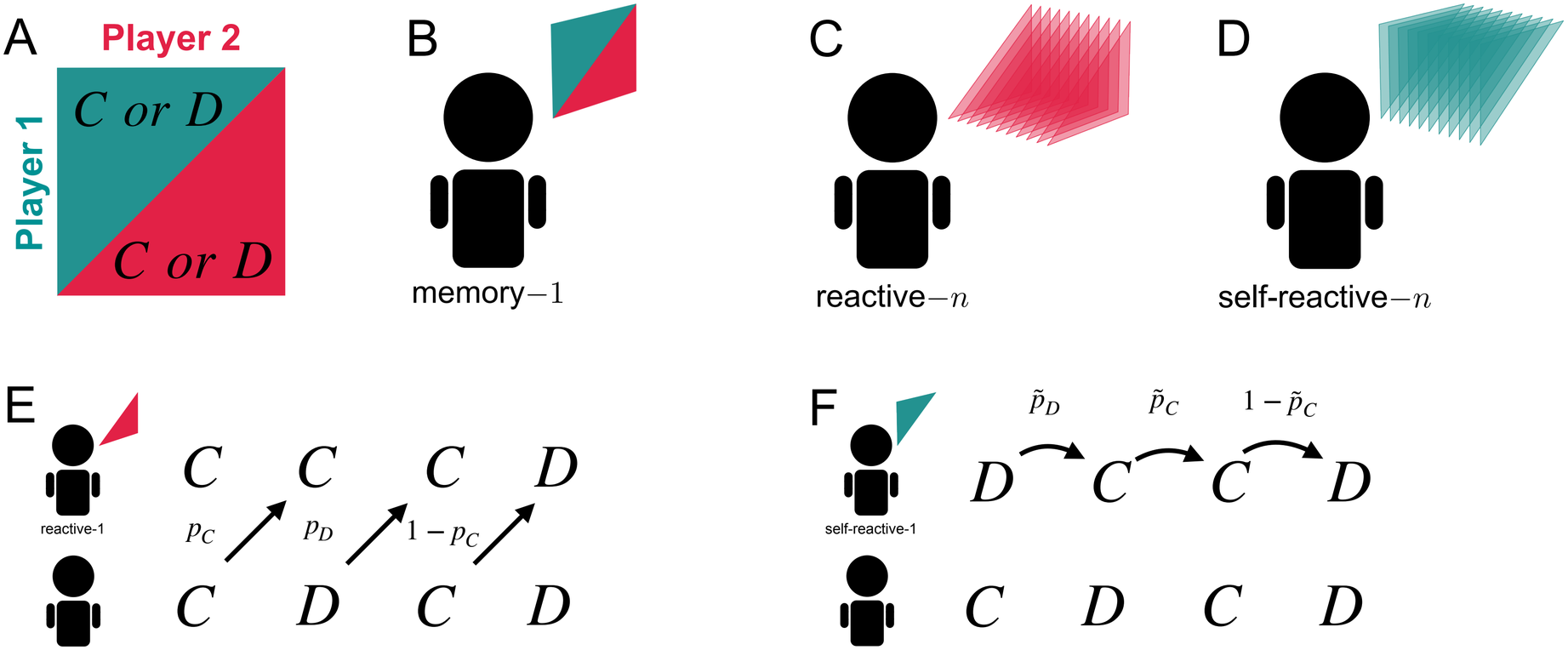
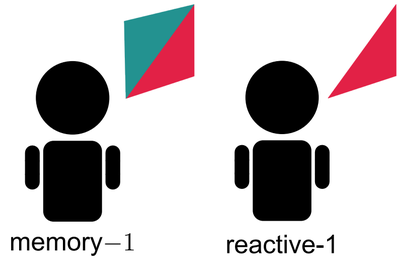

A
Player 2
Player 1
C or D
C or D
B
memory−1
C
reactive−n
D
self-reactive−n
E
reactive-1
C C C D
p_C p_D $1-p_C$
C D C D
F
self-reactive-1
$\tilde{p}_D$ $\tilde{p}_C$ $1-\tilde{p}_C$
D C C D
C D C D

A

reactive-1 vs memory-1



memory-1 | reactive-1

Player 1

$m_{CC} = 0.1$
$m_{CD} = 0.6$
$m_{DC} = 0.2$
$m_{DD} = 0.3$

Player 2

$p_C = 0.8$
$p_D = 0.5$

Realized Repeated Game

Player 1 $D\ D\ C\ D\ D\ \ldots$

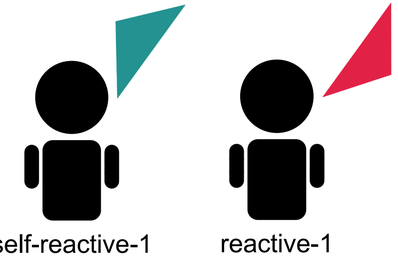
Player 2 $C\ C\ C\ D\ D\ \ldots$

Outcome distribution

$C\ C$	$C\ D$
15.3%	10.6%
$D\ C$	$D\ D$
42.5%	31.7%

B

reactive-1 vs equivalent self-reactive-1



self-reactive-1 | reactive-1

Player 1

$\tilde{p}_C = 0.304$
$\tilde{p}_D = 0.242$

Player 2

$p_C = 0.8$
$p_D = 0.5$

Realized Repeated Game

Player 1 $D\ D\ C\ D\ D\ \ldots$

Player 2 $C\ C\ C\ D\ D\ \ldots$

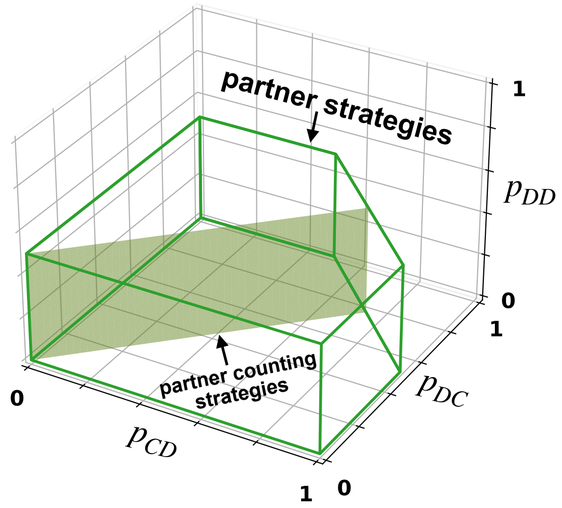
Outcome distribution

$C\ C$	$C\ D$
15.3%	10.6%
$D\ C$	$D\ D$
42.5%	31.7%

C

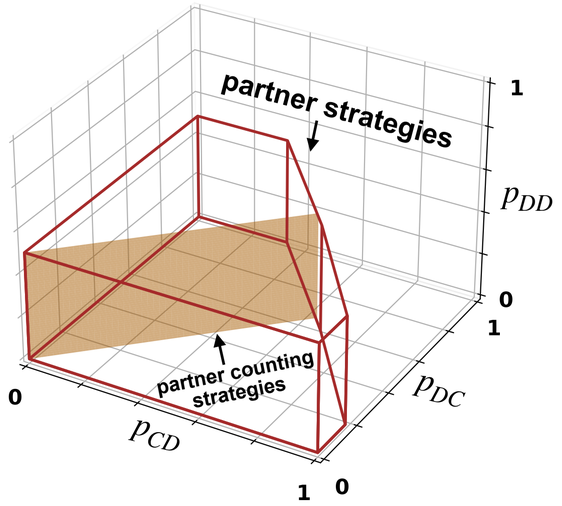
Partners among the reactive-2 strategies

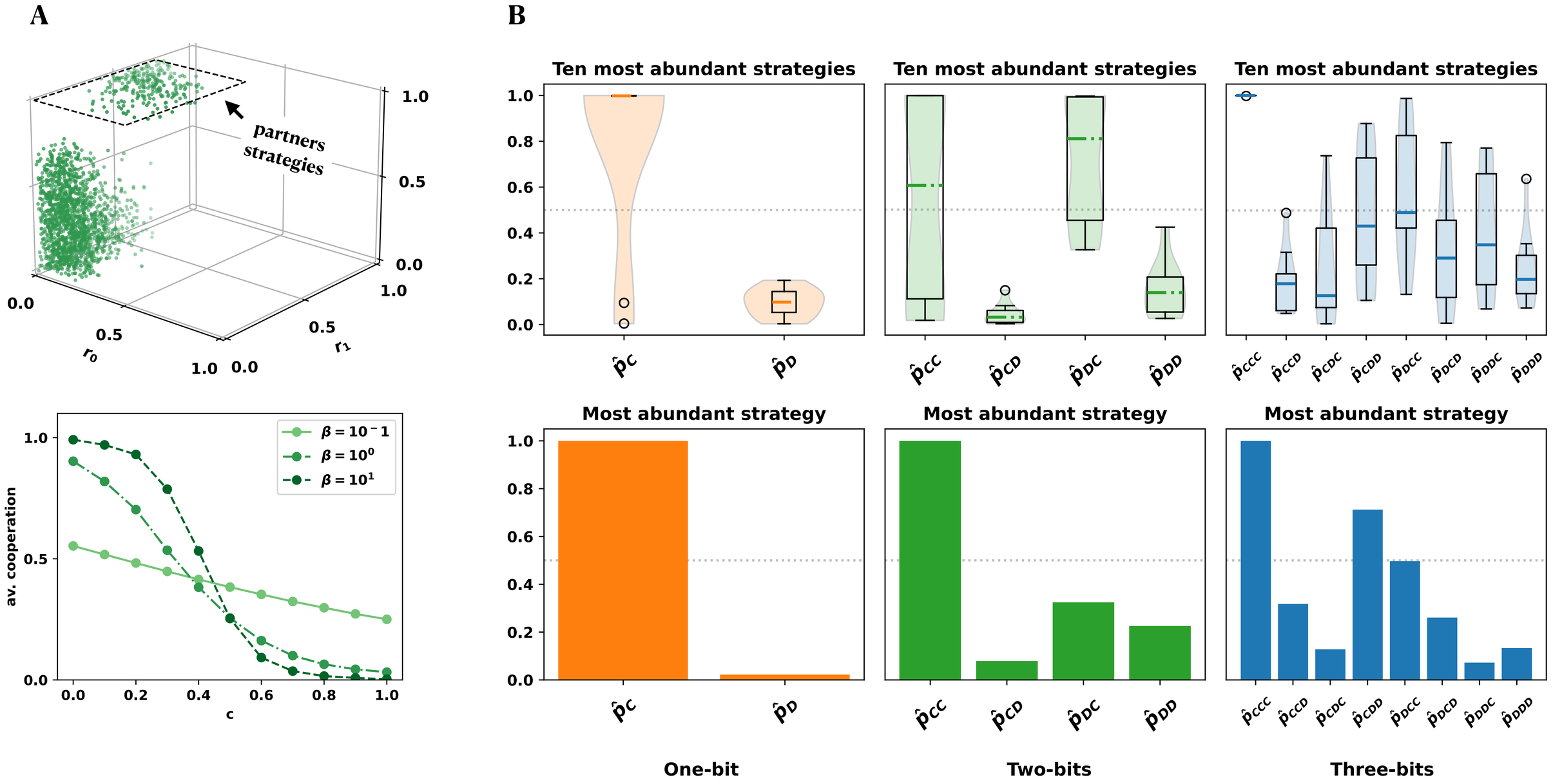
Donation Game (***b*/*c* = 2**)

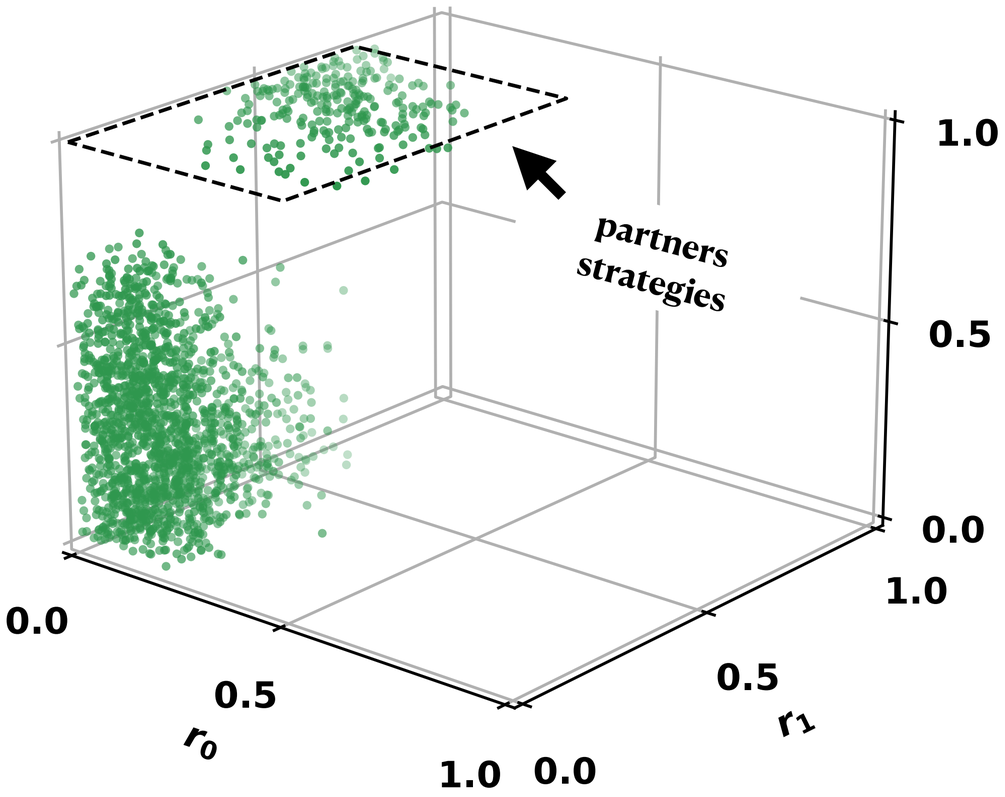


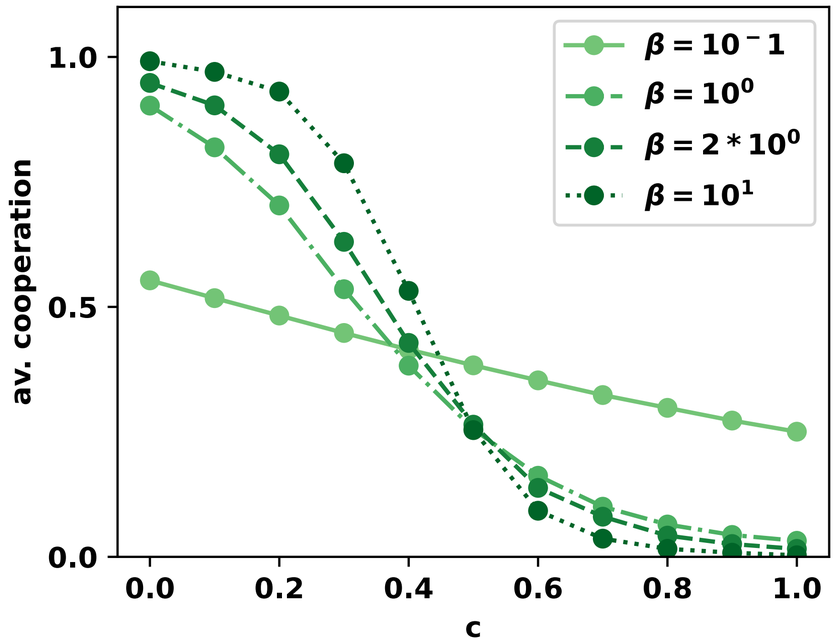
D

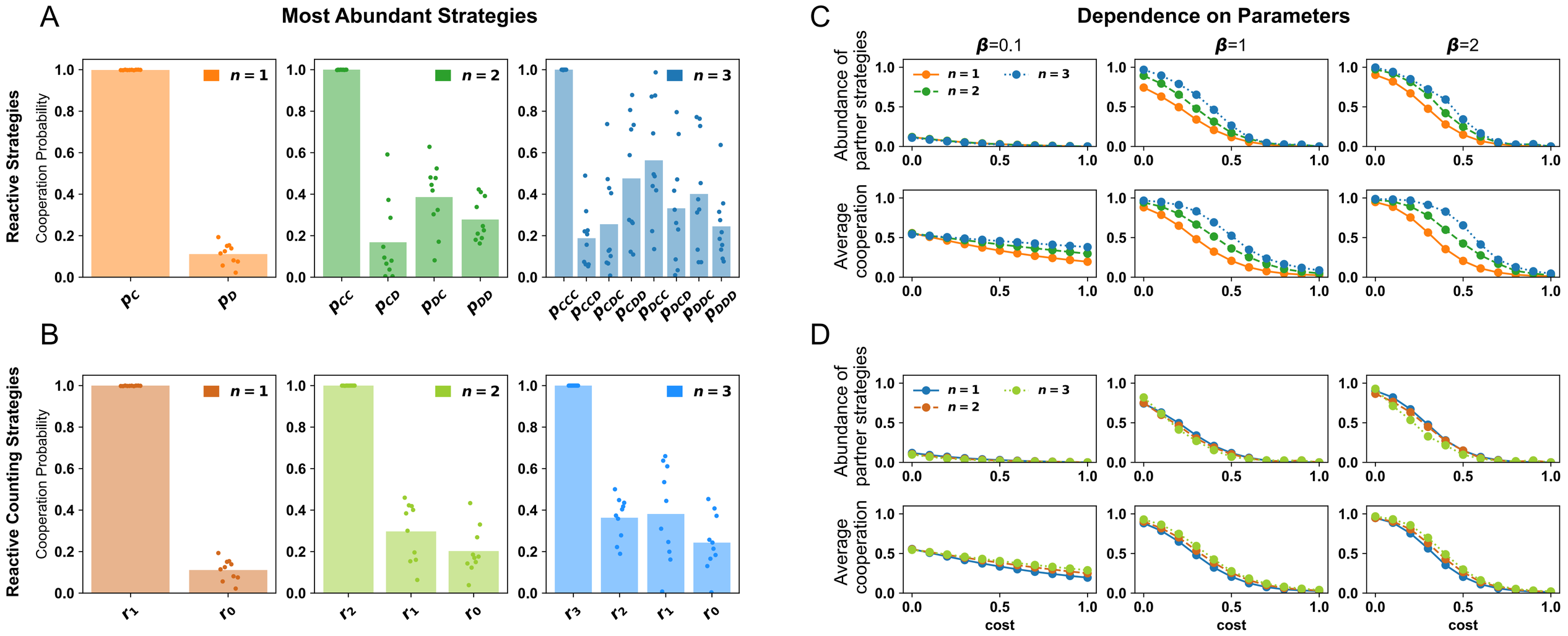
Axelrod's Prisoner's Dilemma

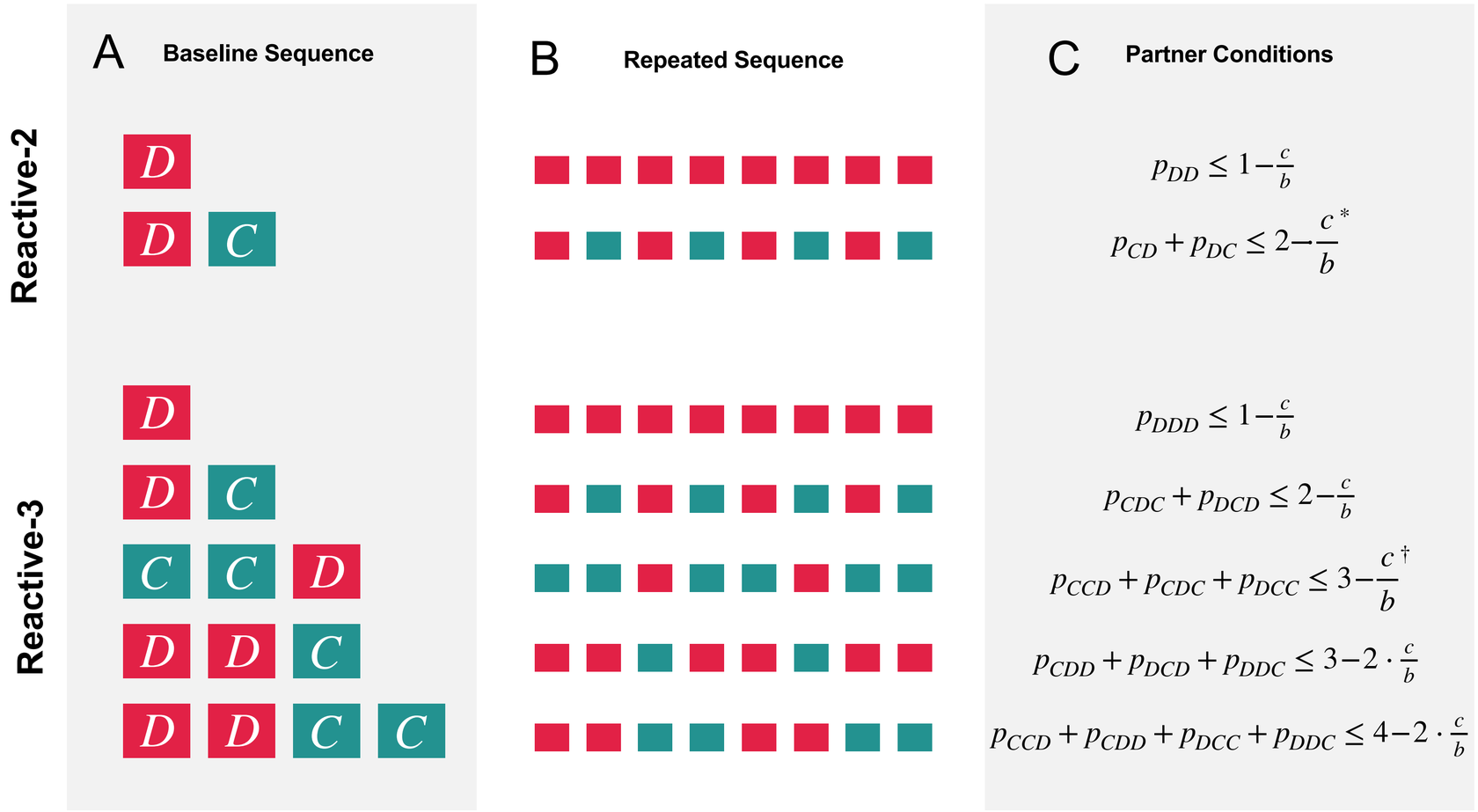


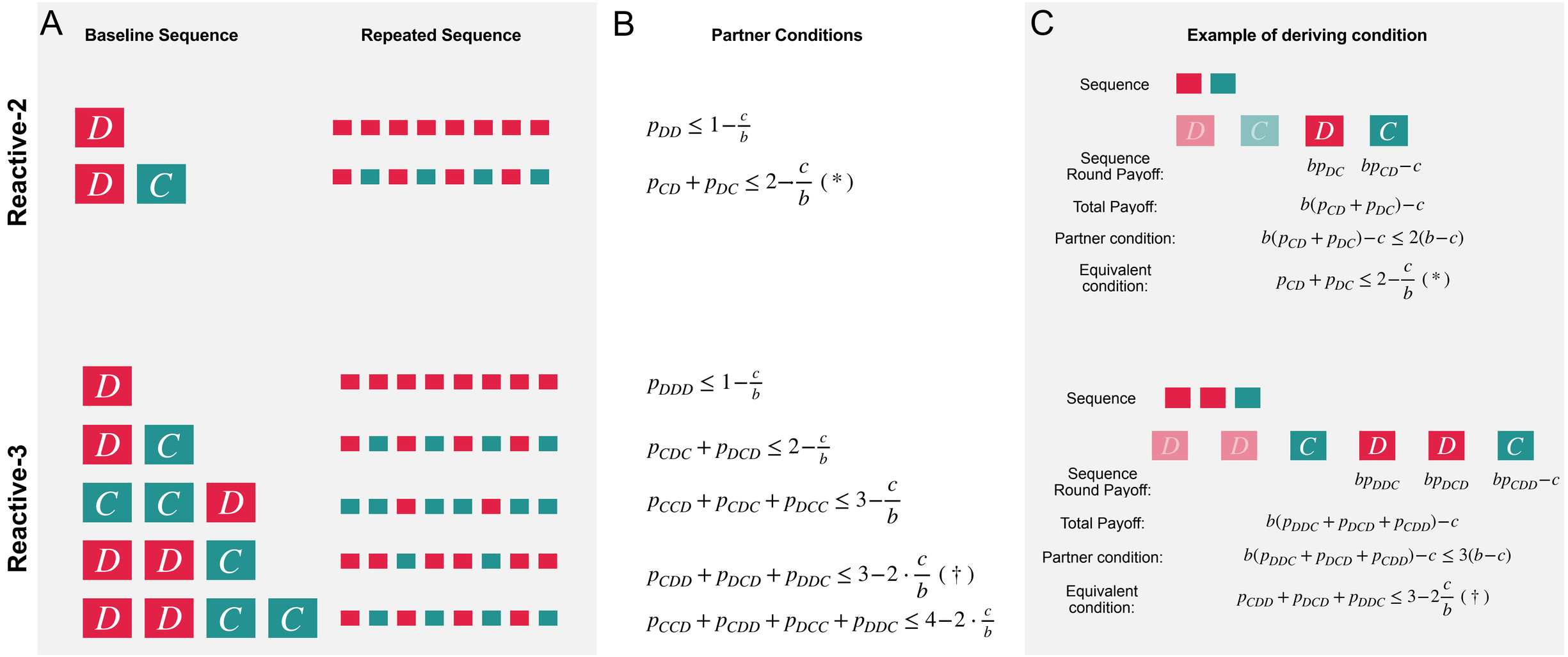

A
partners strategies
1.0
0.5
0.0
0.0
0.5
1.0
r_0
r_1
av. cooperation
c
$\beta = 10^{-1}$
$\beta = 10^{0}$
$\beta = 10^{1}$
B
Ten most abundant strategies
Most abundant strategy
One-bit
Two-bits
Three-bits


partners
strategies
0.0
0.5
1.0
r_0
0.0
0.5
1.0
r_1
0.0
0.5
1.0


$\beta = 10^{-1}$
$\beta = 10^{0}$
$\beta = 2 * 10^{0}$
$\beta = 10^{1}$
av. cooperation
c
0.0
0.5
1.0
0.0
0.2
0.4
0.6
0.8
1.0


A
Most Abundant Strategies
Reactive Strategies
Cooperation Probability
n = 1
n = 2
n = 3
p_C
p_D
p_CC
p_CD
p_DC
p_DD
p_CCC
p_CCD
p_CDC
p_CDD
p_DCC
p_DCD
p_DDC
p_DDD
B
Reactive Counting Strategies
Cooperation Probability
n = 1
n = 2
n = 3
r_1
r_0
r_2
r_1
r_0
r_3
r_2
r_1
r_0
C
Dependence on Parameters
β=0.1
β=1
β=2
Abundance of partner strategies
Average cooperation
n = 1
n = 2
n = 3
D
Abundance of partner strategies
Average cooperation
n = 1
n = 2
n = 3
cost
cost
cost


A
Baseline Sequence
B
Repeated Sequence
C
Partner Conditions
D
Example of deriving condition
Reactive-2
Reactive-3
$p_{DD} \leq 1-\frac{c}{b}$
$p_{CD}+p_{DC} \leq 2-\frac{c}{b}^{*}$
$p_{DDD} \leq 1-\frac{c}{b}$
$p_{CDC}+p_{DCD} \leq 2-\frac{c}{b}$
$p_{CCD}+p_{CDC}+p_{DCC} \leq 3-\frac{c}{b}^{\dagger}$
$p_{CDD}+p_{DCD}+p_{DDC} \leq 3-2\cdot\frac{c}{b}$
$p_{CCD}+p_{CDD}+p_{DCC}+p_{DDC} \leq 4-2\cdot\frac{c}{b}$
Sequence
Sequence Round Payoff:
$p_{DC}\cdot b$ $p_{CD}\cdot b-c$
Total Payoff:
$(p_{CD}+p_{DC})\cdot b-c$
Partner condition:
$(p_{CD}+p_{DC})\cdot b-c \leq 2\cdot(b-c)$
Equivalent condition:
$p_{CD}+p_{DC} \leq 2-\frac{c}{b}^{*}$
Sequence
Sequence Round Payoff:
$p_{DDC}\cdot b$ $p_{DCD}\cdot b$ $p_{CDD}\cdot b-c$
Total Payoff:
$(p_{DDC}+p_{DCD}+p_{CDD})\cdot b-c$
Partner condition:
$(p_{DDC}+p_{DCD}+p_{CDD})\cdot b-c \leq 3\cdot(b-c)$
Equivalent condition:
$p_{CCD}+p_{CDC}+p_{DCC} \leq 3-\frac{c}{b}^{\dagger}$


A
Baseline Sequence
Repeated Sequence
Reactive-2
D
D C
Reactive-3
D
D C
C C D
D D C
D D C C
B
Partner Conditions
$p_{DD} \leq 1-\frac{c}{b}$
$p_{CD}+p_{DC} \leq 2-\frac{c}{b}\ (*)$
$p_{DDD} \leq 1-\frac{c}{b}$
$p_{CDC}+p_{DCD} \leq 2-\frac{c}{b}$
$p_{CCD}+p_{CDC}+p_{DCC} \leq 3-\frac{c}{b}$
$p_{CDD}+p_{DCD}+p_{DDC} \leq 3-2\cdot\frac{c}{b}\ (\dagger)$
$p_{CCD}+p_{CDD}+p_{DCC}+p_{DDC} \leq 4-2\cdot\frac{c}{b}$
C
Example of deriving condition
Sequence
D C D C
Sequence Round Payoff:
bp_{DC} $bp_{CD}-c$
Total Payoff:
$b(p_{CD}+p_{DC})-c$
Partner condition:
$b(p_{CD}+p_{DC})-c \leq 2(b-c)$
Equivalent condition:
$p_{CD}+p_{DC} \leq 2-\frac{c}{b}\ (*)$
Sequence
D D C D D C
Sequence Round Payoff:
bp_{DDC} bp_{DCD} $bp_{CDD}-c$
Total Payoff:
$b(p_{DDC}+p_{DCD}+p_{CDD})-c$
Partner condition:
$b(p_{DDC}+p_{DCD}+p_{CDD})-c \leq 3(b-c)$
Equivalent condition:
$p_{CDD}+p_{DCD}+p_{DDC} \leq 3-2\frac{c}{b}\ (\dagger)$