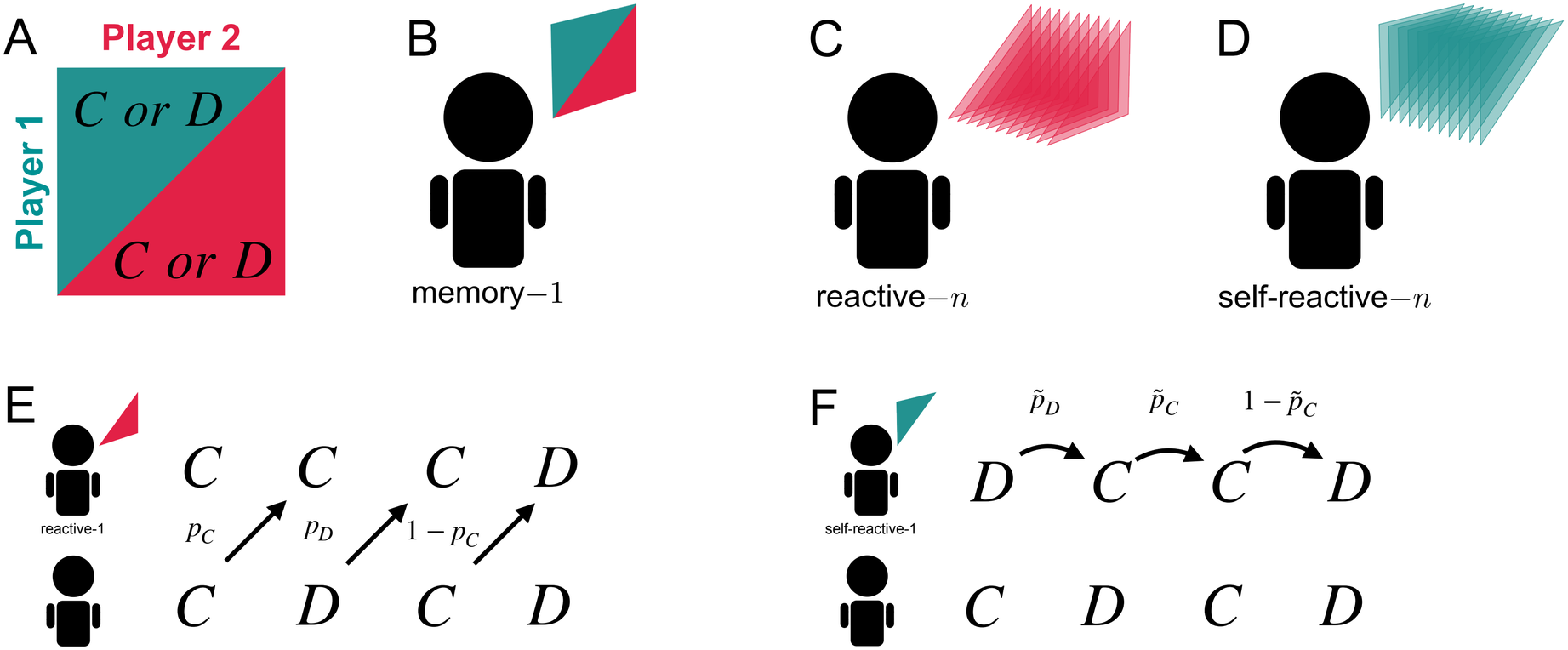
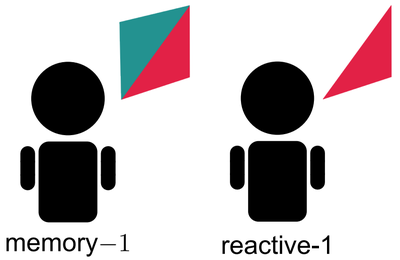

A
Player 2
Player 1
C or D
C or D
B
memory−1
C
reactive−n
D
self-reactive−n
E
reactive-1
C C C D
p_C p_D $1-p_C$
C D C D
F
self-reactive-1
$\tilde{p}_D$ $\tilde{p}_C$ $1-\tilde{p}_C$
D C C D
C D C D

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 $D\ D\ C\ D\ D\ \ldots$

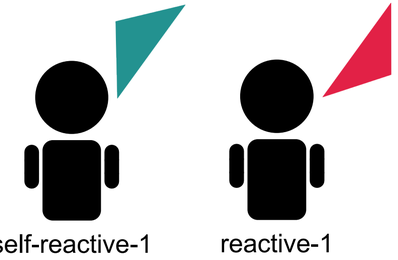
Player 2 $C\ C\ C\ D\ D\ \ldots$

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 $C\ C\ C\ D\ D\ \ldots$

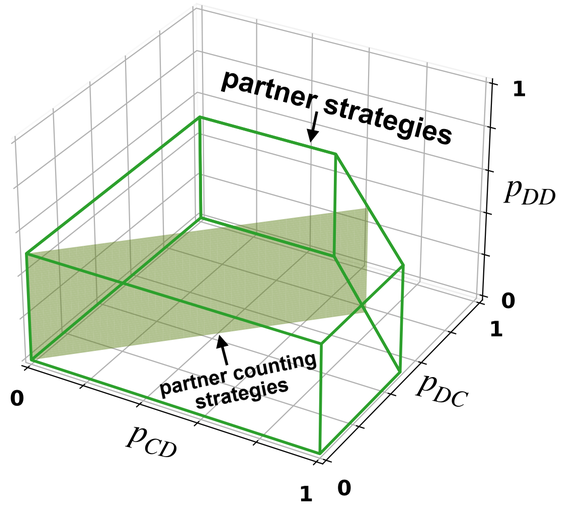
Outcome distribution

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

C

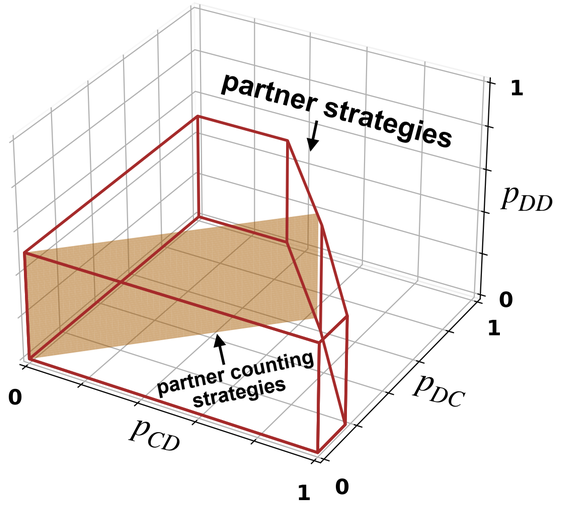
Partners among the reactive-2 strategies

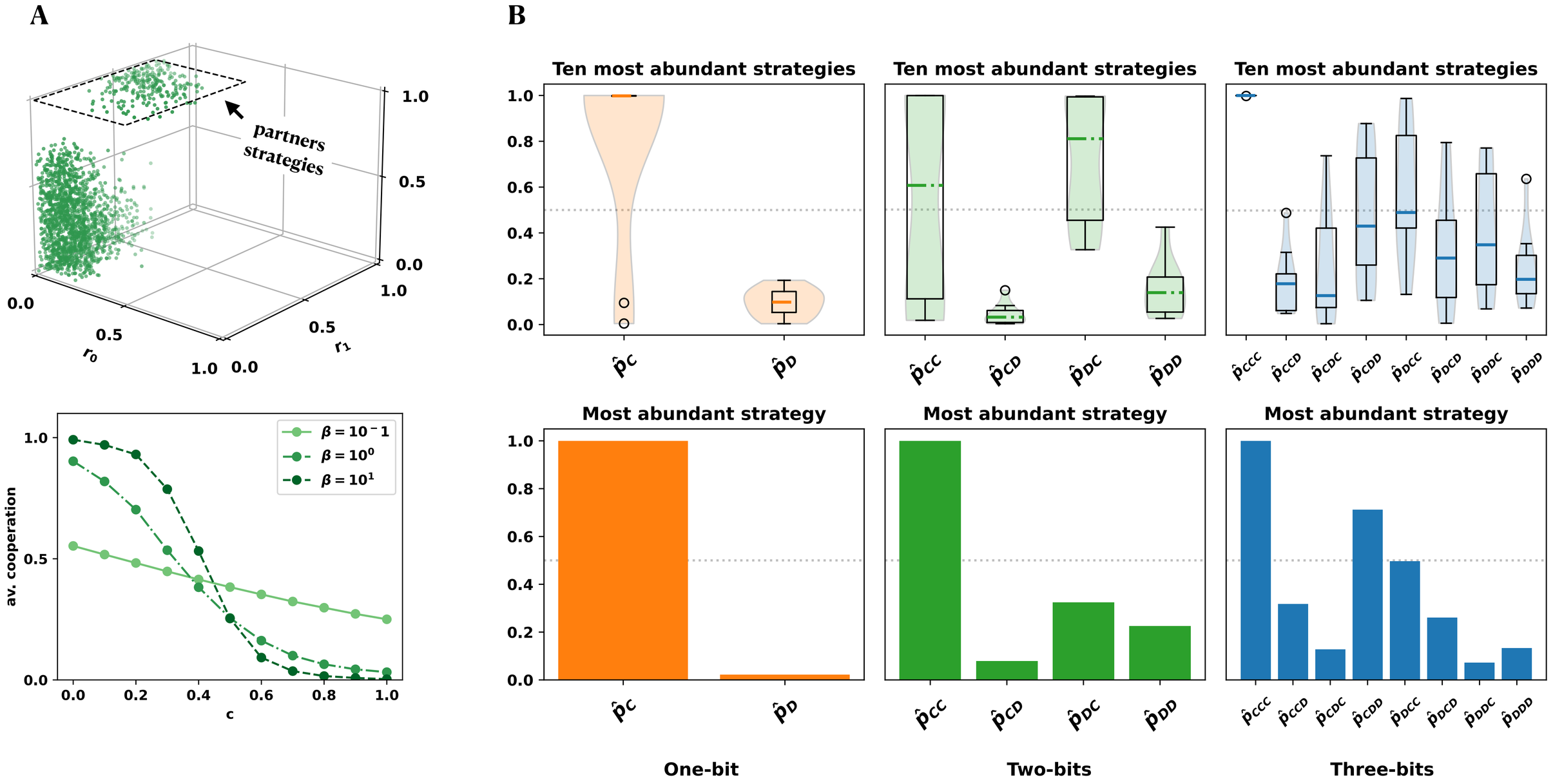
Donation Game (**$b/c = 2$**)

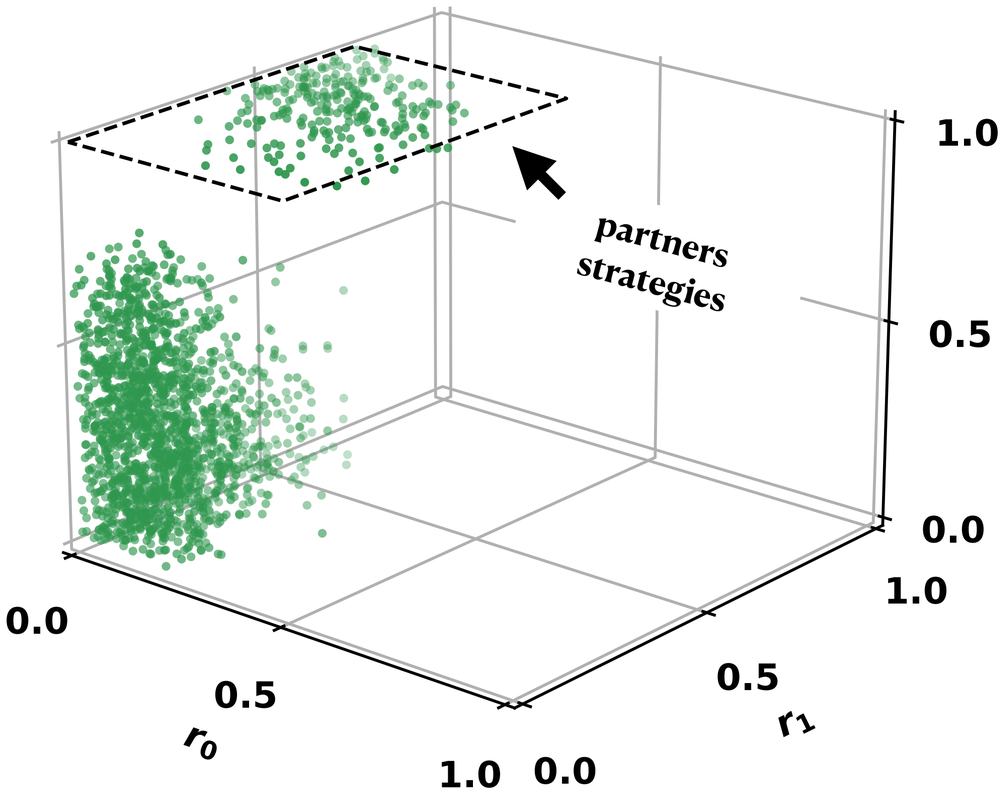


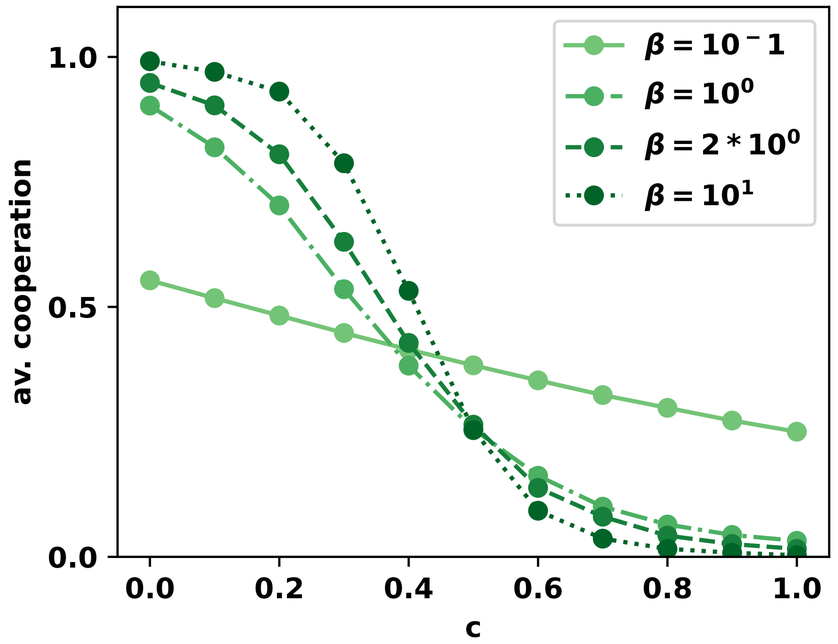
D

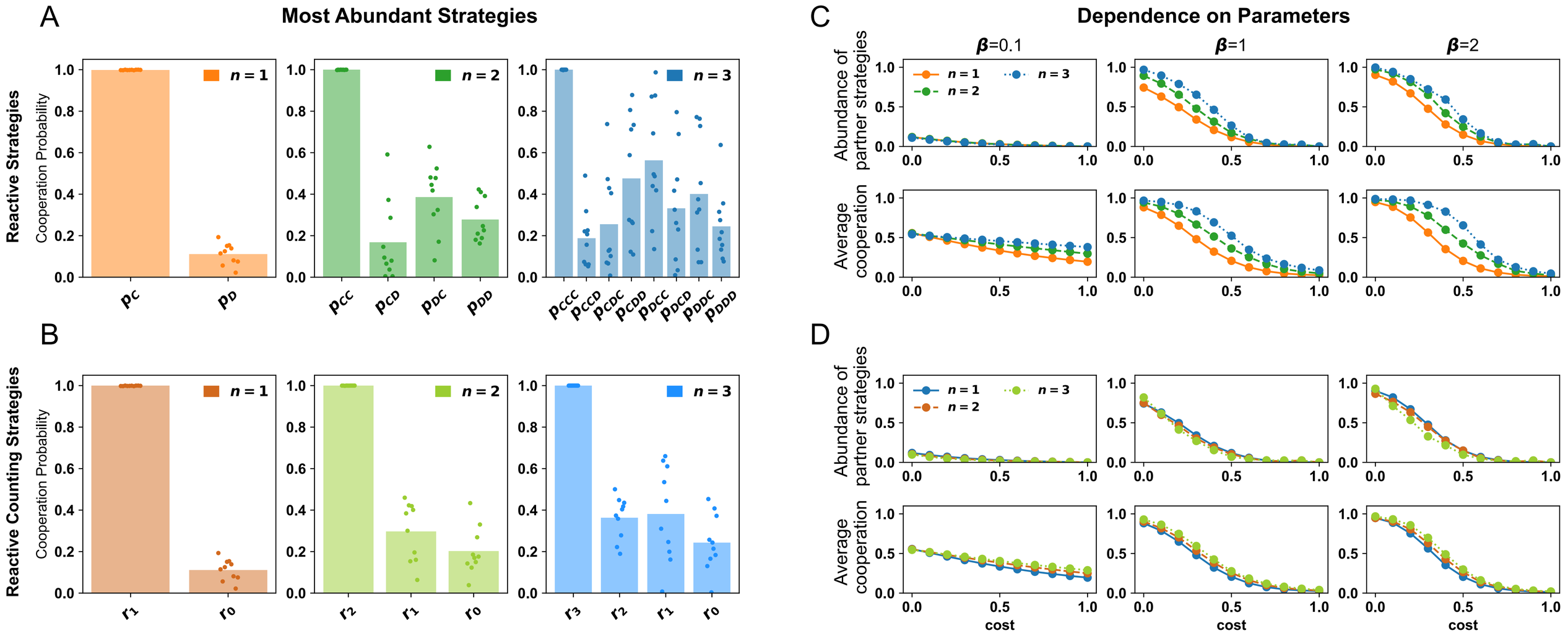
Axelrod's Prisoner's Dilemma




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
$\hat{p}_C$
$\hat{p}_D$
$\hat{p}_{CC}$
$\hat{p}_{CD}$
$\hat{p}_{DC}$
$\hat{p}_{DD}$
$\hat{p}_{CCC}$
$\hat{p}_{CCD}$
$\hat{p}_{CDC}$
$\hat{p}_{CDD}$
$\hat{p}_{DCC}$
$\hat{p}_{DCD}$
$\hat{p}_{DDC}$
$\hat{p}_{DDD}$
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

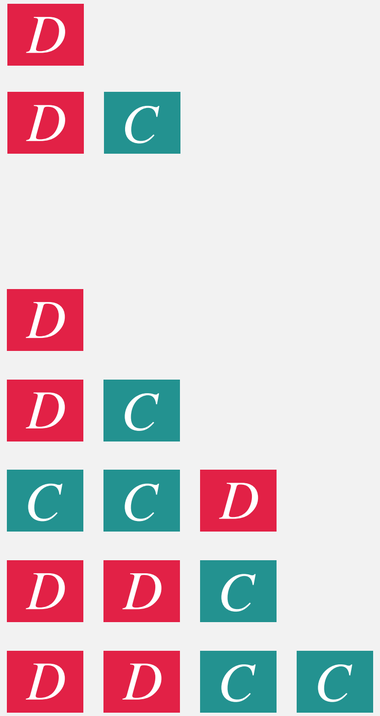

$\beta = 10^{-1}$
$\beta = 10^{0}$
$\beta = 2 * 10^{0}$
$\beta = 10^{1}$
av. cooperation
c
0.0
0.5
1.0
0.0
0.2
0.4
0.6
0.8
1.0


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

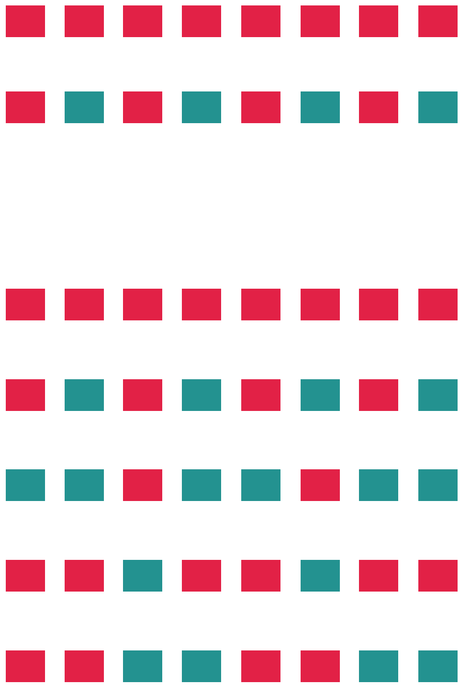
Reactive-2

Reactive-3

A **Baseline Sequence**



B **Repeated Sequence**



C **Partner Conditions**

$$p_{DD} \le 1-\frac{c}{b}$$

$$p_{CD}+p_{DC} \le 2-\frac{c}{b}$$

$$p_{DDD} \le 1-\frac{c}{b}$$

$$p_{CDC}+p_{DCD} \le 2-\frac{c}{b}$$

$$p_{CCD}+p_{CDC}+p_{DCC} \le 3-\frac{c}{b}$$

$$p_{CDD}+p_{DCD}+p_{DDC} \le 3-2\cdot\frac{c}{b}$$

$$p_{CCD}+p_{CDD}+p_{DCC}+p_{DDC} \le 4-2\cdot\frac{c}{b}$$

D **Example of deriving condition**

Sequence: D C D C

Sequence Round Payoff: $p_{DC}\cdot b$ $p_{CD}\cdot b-c$

Total Payoff: $(p_{CD}+p_{DC})\cdot b-c$

Partner condition: $(p_{CD}+p_{DC})\cdot b-c \le 2\cdot(b-c)$

Sequence: D D C D D C

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: $(p_{DDC}+p_{DCD}+p_{CDD})\cdot b-c \le 3\cdot(b-c)$