Learning Dynamics of Costly Signals

Intuition:

Suppose…
- long tails hinder flight for all
- less so for healthy males.
- females mate with those with long tails
- -only healthy grow long tails

➔ noone can benefit by deviating

(will formalize soon…)

Zahavi

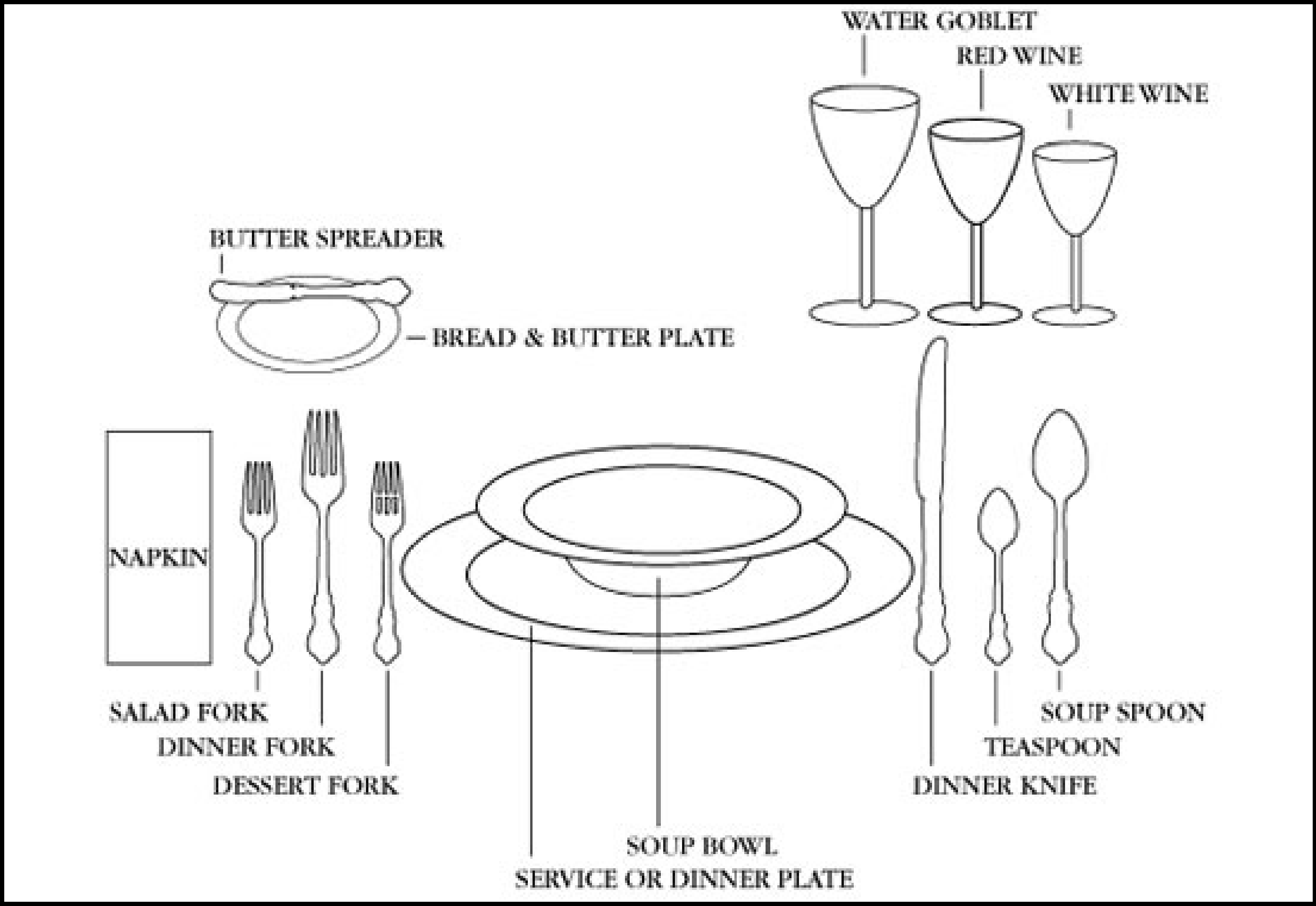
The Handicap Principle (1975)

“…a highly paradoxical theory... That theory is the Handicap Principle… I used to think it was nonsense, and I said so in my first book, The Selfish Gene. In the Second Edition I changed my mind…”

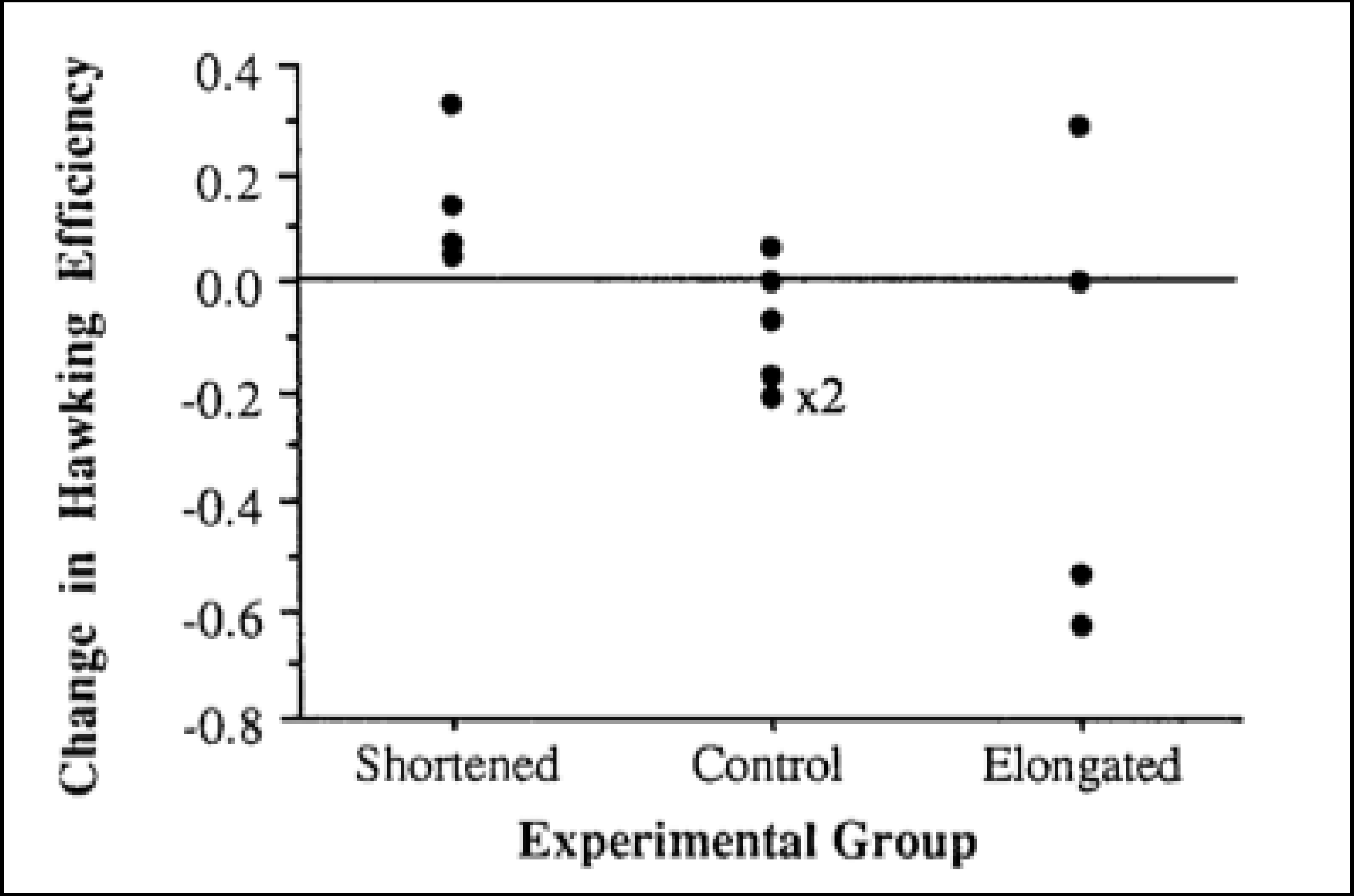
- Richard Dawkins

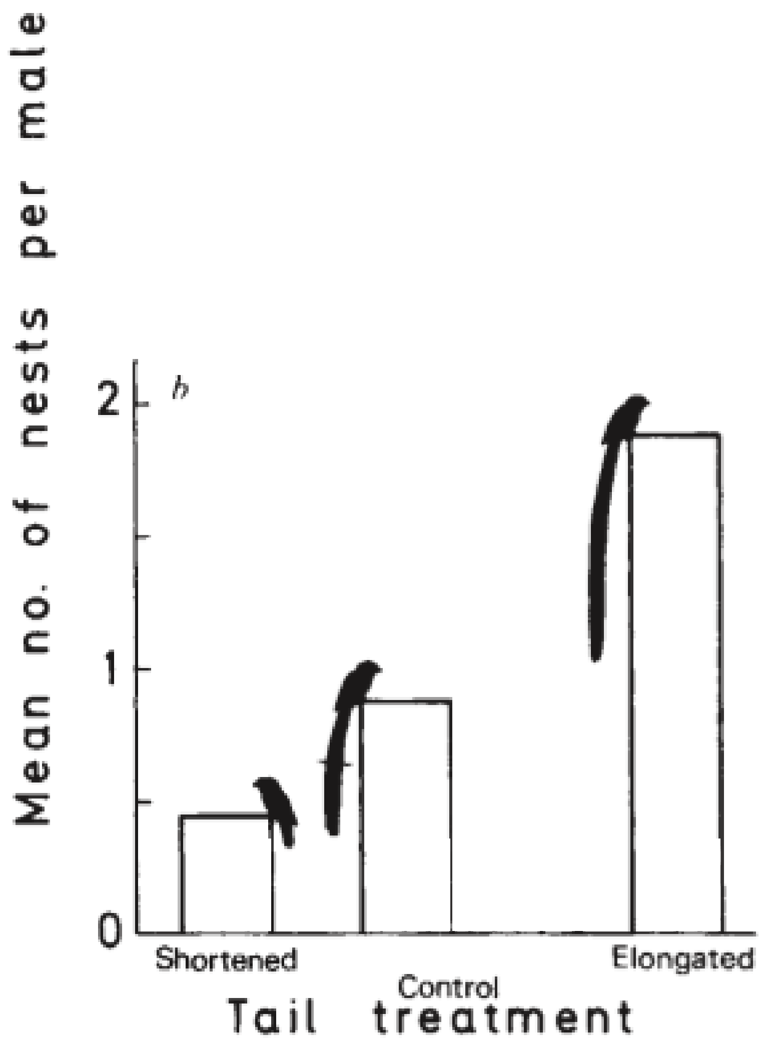
The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2001

George A. Akerlof, A. Michael Spence, Joseph E. Stiglitz

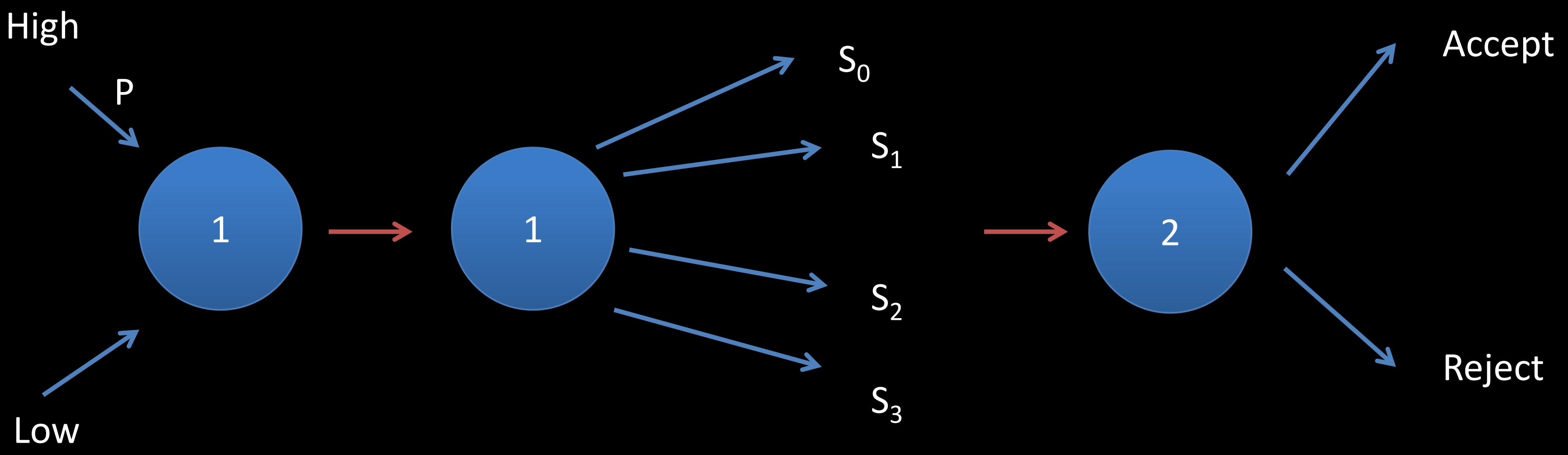

WATER GOBLET
RED WINE
WHITE WINE
BUTTER SPREADER
BREAD & BUTTER PLATE
NAPKIN
SALAD FORK
DINNER FORK
DESSERT FORK
SOUP BOWL
SERVICE OR DINNER PLATE
DINNER KNIFE
TEASPOON
SOUP SPOON

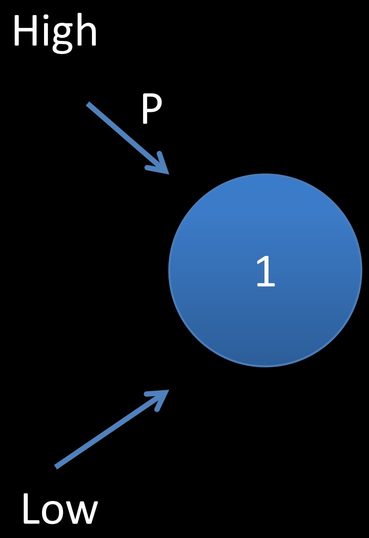
Shorter tails better at “hawking”

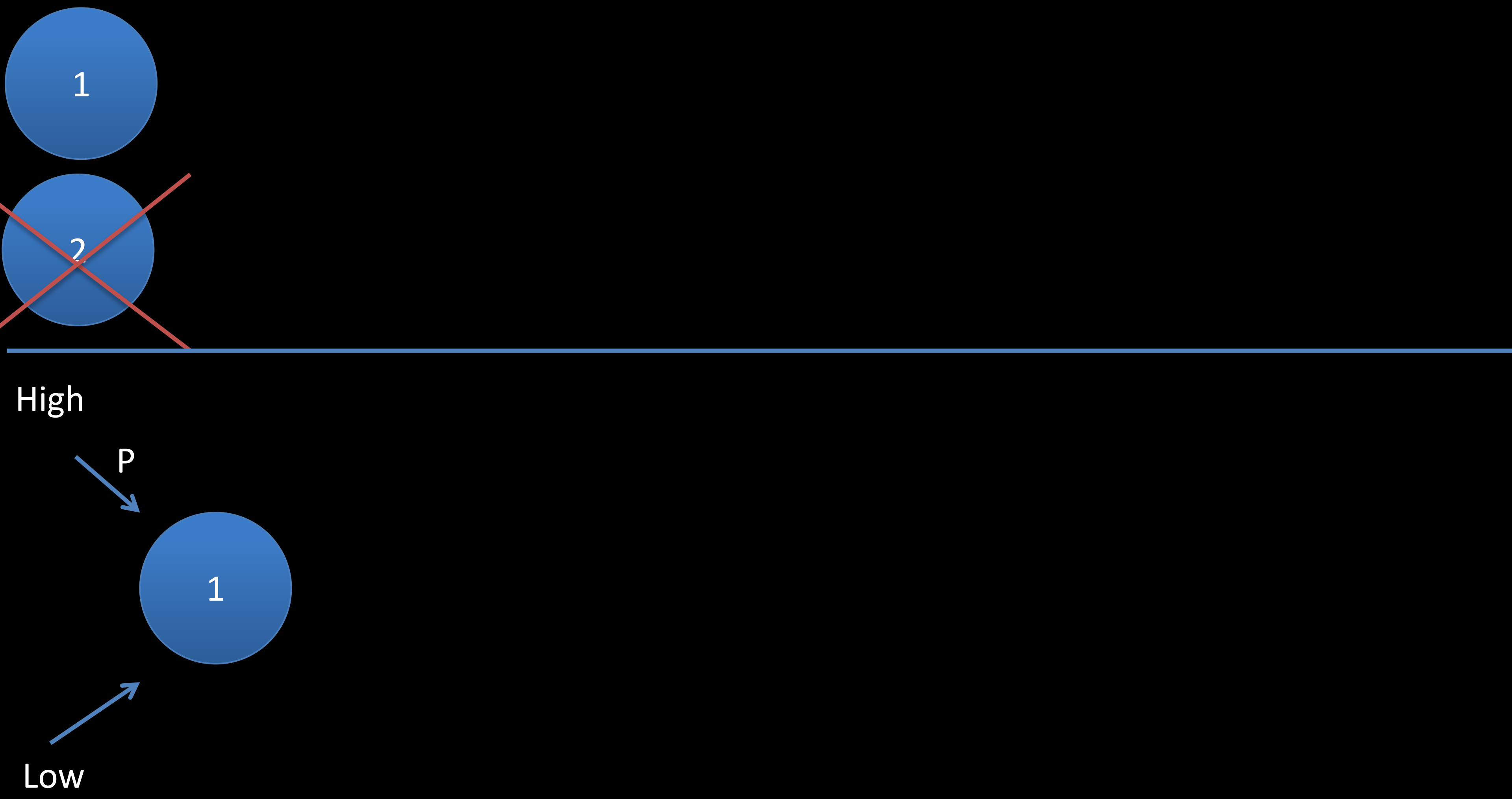


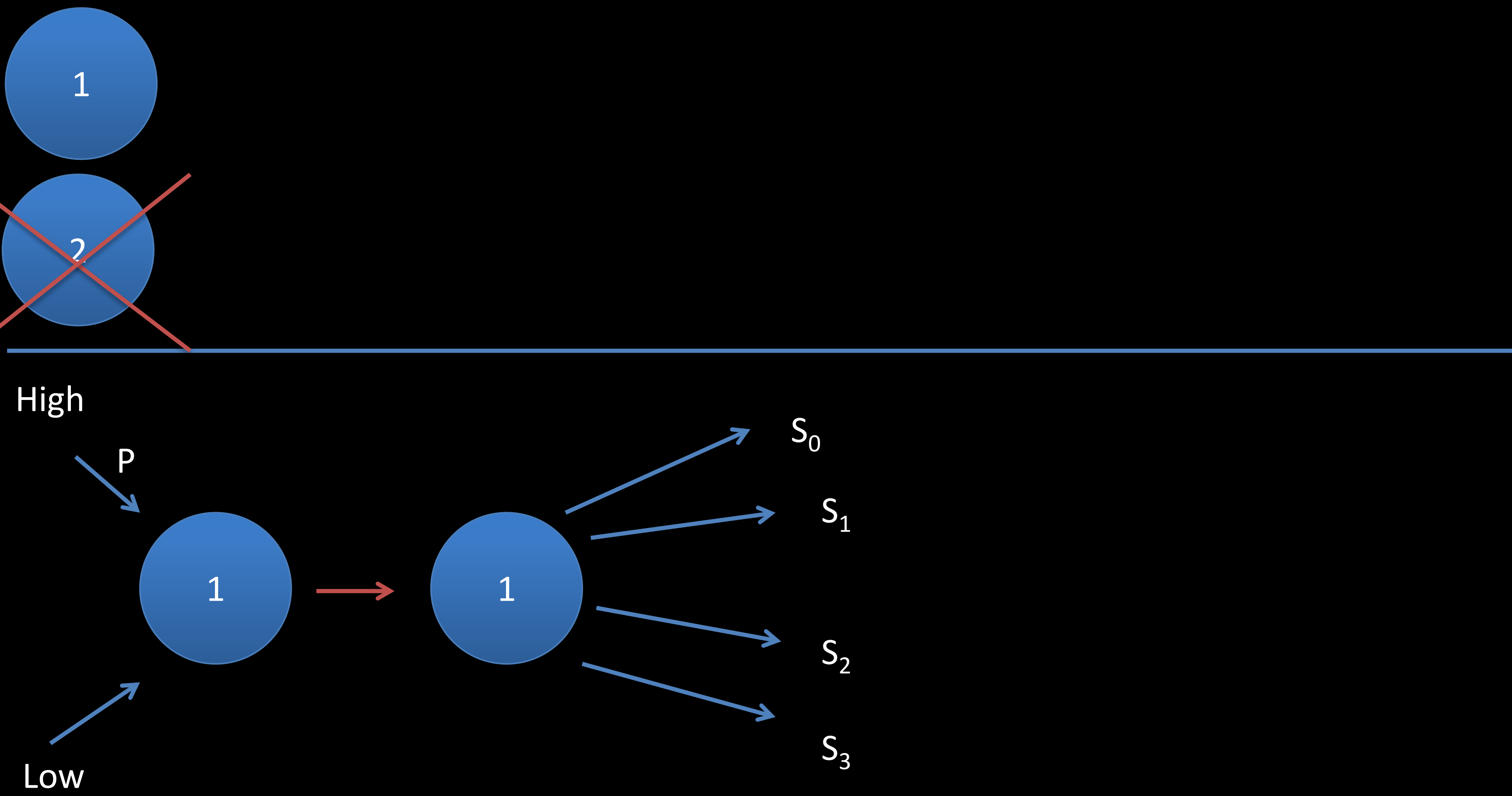

Mean no. of nests per male
b
2
1
0
Shortened
Control
Elongated
Tail treatment

Can costly signaling emerge from social learning?


High
P
Low
1
1
S_0
S_1
S_2
S_3
2
Accept
Reject

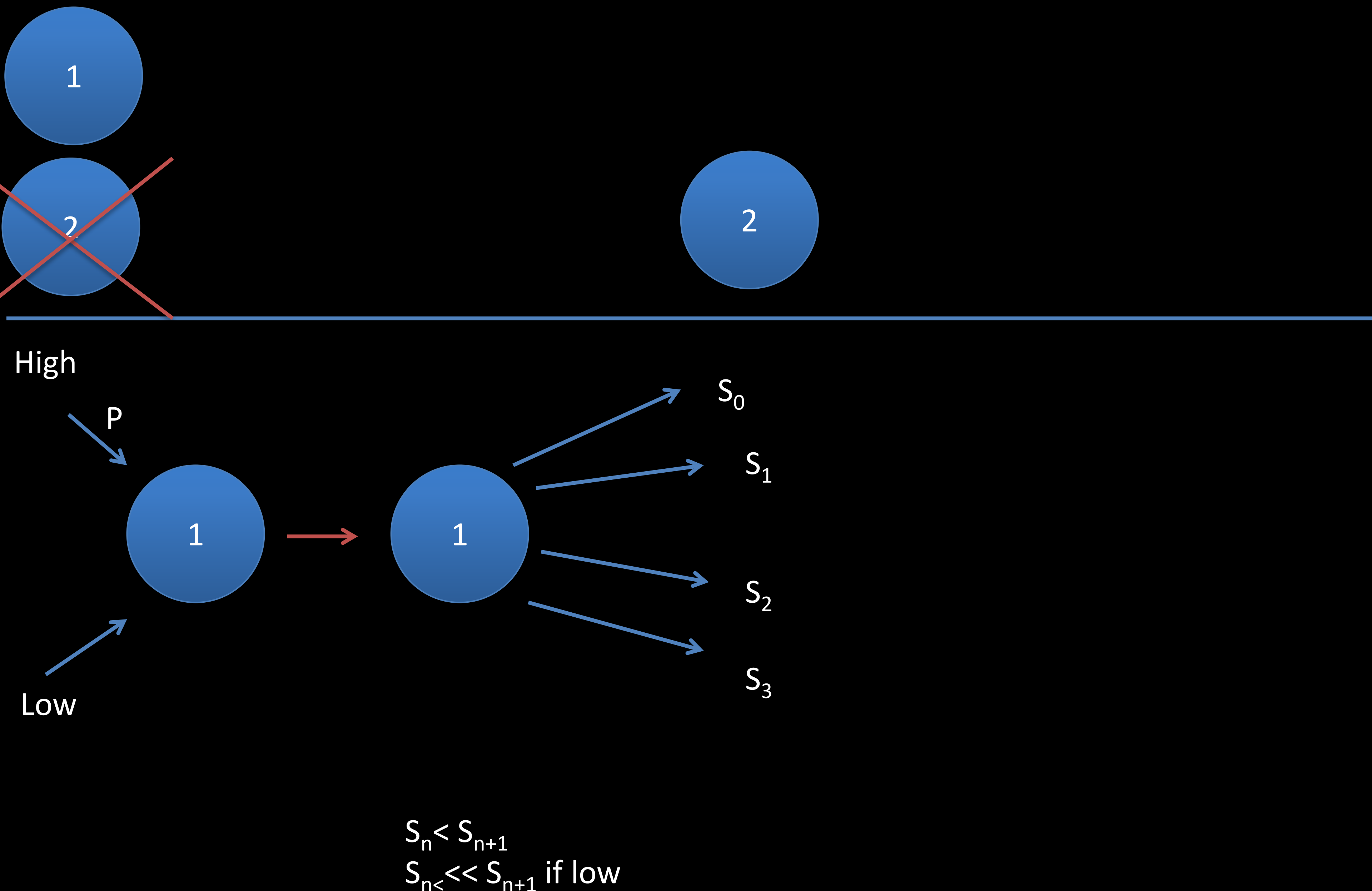

High
P
1
Low


1
2
High
P
1
Low

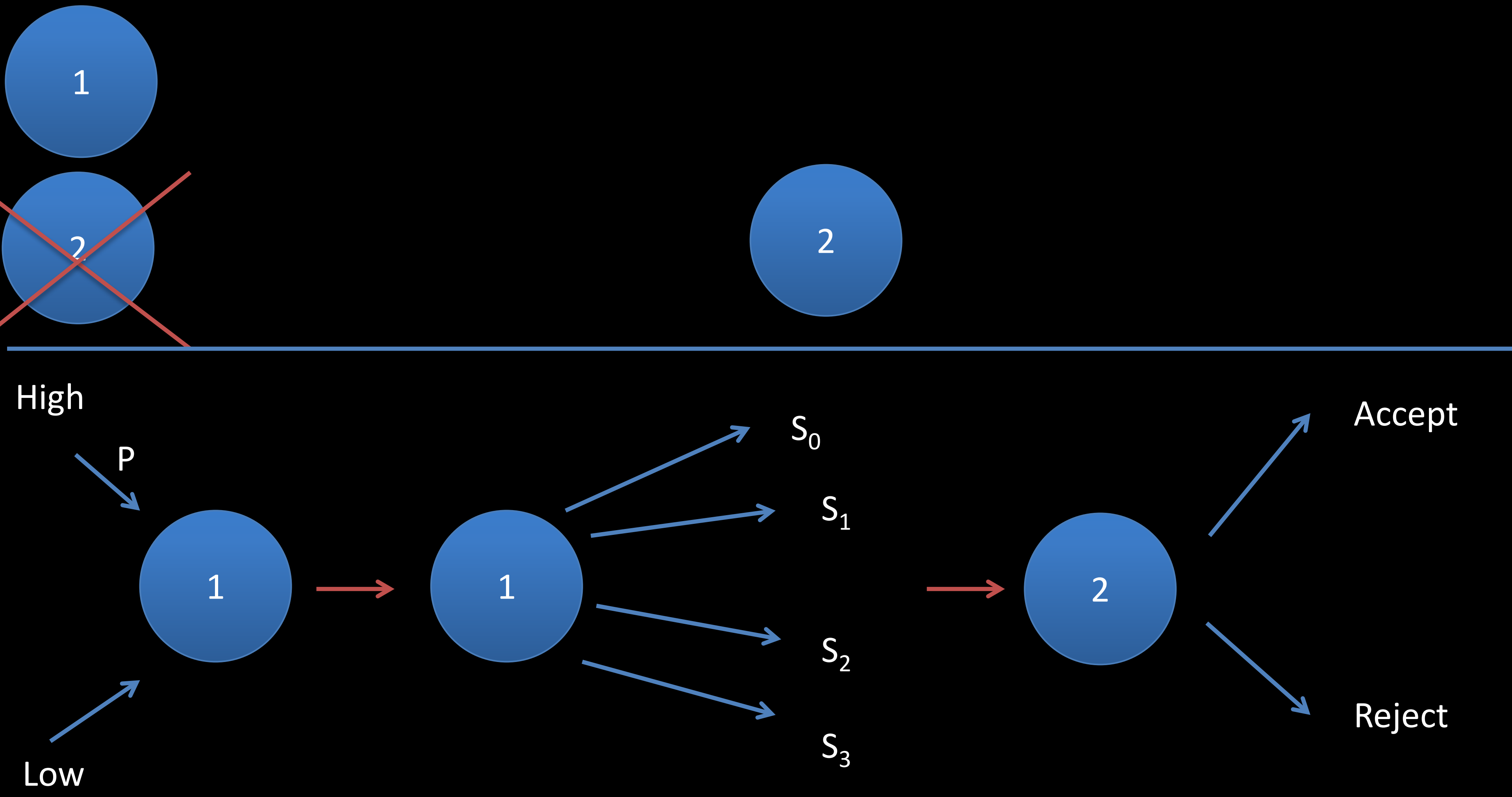


$S_n < S_{n+1}$

$S_{n<} \ll S_{n+1}$ if low

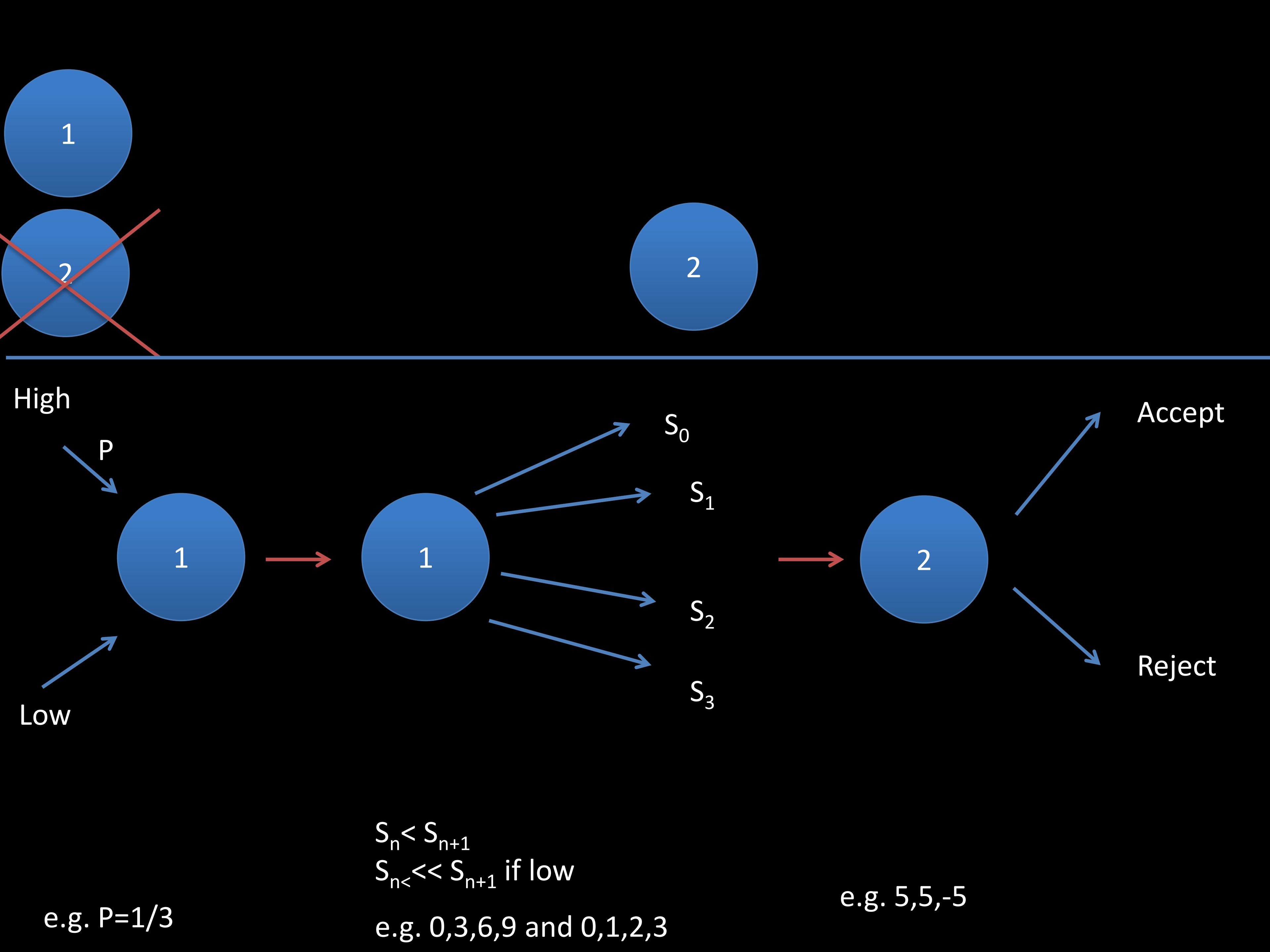


1
2
2
High
P
1
1
Low
S_0
S_1
S_2
S_3
$S_n < S_{n+1}$
$S_{n<} << S_{n+1}$ if low



$S_n < S_{n+1}$

$S_{n<} << S_{n+1}$ if low


1
2
2
High
P
Low
1
1
S_0
S_1
S_2
S_3
2
Accept
Reject
$S_n < S_{n+1}$
$S_{n<} << S_{n+1}$ if low
e.g. P=1/3
e.g. 0,3,6,9 and 0,1,2,3
e.g. 5,5,-5

$\langle s_0, s_1, \{s_2, s_3\}\rangle$

(0,0,0)

$\langle s_3, s_1, \{s_3\}\rangle$

(5,0,-10/3)

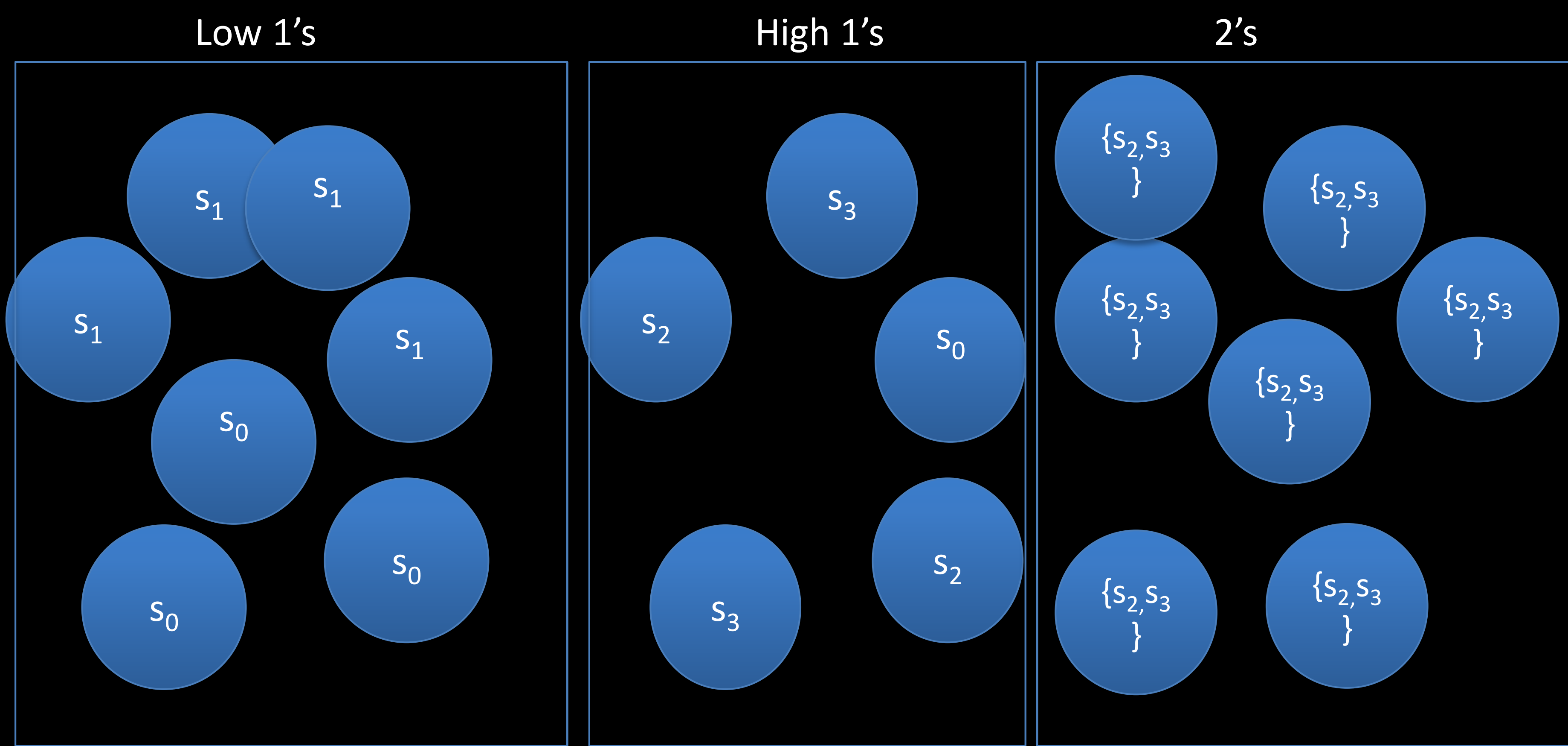
Nash Equilibrium = $< , , >$ s.t. none benefit by unilaterally deviating

$<s_0, s_2, \{s_2, s_3\}>$

$<s_0, s_3, \{s_3\}>$

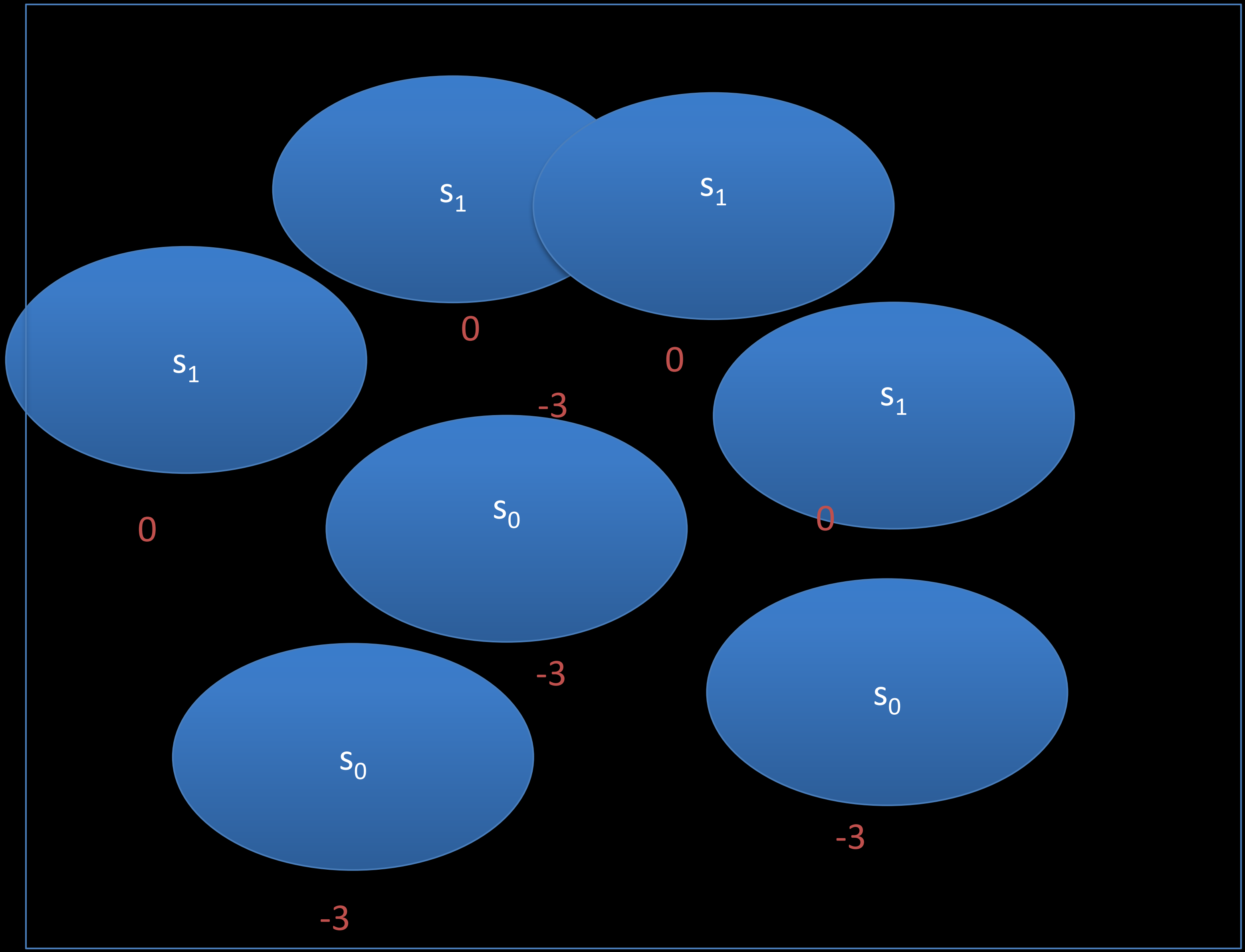
$<s_0, s_0, \{\}>$

~~$<s_0, s_1, \{s_1, s_2, s_3\}>$~~

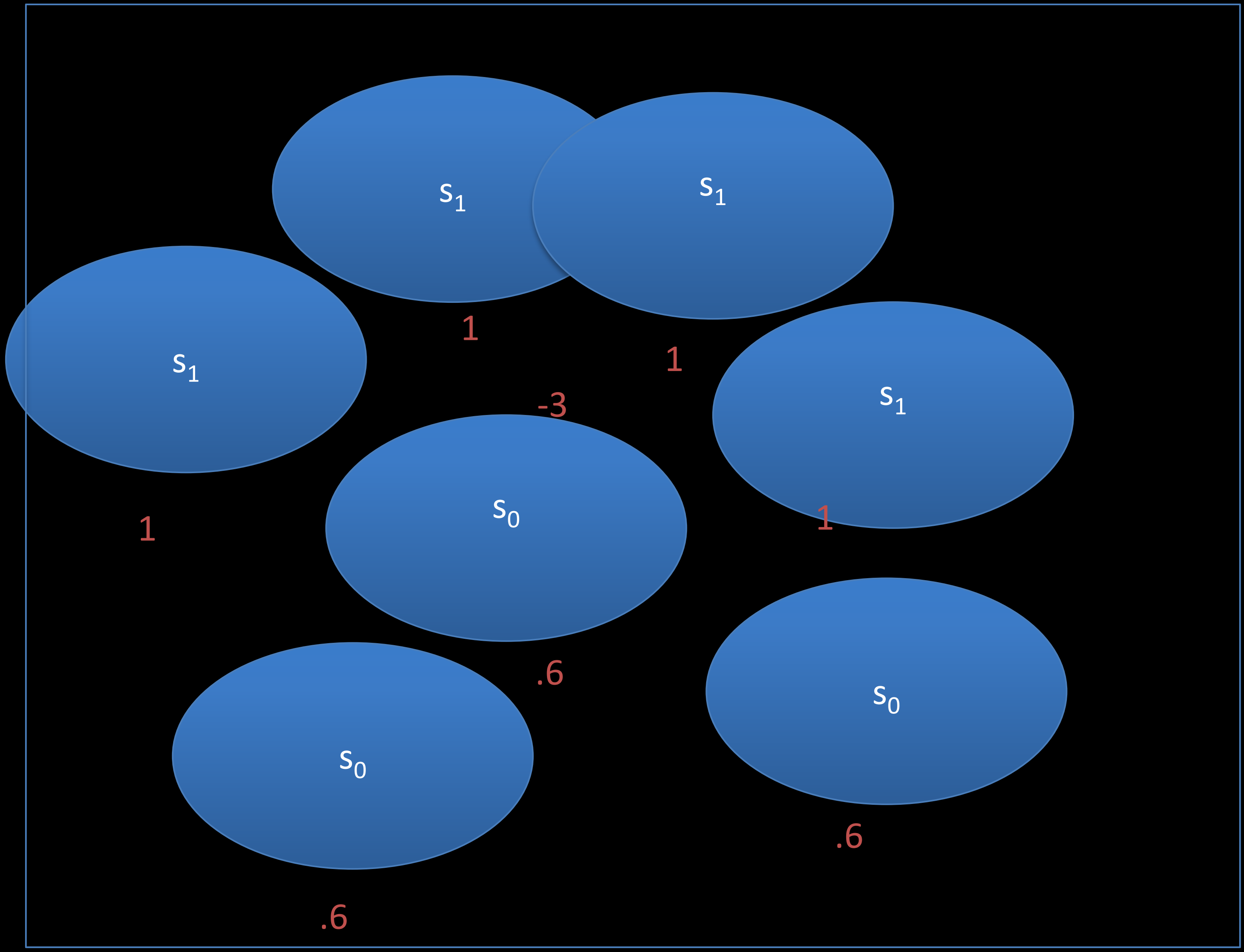


e.g. N_L=100 N_H=100 N_2=150

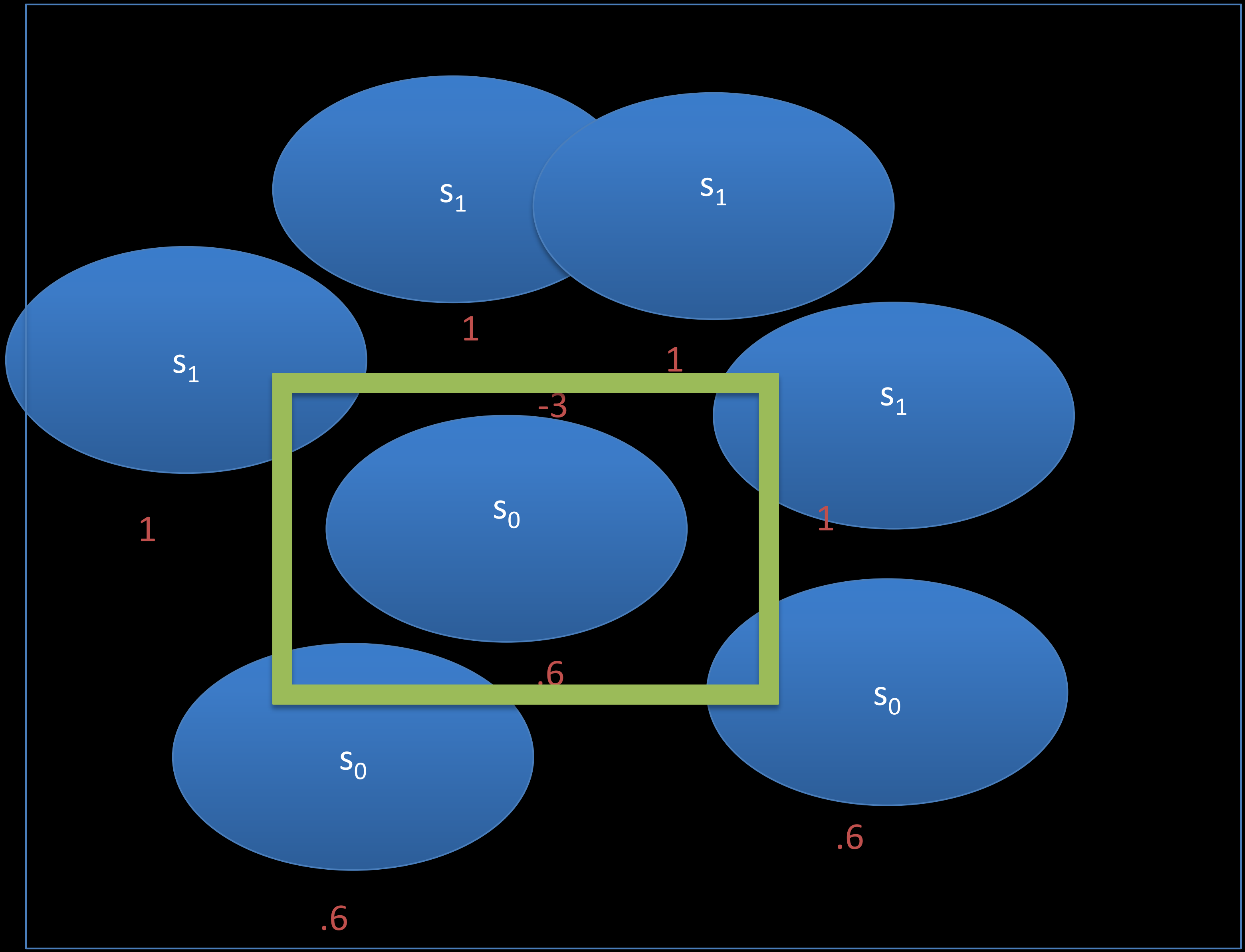
Low 1's

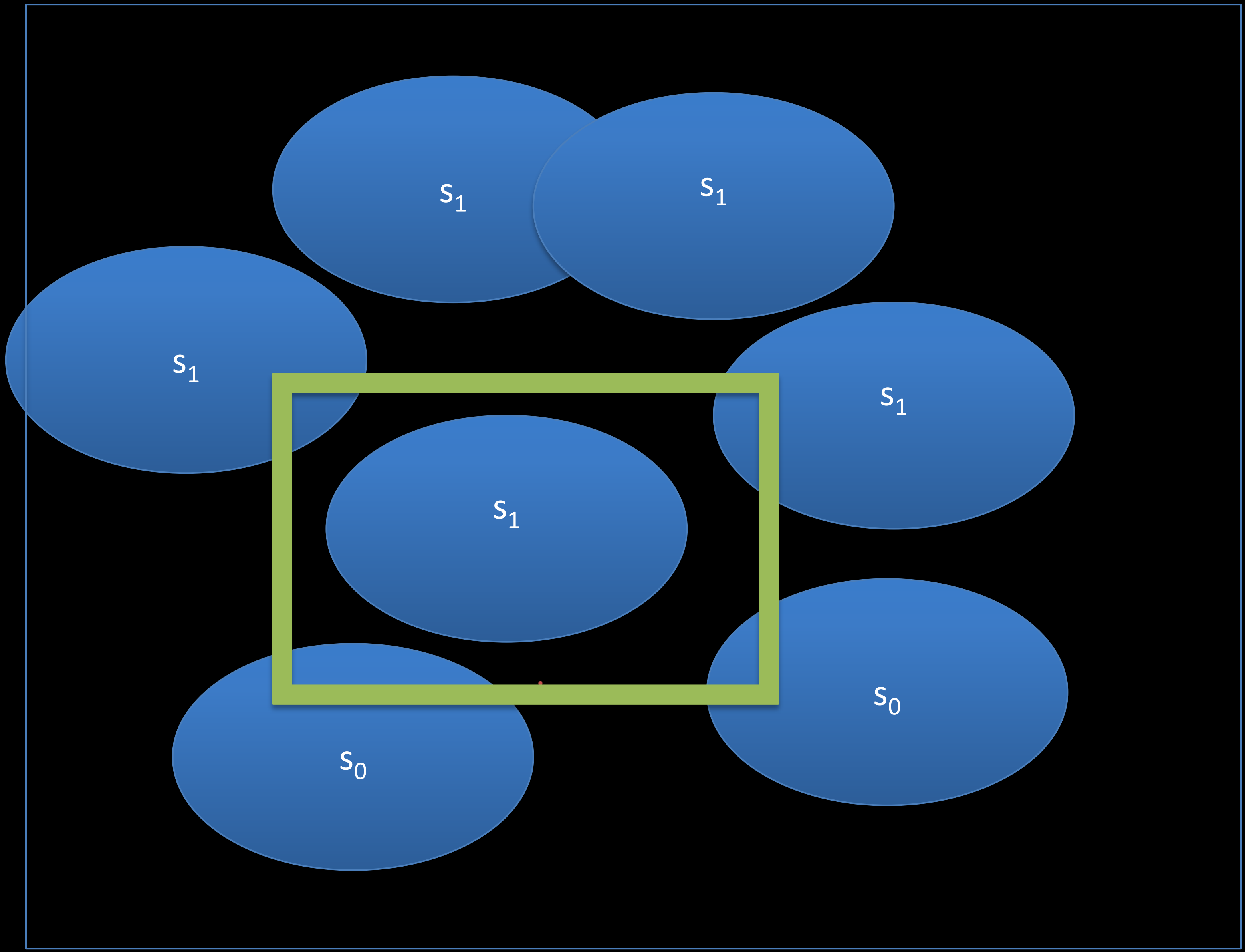


1-w+w(payoffs) e.g. w=.1



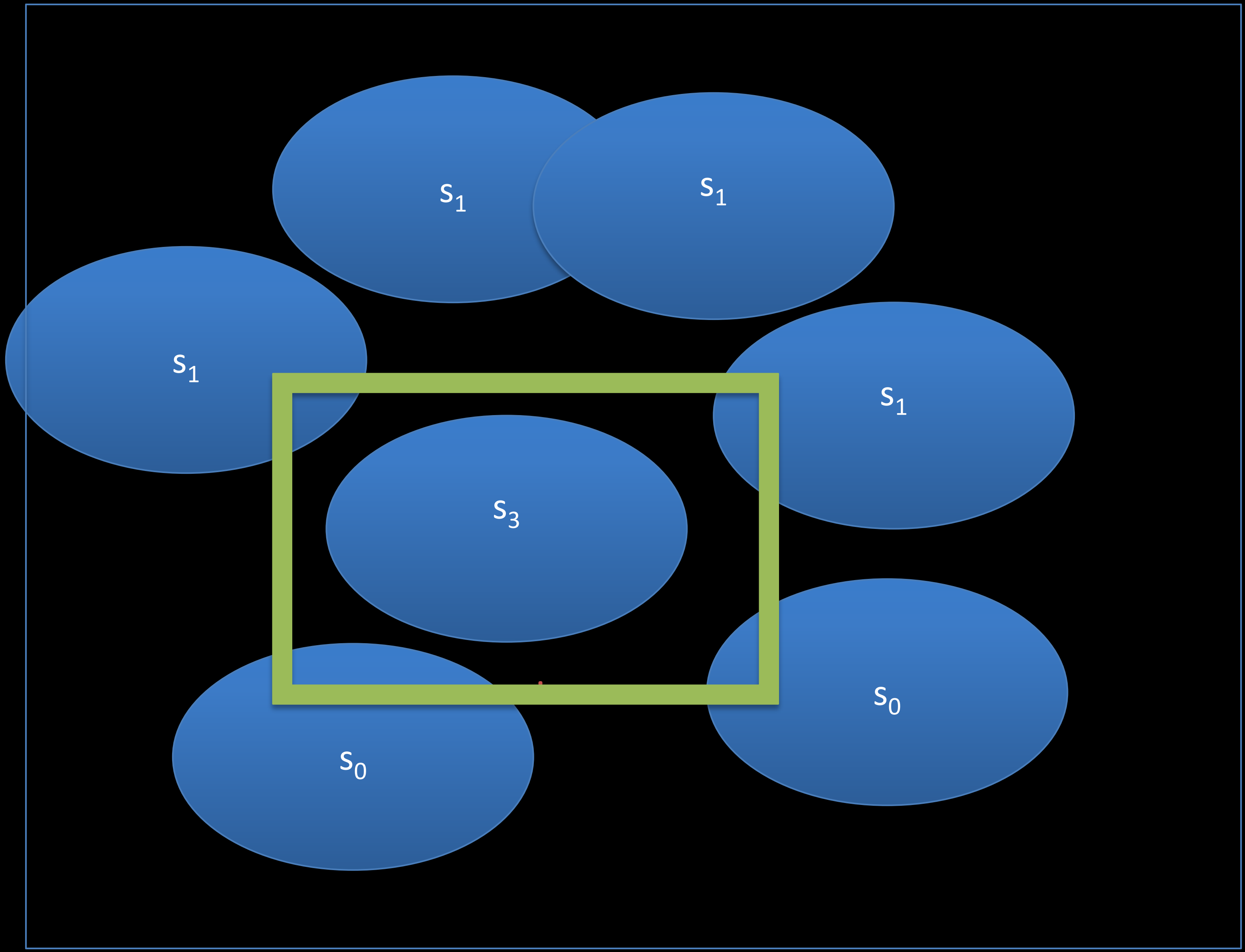
1-w+w(payoffs) e.g. w=.1



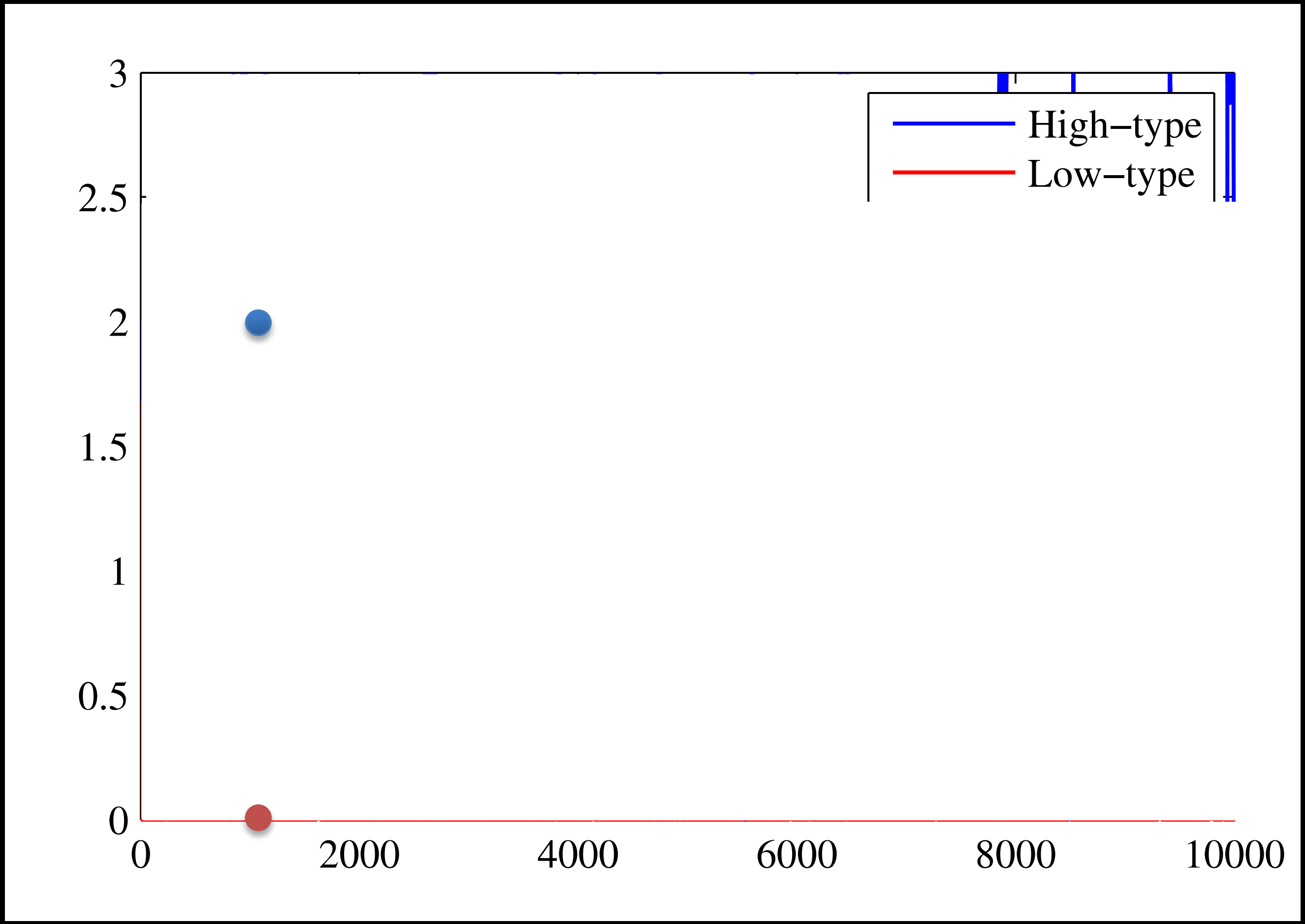


s_1
s_1
s_1
s_1
s_1
s_0
s_0

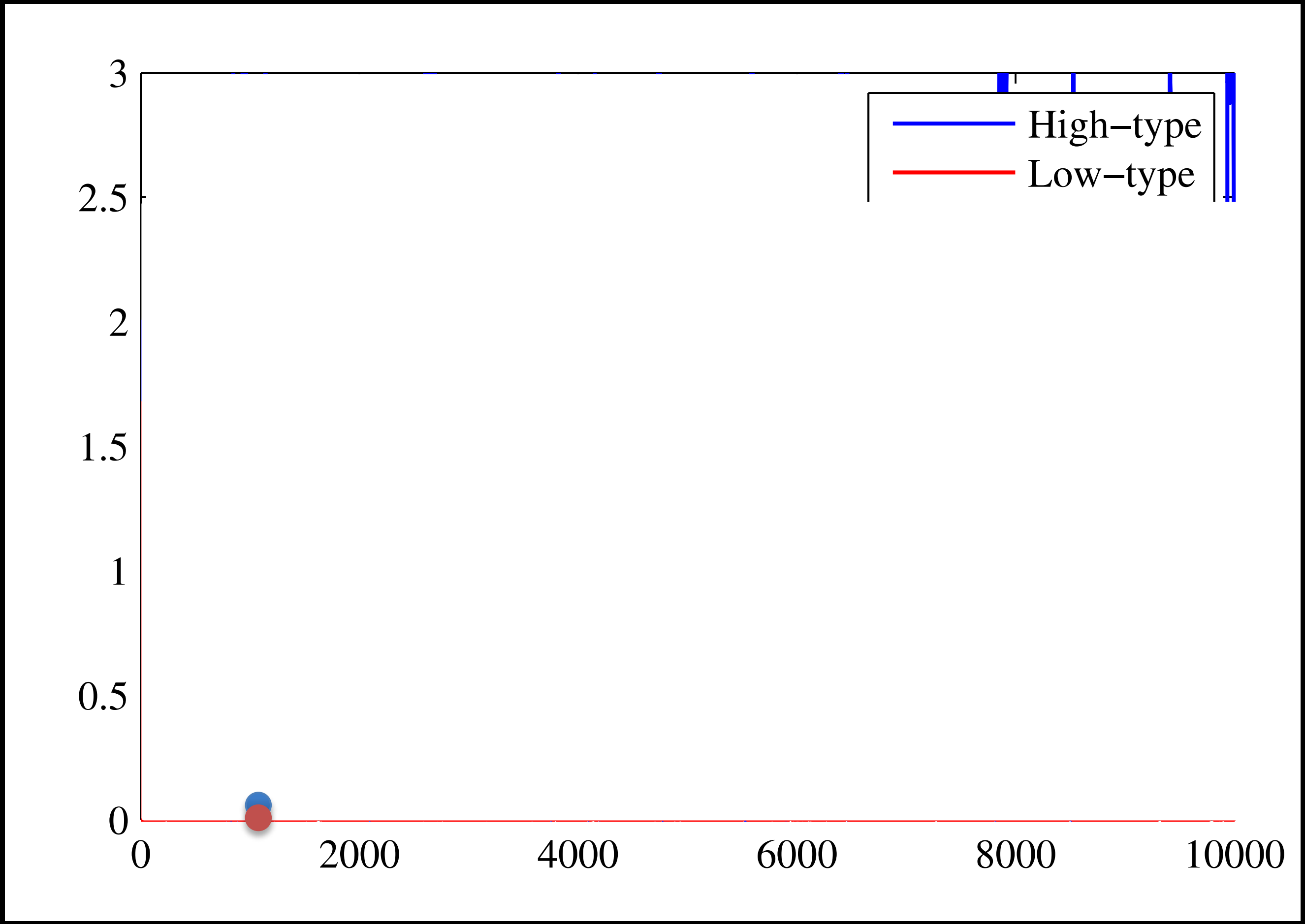
With probably μ choose random strategy



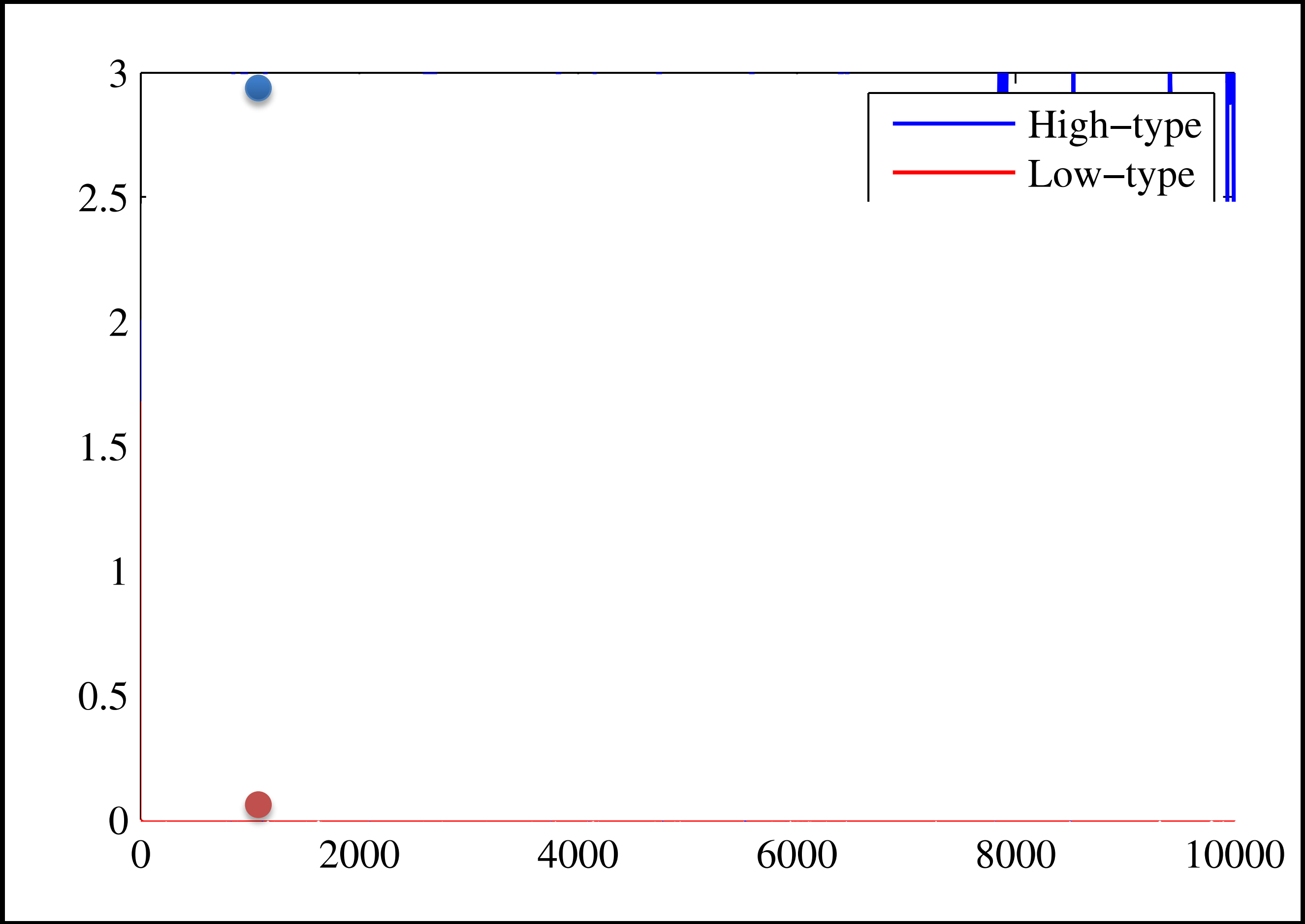
<s_0, s_2, {s_2, s_3}>

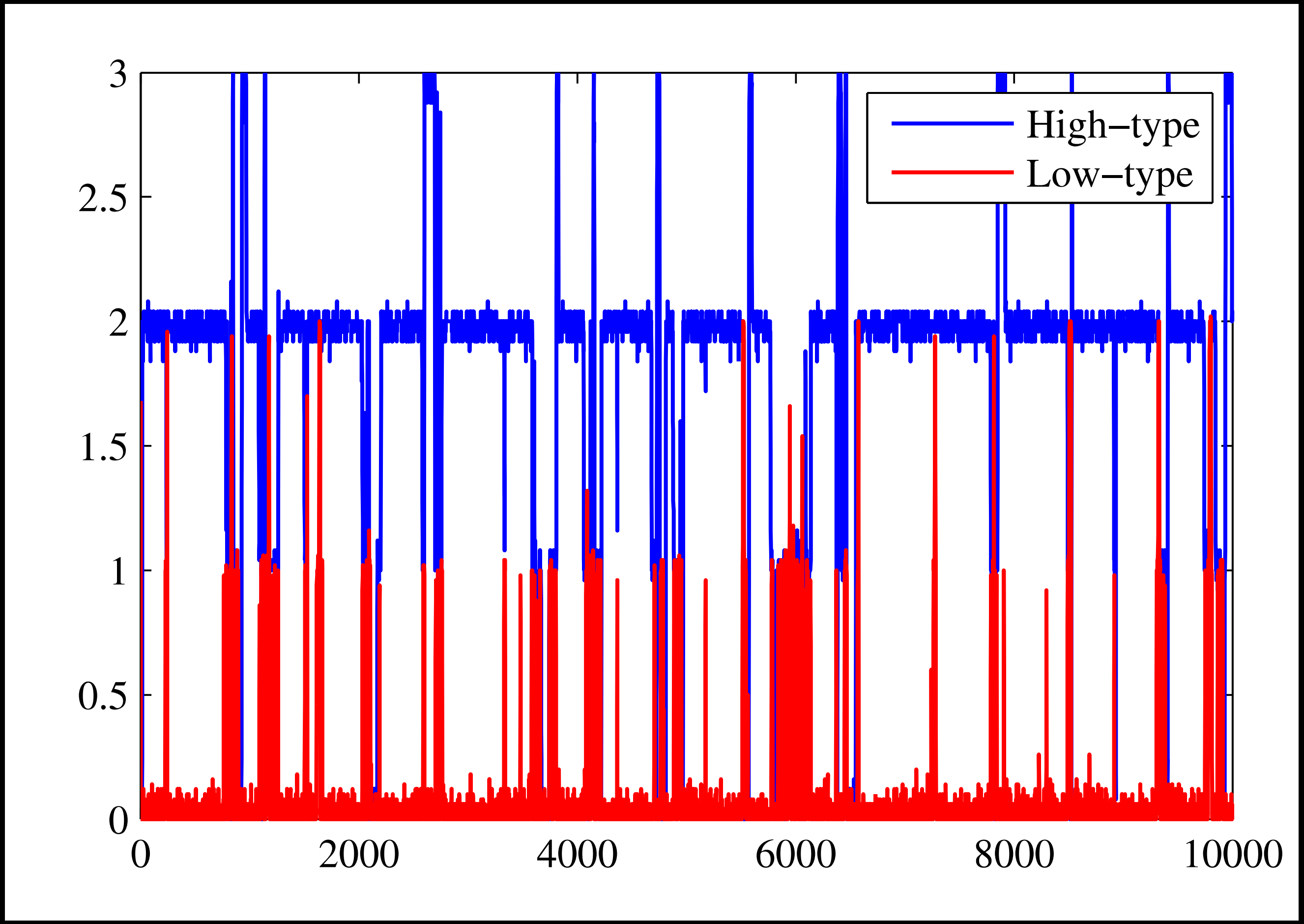


<s_0, s_0, {}>



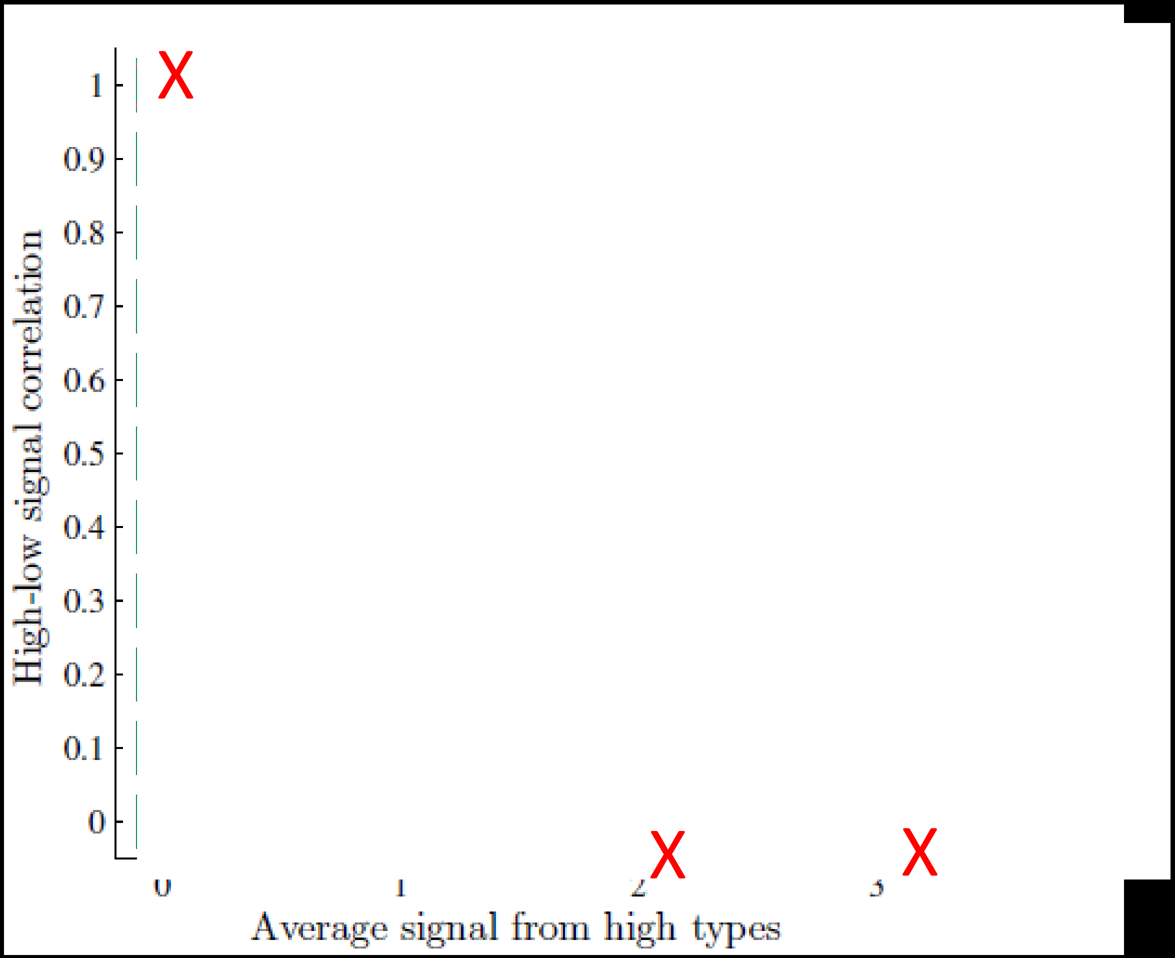
<s_0, s_3, {s_3}>



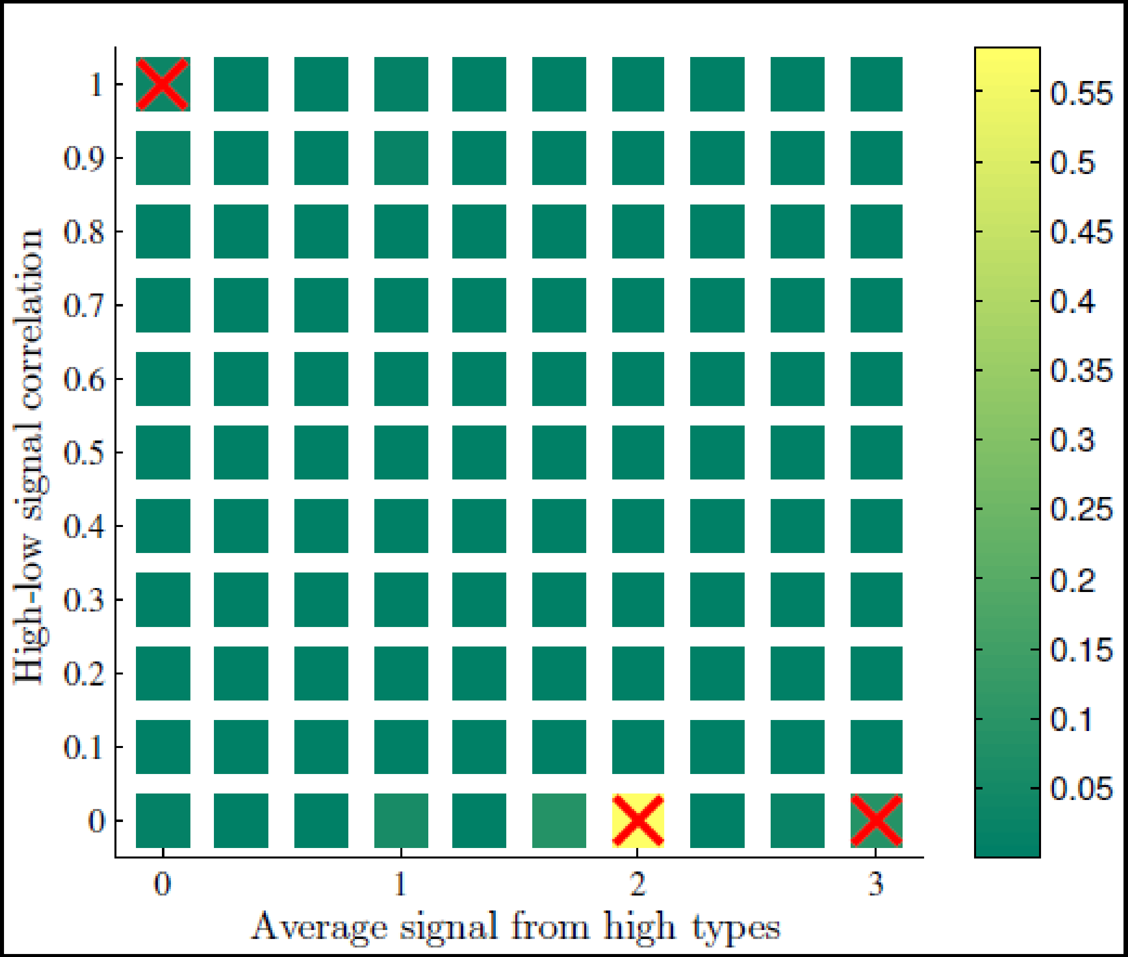


High−type
Low−type
3
2.5
2
1.5
1
0.5
0
0
2000
4000
6000
8000
10000

Efficient Separating!



High-low signal correlation
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
Average signal from high types
X
X
X



High-low signal correlation
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
Average signal from high types
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05

Suppose all $<s_0, s_0,\{\}>$

Then any female who experiments with $\{s_2\}$ does equally as well. So may spread by chance.

Then High can experimentally send s_2 does well, so will be imitated!

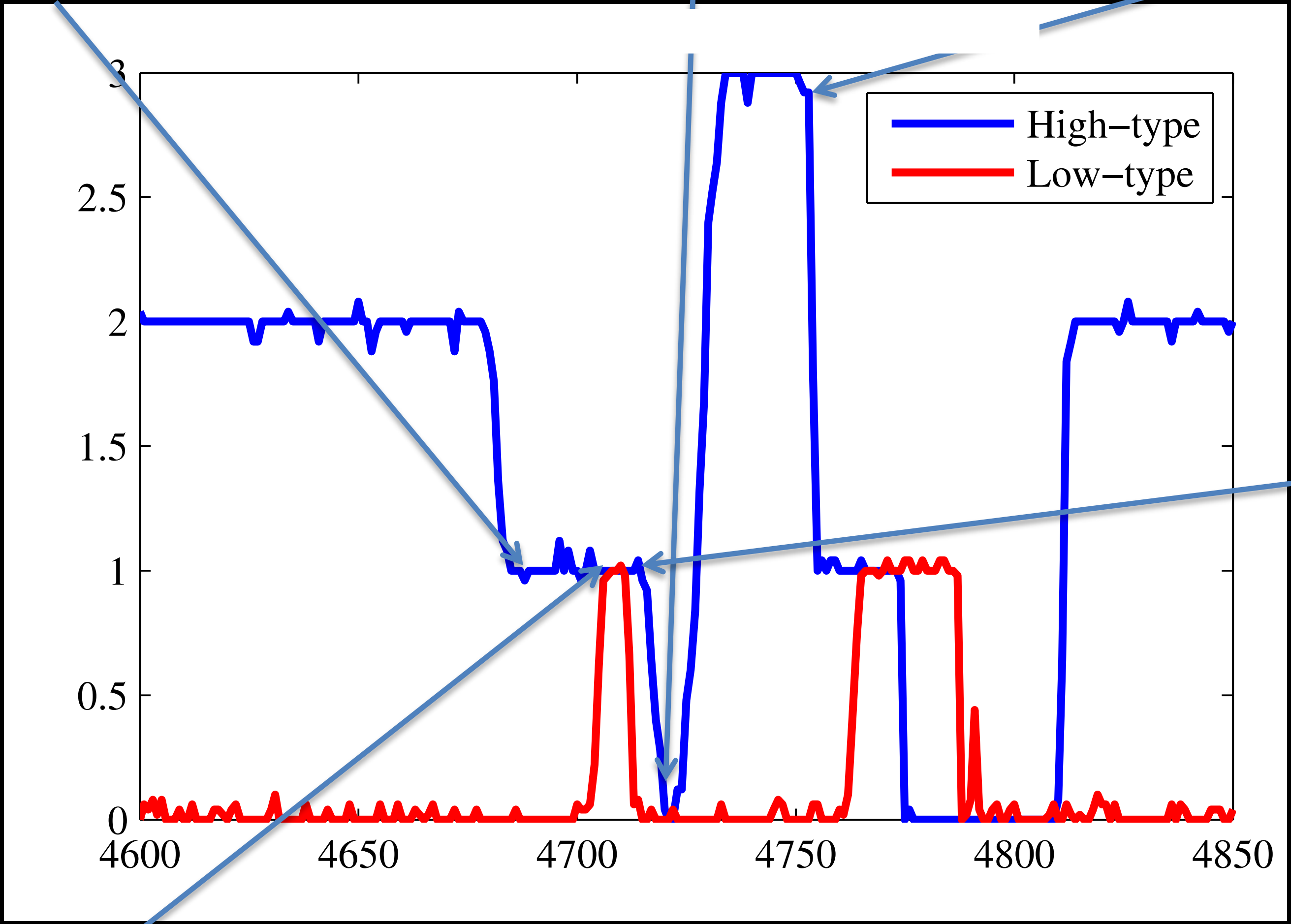
Likewise, for $<s_0, s_3,\{s_3\}>$

But if $<s_0, s_2,\{s_2,s_3\}>$, then REALLY complicated to leave…

As soon as receiver drifts to accepting 2 or 3

Enough receivers must have "neutrally drifted" to accept 1 so worth for good but not bad types

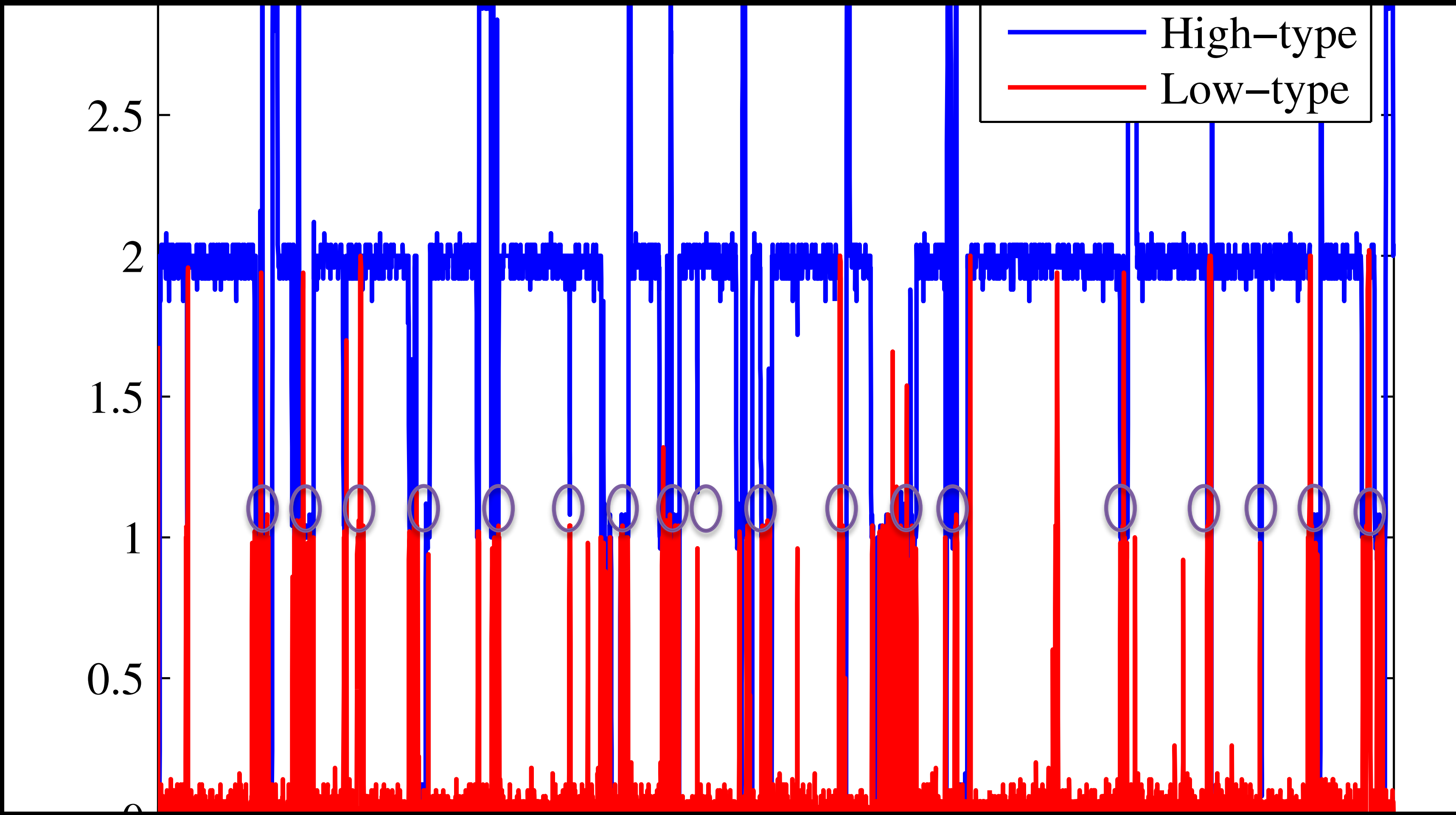
As soon as receiver drifts to accepting 1 or 2



Very quickly After bad start Sending 1, receivers stop Accepting 1

If in meantime Receivers stop Accepting 2 (by drift), then Both good and Bad better Sending 0

Since good but not bad sending 1, receivers start accepting 1, to point where bad start sendin

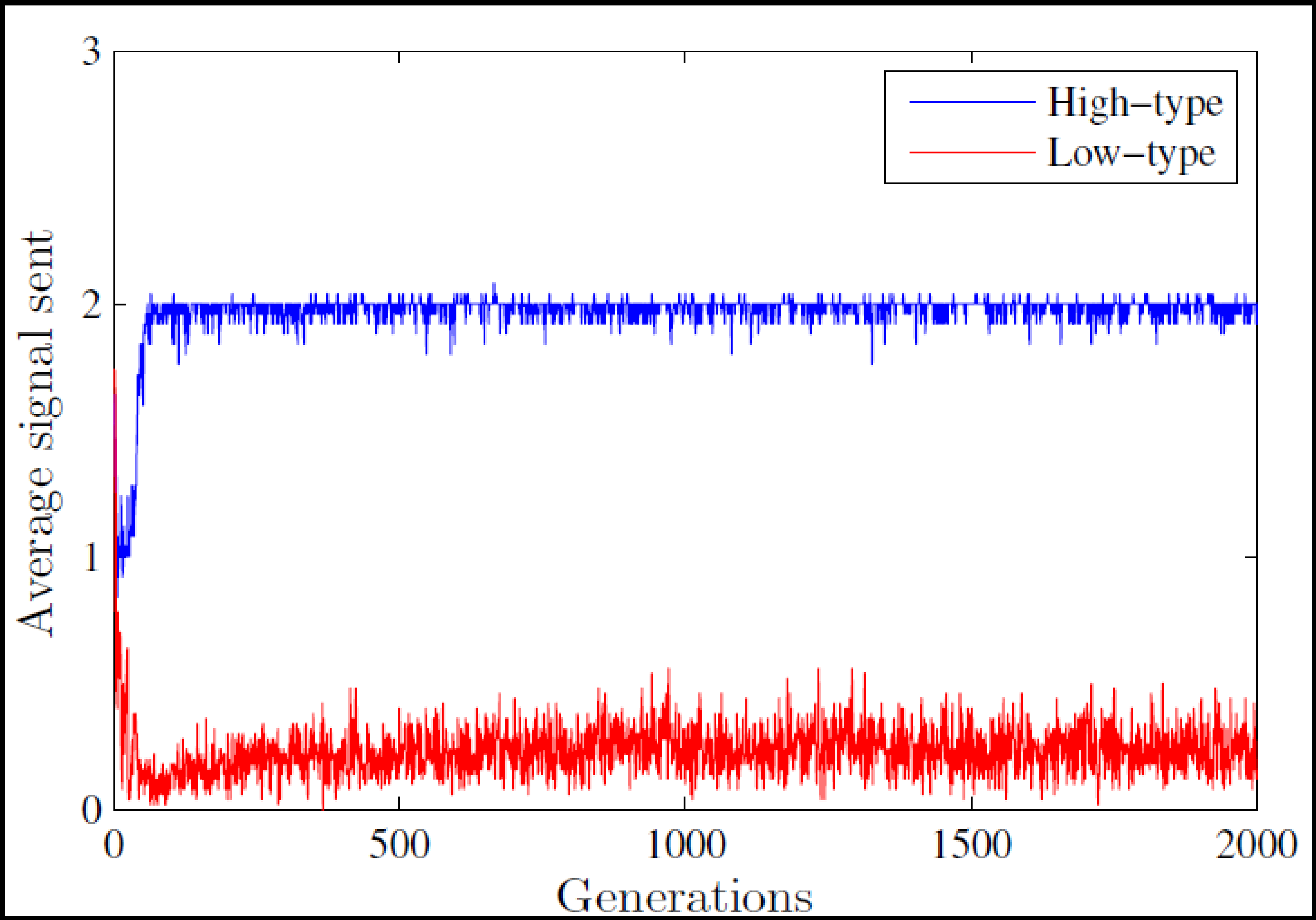


High−type
Low−type
2.5
2
1.5
1
0.5
0

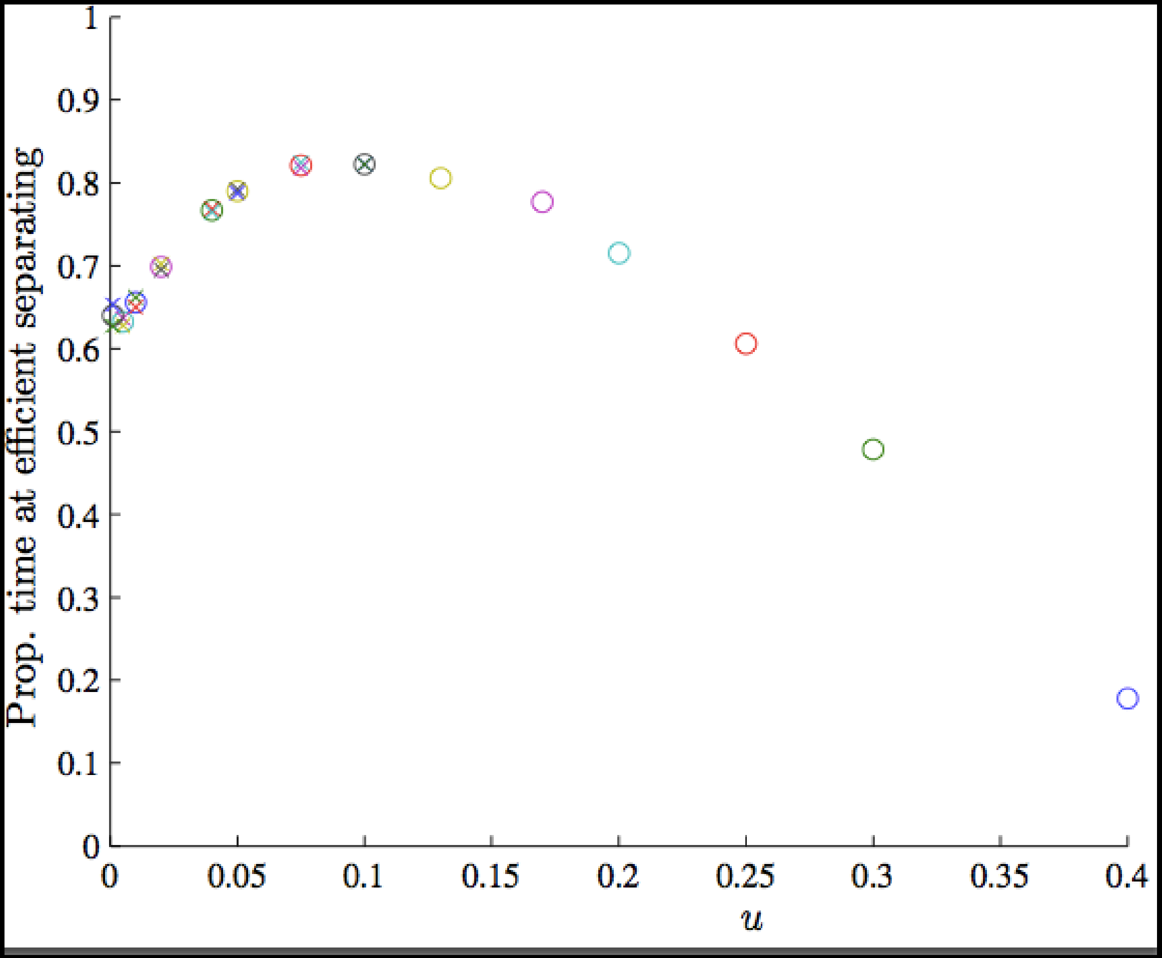
Robust?

1) payoffs
2) Noise
3) Experimentation rate
4) reinforcement learning

Reinforcement Learning



Even works for super high experimentation rates!



Does depend on interesting new condition:

Do females prefer to pair with random male?

P=1/2

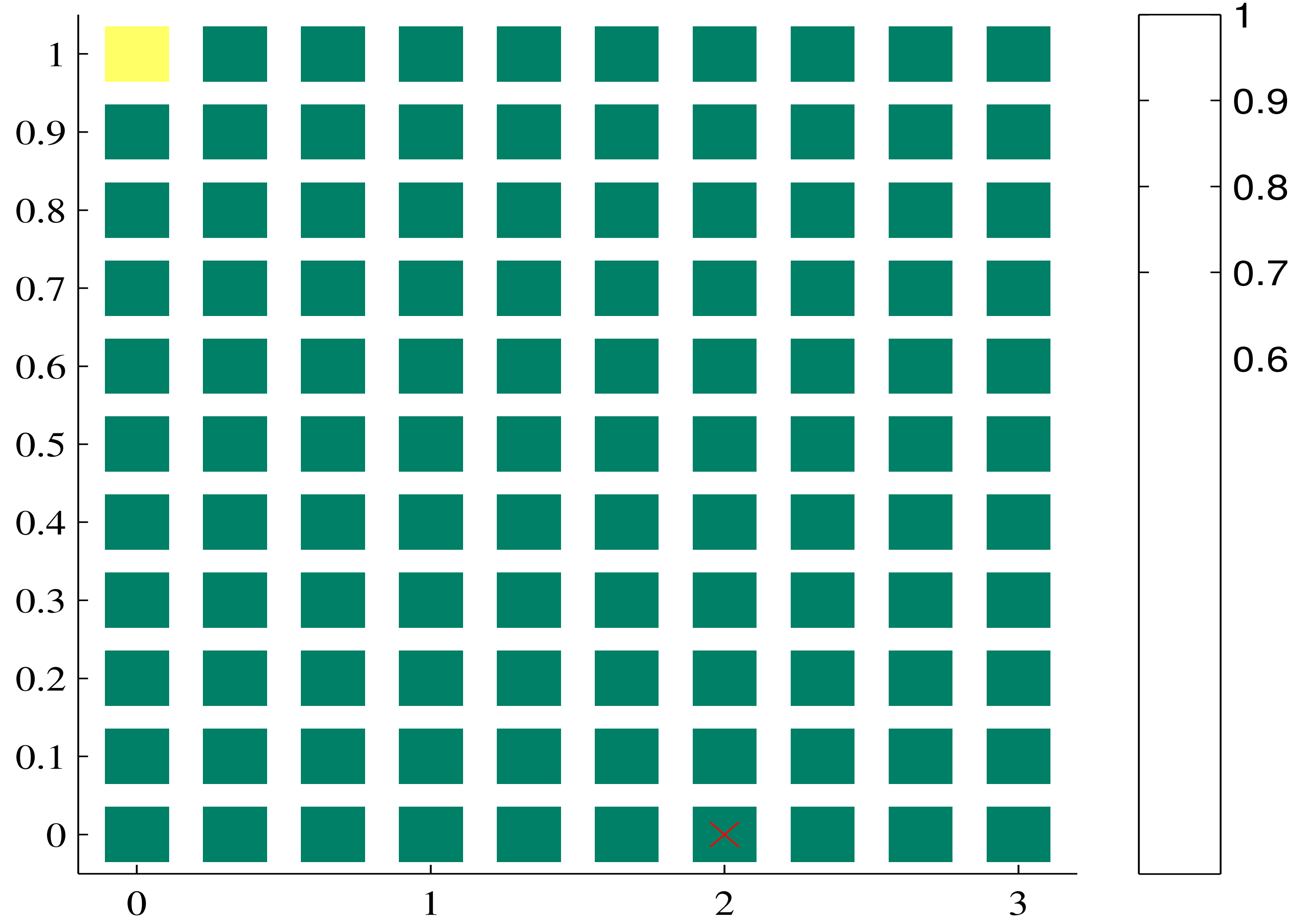
$<s_0, s_0, \{\}>$

~~$<s_0, s_0, \{s_0\}>$~~

$<s_0, s_2, \{s_2, s_3\}>$

$<s_0, s_3, \{s_3\}>$

No longer easy to leave pooling!



1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
1
0.9
0.8
0.7
0.6

→Can explain puzzling behaviors!

→Efficient Separating!

→When no acceptance at pooling!

Hoffman.moshe@gmail.com

Evidence?

Who cares?