Party Game

Imagine a party in a big hall with lots of guests milling around. Each guest has a card. Some guests have a red card and some guests have a green card. If two guests happen to bump into each other then they show each other their cards and points are awarded.

If two reds bump into each other, they both win -6 points.

If two greens bump into each other, they both win 1 point.

If a red bumps into a green, the red wins 4 points and the green wins 0 points.

I arrive late to the party and the host asks me if I want a red card or a green card. Assuming I want to win as many points as possible, which colour should I choose?

Say r is the proportion of guests with red cards and $1-r$ is the proportion of guests with green cards.

If I take a red card then my expected score when I bump into another guest is:

$$r(-6)+(1-r)(4)$$

If I take a green card then my expected score when I bump into another guest is:

$$r(0)+(1-r)(1)$$

I should take a red card if:

$$r(-6)+(1-r)(4)>r(0)+(1-r)(1)$$

so $r<1/3$

I should take a green card if:

$$r>1/3$$

If $r=1/3$ then it doesn't matter which card I take.

Now let's change the rules so that guests can ask the host for a different card during the party.

How will the proportions of red cards evolve over time?

If we wait long enough, the proportion of red cards will settle down to $1/3$