
e. no
III. one cat. indoors
IV. up to date - on HW prev. interceptor
V. no V/D/C/S. no PU/PD.
no other concerns
VI. lams dog food. 5 cups daily
VII. no Δ.
Warm Kennel [illegible] - strained-diarrhea

VTH-039 (rev. 6/94) **HISTORY**

UNIVERSITY OF MINNESOTA
VETERINARY TEACHING HOSPITALS
PHYSICAL EXAMINATION

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Date: 1/12/00 Student: Jones Clinician: Dr. X

REFERRING VETERINARIAN:

Weight 104 /lbs. ____ kgs. Capillary Refill Time 1 /Sec.
Temp 102° °F Membrane Color PK
Pulse 80 BPM Hydration N
Respiration Pant. /Min. Attitude BAR

Body condition score:
- ☐ Severely underweight (1)
- ☒ Normal (3)
- ☐ Underweight (2)
- ☐ Overweight (4)
- ☐ Severely overweight (5)

CHECK APPROPRIATE BOX/SYSTEM. DESCRIBE ABNORMAL FINDINGS BELOW BY SYSTEM LETTER.

	N	ABN	No Exam		N	ABN	No Exam
A. Integumentary	☒	☐	☐	G. Alimentary	☒	☐	☐
B. Ophthalmic	☒	☐	☐	H. Reproductive/Mammary/Prostate	☒	☐	☐
C. Otic	☒	☐	☐	I. Urinary	☐	☒	☐
D. Cardiovascular	☒	☐	☐	J. Endocrine	☒	☐	☐
E. Respiratory	☒	☐	☐	K. Nervous	☒	☐	☐
F. Lymphatic	☒	☐	☐	L. Musculoskeletal	☒	☐	☐

rectal exam - could only feel caudal edge of prostate

Problem	R/O	Plan
blood in urethra	UTI	UA
	uroliths	C&S
	prostate	rads

VTH-034-A (rev. 6/94) **PHYSICAL EXAMINATION**

How to take A Good History 1

(Molgaard)

- **Introduction**
  - Greet Client
  - Build rapport
  - Confirm owner information
  - Confirm patient signalment – including use (horses) or when they freshened and how much milk they are producing (cow)
  - Use correct gender!
- **Throughout the process:**
  - Use appropriate terminology
  - Ask unbiased questions
  - Use open vs. closed questions as needed
  - Maintain eye contact, body language should show interest

How to take A Good History 2

(Molgaard)

I. History of Chief Complaint (reason client has presented the animal to you)

- Questions may pursue "location, quality, severity, onset, duration, frequency, setting, factors that increase or decrease the signs, associated problems, and progression or improvement of problems"
- Questions should attempt to verify and localize onset/duration, progression, prior treatment

II. Past History

- Medical Illness, Surgical, Reproductive, Adverse Drug Reaction, Trauma

III. Housing/Animal contact

IV. Preventive medication/Vaccinations/Dates

V. Systems Review

VI. Diet/Nutritional History

VII. Behavioral Changes

Teaching Tools

- DAMIT

  (used to help categorize a disorder)

  D = degenerative

  A = anomalous/anatomical

  M = metabolic

  I = idiopathic, iatrogenic, inflammatory, immune-mediated

  T = trauma. toxic, tumor

Teaching Tools 2

- SOAP

  S = subjective

  Info from owner, historical data

  O = objective

  Skilled person could repeat

  A = assessment

  Label the issue (in a gross or detailed way)

  P = plan

- (Do sysadmins need acronyms like this?)

Teaching Tools 3

- Miscellaneous advice:
  - Slow down, don't be quick to diagnose
    - Students initially accustomed to instant answers
    - They watch their mentors jump to conclusions
    - Jump to wrong conclusions.
    - Reasoning backwards
  - Find a single problem first before looking for multiple causes (Hypothetico-deductive)
  - Nobody gets out of here without an injection.

Stories

- Ingredients (Klein):
  - Agents
  - Predicament
  - Intentions
  - Actions
  - Objects
  - Causality
  - Context
  - Surprises
- Good ways of encapsulating complex/ill-formed models
  - not just shared stories, but shared interpretations
- Some stories are more useful than others
- PBL is largely stories

Problem List Generator

- Dr. Holly Bender (and others) at Virginia-Maryland Regional College of Veterinary Medicine
- Been teaching clinical pathology for 10 years, 2nd year 2nd semester class
- Study the norms (do we?)
- Problem: turn rote memorizers into problem solvers with a framework and method of thinking
- Built a tool call the PLG

PLG 2

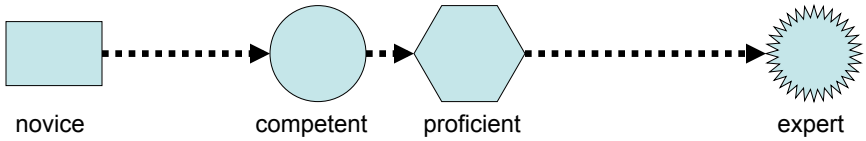
- PLG
  - Extract relevant data from observations
  - Identify data abnormalities
  - Name them
  - Construct a causal hierarchy
  - Causal hierarchy uses history/data abnormalities as supporting evidence
  - Make a diagnosis

Simulations

- Good simulations are sometimes better than real life because:
  - Stop the action
  - Back up and see what happened
  - Run many trials one after another
- Klein's Crystal ball exercises
- Two simulations:
  - Dr. Wayne E. Wingfield at Colorado State
  - Dr. Dez Hughes and Ernest Ostro at University of Pennsylvania

What Can We ~~Learn~~ Copy?

- Bad news:
  - No way we can replicate the rigor of the vet educational experience
  - There are only pockets of concentrated interest in this topic (radiology)
  - They rely heavily on their on-the-job experiences to teach these skills too.
  - Scaling/team questions
  - Vet schools don't (and perhaps they can't) create experts. Let's not give up that easily.



What Can We Copy? 2

- Good news, let's start to think about:
  - Maybe the normality, abnormality, intervention/prevention, clinical practice model
  - Problem Based Learning
  - Standardized case histories & presentation
  - Communication classes with fake users
  - Benefiting from the decision process research
  - Using tools like the PLG
  - Building better tools, like simulators or…

Games

- Burgess' work on game theory suggests maybe we need some sysadmin games
- Two models for games:
  - Black & White
  - SimSysadmin
- Help me build these: dnb@pobox.com

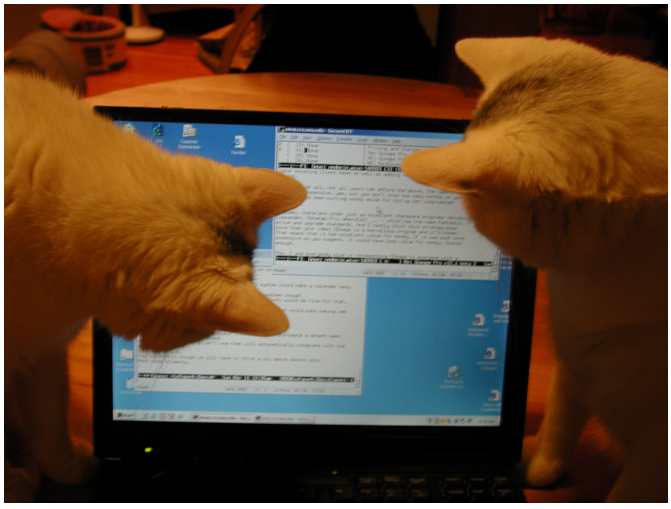
References and Acknowledgements

- Much of this talk from *Sources of Power: How People Make Decisions* by Gary Klein, MIT Press
- Thanks to the following veterinarians who took the time to talk to me:
  Drs. Bender, Bruce, Kleine, Ludders, Molgaard, Ott, Riedesel, Steward, Turnwald, Vestweber

(and any others I may have forgotten)

Thanks Also To My Two Proofreaders

Shimmer



Bendir