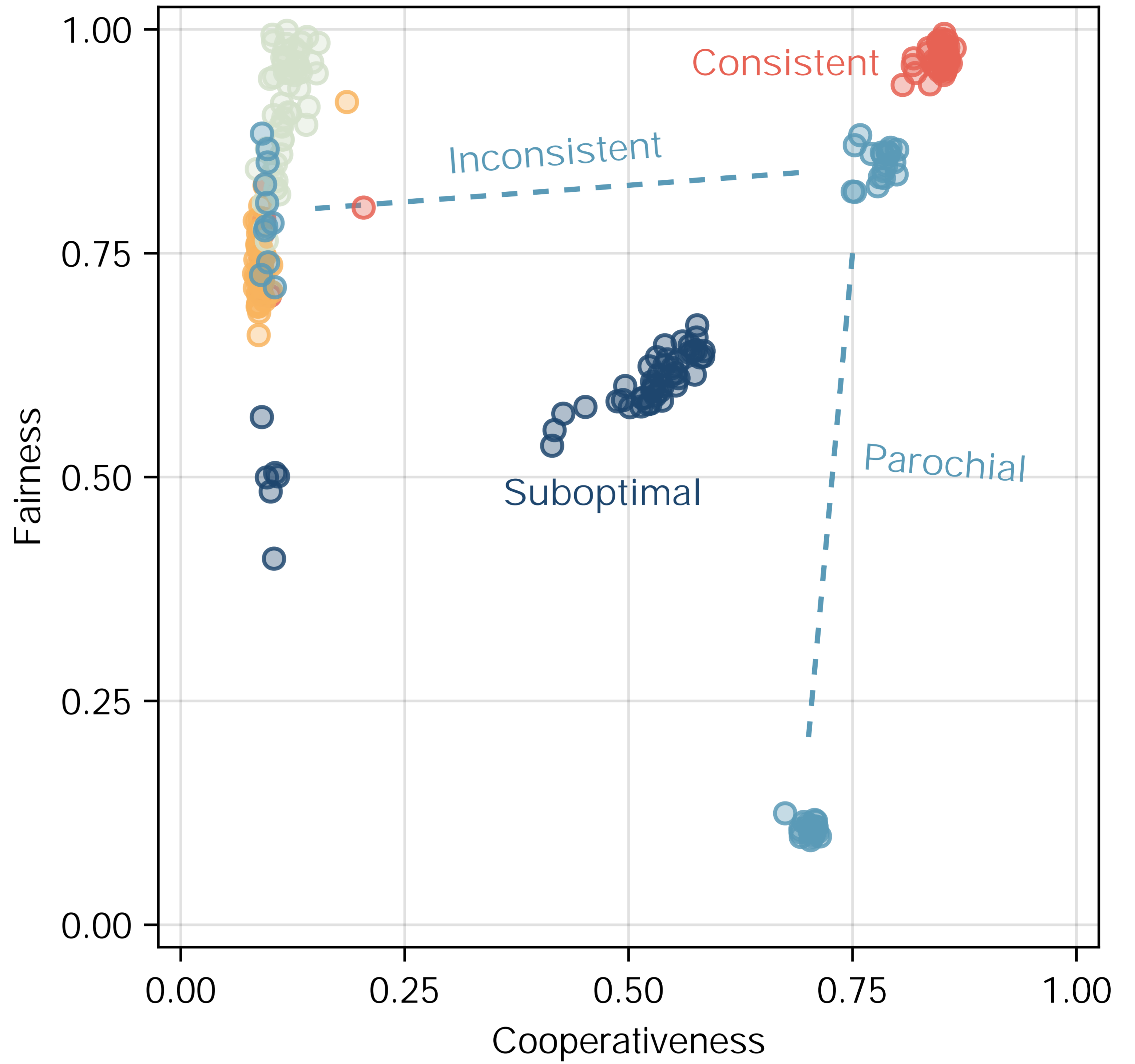


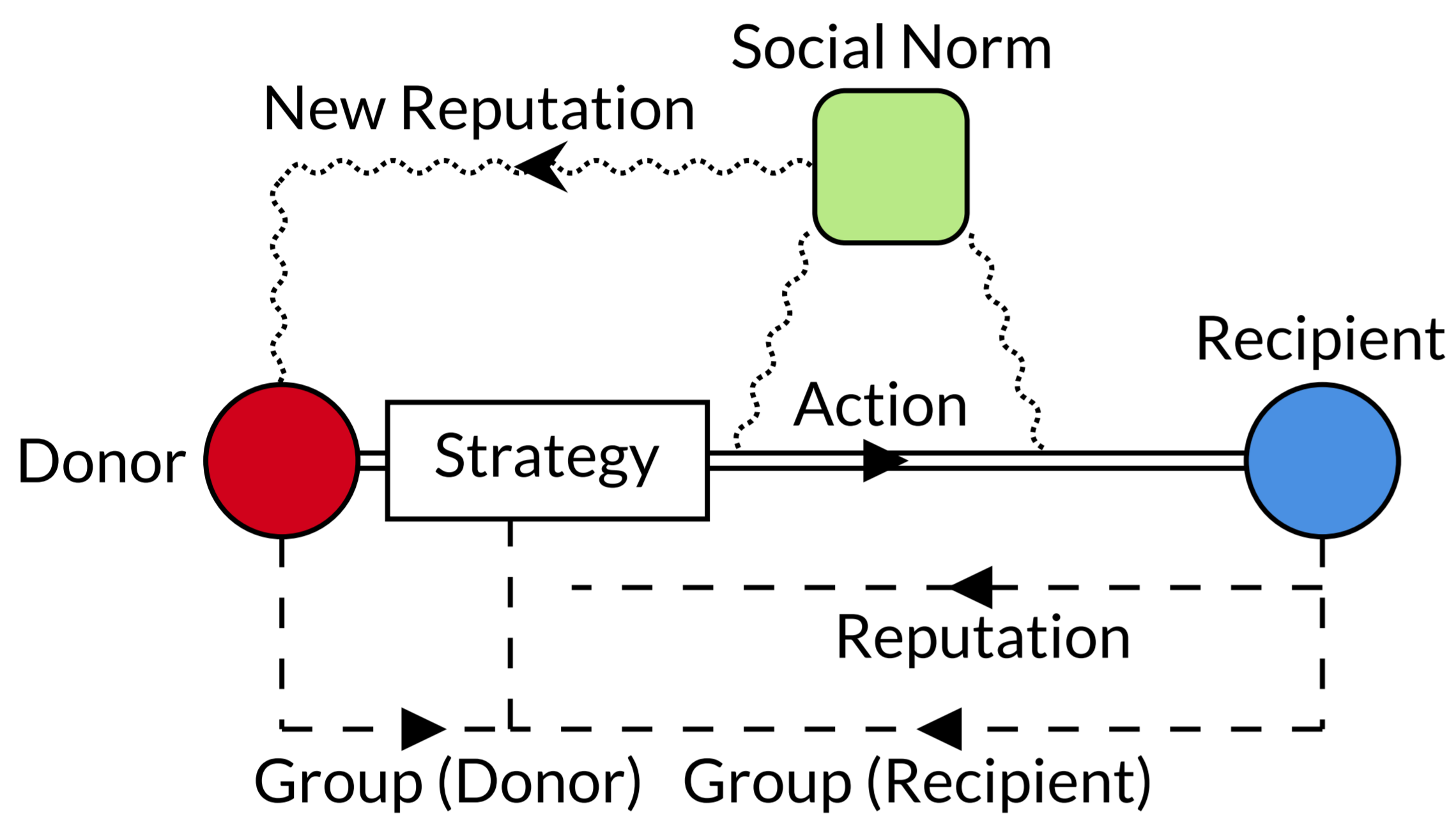
C dYZa

f|C^L^?>nL~" p>%E, C%AL Bp>^>B"L^S%oB%o> %> B">n
s-HB> ~n} L} AL^%ps.., , ~L, N^E, n^, Y..%>~H
HY~>} SB^L..Y"> , ~Y..H>LHN , E s-n %oB> ~, ^} %o
nL~" %>L^>B" s-..>s%& sp ^>~H, } %Bp, %>~ , L%o"pL
H, ~, ^B>~ Bp, , %> , ..>%B, %oc", B, ~NL^AL~LT" b",
"pL^LBS.d~"
5pL H, ~, ^%o., SB^} >%HSB^} s->L A>%dH, ~"pL
^L> , ~AL^ELL~"pLS>~H"pL^LBS.d~" %>n%&L, ^
HQL^L~" >~H"pL^LBS.d~" %d..Y"> , ~n, , H, ^A>H
^L^L^s^L^>B ~n "pL %B> ~, ^} HL^L^} s-L%&pL
H, ~, ^%oLE^L..Y"> , ~A>%dH, ~"pL >B , ~">yL~>~H
"pL^L> , ~^L..Y"> , ~B, ~"L^"
5pL^L>L .., %>ALB, } As-> , ~%oN As%oNs-N ^} > , ~
>B , ~ B, ~"L^" pL~BL>~ , ^} %>~ As^CLB", ^>~H"pL^L
>L "pL^LN^L .., %>AL ~, ^} %o

Very few norms make fair cooperation consistently learnable



- Ingroup Norm/Outgroup Norm
- SternJudging (red circle)
 - SimpleStanding (orange circle)
 - Shunning (green circle)
 - SternJudging/ImageScore (light blue circle)
 - Shunning/SimpleStanding (dark blue circle)



Cj a ^#\Zci HZ ^[dgXZb Zci BZVgc^ \

5E, >nL~" %oI, j E p, p>C^L n^, Y...^L> , ~x {0,1} LL"
j %d..Y"> , ~ %> {0,1} : sp Q_i R^3 >%oPL 1 ">AL, N
>nL~" i "pL >B , ~">yL~ A^i %>

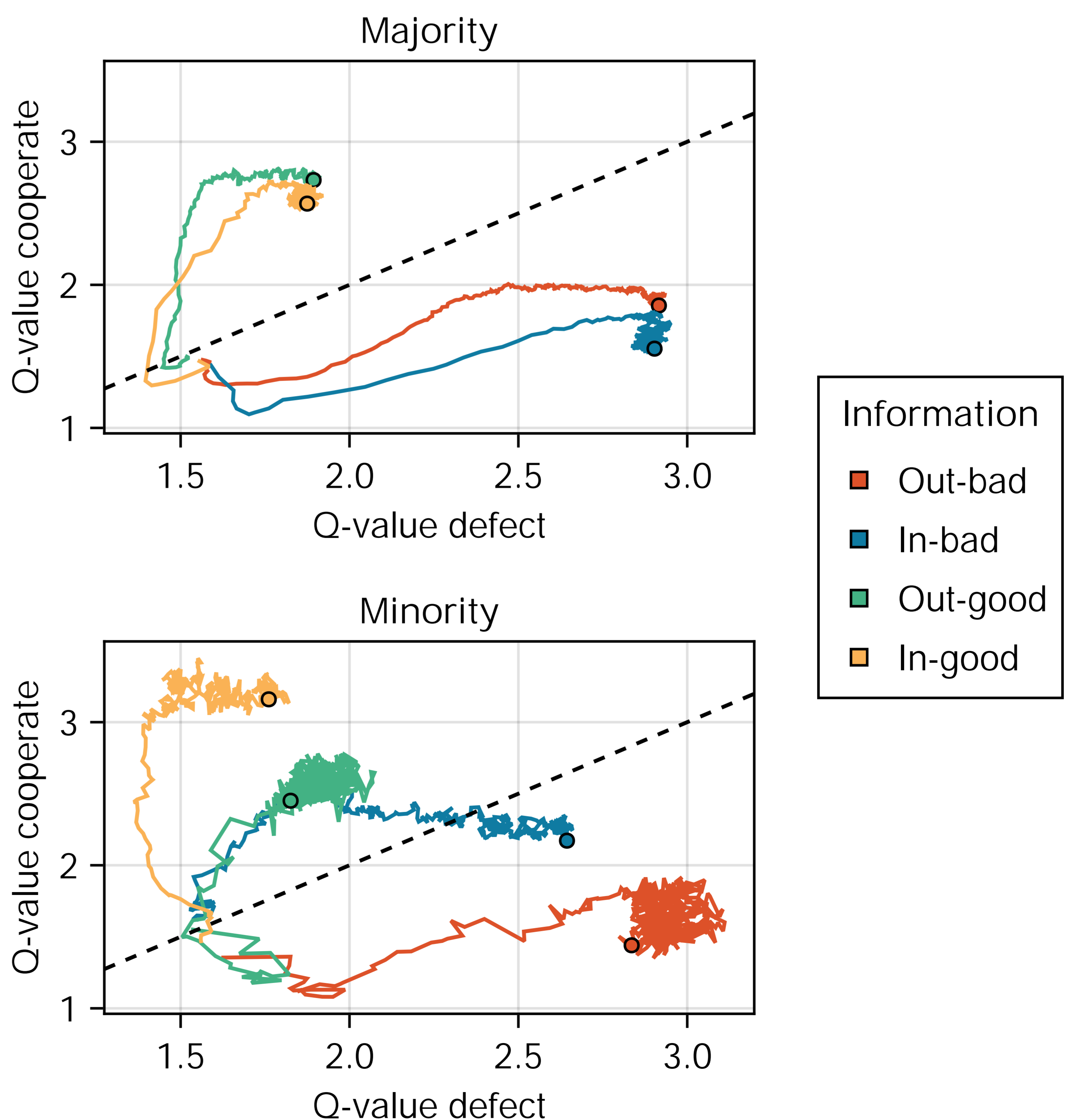
$$a = \arg \max_{a \in \{0,1\}} Q_i[x, y, a]$$

"~ H, s-n %> >nL~" j E s ^LBS.d~" ..>% Q a b >~H >nL~" i E s
..>% B, %oa c ^ nL~" j E s >^M^AY^L "p%>. >% Q", "pL >%>
>B , ~"pL^", , y a s-B, ~"L^" x >~H y

$$Q_i[x, y, a] = (1 - a)Q_i^0[x, y, a] + aQ_i^1[x, y, a]$$

^, ^L%o. ~Hs-n 1 C>Y^L%>^L HLB>%LHs- LCL^?s^L^>B , ~
^Ln>^HL%o N>~ >nL~" %o, L 5pL ^L L C>~" 1 C>Y^L %&pL
>%>B , ~">yL~>%> H, ~, ^

Average path of Q-values under SternJudging



FVeZg'9dYZ"VcY FdhiZg