

# Social Complexity



- In Primates, the shift from solitary nocturnal Prosimians to social diurnal Anthropoids led to feeding in groups
- In Cetaceans, the critical role of the school & the development of collaborative foraging makes them particularly social
- Grouping offers defense against increased predator pressure, but requires developing social skills
  - i.e. Group living raises issues of food & mate competition, signals of rank, opportunities for co-op, etc.
- What are some of the cognitive demands of such a dependence on social interaction?



# The Social Function of Intellect

Humphrey 1976

- The social domain is the most cognitively demanding
  - Physical domain highly predictable



# The Social Function of Intellect

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  - Physical domain highly predictable
  - Natural world somewhat more difficult to predict



# The Social Function of Intellect

Humphrey 1976

- The social domain is the most cognitively demanding
  - Physical domain highly predictable
  - Natural world somewhat more difficult to predict
  - Social domain MOST difficult to predict!

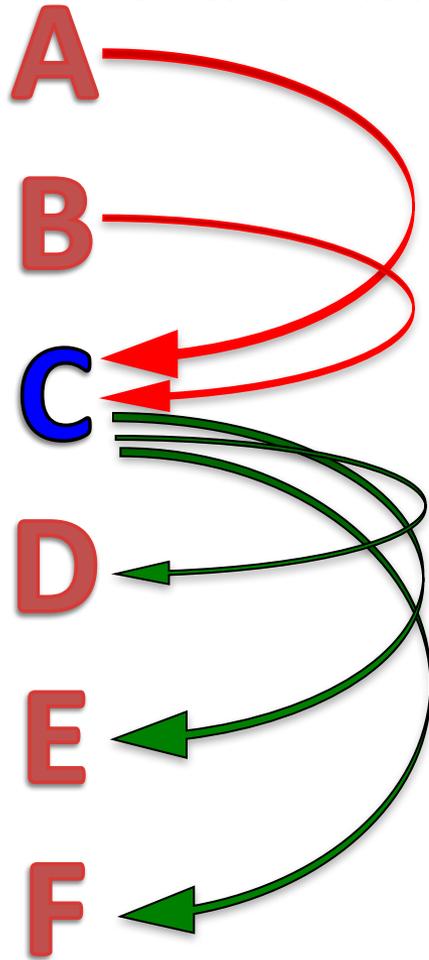
Problem changes  
as a consequence of  
trying to solve it



# Social Complexity

# Social Complexity

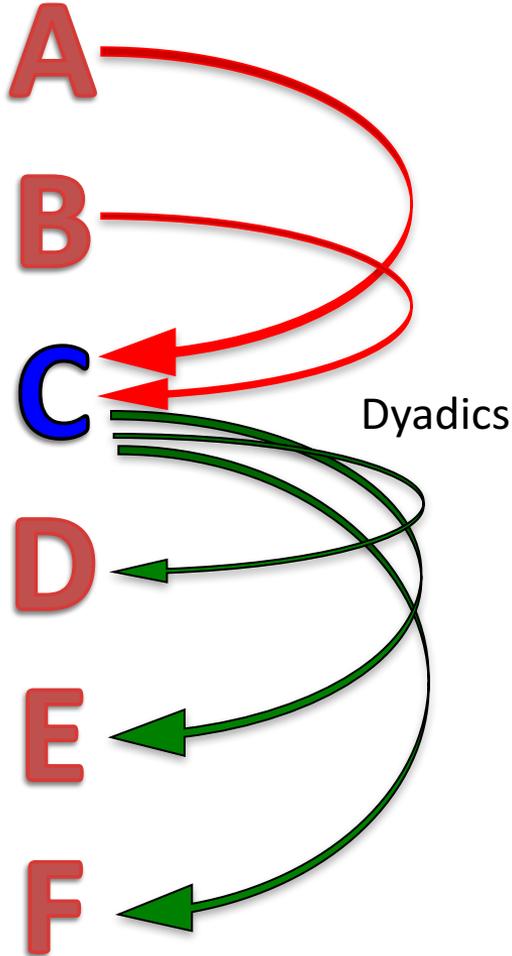
Power = Rank



In a “simple” hierarchical society,  
C only needs to track its  
own DYADIC relationships.

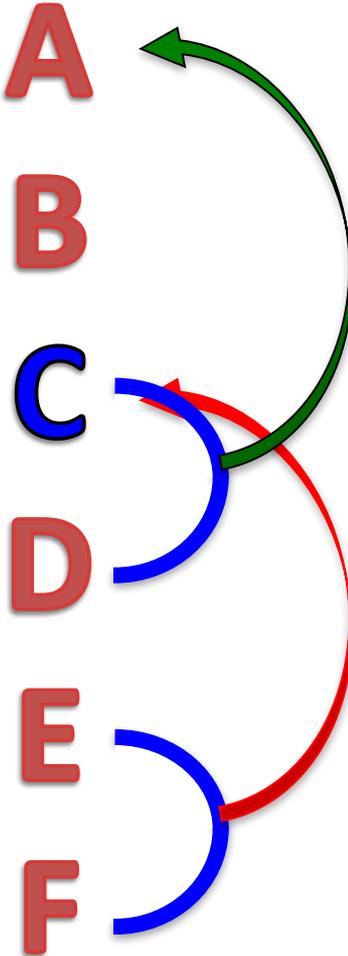
# Social Complexity

Power = Rank



Power not = Rank

(de Waal, 1986)



COALITIONS

between lower ranking individuals can out-compete higher ranking individuals

So, C must track not just its own dyadic relations, but also the relations between others.

BABOONS

## Baboons - Male Mating Strategies



# BABOONS

## Baboons - Male Mating Strategies



Sex & Violence -  
And Friendship!



# BABOONS

## Immigrant Male Strategy



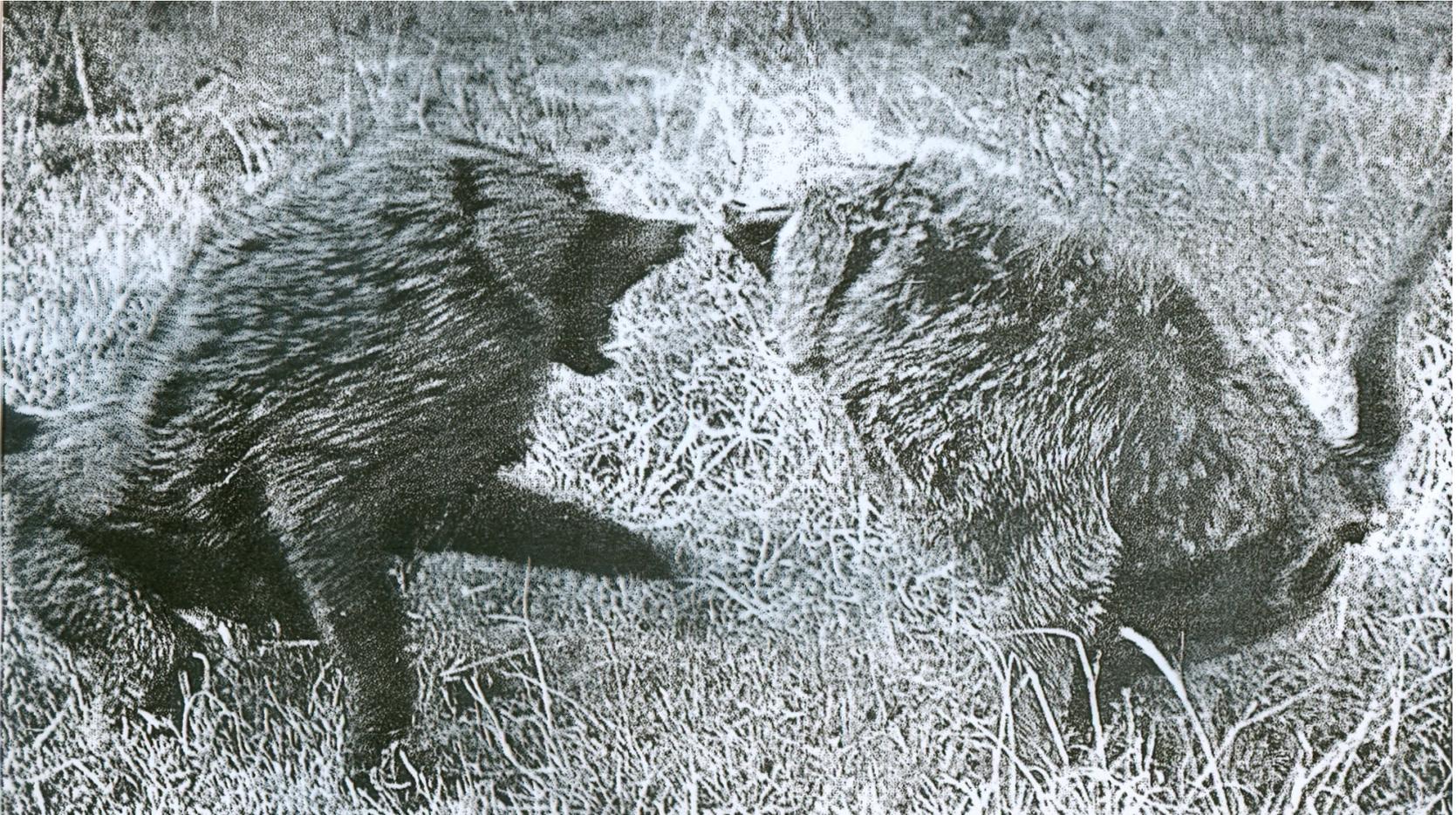
*Testosterone!*

Young males joining a new troop have highest testosterone levels of their lives.



## Immigrant Male Strategy

So, in dyadic interactions,  
young immigrant males are dominant  
over older resident males



## Resident Male Strategies

After they have been residents for a while, males make friends, esp with females.



## BABOONS

# Benefits of Friendship



Calmer, so  
more accepting  
of sex

# BABOONS

## Benefits of Friendship

Proximity >>  
familiarity >>  
trust of infants



# BABOONS



## Resident Male Strategies

Also make friends  
with infants

# BABOONS

## Resident Male Strategies



Use infant as “Buffer”  
against male aggression

Adult males inhibit  
their aggression  
around infants

# BABOONS

## Long-Term Resident Male Strategies

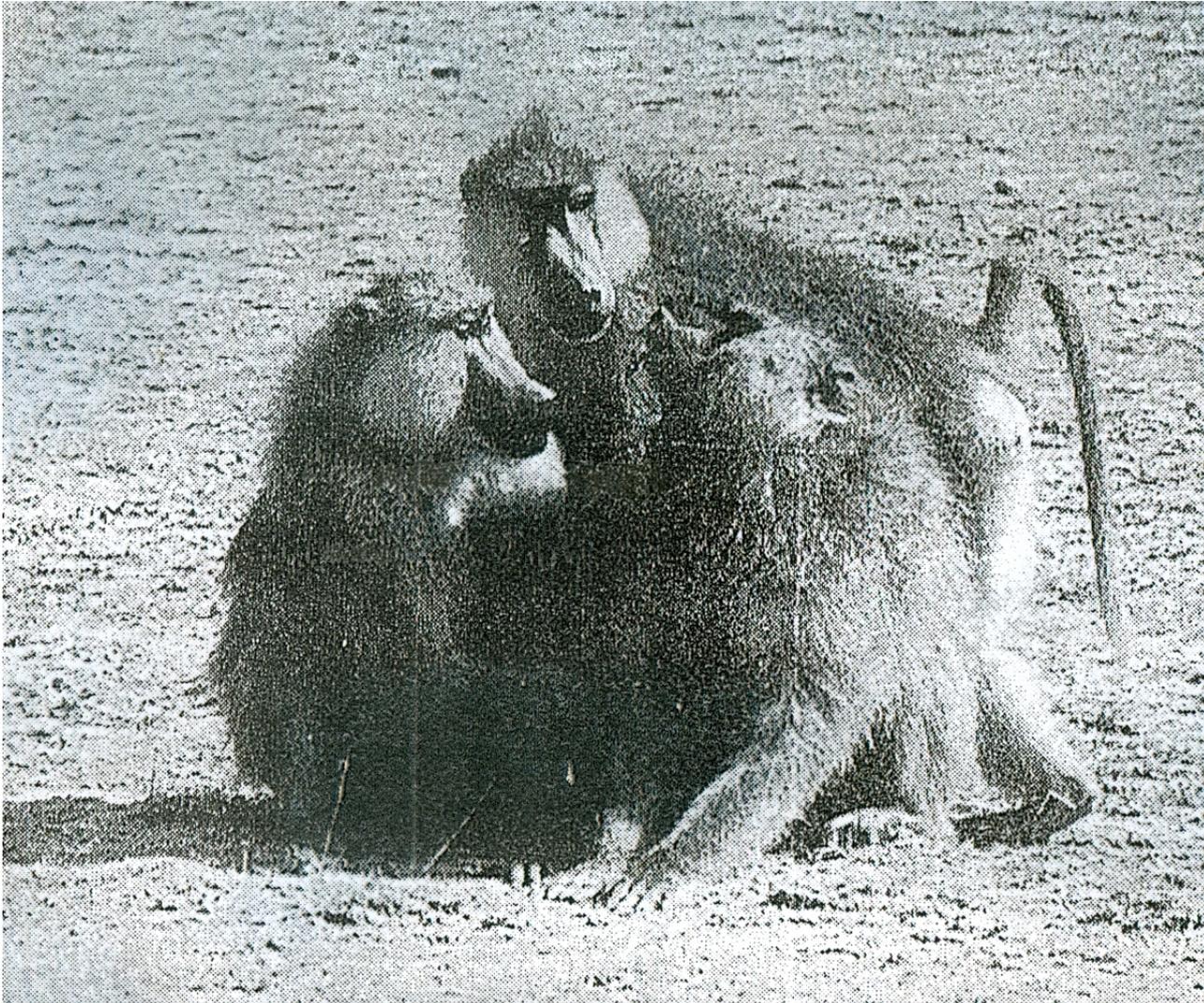


In time,  
make friends with  
other resident males.

Via grooming...

## BABOONS

# Long-Term Resident Male Strategies



In time,  
make friends with  
other resident males.

Via grooming...

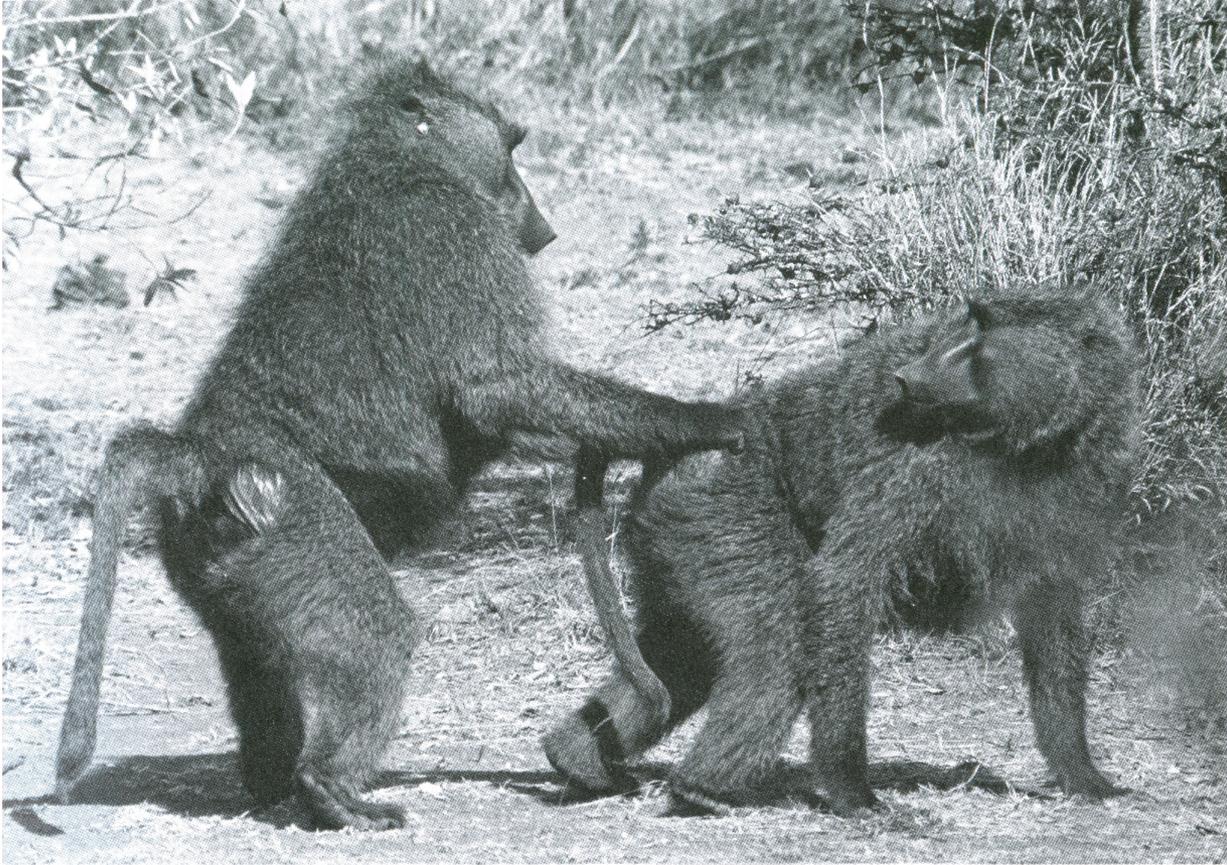
...and through repeated  
reciprocal exchanges  
of support

## Long-Term Resident Male Strategies

Synchronous displays convey  
Coalition as UNIT.



## Long-Term Resident Male Strategies



“Hold Bottom” display,  
Includes handling testicles.

At first, asymmetric,  
but later both play both roles.

If remain calm,  
shows this is a coalition  
of consequence!

## Long-Term Resident Male Strategies

Finally, resident male coalition  
can beat “dominant” younger male.



# Coalitional Behavior

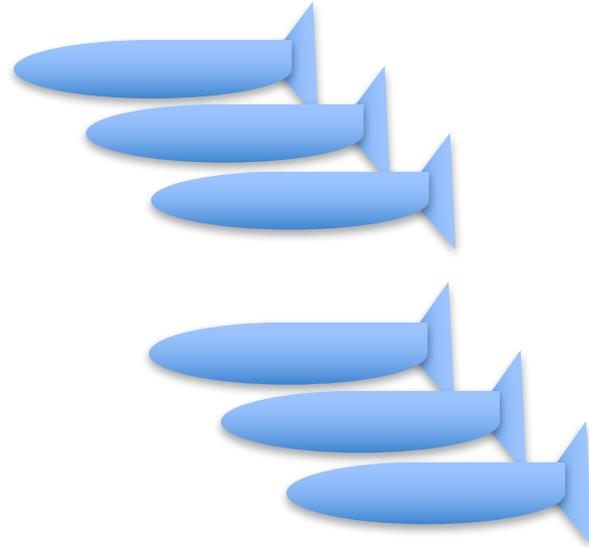
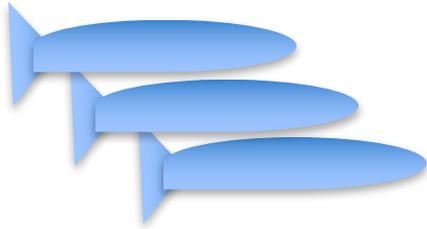
Bottlenose Males tend to form long-term alliances



In Shark Bay, Australia, usually TRIOS of males  
that herd/sequester females,  
competing with other alliances for reproduction rights

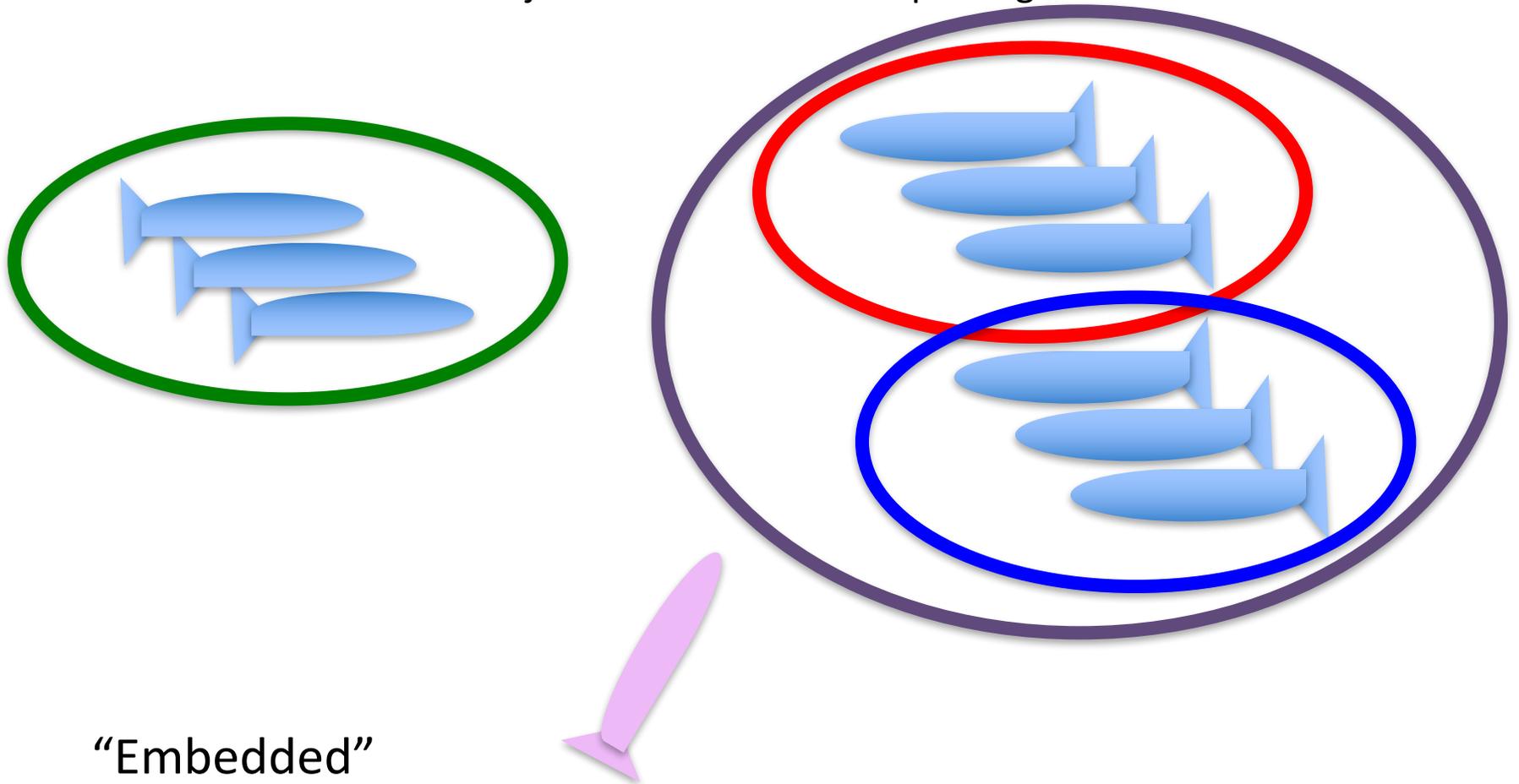
# Coalitional Behavior

In Shark Bay, can get “Super Alliances”  
Alliances that join with others to compete against others



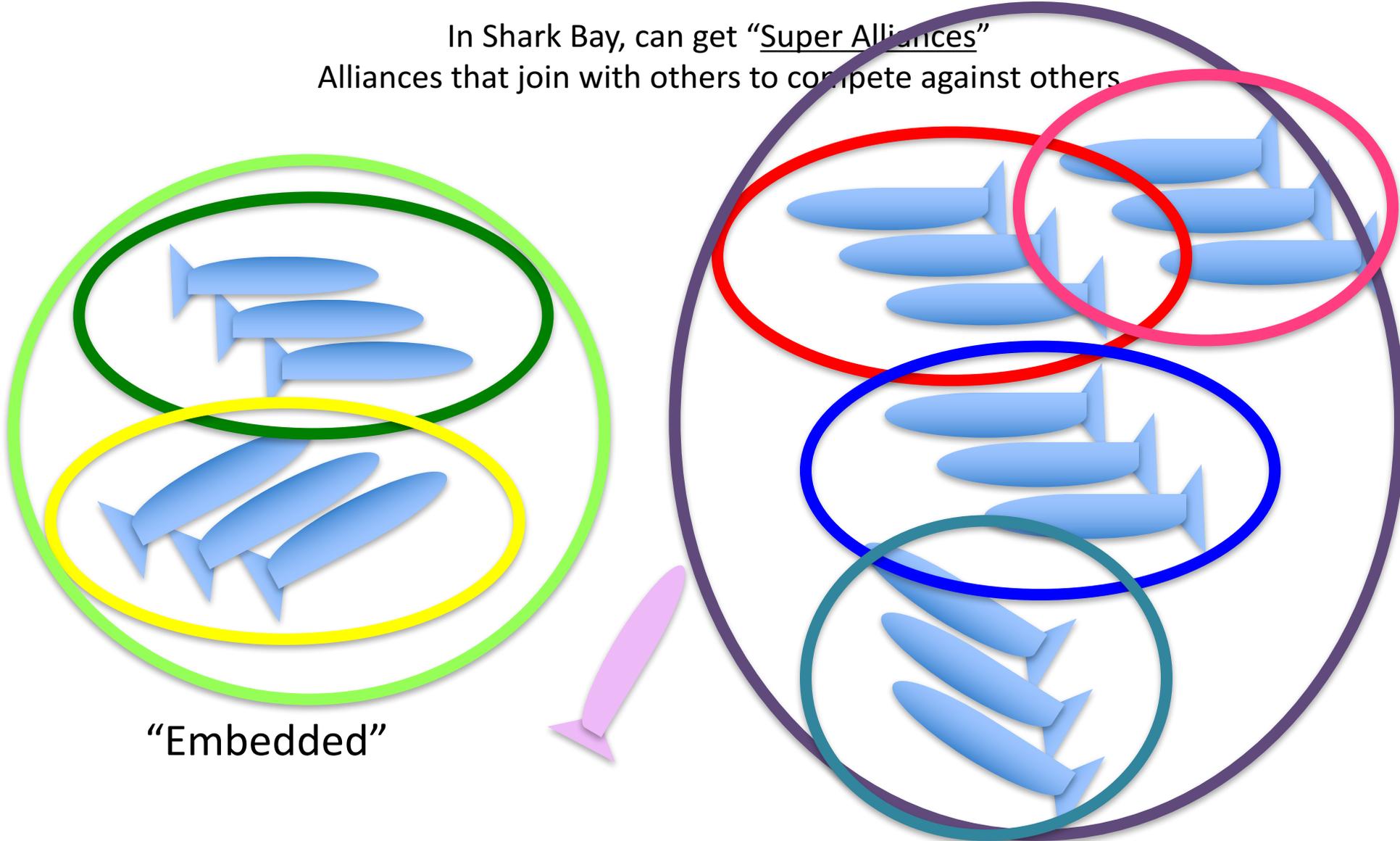
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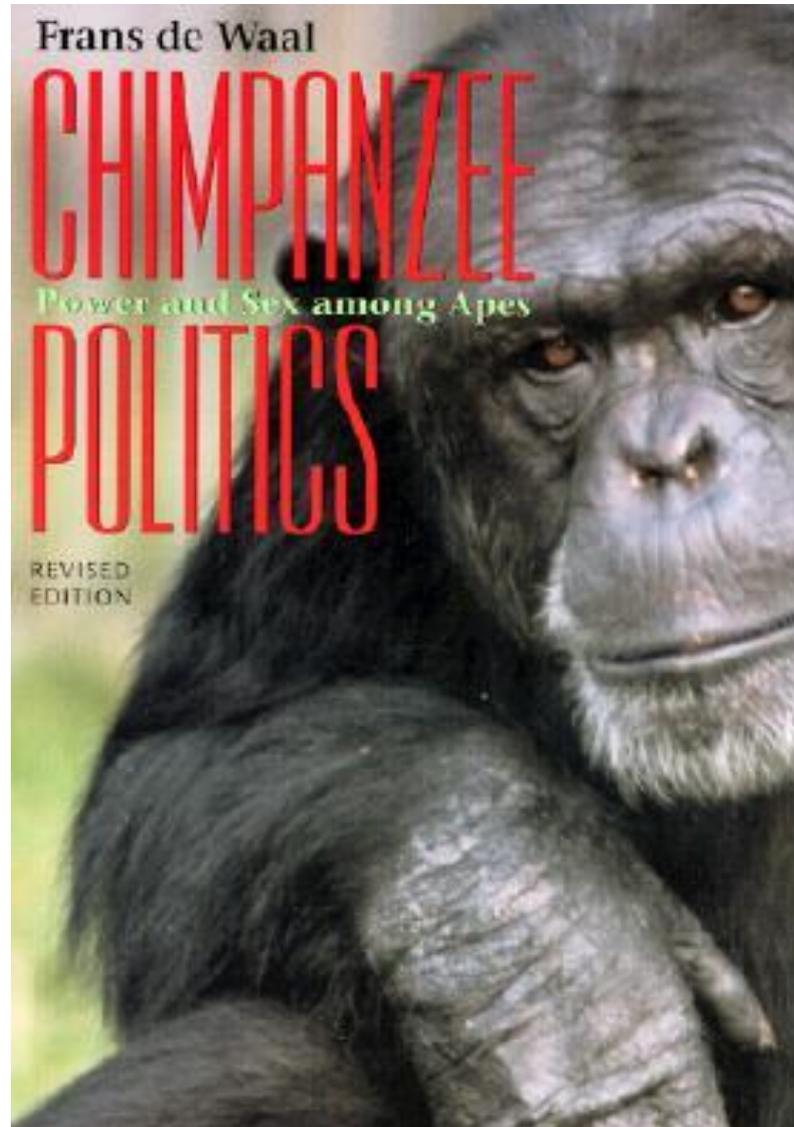


# Coalitional Behavior

In Shark Bay, can get “Super Alliances”  
Alliances that join with others to compete against others



## Chimpanzee Politics



Frans de Waal 1982

# Chimpanzee Politics

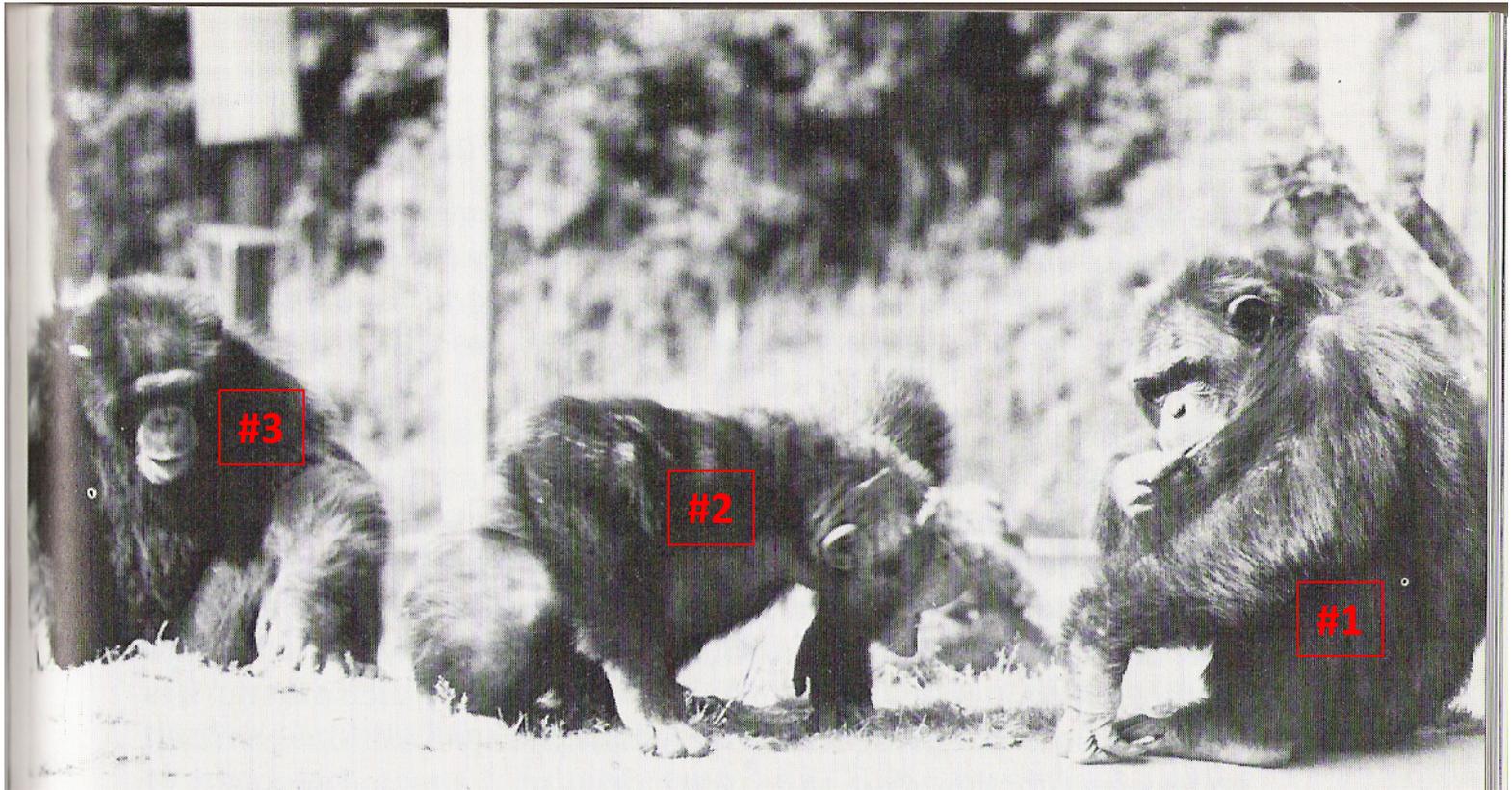
## Dominance Rank (Dyadic) of chimps at Arnhem Zoo

Top 3 ranked males contest the top position...

- # 1 & #3 are long-time coalition partners
  - Although #3 still subordinate to #1
- # 2 is an up-and-coming young male
  - Subordinate to #1, dominant to #3
- ... Other males
- ... Females

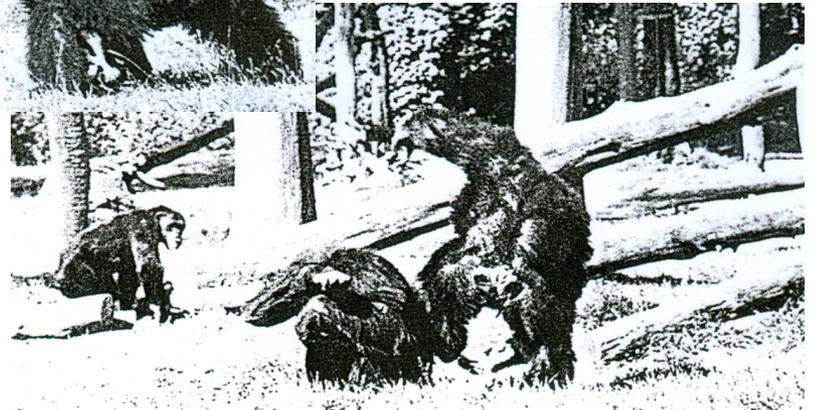
# Chimpanzee Politics

In the beginning, #2 consistently demonstrates respect to #1



# Chimpanzee Politics

#2 begins his campaign for dominance by harassing females. . .



## Chimpanzee Politics

1 must then invest in supporting these females in their retaliations and other conflicts



## Chimpanzee Politics

While a distracted #1 deals with the females,  
#2 can start to play up to (e.g. groom) #3



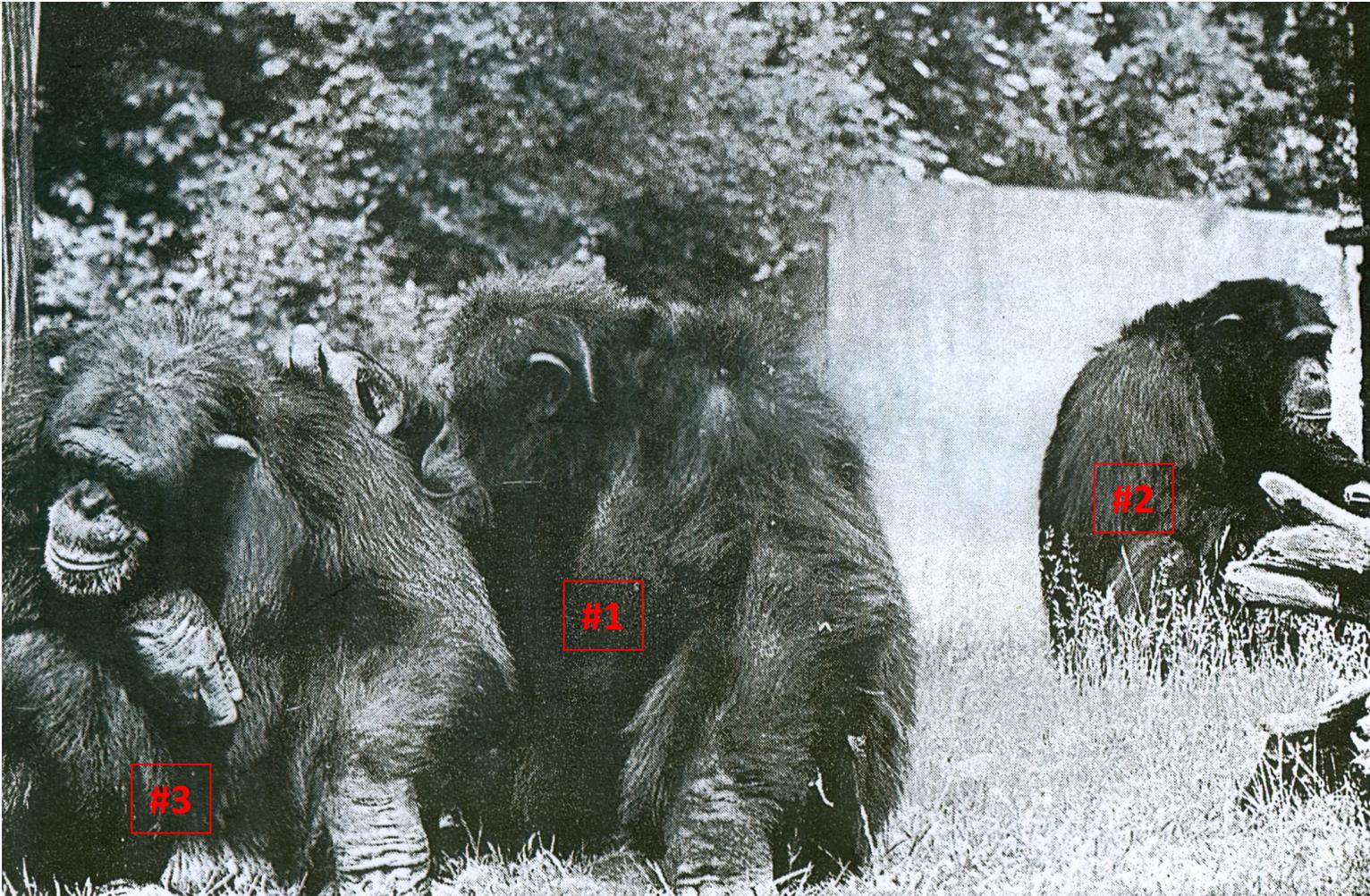
# Chimpanzee Politics

#1 breaks up any friendly (i.e. potentially coalition-forming)  
Interactions between #2 and #3



# Chimpanzee Politics

#1 must also to put in extra time grooming  
(i.e. coalition-securing) with #3



## Chimpanzee Politics

Then #2 switches to doing favors for the females (e.g. groom, share food, come to aid in fights, etc.)



## Chimpanzee Politics

So now #1 also needs to watch for/break up friendly interactions between #2 and females.



## Chimpanzee Politics

#1 grows testy, aggressive toward females, especially those who have been friendly to #2.



# Chimpanzee Politics

## *THE COUP!*

Throughout, #2 has been acting subordinate in dyadic interactions with #1.

But finally #2 makes his move, aggressively standing up to #1.



## Chimpanzee Politics

### *THE COUP!*

And, with support from both #3 and the Female,  
#2 triumphs over #1.

**#2 becomes #1!**



## Chimpanzee Politics

As far as gaining "resources" go, throughout this period, it was **#3** who had the most matings!!!



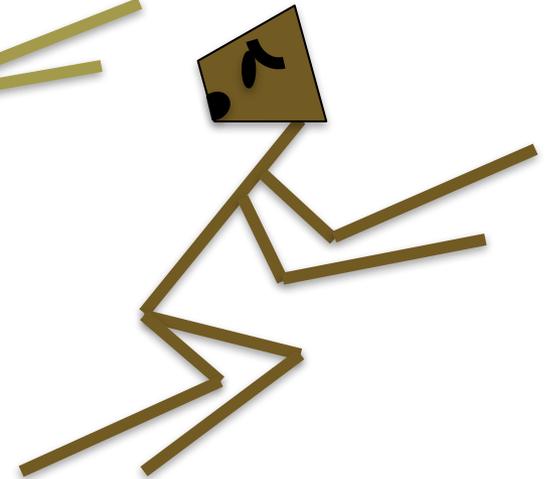
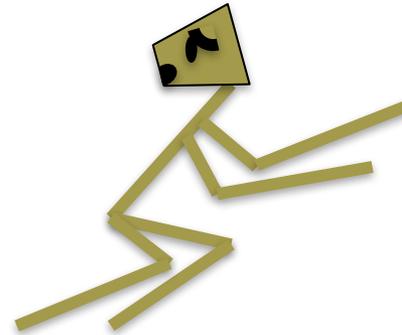
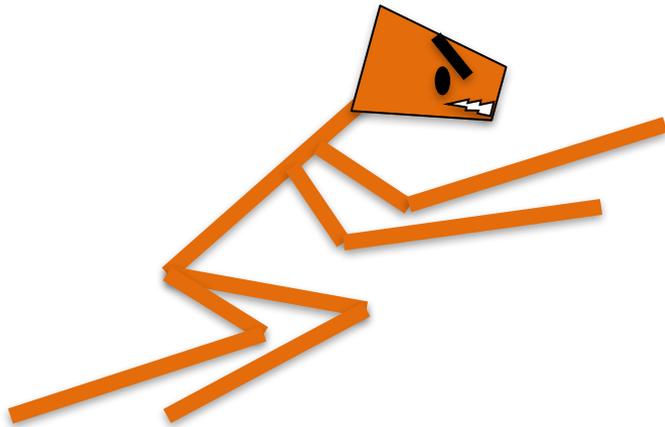
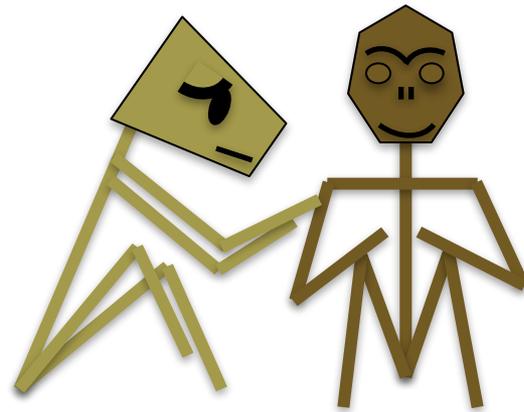
Since both other males had to be tolerant of him, to win/maintain his support, and since females became wary of those males.

- SO, Social Complexity is distinguished by **Triadic** (or Polyadic) interactions



# Triadic Interactions

## Intervention in Alliance Formation

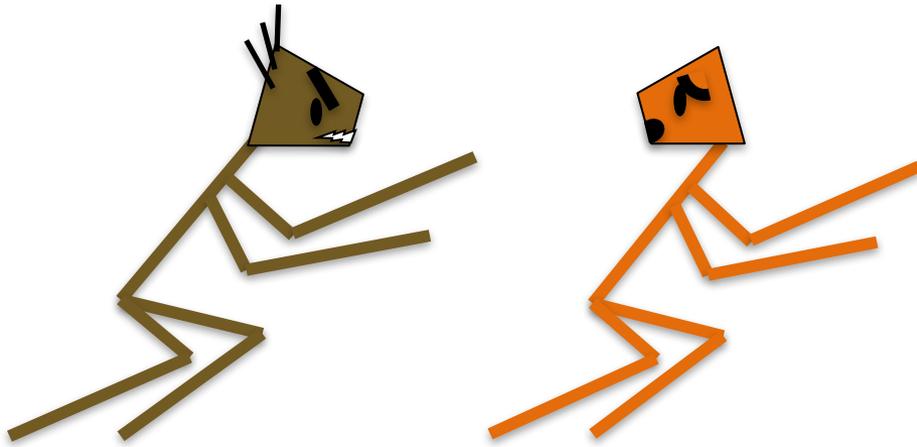


# Triadic Interactions

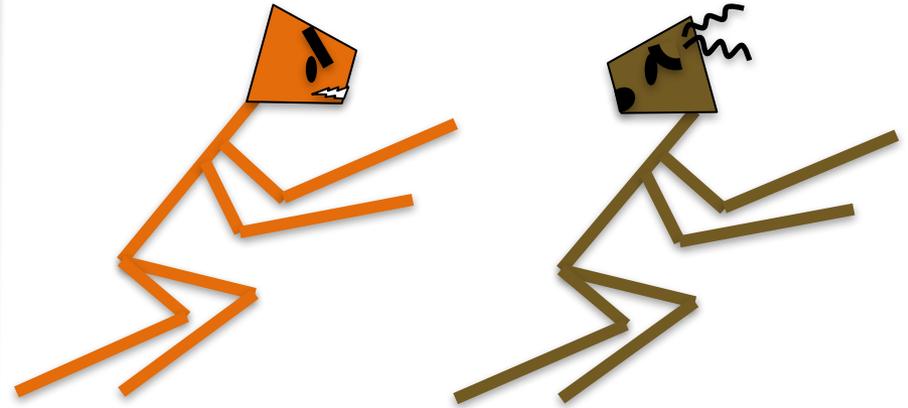
## “Re-Directed Aggression”

Often directed to ally/kin of adversary

**A aggress B**

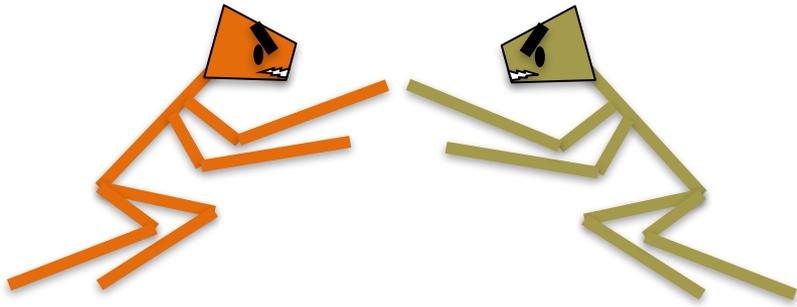


**B redirect to A'**

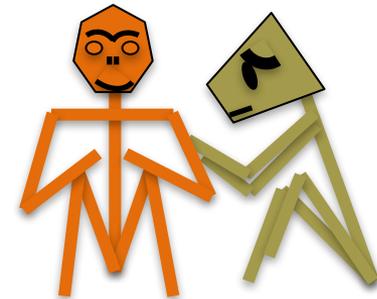
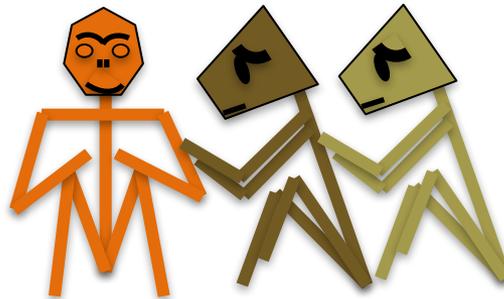
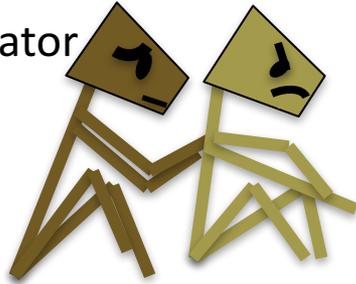


# Triadic Interactions

## Mediation of Reconciliation



Mediator



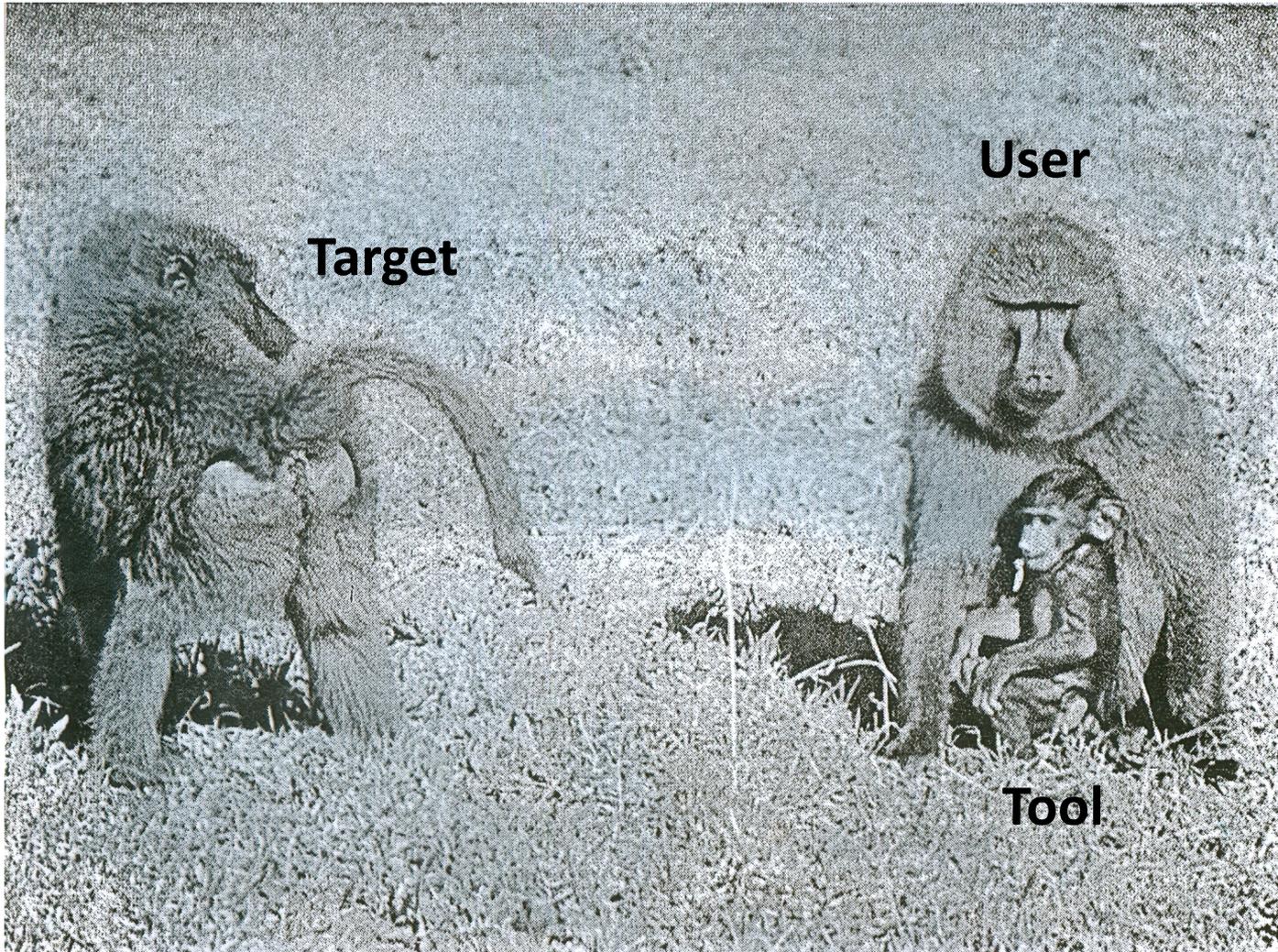
# Social Tool Use

“Social Tool” = a TRIADIC interaction,  
involving a USER, a TOOL and a TARGET

USER manipulates the TOOL in some way to influence  
the User’s relationship with the TARGET

## Buffer

User places Tool between User and threatening Target



Male baboon  
using infant as  
a "Buffer"

# Buffer

User places Tool between User and threatening Target



See VIDEO

## Recruit

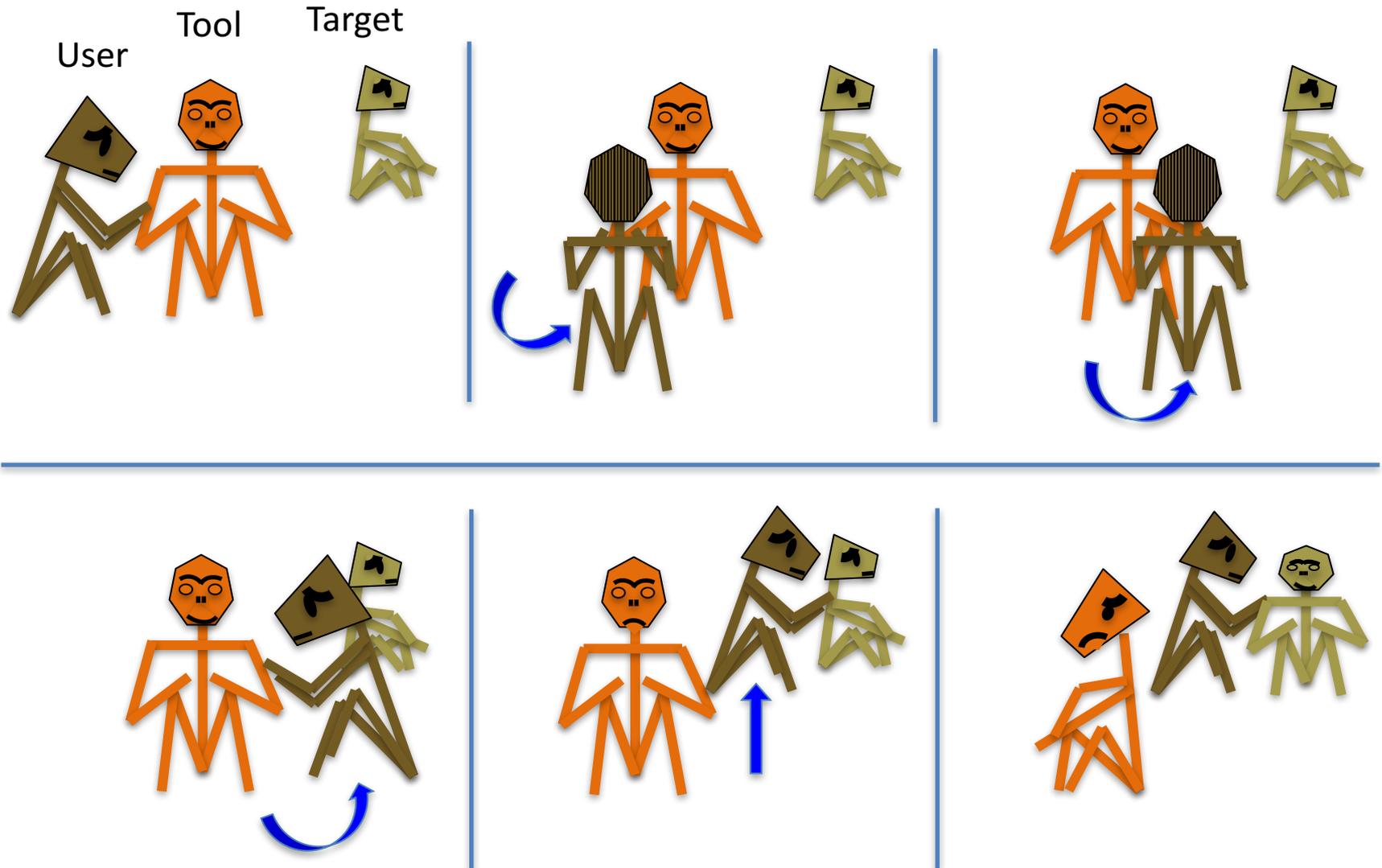
User recruits Tool to join in aggression/threat against Target



See VIDEO

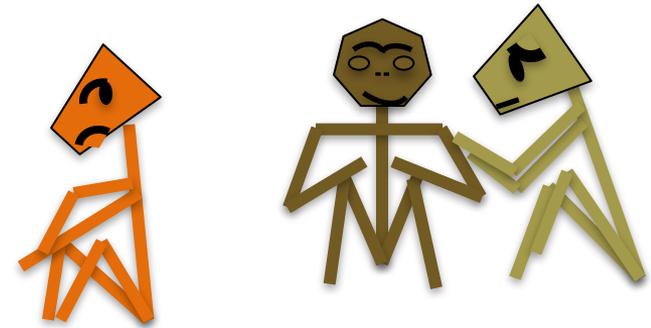
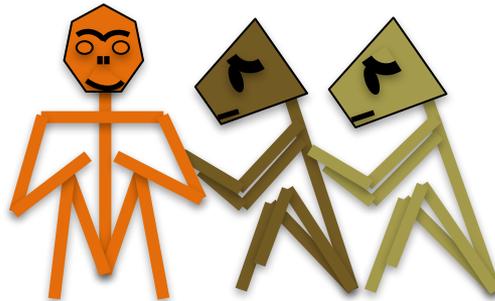
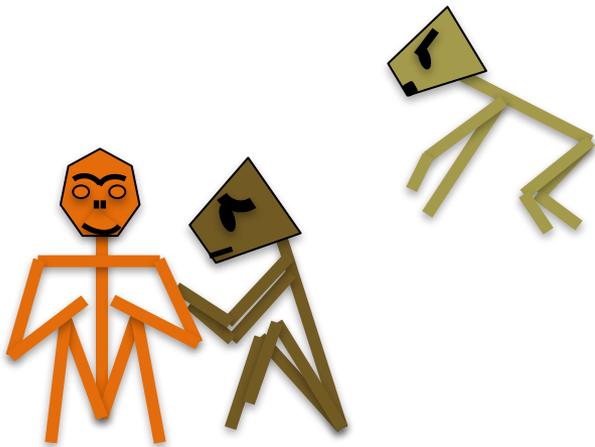
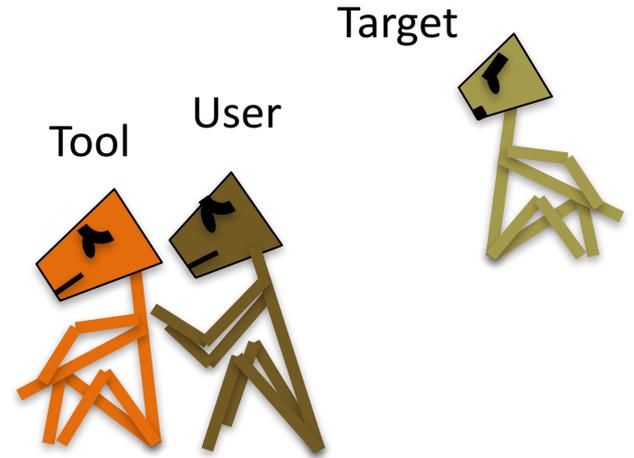
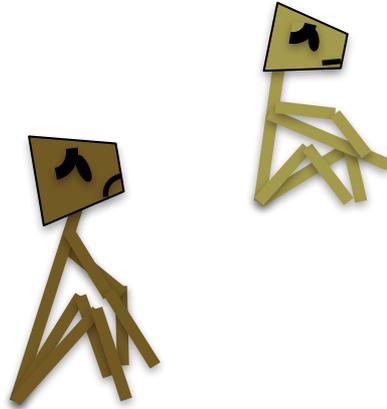
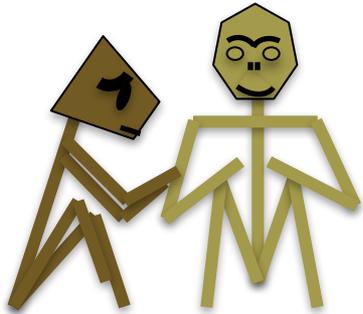
# Passport

User uses its access to Tool to gain access to Target



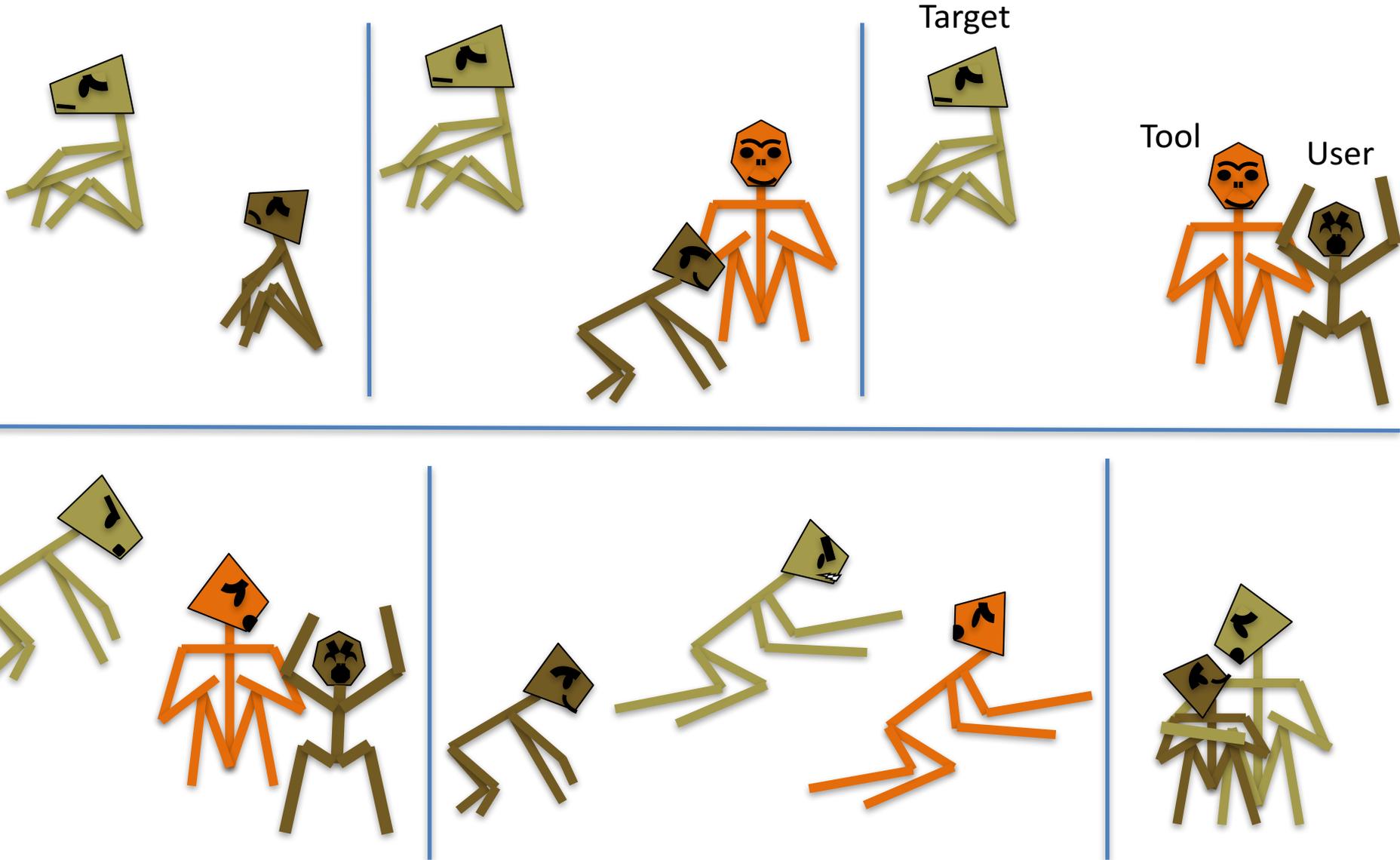
# Incite

User shows an investment in Tool to incite an investment from Target



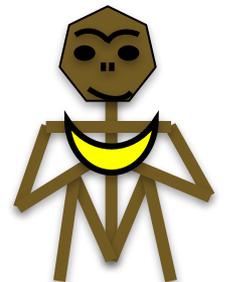
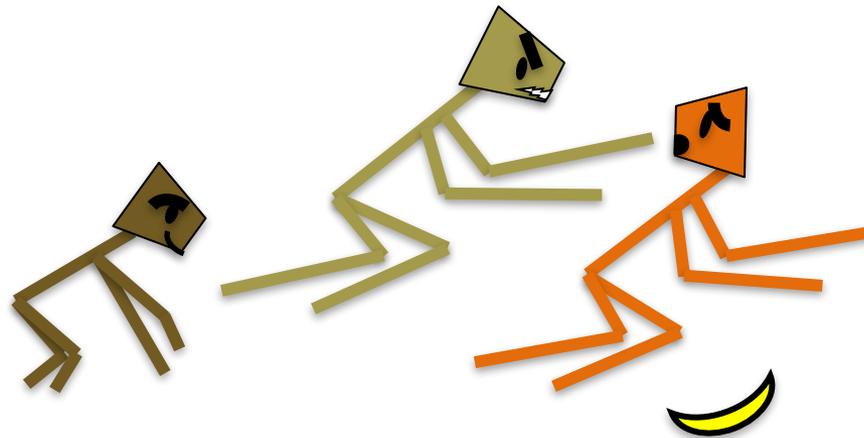
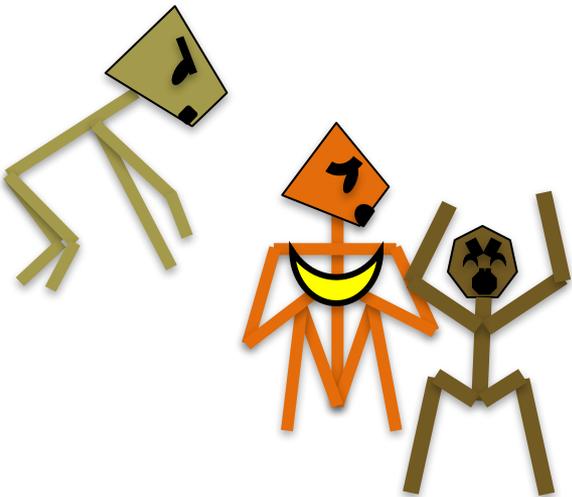
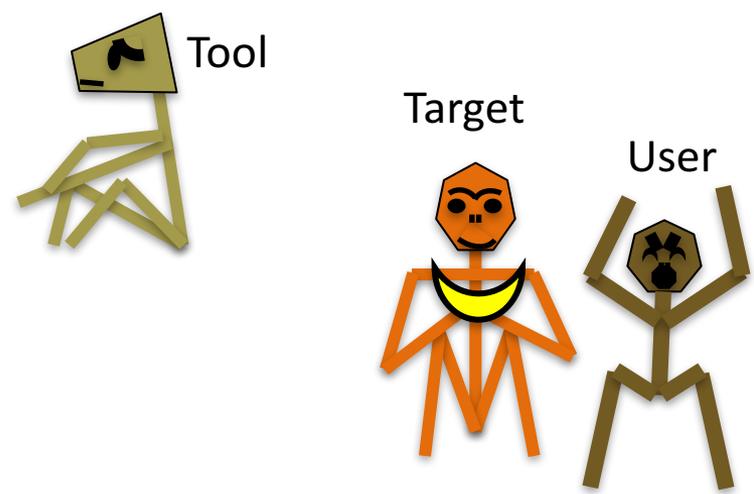
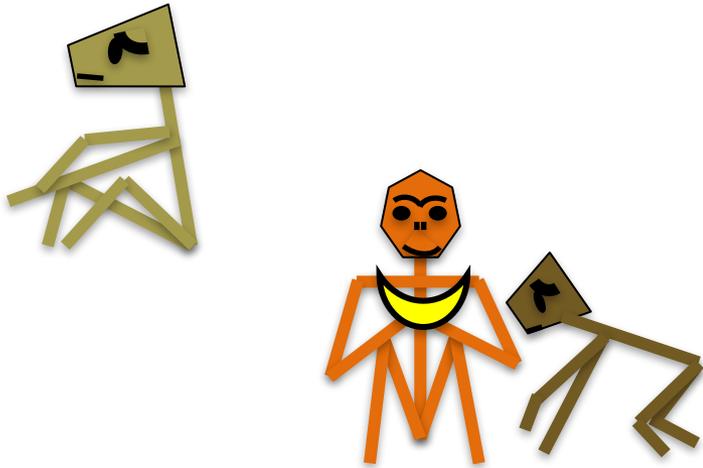
# Slander

User acts as if (innocent) Tool was abusive, provoking retaliation from Target

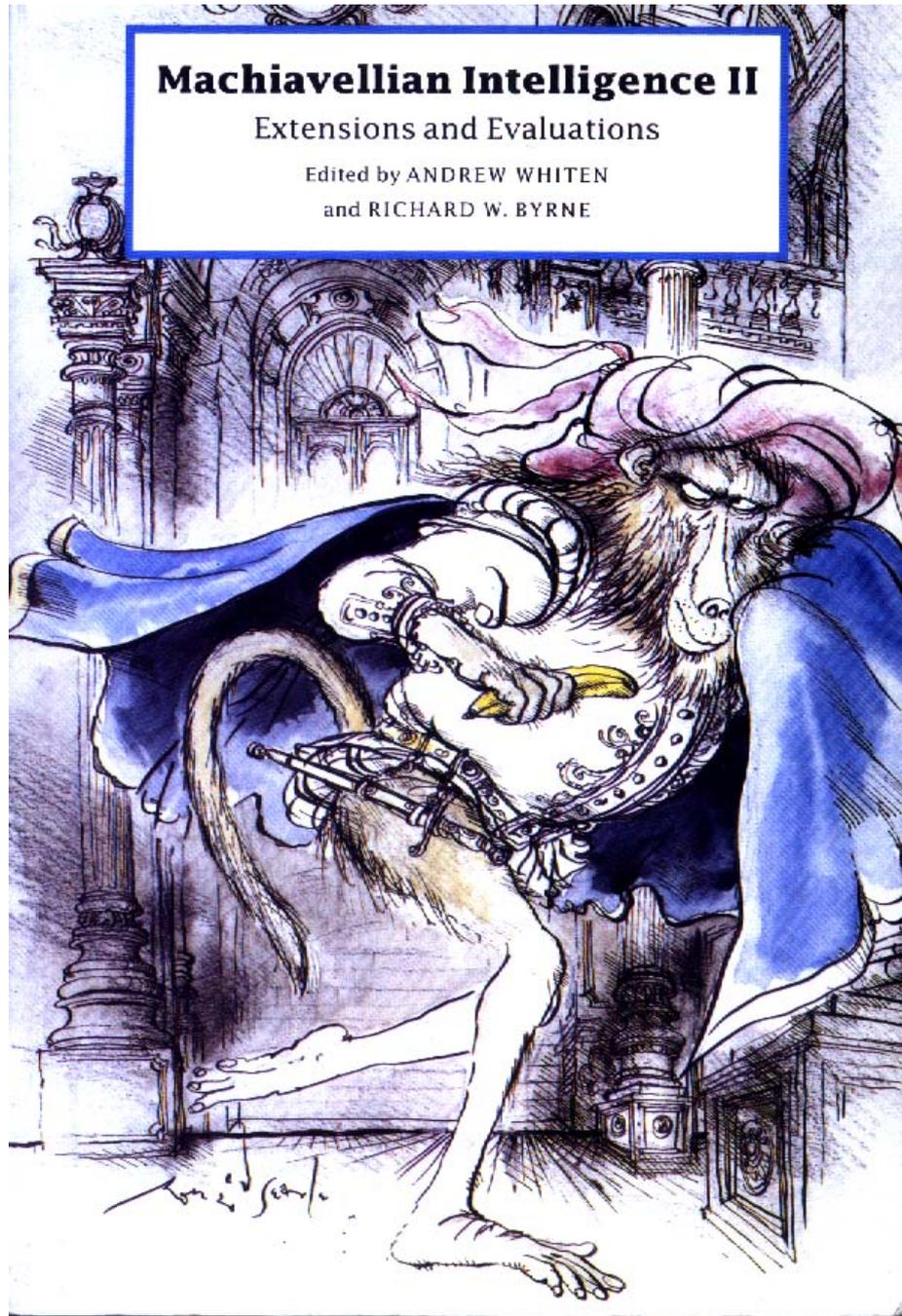
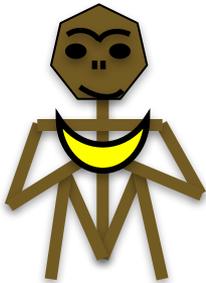


# Slander

In another version of Slander, User uses Tool to gain access to Target's resource

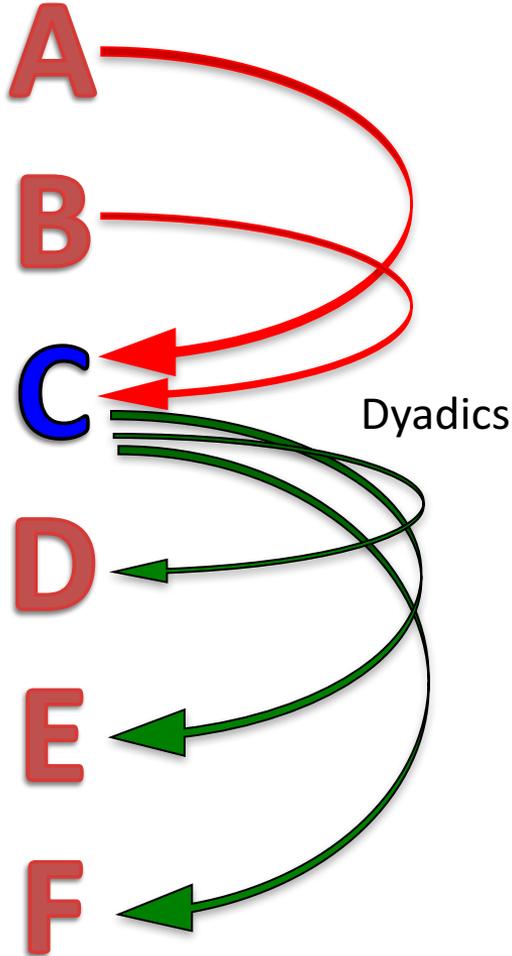


User's behavior is often connoted as “exploitative”, “insincere”, “Machiavellian”, etc.



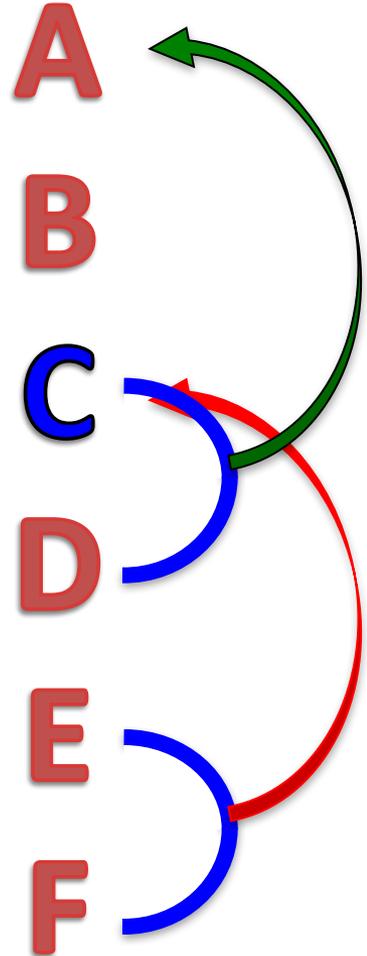
# Social Complexity

Power = Rank



Power not = Rank

(de Waal, 1986)



COALITIONS

between lower ranking individuals can out-compete higher ranking individuals

So, C must track not just its own dyadic relations, but also the relations between others.

# Knowing about the Relations Between Others

Dasser 1988

Match-to-Sample with Long Tailed Macaques

Training...



Sample:  
Known Mother



Alternates:  
Known Offspring

Correct Response:  
Select infant of  
mother



# Knowing about the Relations Between Others

Dasser 1988

Match-to-Sample with Long Tailed Macaques

Testing...



Novel Sample of  
Known Mother



Alternates:  
Known Offspring



# Knowing about the Relations Between Others

Dasser 1988

Match-to-Sample with Long Tailed Macaques

Note that  
Offspring may be  
grown up, so not just  
closest associate



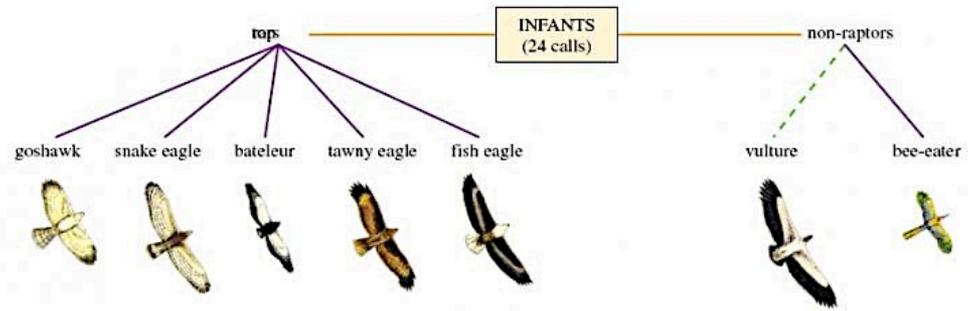
Subjects showed  
First Trial Success on tests,  
suggesting already organize  
known animals  
by their kinship relations



# Knowing about the Relations Between Others

Seyfarth & Cheney 1990

Observational study of Vervet Alarm Calls – Response of others to Infant Alarms



Immature vervets are unreliable signalers

Others look to mom for confirmation re alarms, suggesting that they know the kinship relations of their group-mates.

# Knowing about the Relations Between Others

Perry 2004  
*Cebus* Coalition Structure

Threatened



Two friends to choose from



Friend 1 is  
Subordinate  
to adversary



Needs an ally



Friend 2 is  
Dominant  
(or closer in rank)  
to adversary



# Knowing about the Relations Between Others

Perry 2004  
*Cebus* Coalition Structure

Two friends to choose from



Friend 1 is  
Subordinate  
to adversary



Cebus take into account  
not only its *own* relation to ally,  
but ally's relation to  
adversary as well



Friend 2 is  
Dominant  
(or closer in rank)  
to adversary



# Knowing about the Relations Between Others

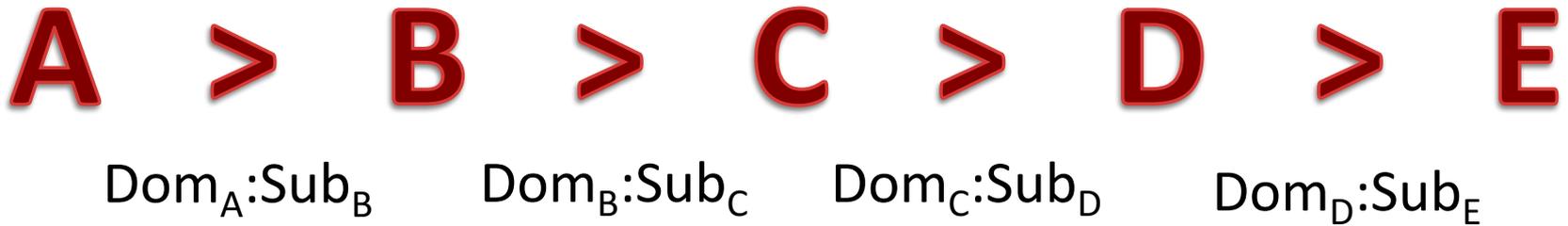
Cheney, Seyfarth & Silk 1995  
Playback experiments to wild Chacma Baboons



# Knowing about the Relations Between Others

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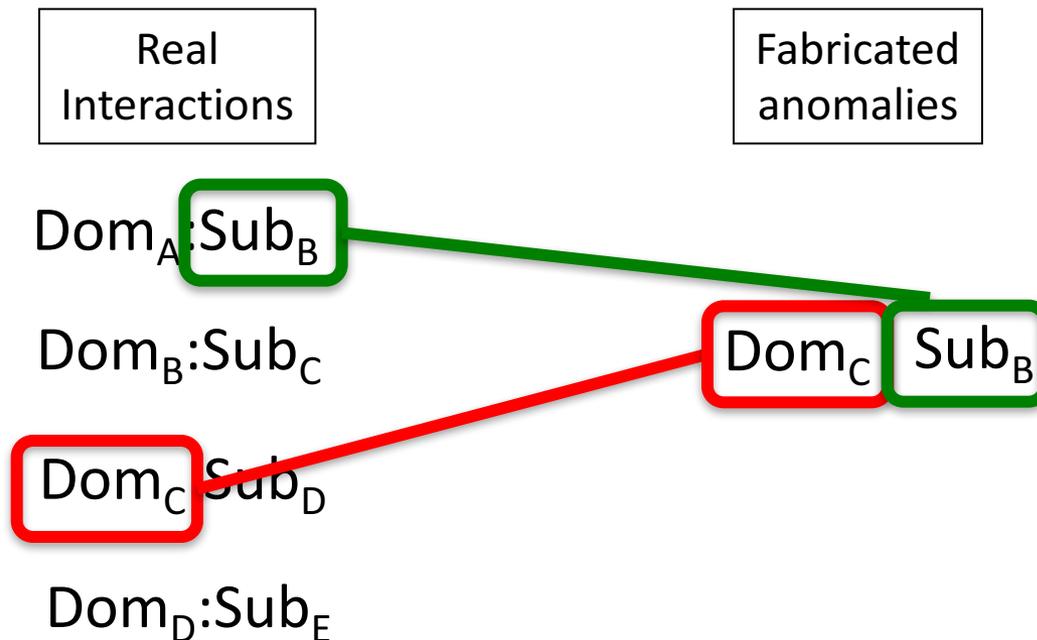
Make audio recordings of calls that occur during dominance interactions



# Knowing about the Relations Between Others

Cheney, Seyfarth & Silk 1995  
Playback experiments to wild Chacma Baboons

During playbacks, use real call interactions and  
fabricated, anonalous combinations



# Knowing about the Relations Between Others

Cheney, Seyfarth & Silk 1995  
Playback experiments to wild Chacma Baboons

During playbacks, use real call interactions and  
fabricated, anomalous combinations

Real  
Interactions

$\text{Dom}_A : \text{Sub}_B$

$\text{Dom}_B : \text{Sub}_C$

$\text{Dom}_C : \text{Sub}_D$

$\text{Dom}_D : \text{Sub}_E$

Fabricated  
anomalies

$\text{Dom}_C : \text{Sub}_B$

$\text{Dom}_D : \text{Sub}_C$

# Knowing about the Relations Between Others

Cheney, Seyfarth & Silk 1995  
Playback experiments to wild Chacma Baboons

Await opportunity when group (not including those recorded) present



# Knowing about the Relations Between Others

Cheney, Seyfarth & Silk 1995  
Playback experiments to wild Chacma Baboons

Play back real & fabricated call pairs  
from hidden speaker



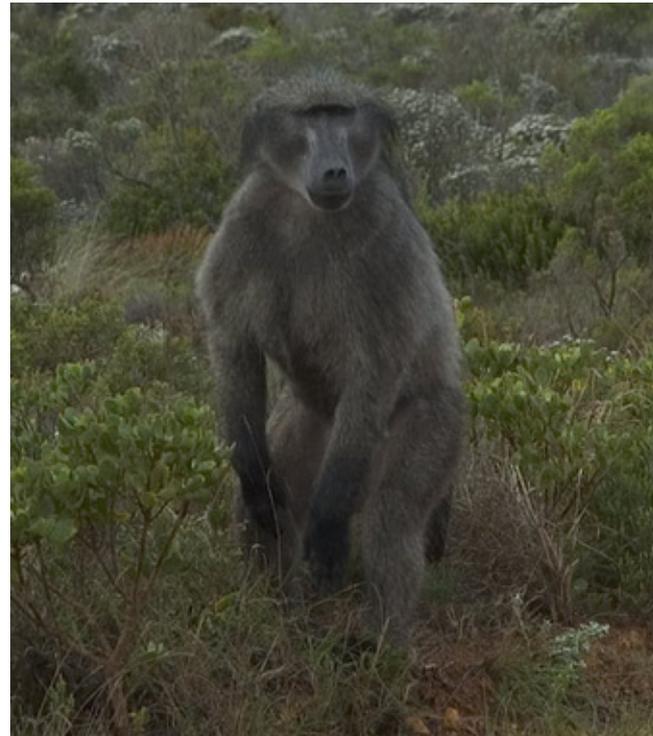
# Knowing about the Relations Between Others

Cheney, Seyfarth & Silk 1995  
Playback experiments to wild Chacma Baboons

NO reaction to  
real interactions



BIG reaction to  
fabricated interactions  
– investigate!



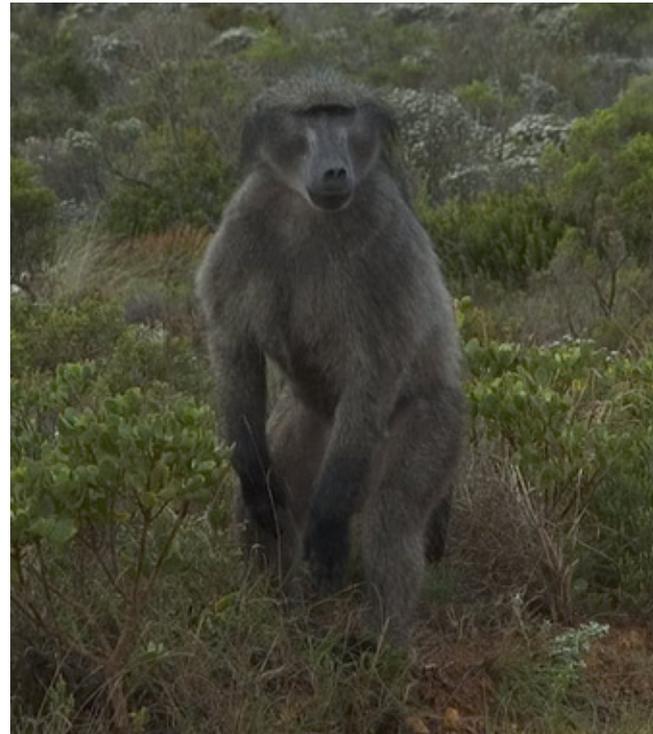
# Knowing about the Relations Between Others

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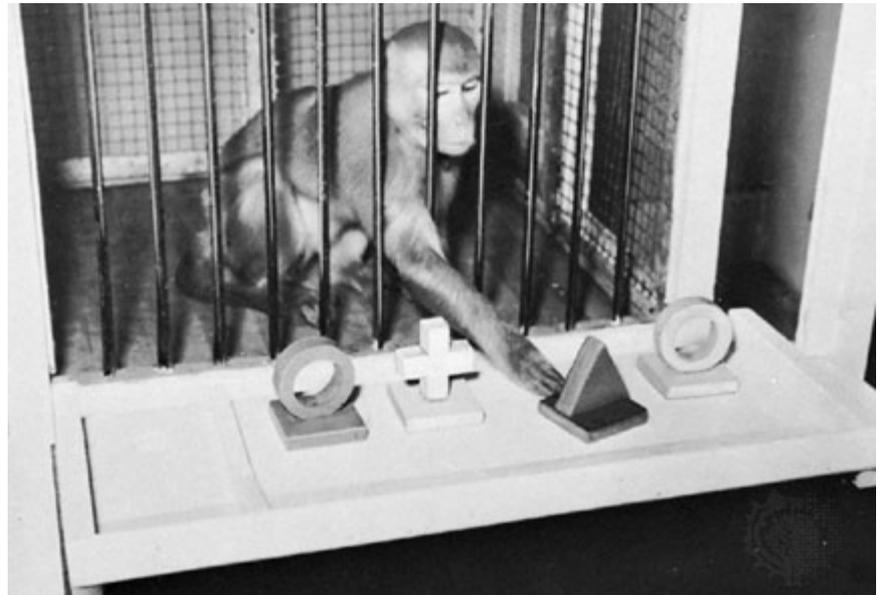
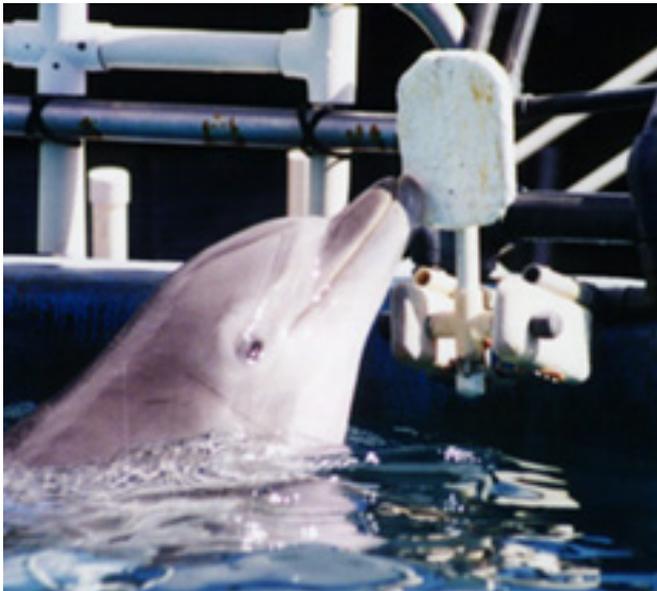
Suggests know relations between others;  
as a result, recognize violations of  
those expectations

Investigate,  
since apparent rank changes  
may impact YOU as well!

BIG reaction to  
fabricated interactions  
– investigate!



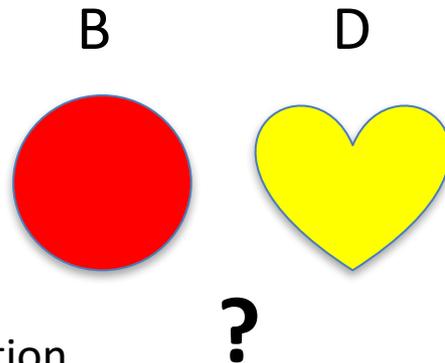
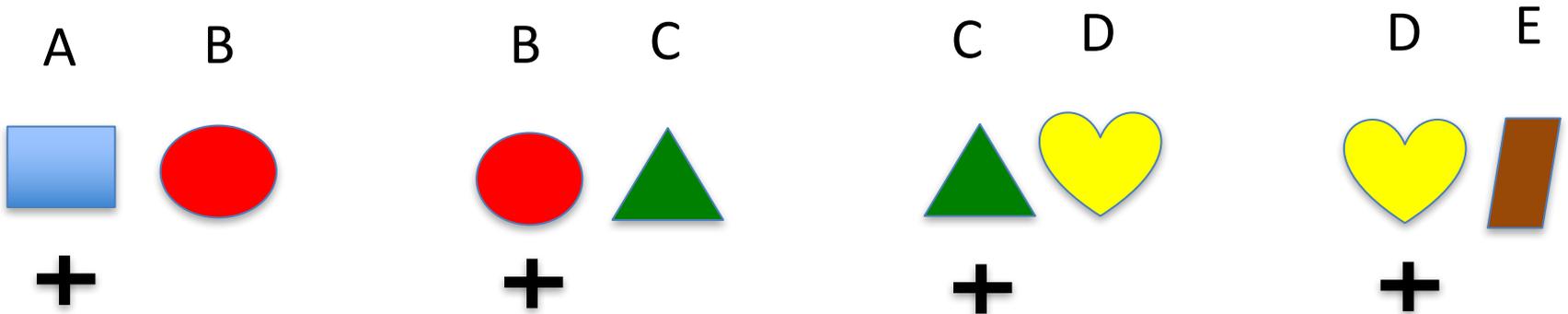
- Research in the lab can also provide insights into the cognitive mechanisms required
- Although the Ecological Validity of this work is less obvious, we can consider how might apply to social domain



# Transitive Inference

# Transitive Inference

First, train up pairwise choices...



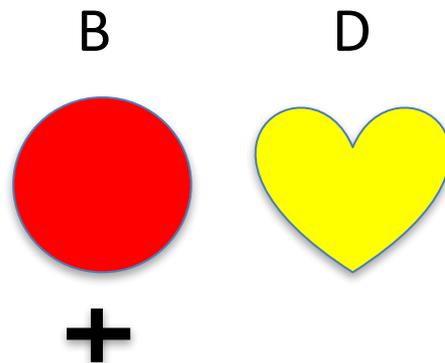
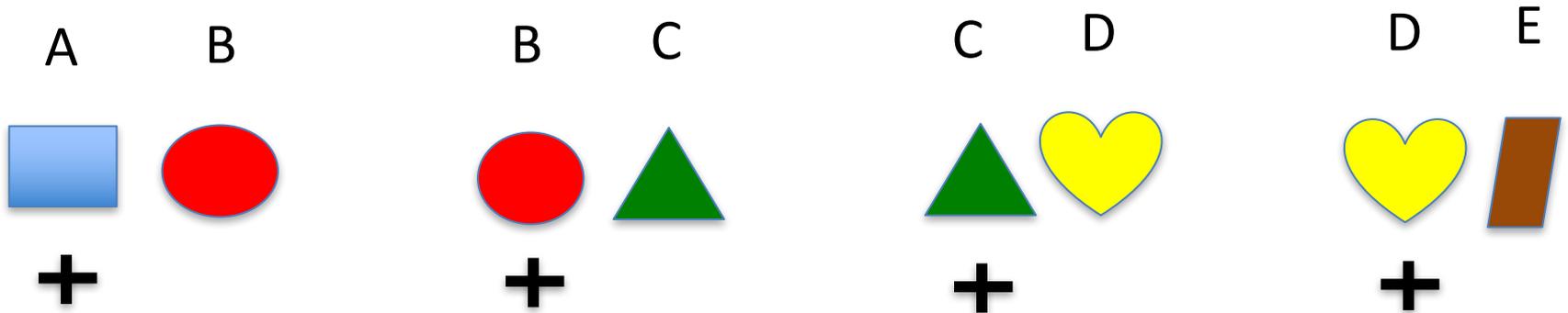
Then, test with novel combination  
(familiar objects, new pairing)



Pigeons respond at Chance

# Transitive Inference

First, train up pairwise choices...



$B > C$

$C > D$

Therefore  $B > D$

Primates **infer** an ordered relationship

# Transitive Inference

Social applications – deduce relative rank of others?

A dominant over B



B dominant over C



# Transitive Inference

Social applications – deduce relative rank of others?

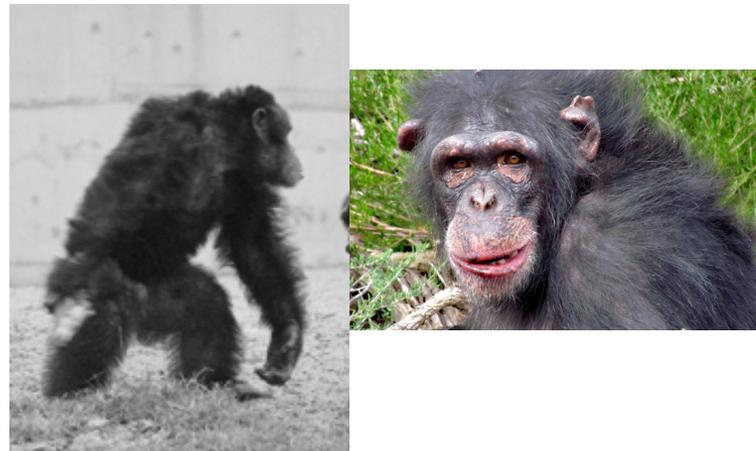
A dominant over B



B dominant over C



Infer that  
A dominant over C...?

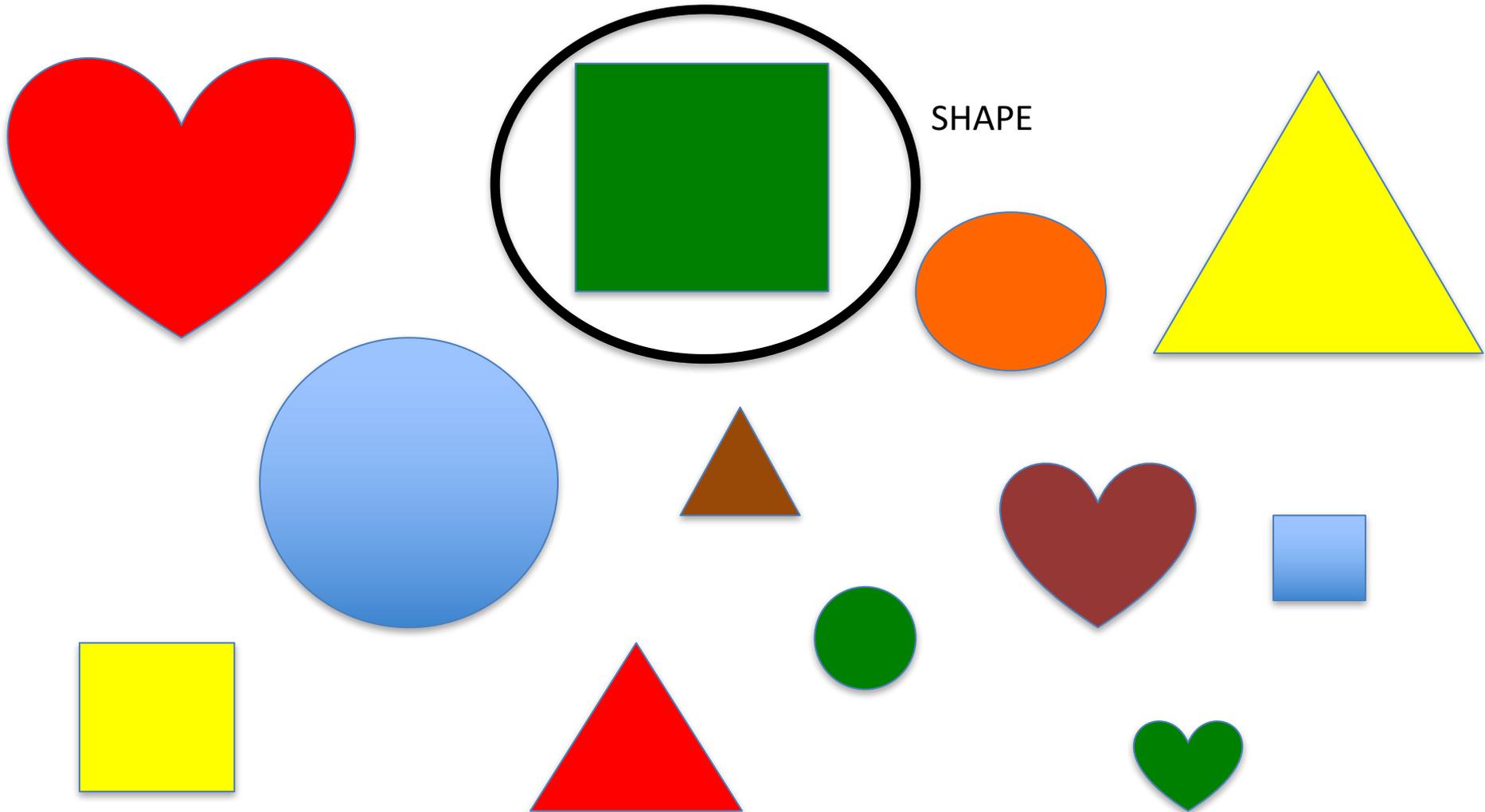


# “Weigl Principle”

Classify a single object along multiple different dimensions

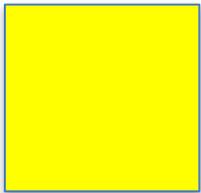
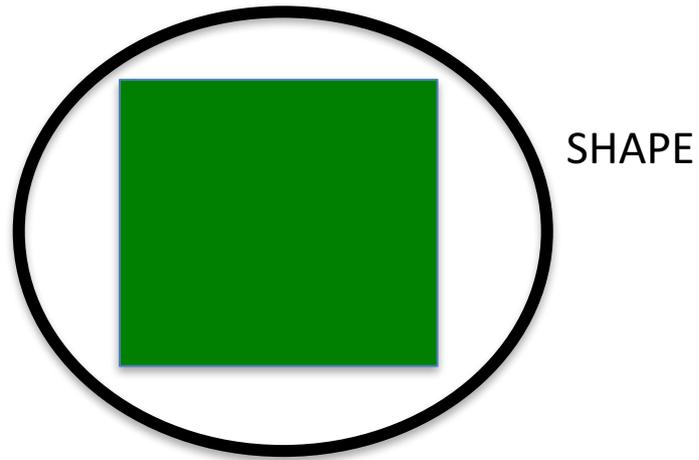
# “Weigl Principle”

Classify a single object along multiple different dimensions



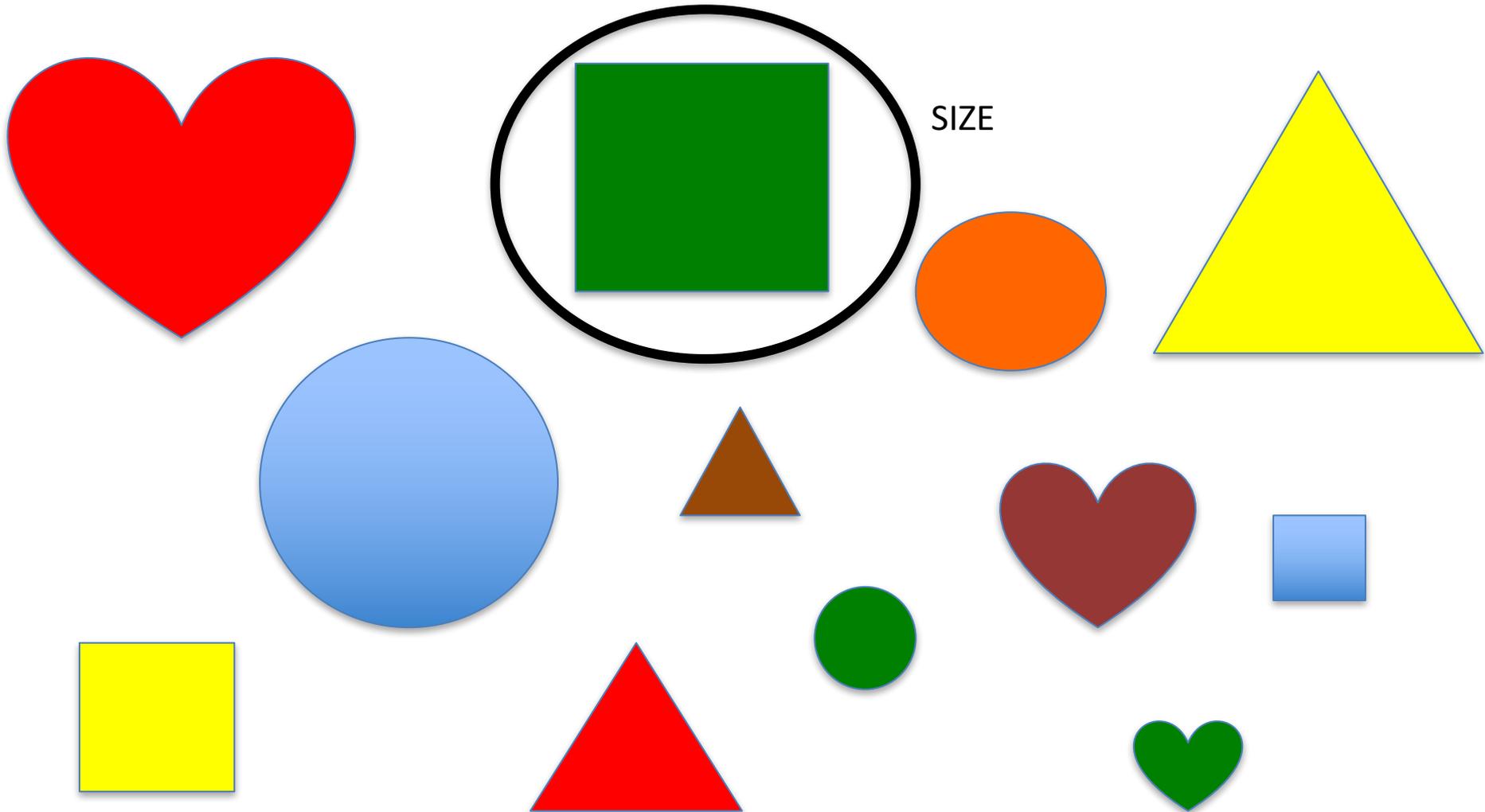
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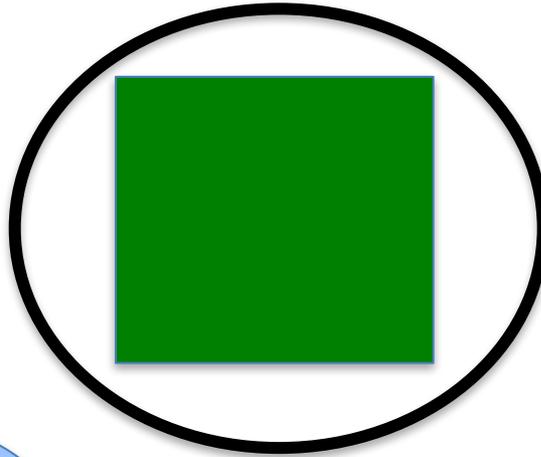
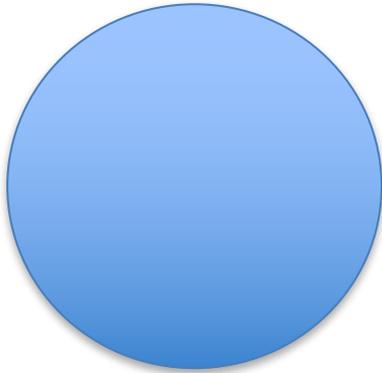
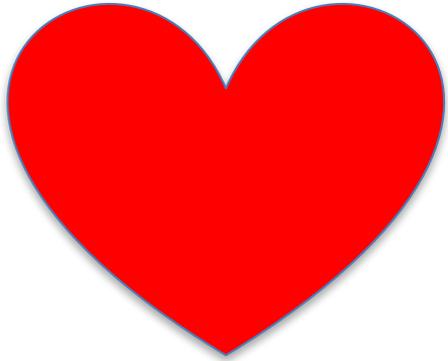
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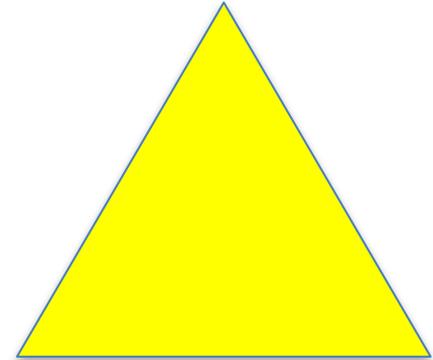


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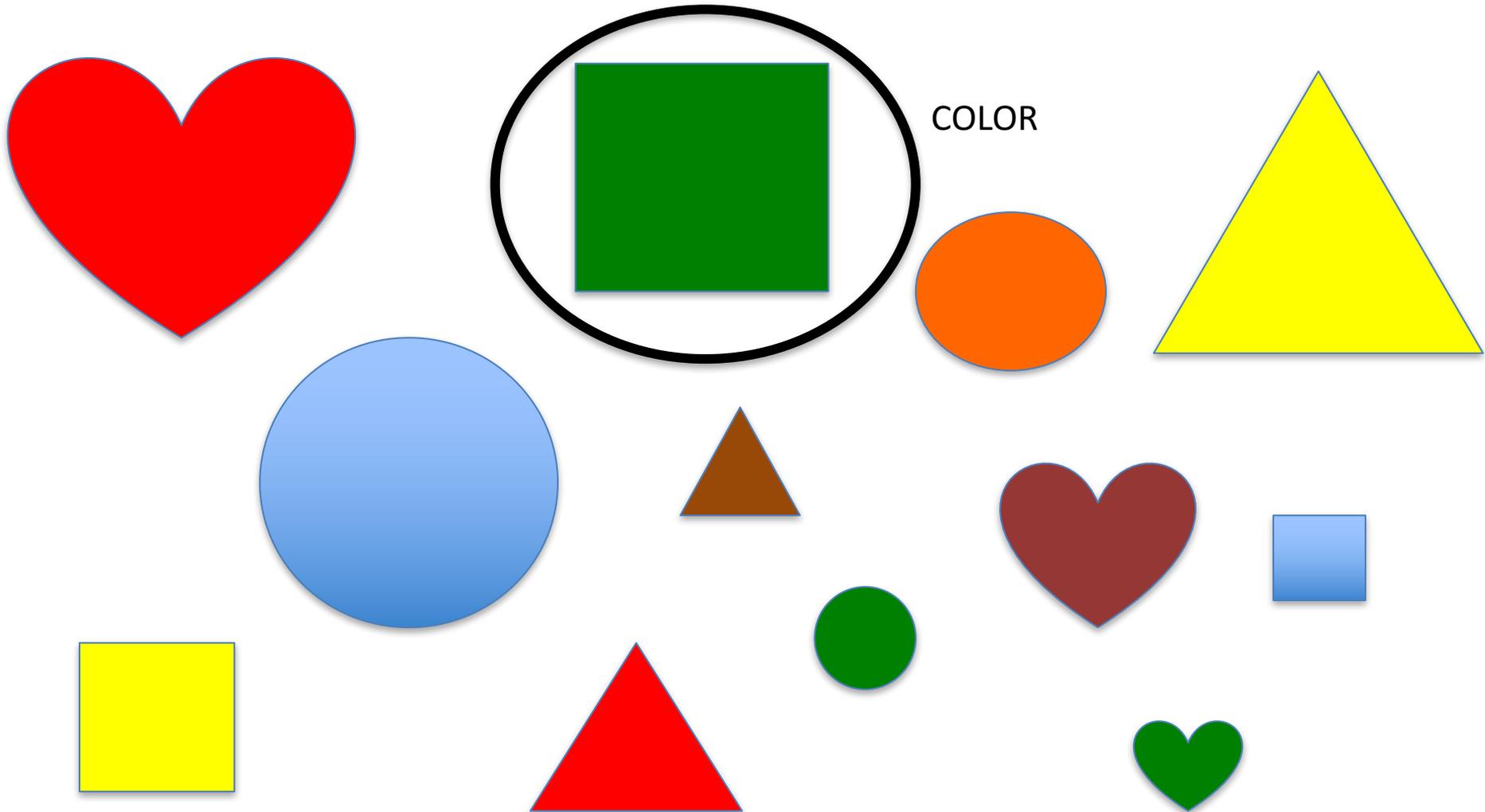


SIZE



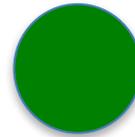
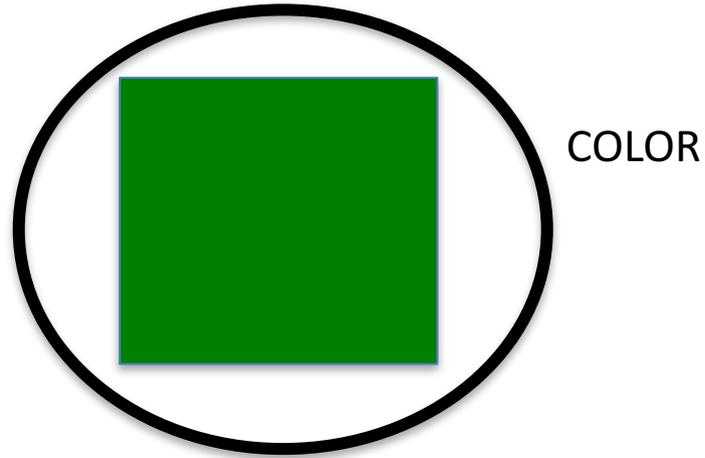
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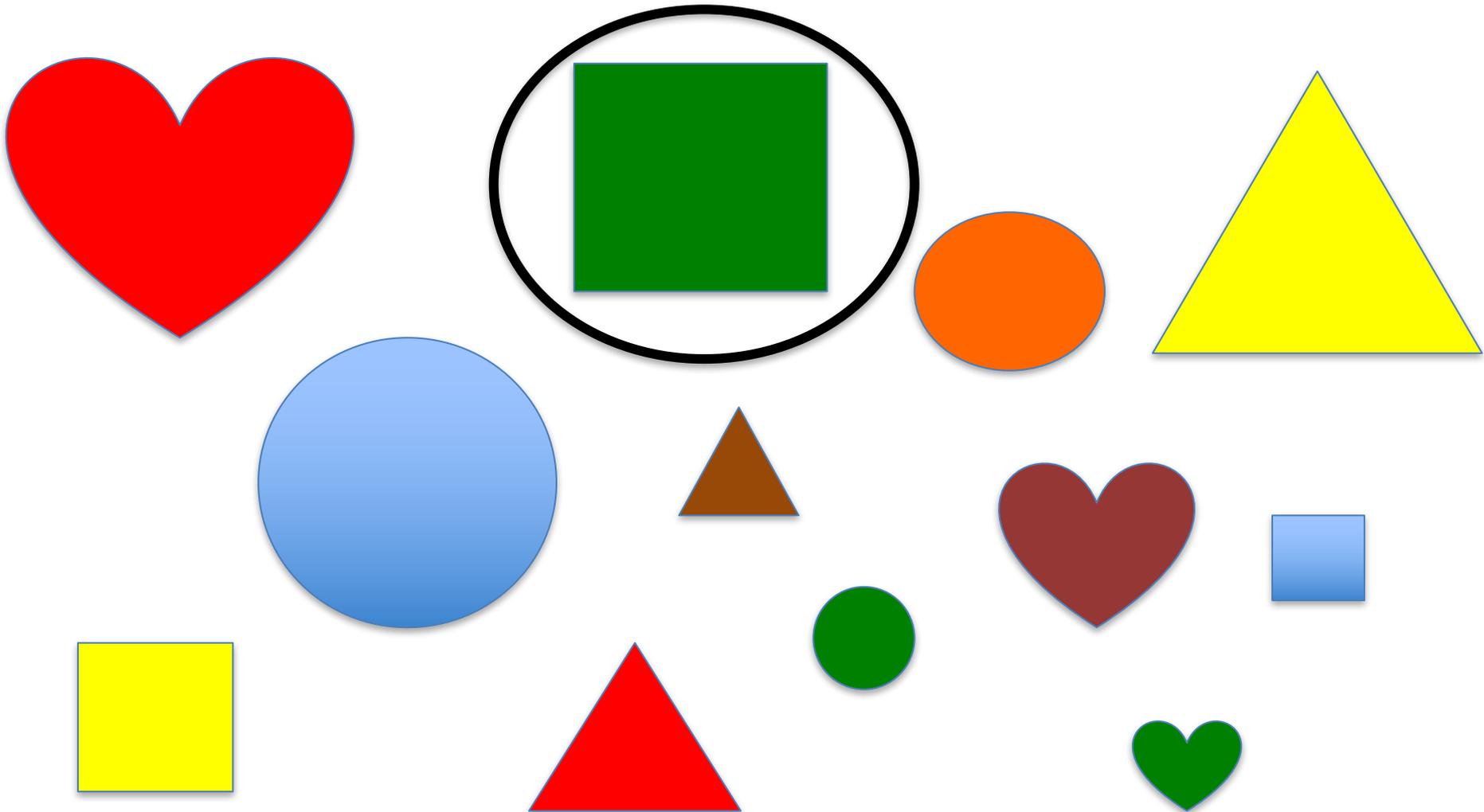
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# “Weigl Principle”

Applied to Social relations...



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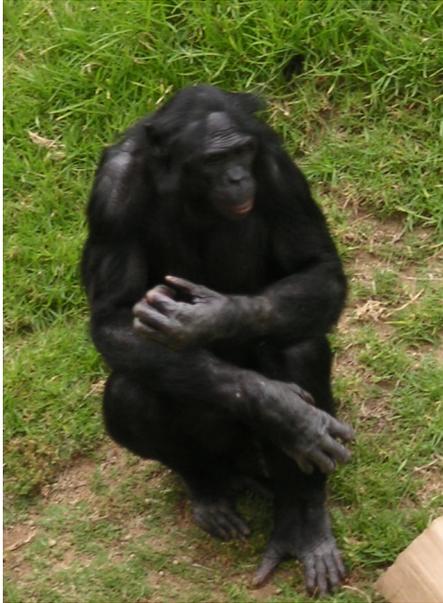
PARENT



# “Weigl Principle”

Applied to Social relations...

MATE



# “Weigl Principle”

Applied to Social relations...

ALLY



# “Weigl Principle”

Applied to Social relations...



COMPETITOR



# “Weigl Principle”

Applied to Social relations...

