INDOOR GAME FOR CHILDREN:
HOW DISEASES SPREAD

...THROUGH FRIENDSHIP NETWORKS

PREPARATIONS

This game is a useful addition to educational topics such as:

- Why do we get sick?
- What are viruses and microbes?
- How do they spread?
- How does a body fight against them?
- How can we protect ourselves against such diseases?

In order to play this game, you will need to do the following pre-steps and provide required props:

- Each player crafts three paper bracelets: one white, one red and one green
- Each player needs to be able to read and understand numbers on a six-sided dice
- Each player gets one dice or the entire group uses at least *P* number of dices (to make the game go faster)
- Prepare tokens that will be used by infected players for counting the game rounds (e.g. paper cut outs of flowers or stars)
- Describe to players how the numbers in each round will be visualized with histogram (explained in the appendix)

PREPARATIONS

During the game, the players will interchangeably wear three colored paper bracelets:

White bracelet
(identifies a healthy person which is not immune)

Red bracelet
(identifies a sick/infected person)

Green bracelet
(identifies a healthy and immune person)

SETTING UP THE GAME PARAMETERS

The game has three parameters that control progression of the number of infected and the number of recovered players:

K = probability of a disease transmission

P = an average number of friends we come into contact with

N = duration of illness

SETTING UP THE GAME PARAMETERS

GAME A: This setup results in a fast growth of infected (uncontrolled epidemic spread).

Number of players in the game →	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
K	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
P	4	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6
N	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

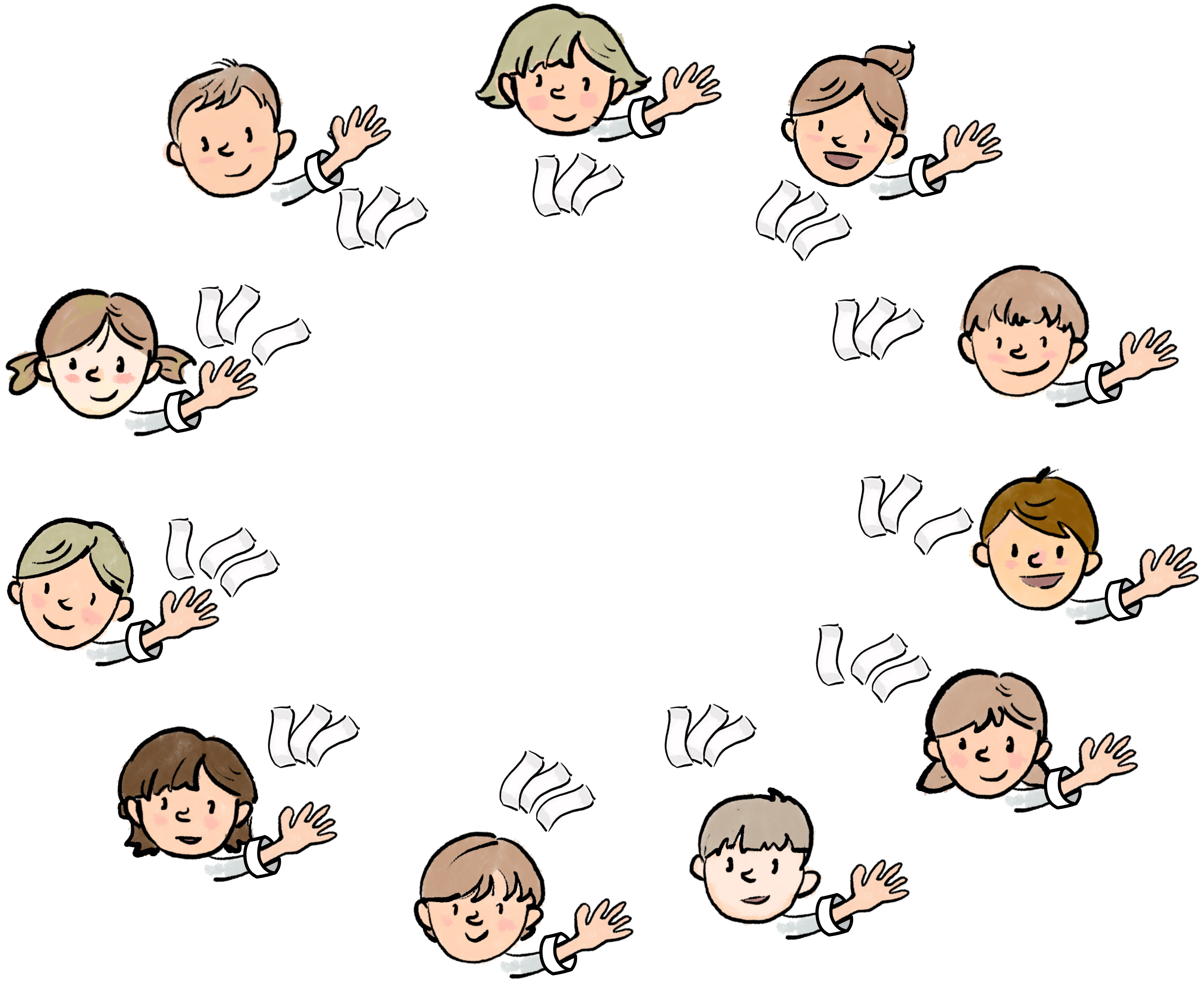
SETTING UP THE GAME PARAMETERS

GAME B: This setup slows down epidemic spread, resulting in a lower number of infected, but epidemic spread will last longer.

Number of players in the game →	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
K	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
P	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
N	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

GAME B shows why we had to stay at home: to reduce the number P, i.e. the number of people we come in contact with and thus potentially infect them. When we are not careful, we get in contact with a lot of people, making P larger (GAME A).

INTRODUCTORY STEP – PART ONE

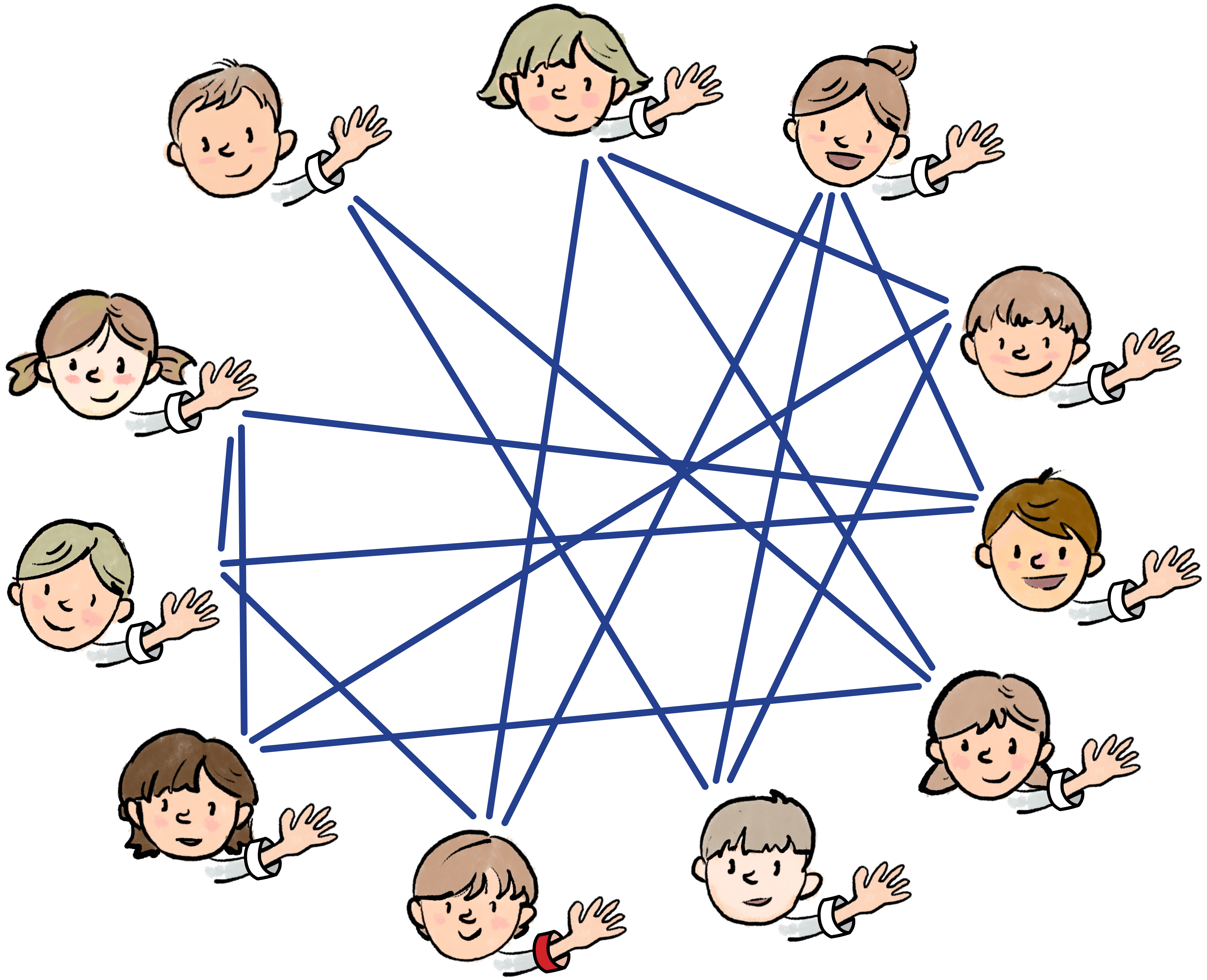


Each player has *P* paper slips with their name on it (or their picture, if they cannot read). The game host then lets each player exchange one of their slips with one slip of each other player.

CAUTION 1: The game host must take care that each player makes *at least one* exchange. If some players did not make any exchanges, the game host needs to try to correct this step so that every child has made at least one exchange.

CAUTION 2: Most likely not everyone will be able to exchange *all* of their slips. The game host must make sure that players make the maximum number of exchanges.

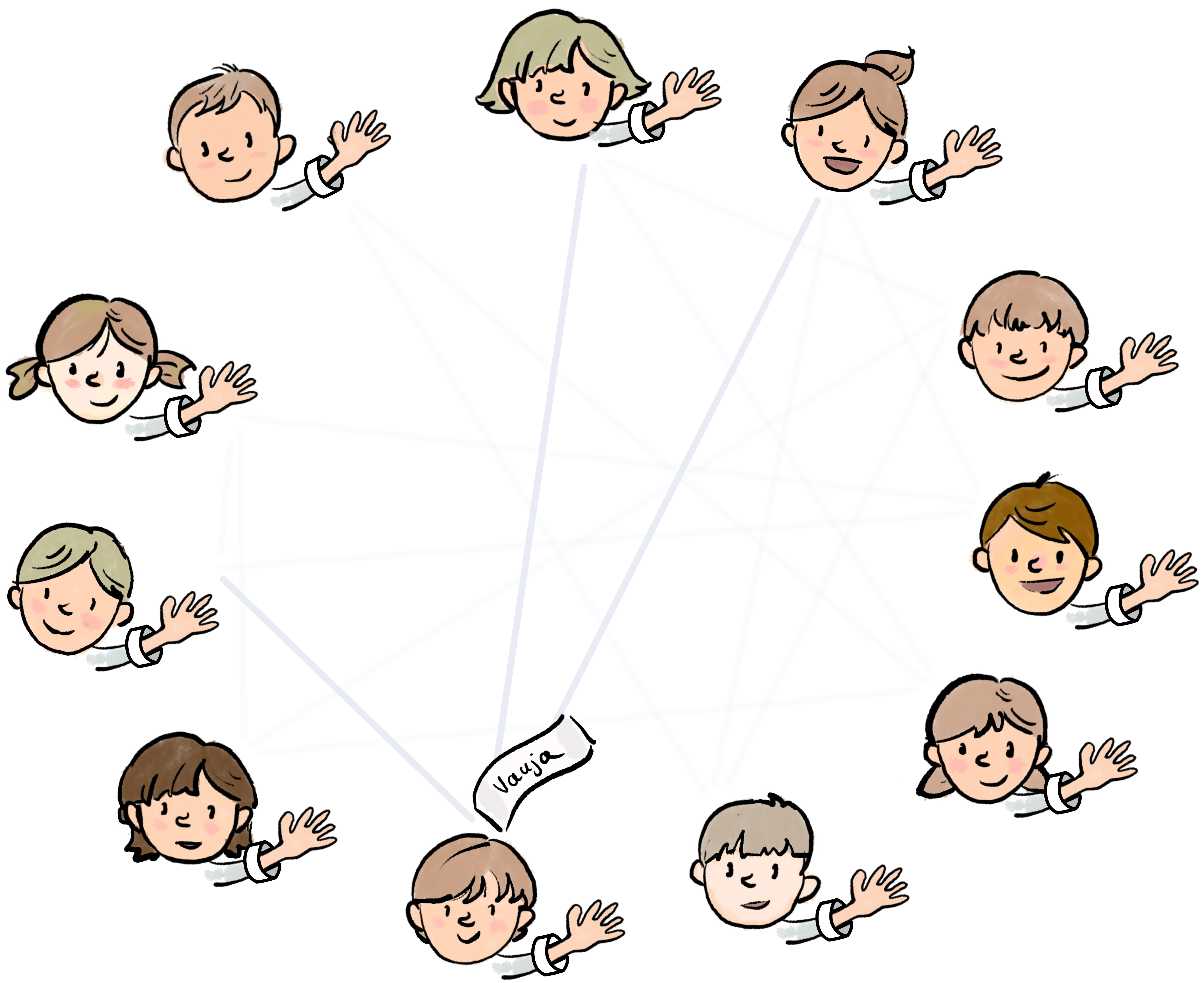
INTRODUCTORY STEP – PART TWO



Each player's name or a picture is placed on a large paper sheet (most commonly in around a circle). Each player than draws a line between their name/picture and each player whose slip they got during exchange step.

This is how a network of contacts is obtained: connections between children who were in contact long enough so that they could infect their contacts or get infected by their contacts.

INTRODUCTORY STEP – PART THREE



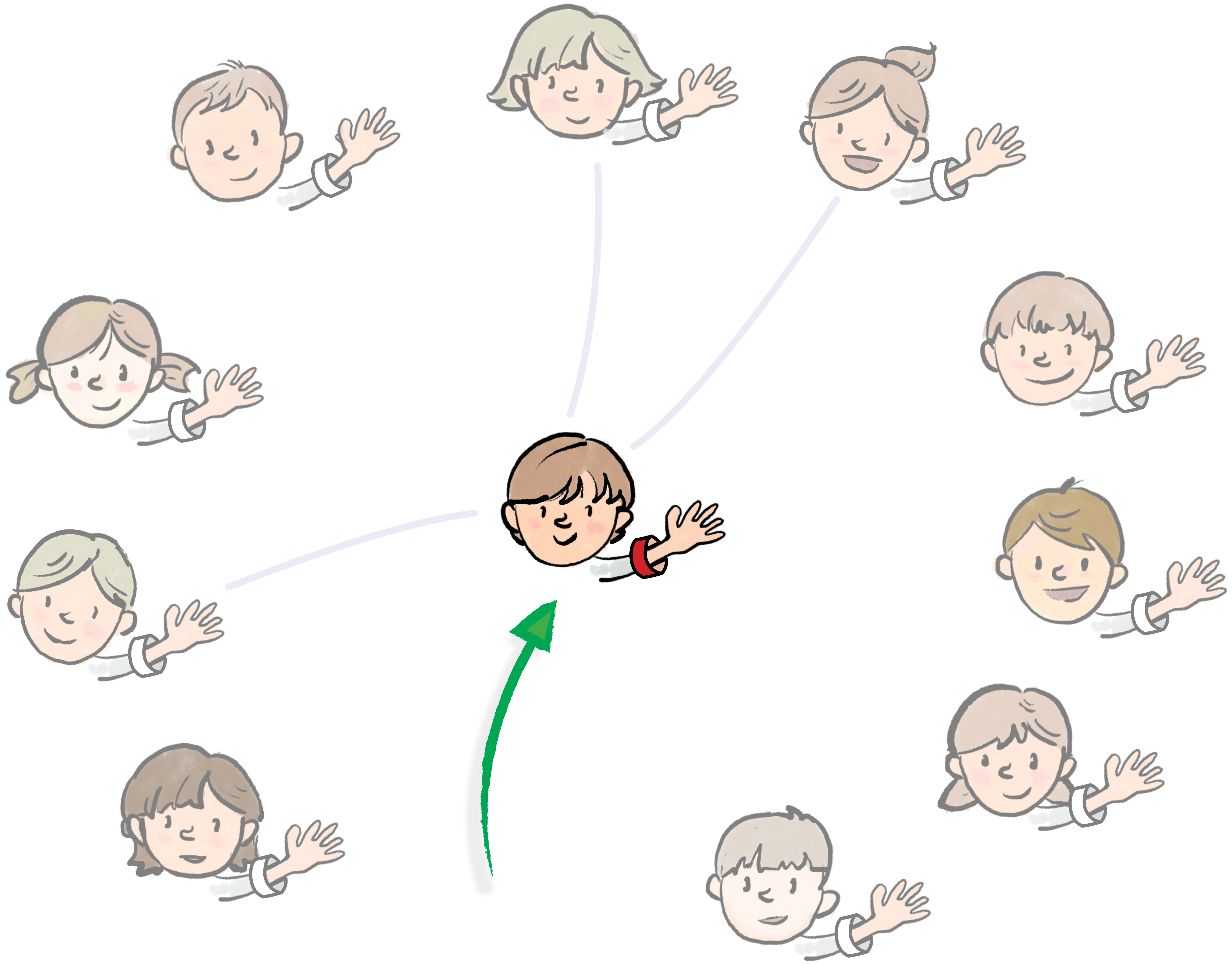
All players form a circle.

Each player puts on a white bracelet.

The game host has a bag with the names of all players in the game. Each name is written on a piece of paper.

The game host then takes a random piece of paper from the bag: the name on this piece is the name of the first infected player.

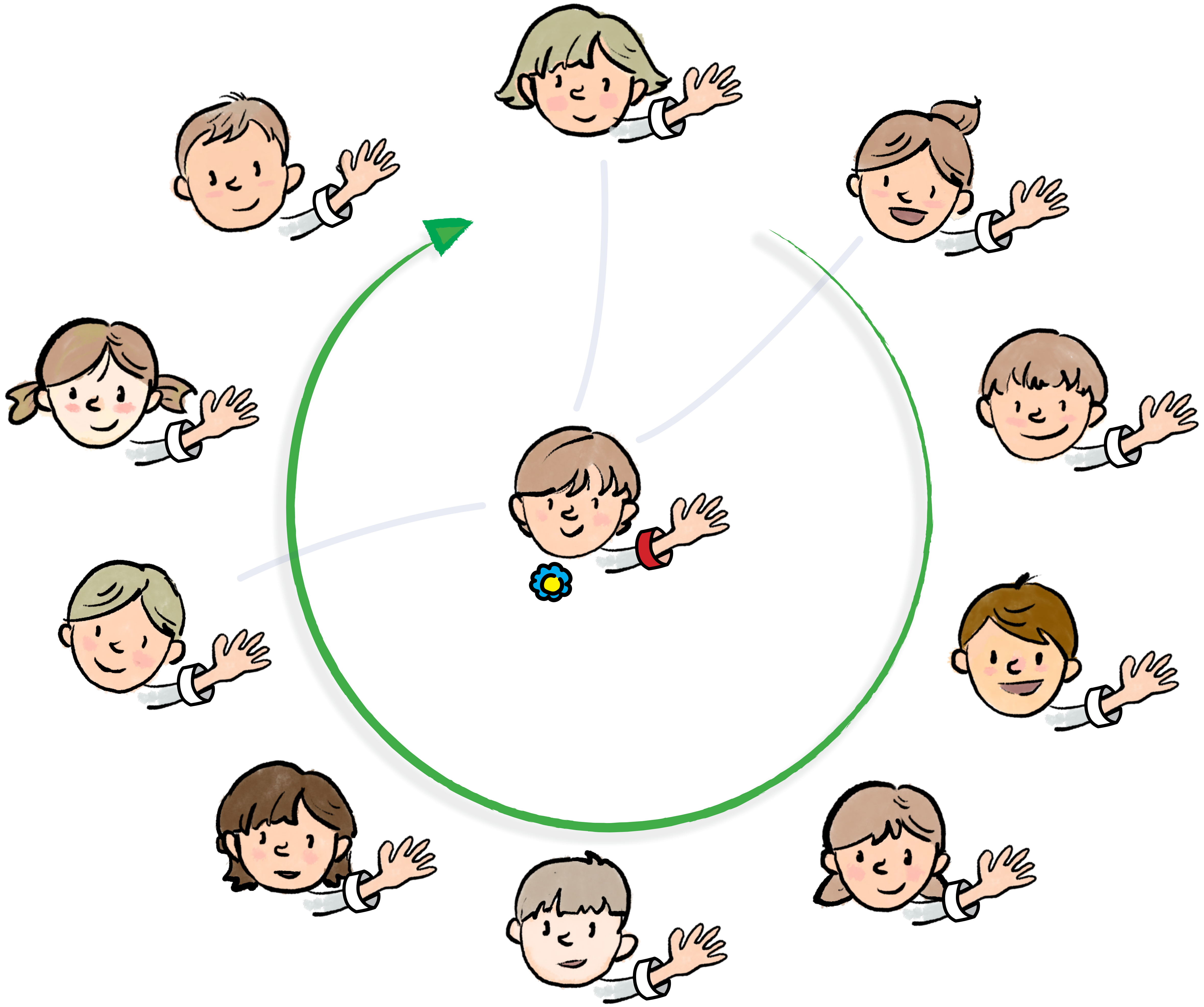
INTRODUCTORY STEP – PART THREE



The first infected player replaces their white bracelet with a red one and sits in the middle of the circle.

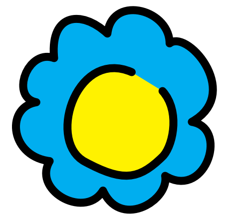
Each infected player waits for *N* game rounds in a recovery in order to become healthy again.

1ST STEP

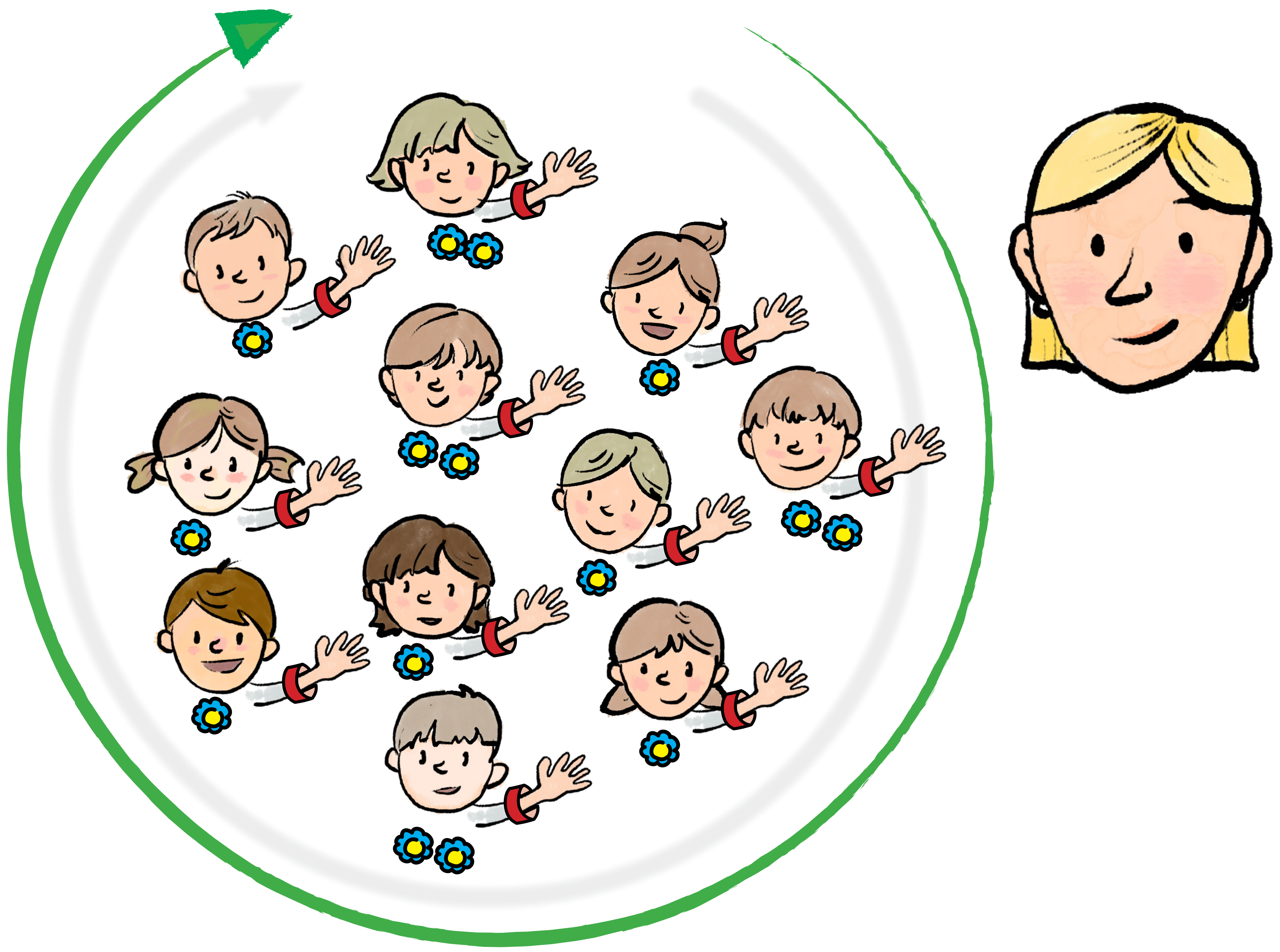


Players that are not wearing a red bracelet walk one full lap around the infected players sitting in the center. After that they stop and sit down.

Each infected player sitting inside the circle gets one token that marks a round they spent sitting in a recovery:



1ST STEP: NOTE 1

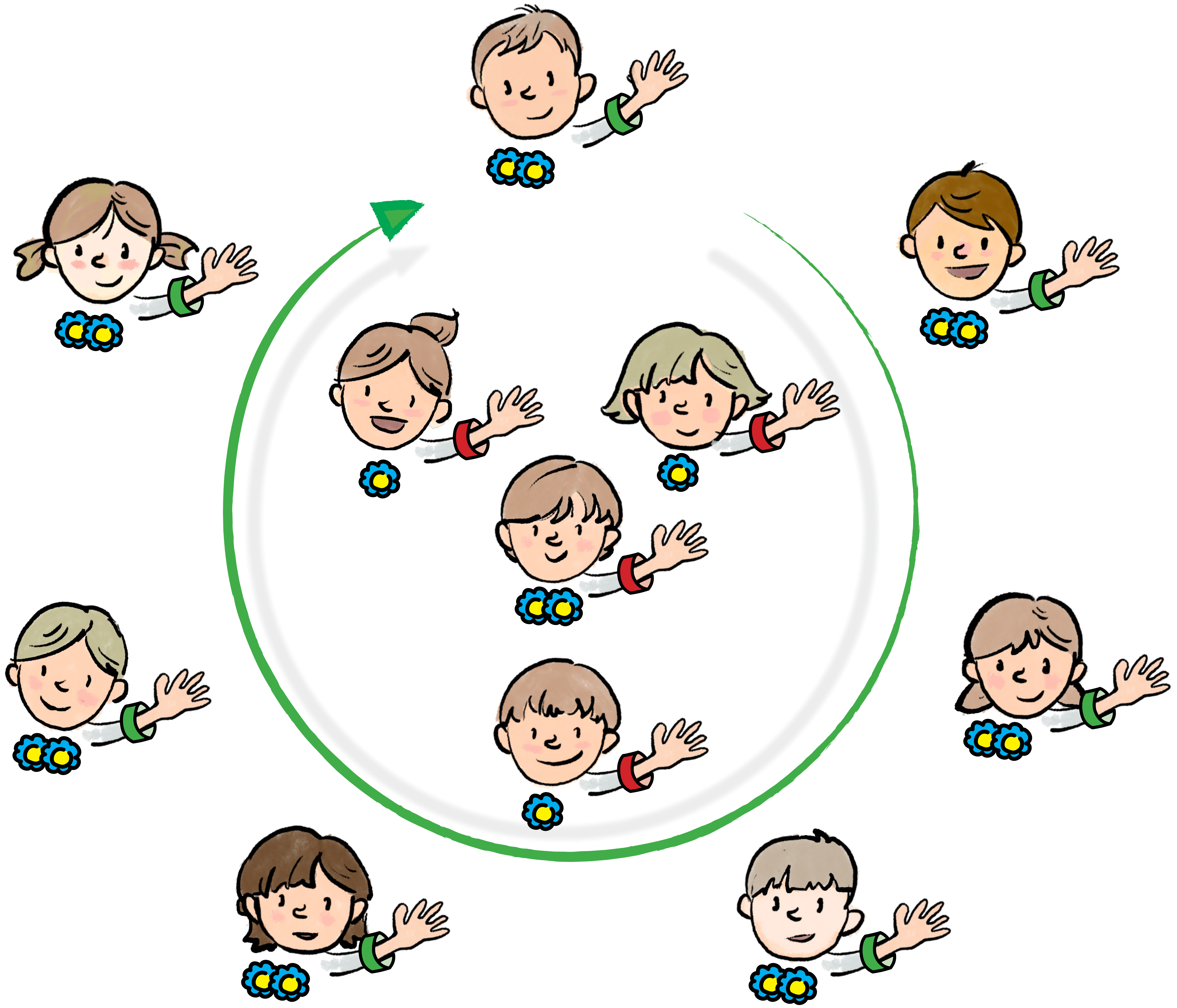


If every player in the game in an ongoing round is marked as infected (i.e. wearing a red bracelet), the game host then walks one lap around the group.

After that, each infected players gets one token that marks that round (a round they spent sitting in a recovery).

The game than skips to the fifth step.

1ST STEP: NOTE 2

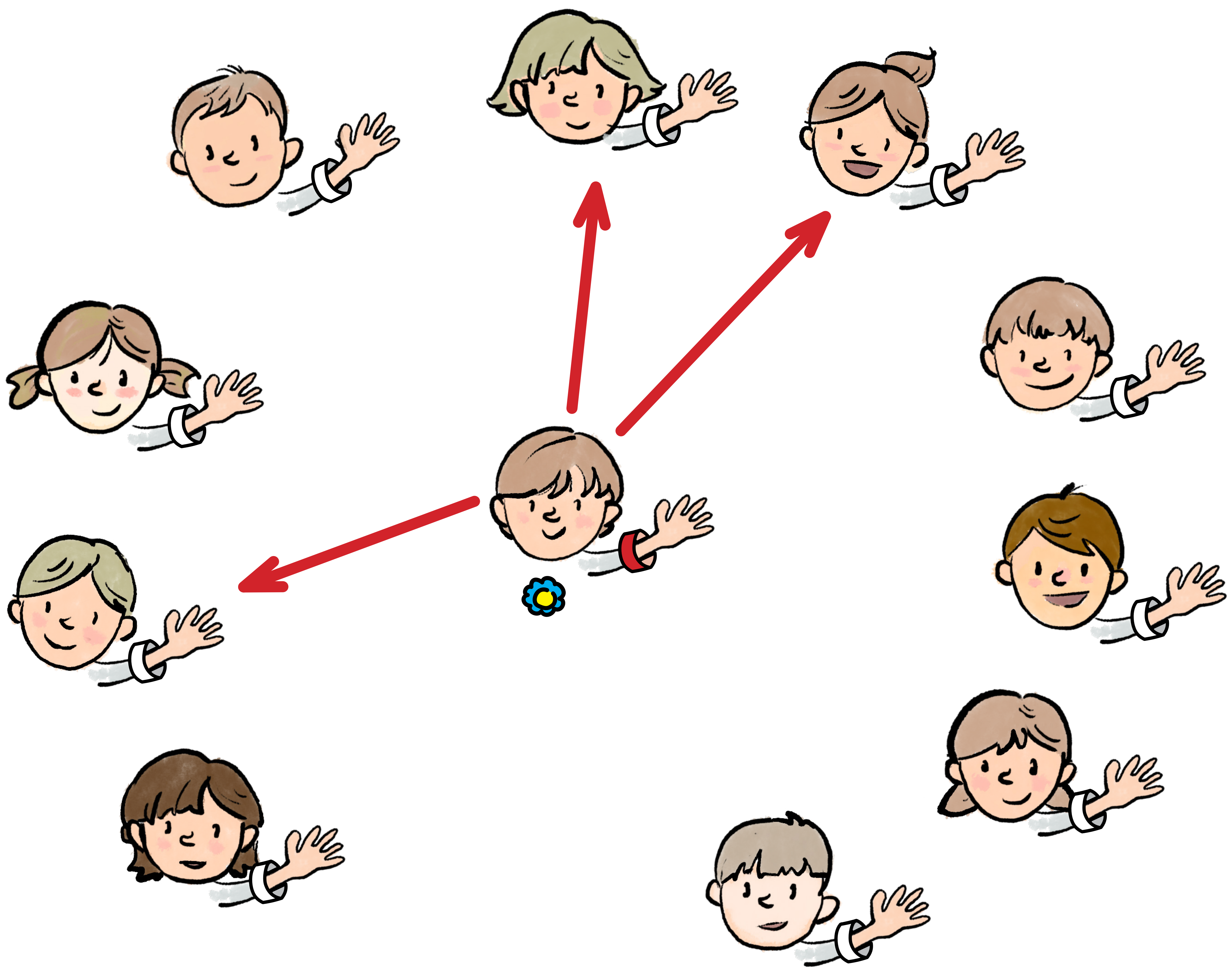


If there are no players wearing a white bracelet, then *all* players walk one lap.

After that, each infected players gets one token that marks that round (a round they spent sitting in a recovery).

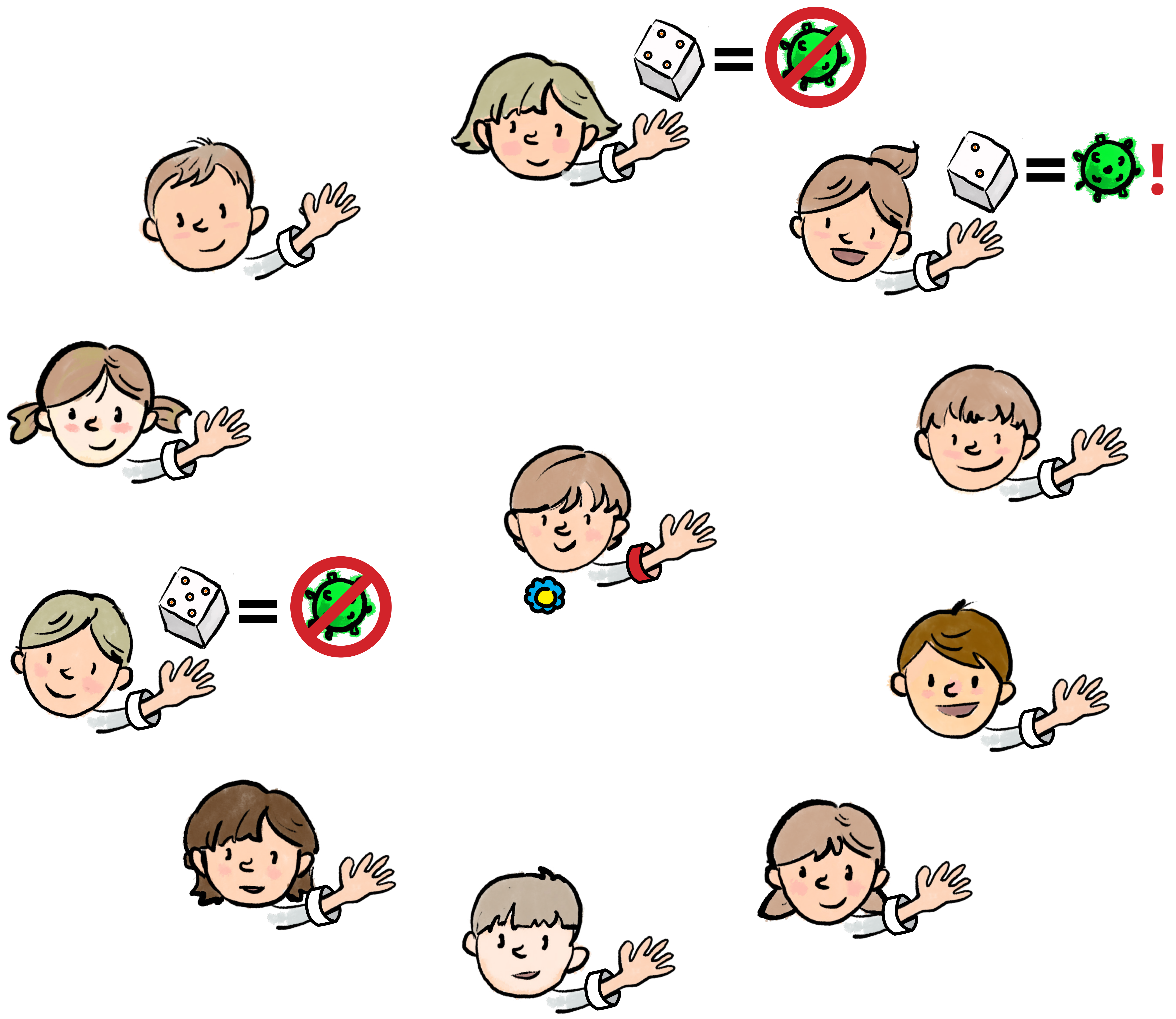
The game than skips to the fifth step.

2ND STEP



We check the network of connections (the large paper sheet with names/pictures and lines between them) and find all the players that are connected with the newly infected one.

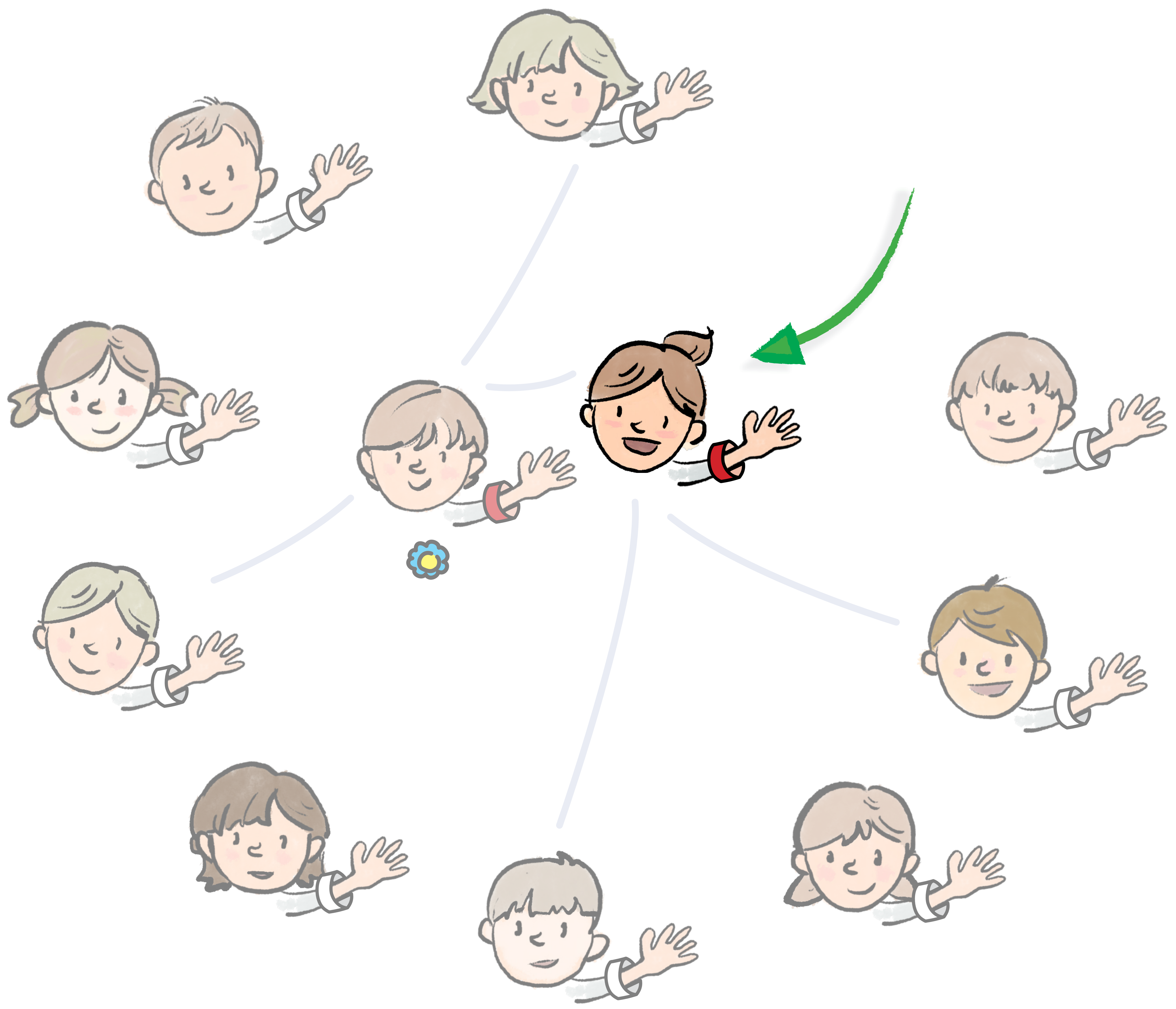
3RD STEP



Each selected players rolls a dice. Rolled value will determine whether the player is infected or not.

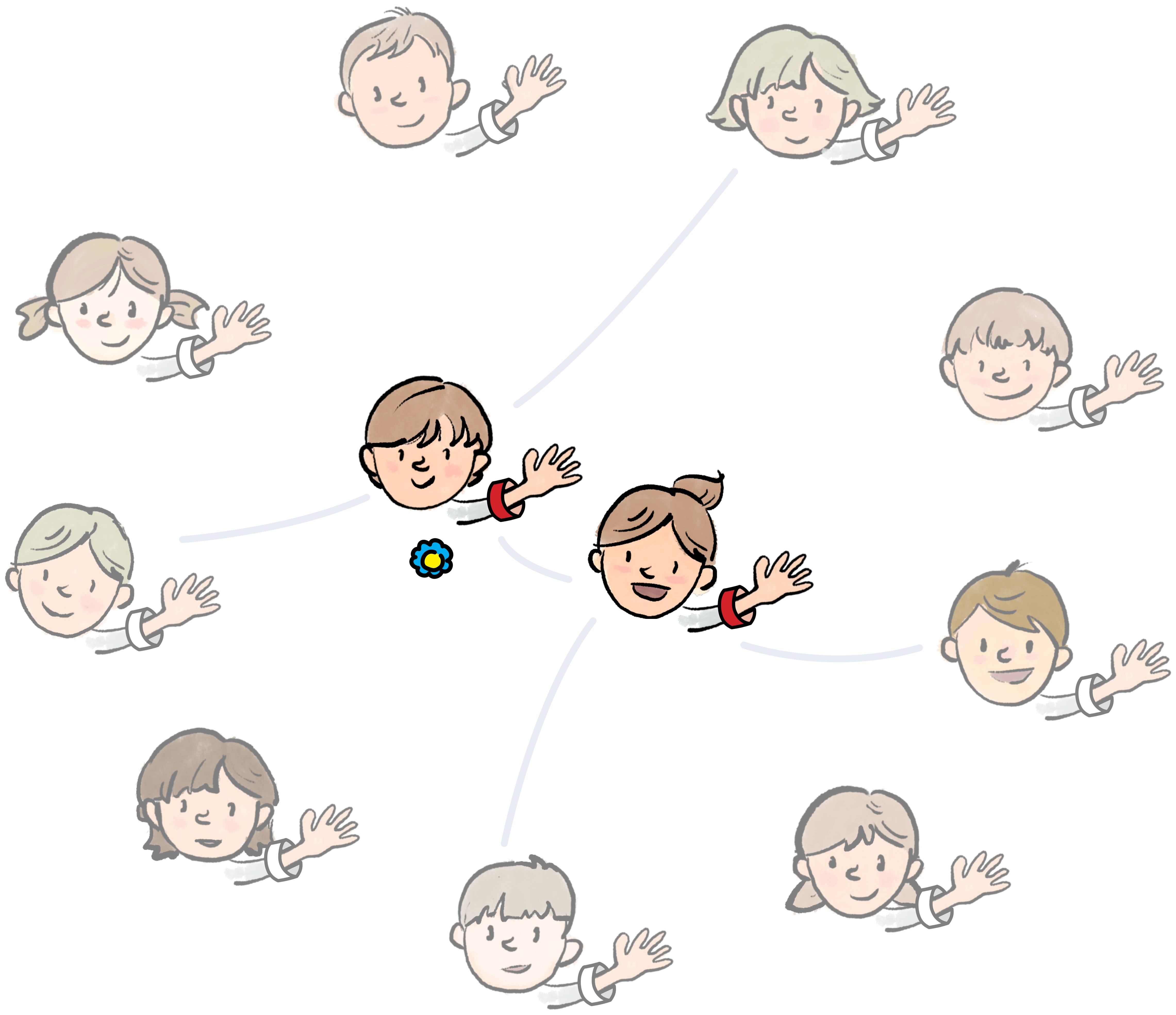
If a rolled value is *less than or equal to K*, then the player is marked as infected.

4TH STEP



Each newly infected player puts on a red bracelet and sits in the middle of the circle.

5TH STEP

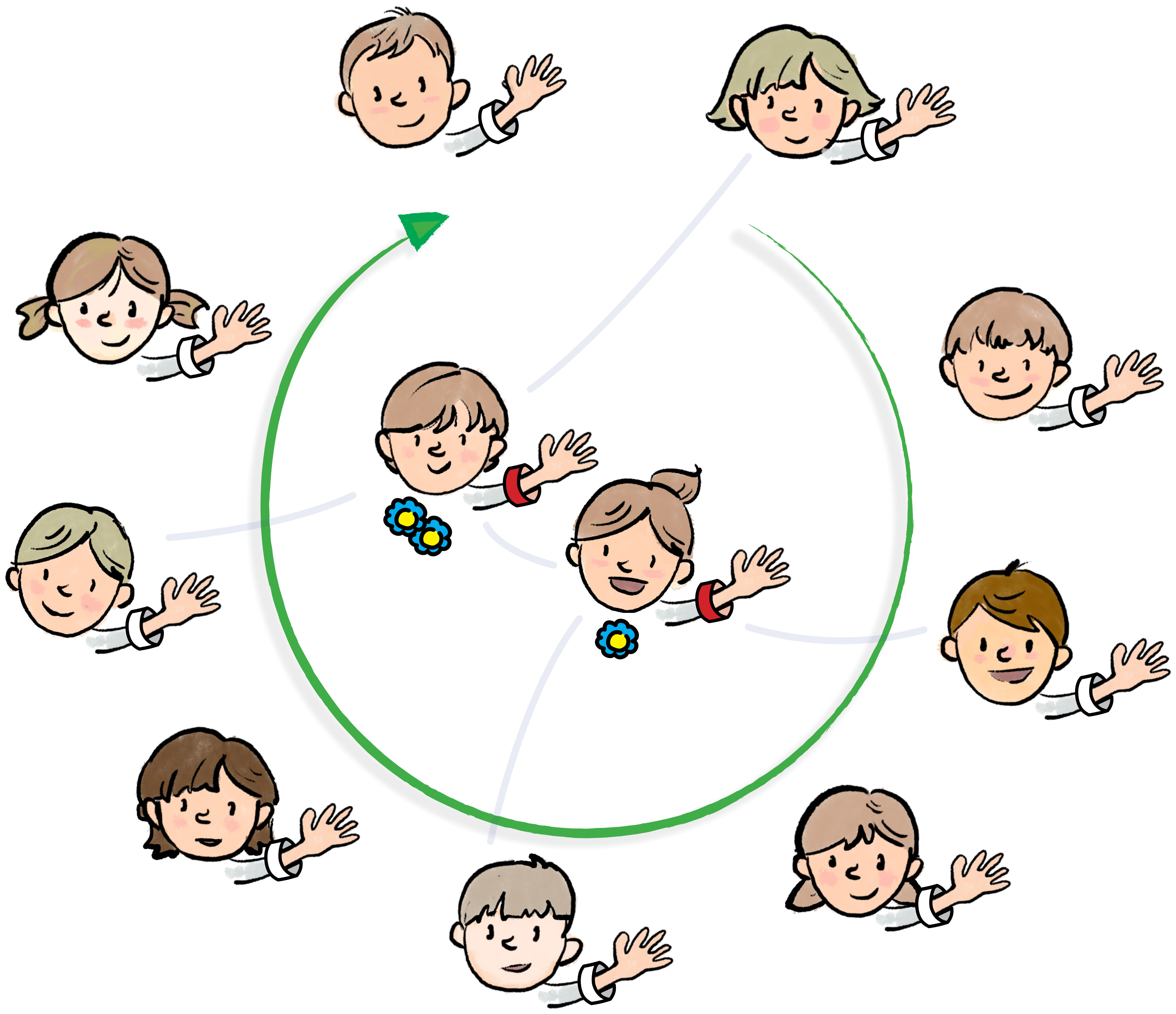


The game host checks if there are any infected players with *N* tokens sitting in the middle of the circle.

If there are, then each of those players replaces their red bracelet with a green one and returns into the circle with healthy players.

After this step one round is completed and the game goes back to the 1st step.

1ST STEP (ROUND 2)



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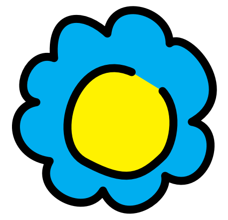
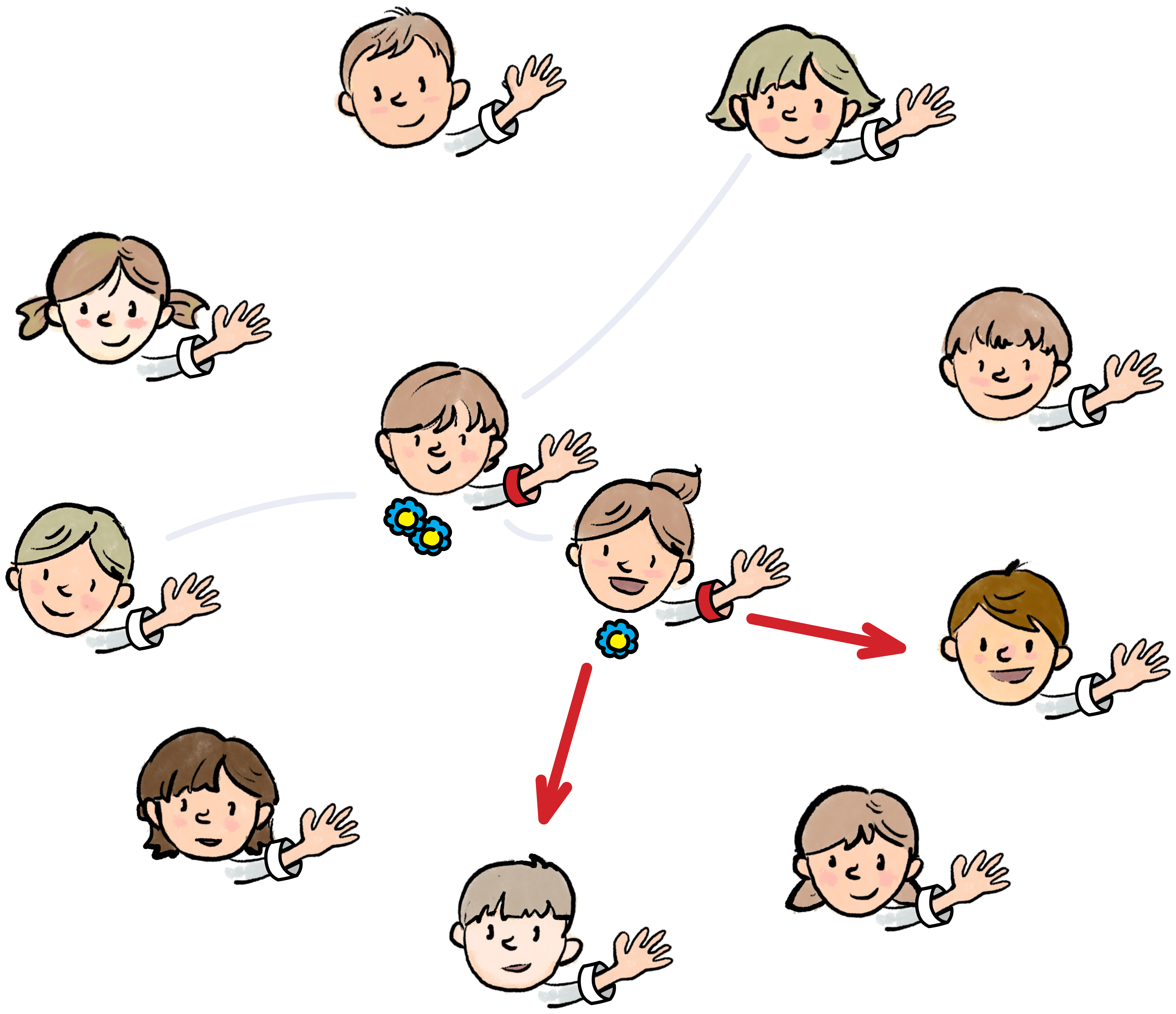


2ND STEP (ROUND 2)



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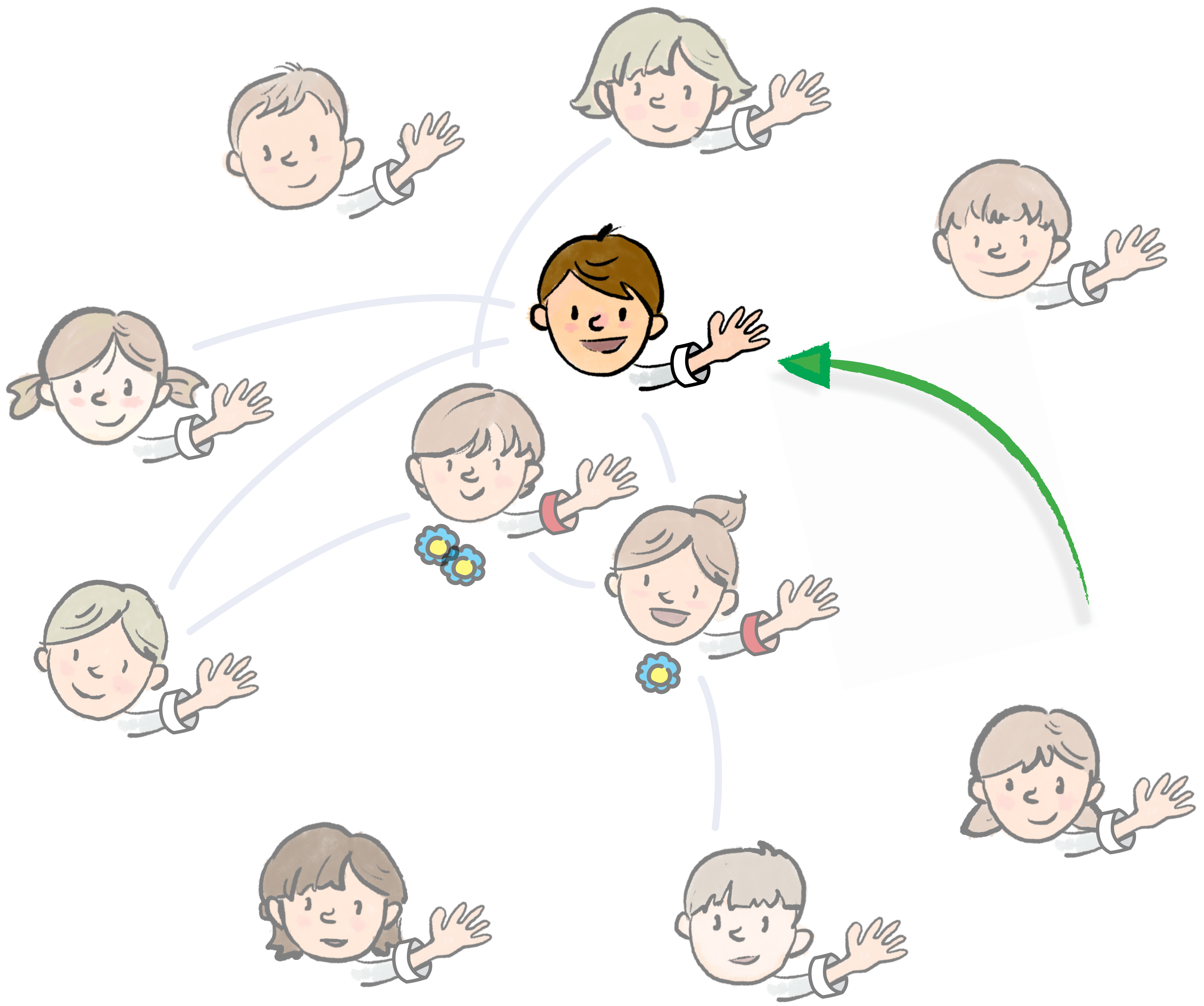
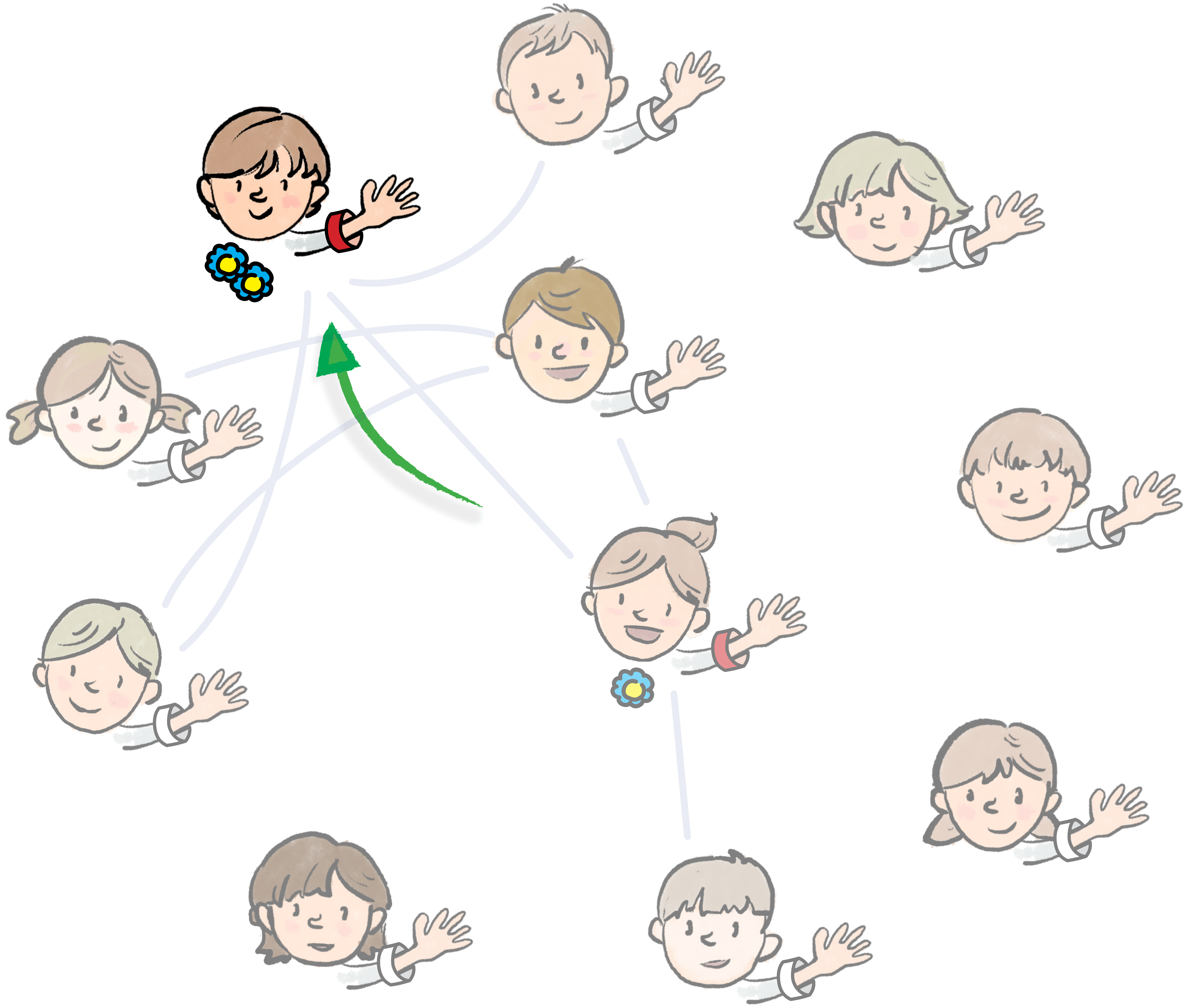


Each newly infected player puts on a red bracelet and sits in the middle of the circle.

5TH STEP (ROUND 2)



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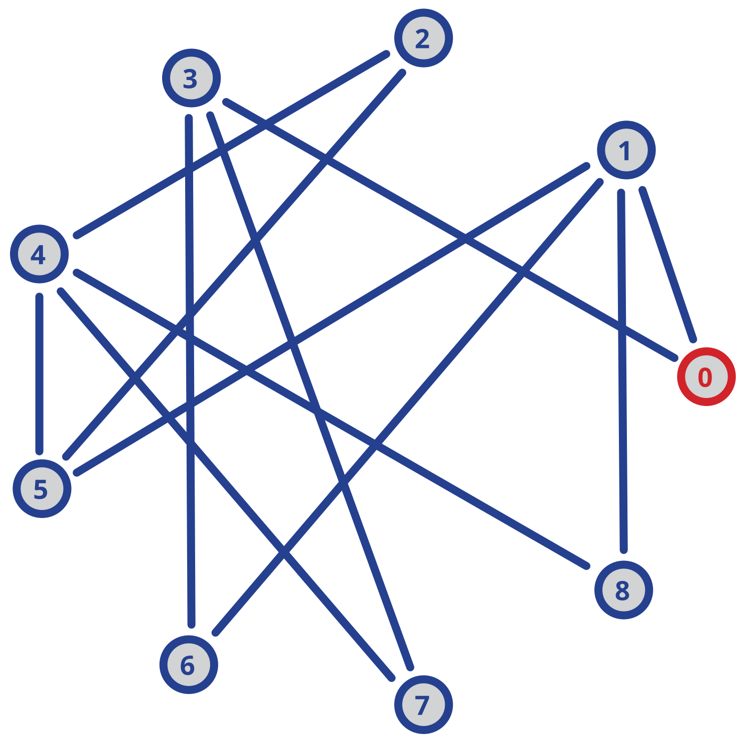
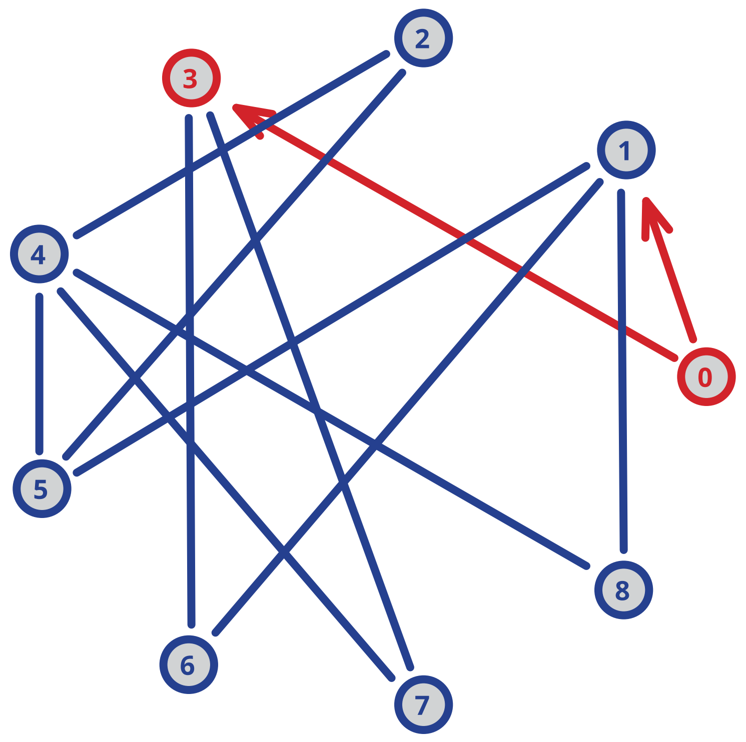
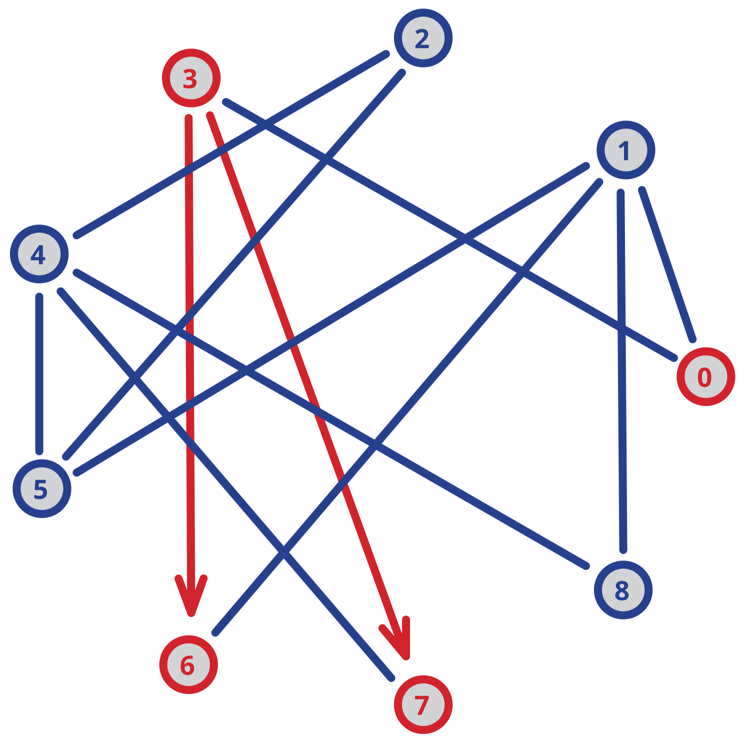
PLAYTHROUGH EXAMPLE



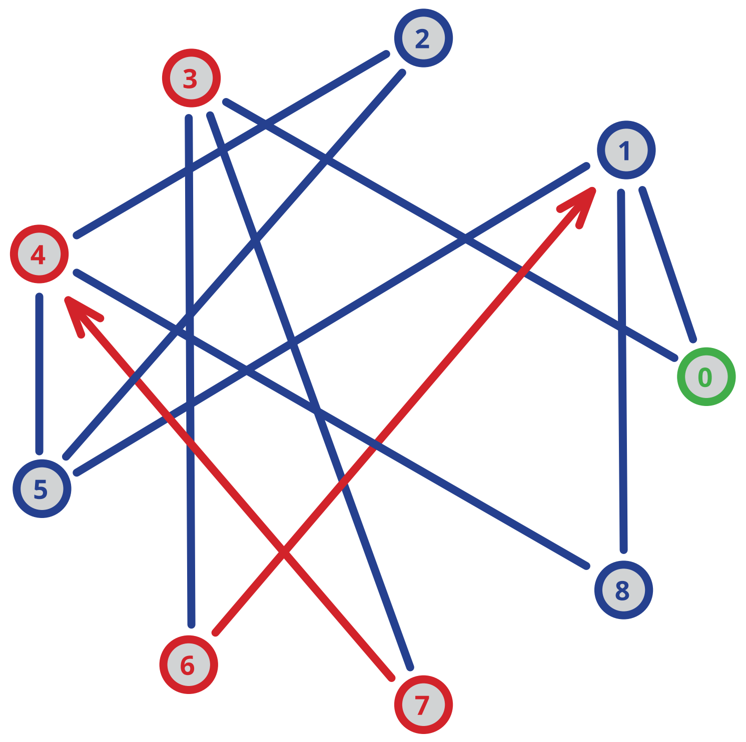
Introductory step



Round 1

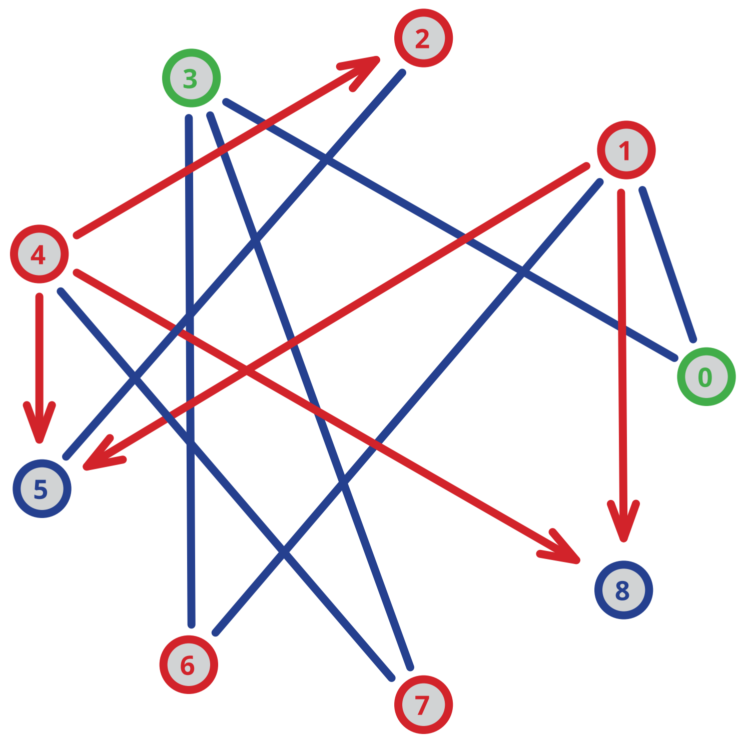


Round 2

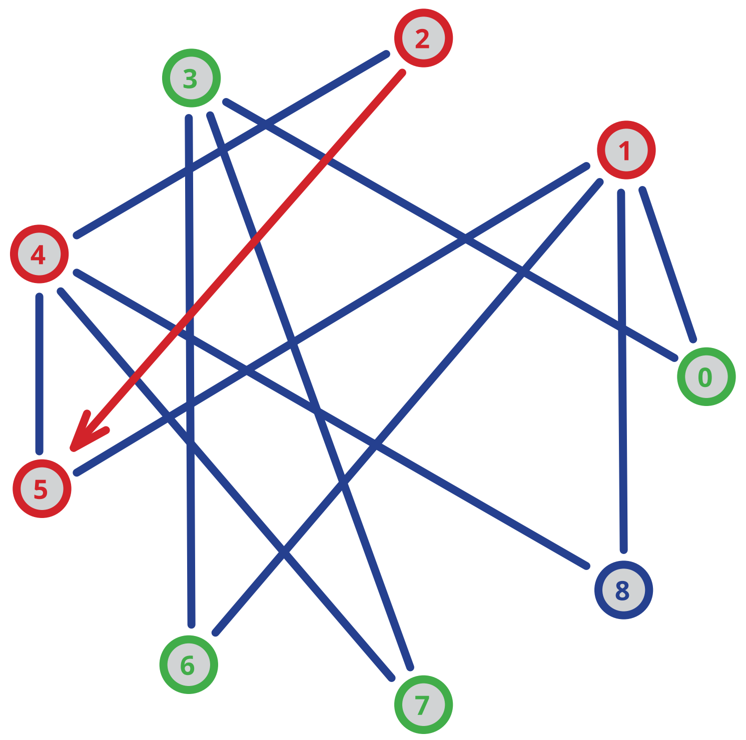


Round 3

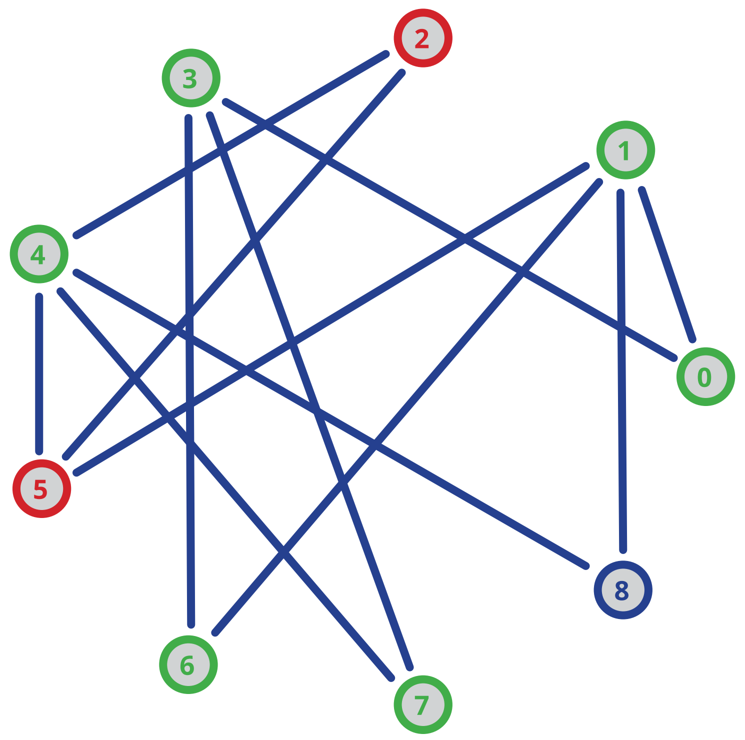
PLAYTHROUGH EXAMPLE



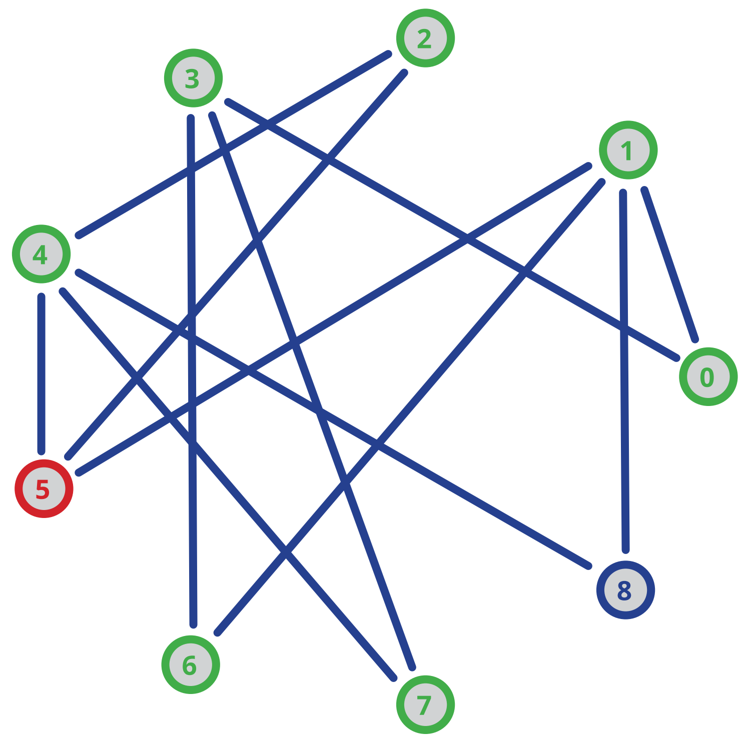
Round 4



Round 5

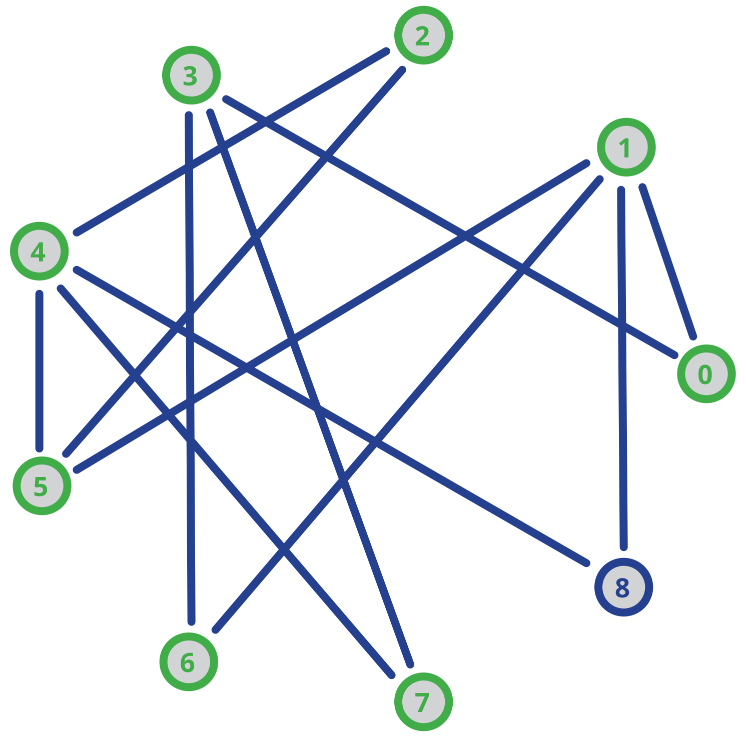


Round 6

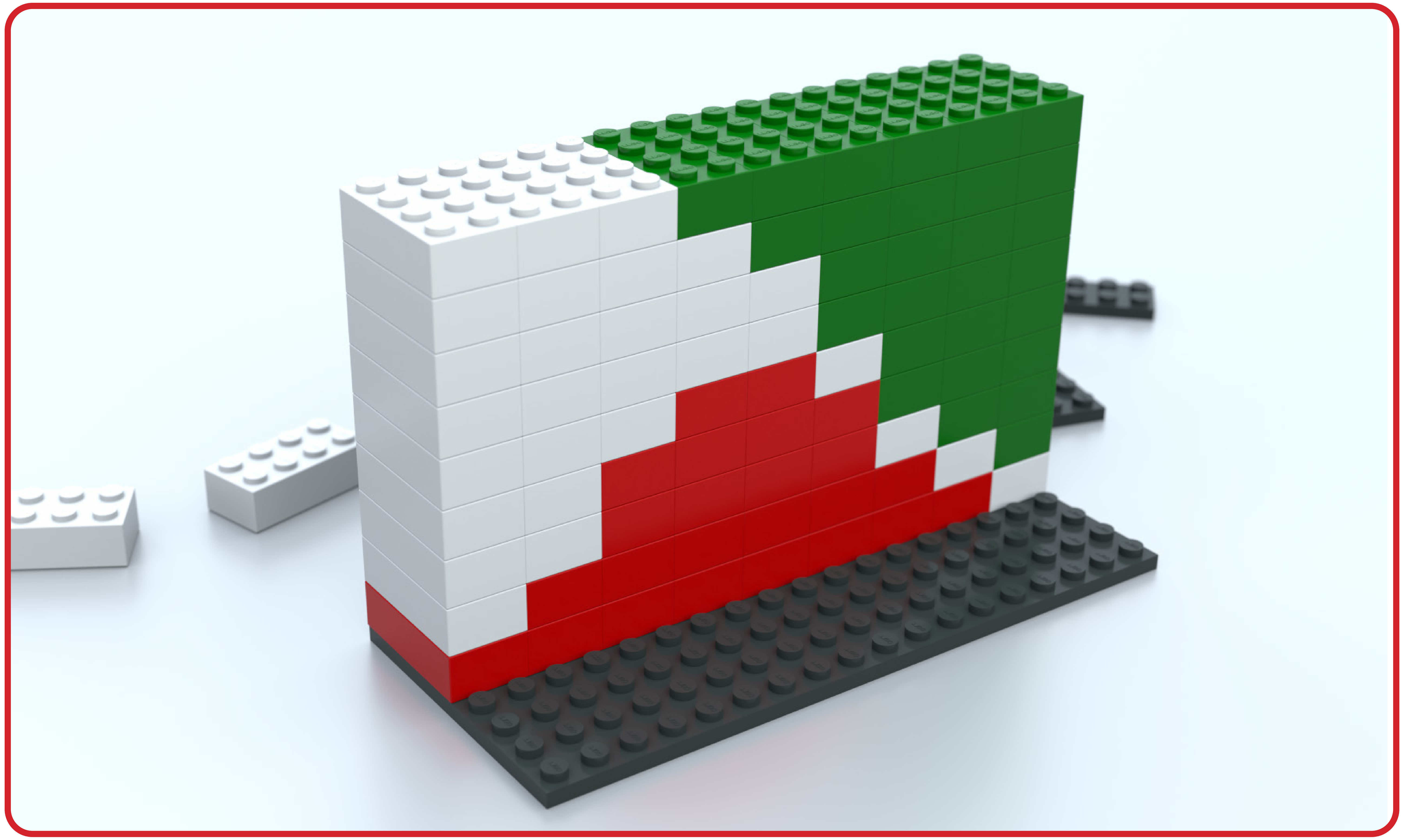


Round 7

PLAYTHROUGH EXAMPLE

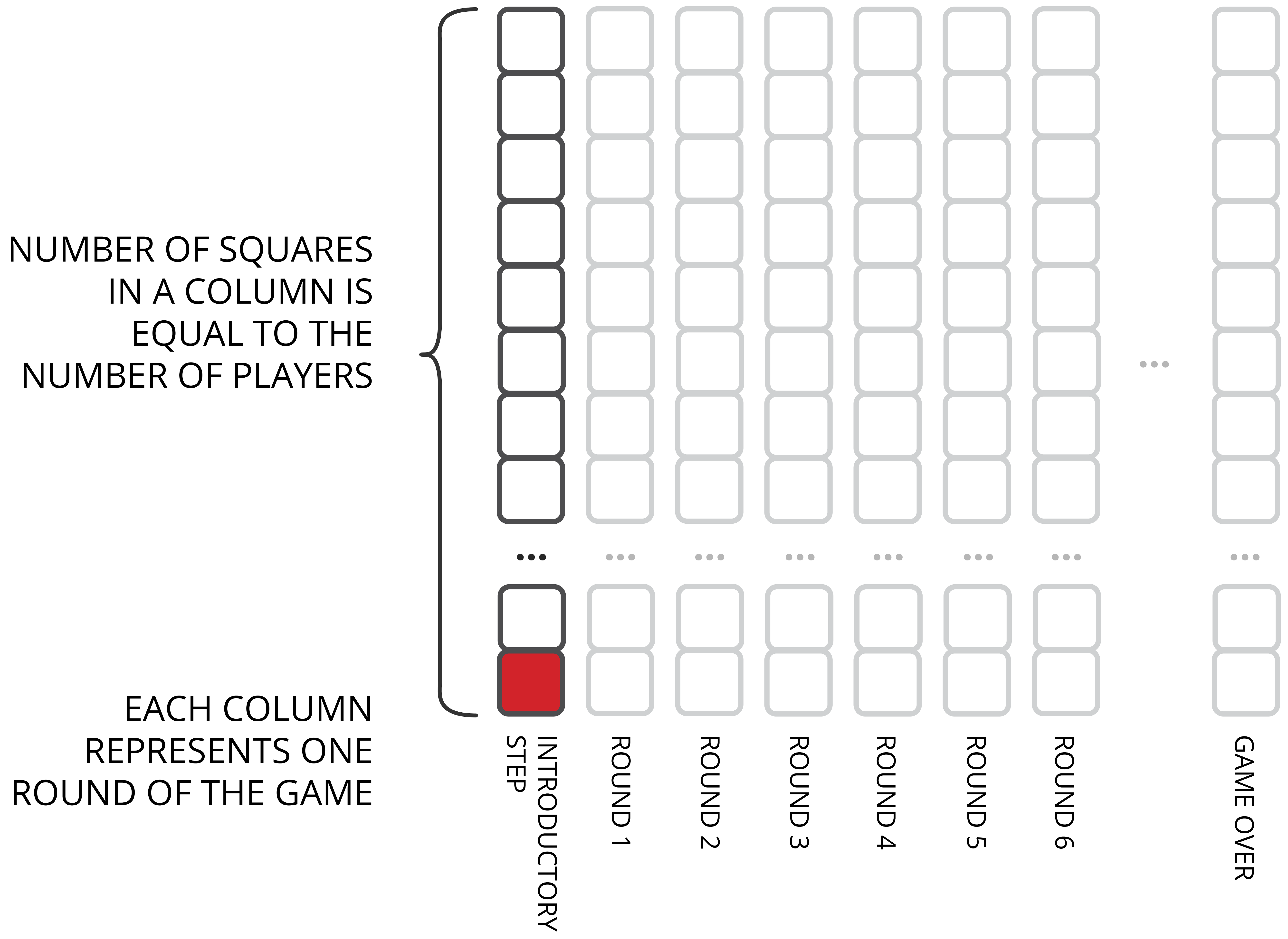


Round 8



Total number of kids in the game = 9, probability of disease transmission K=4, an average number of friends P=3, duration of illness N=4

APPENDIX: HISTOGRAM



If an additional goal of a game is to teach about numbers, keeping a tab on numbers of infected and healthy players is a great exercise.

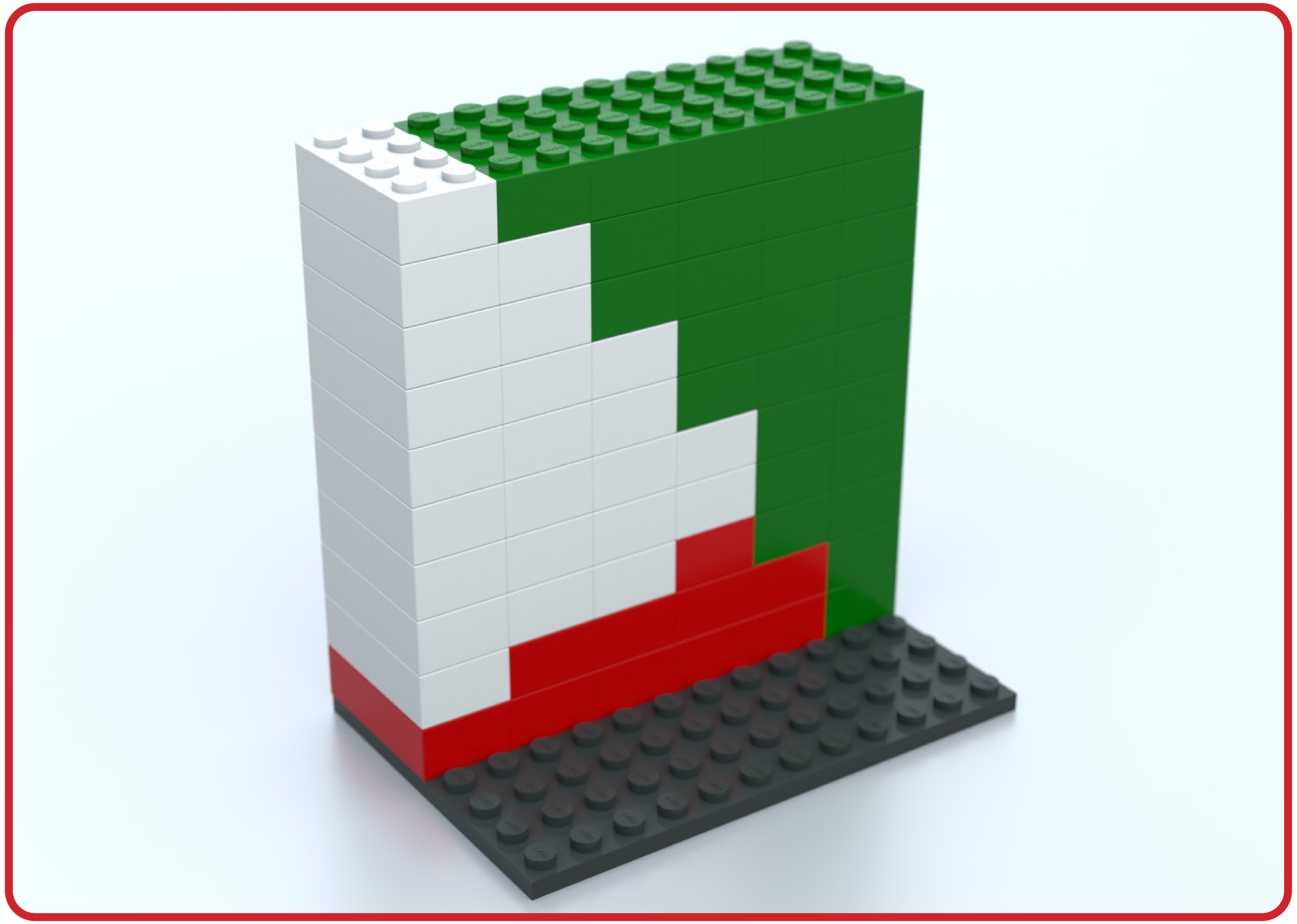
For this purpose we suggest you use a histogram, where each column has as many squares as there are players in the game.

Columns represent game rounds. The color of a square matches the bracelet color of a corresponding player.

The nice way to construct a histogram is to use Lego bricks or similar toys.

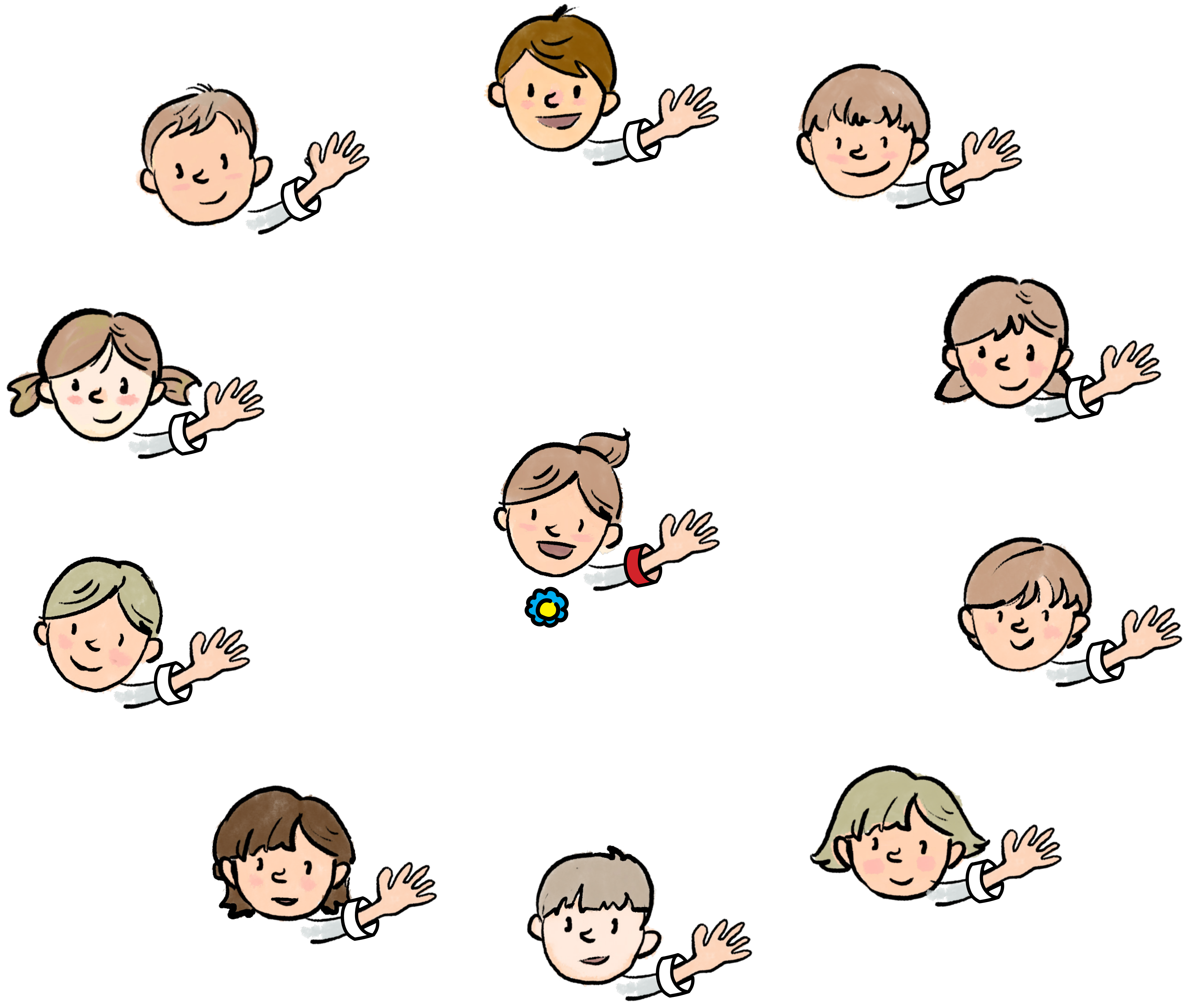
The colors of squares are filled in at the end of each round!

APPENDIX: HISTOGRAM

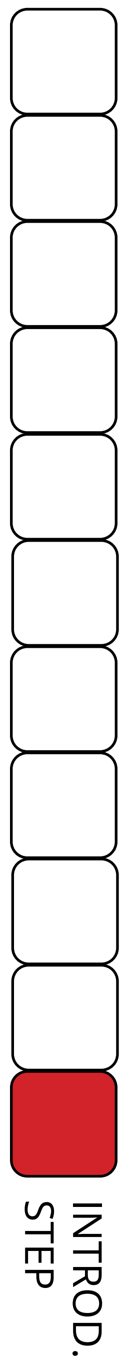


An example of a histogram constructed out of Lego bricks.

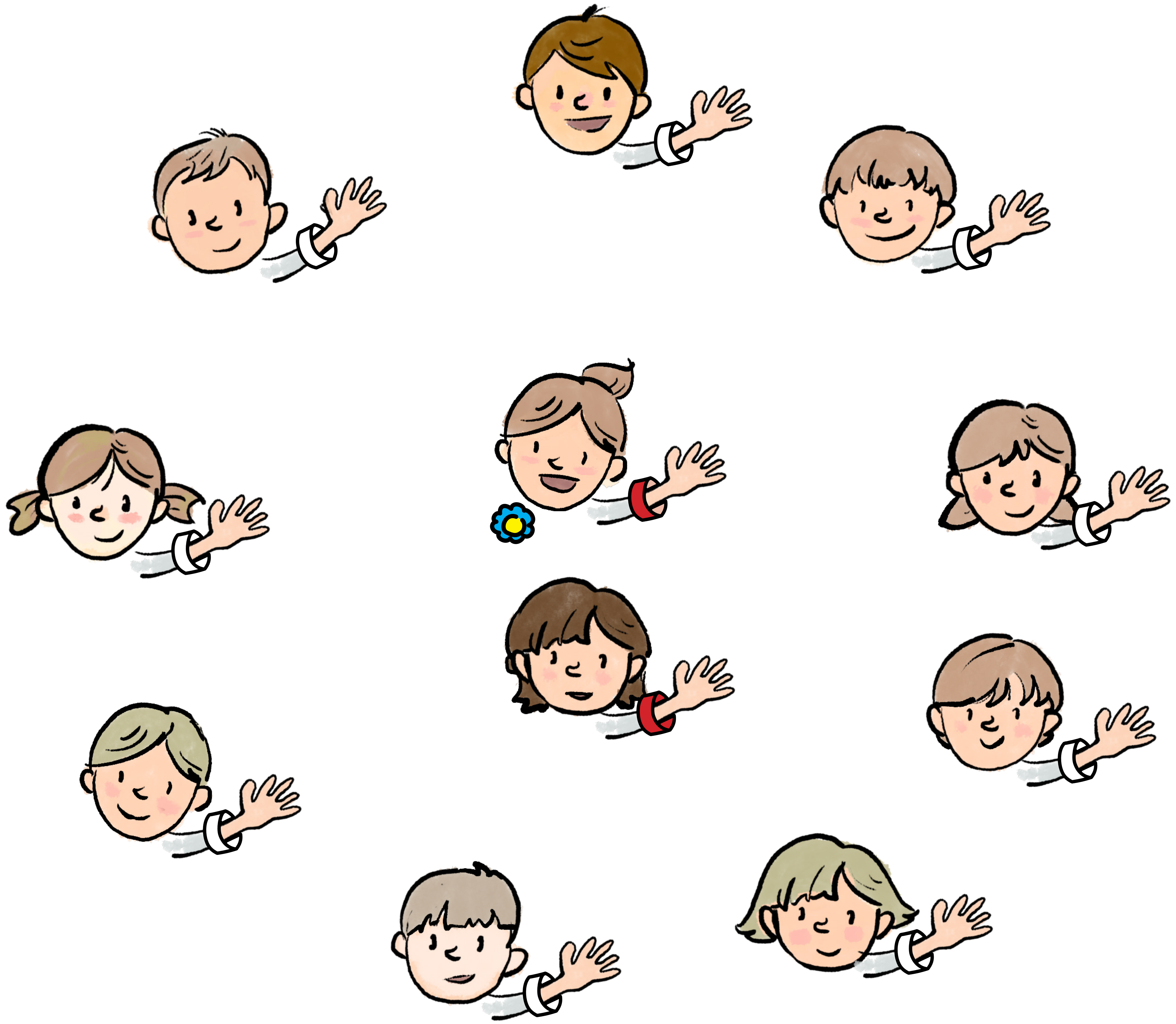
INTRODUCTORY STEP: HISTOGRAM



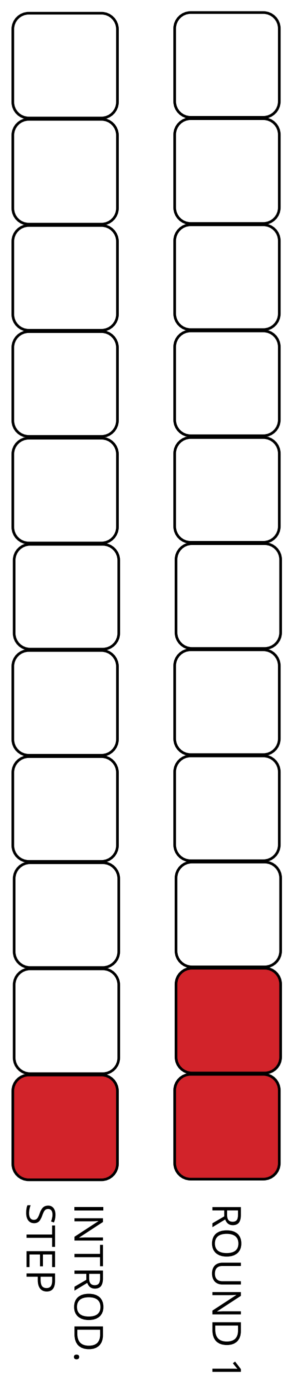
At the end of the introductory step we always have the following game state: one red square - representing infected player. All other squares are white.



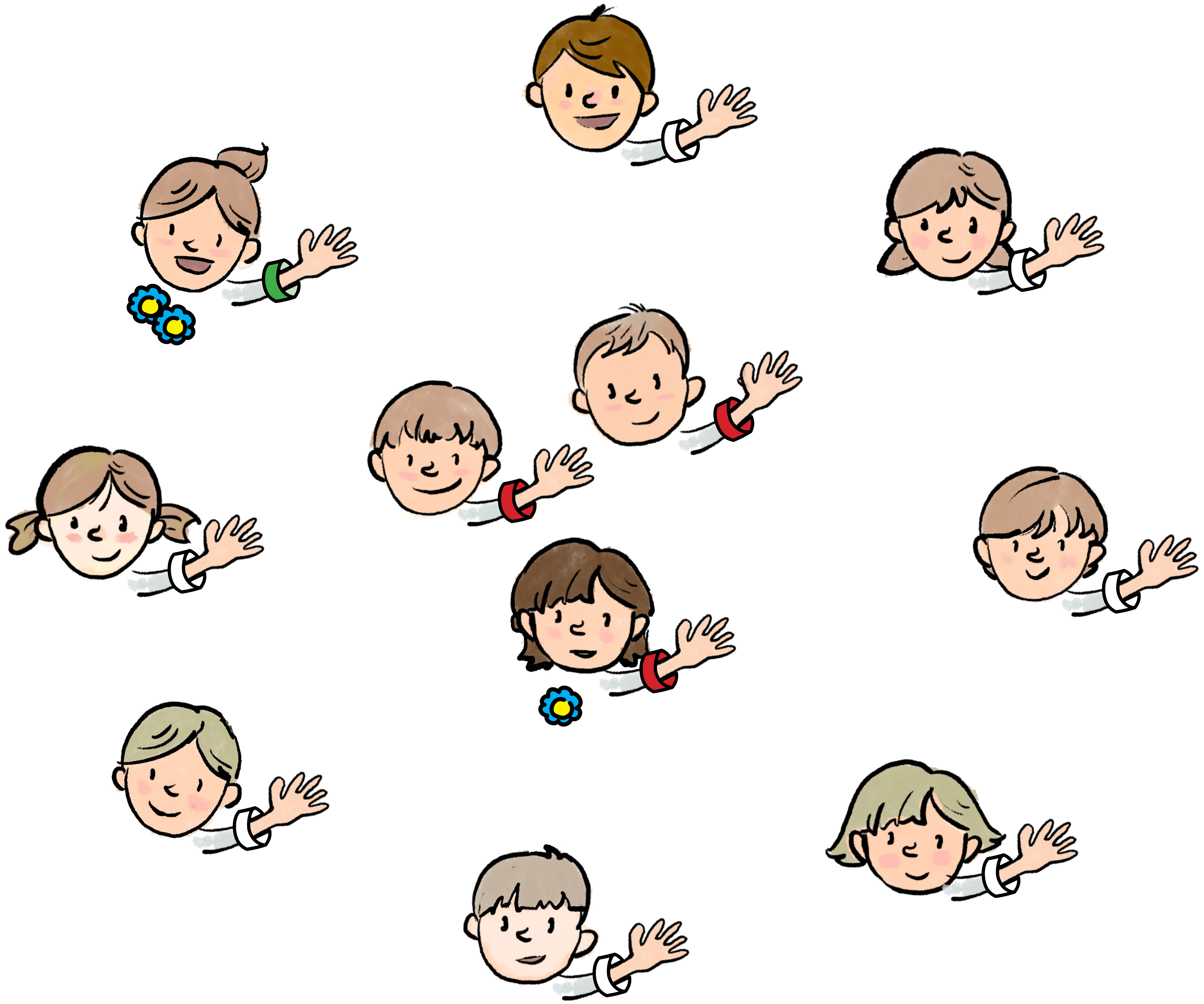
1ST ROUND: HISTOGRAM



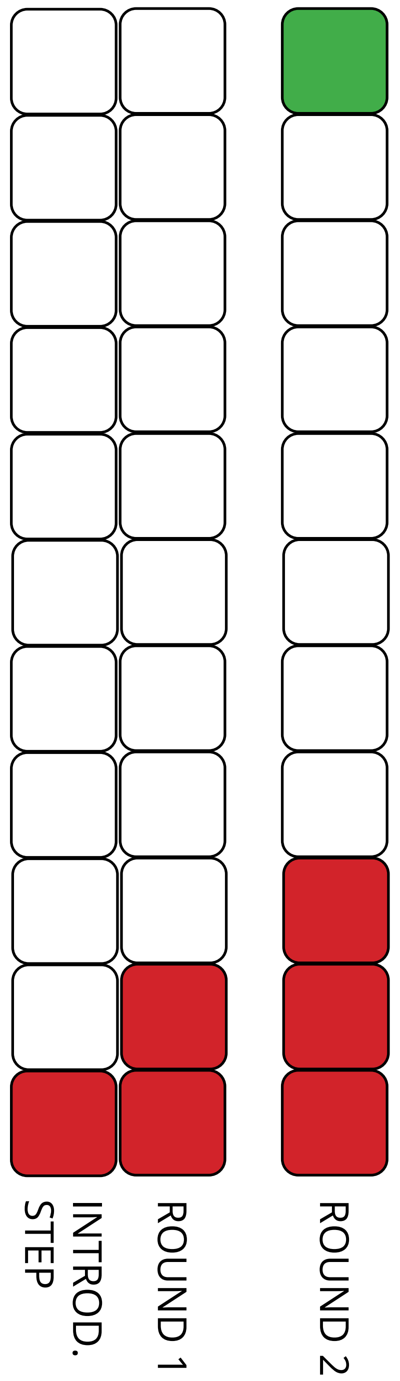
At the end of the first round the number of red squares (infected players) increases.



2ND ROUND: HISTOGRAM

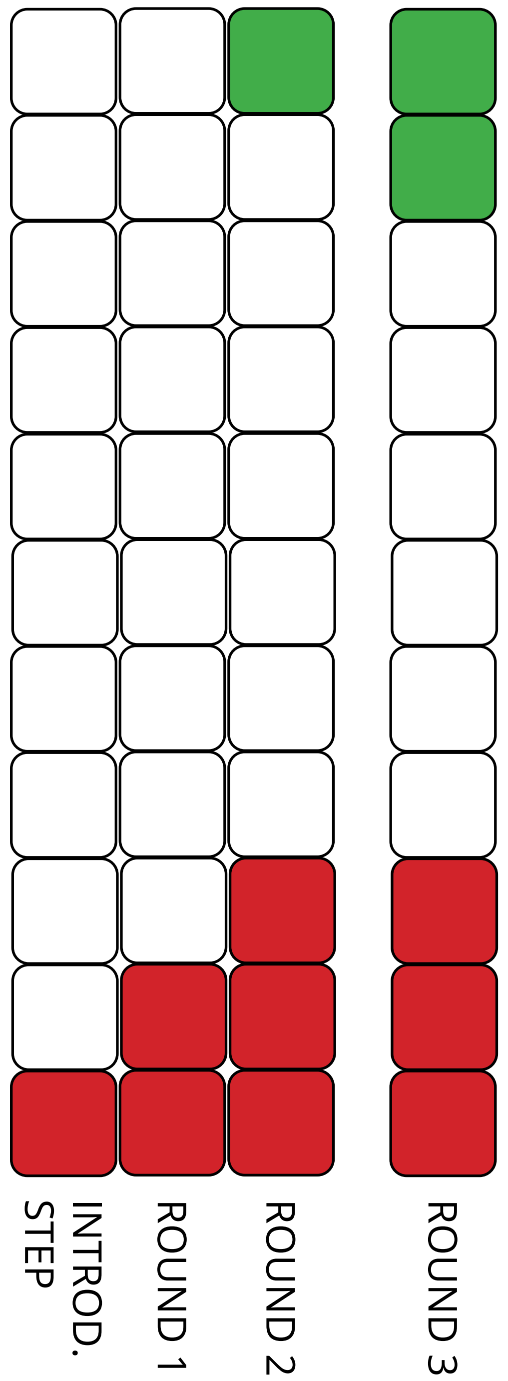


At the end of the second round we have the first green square (recovered player) and the number of red ones (infected players) increases further, while the number of white squares decreases.

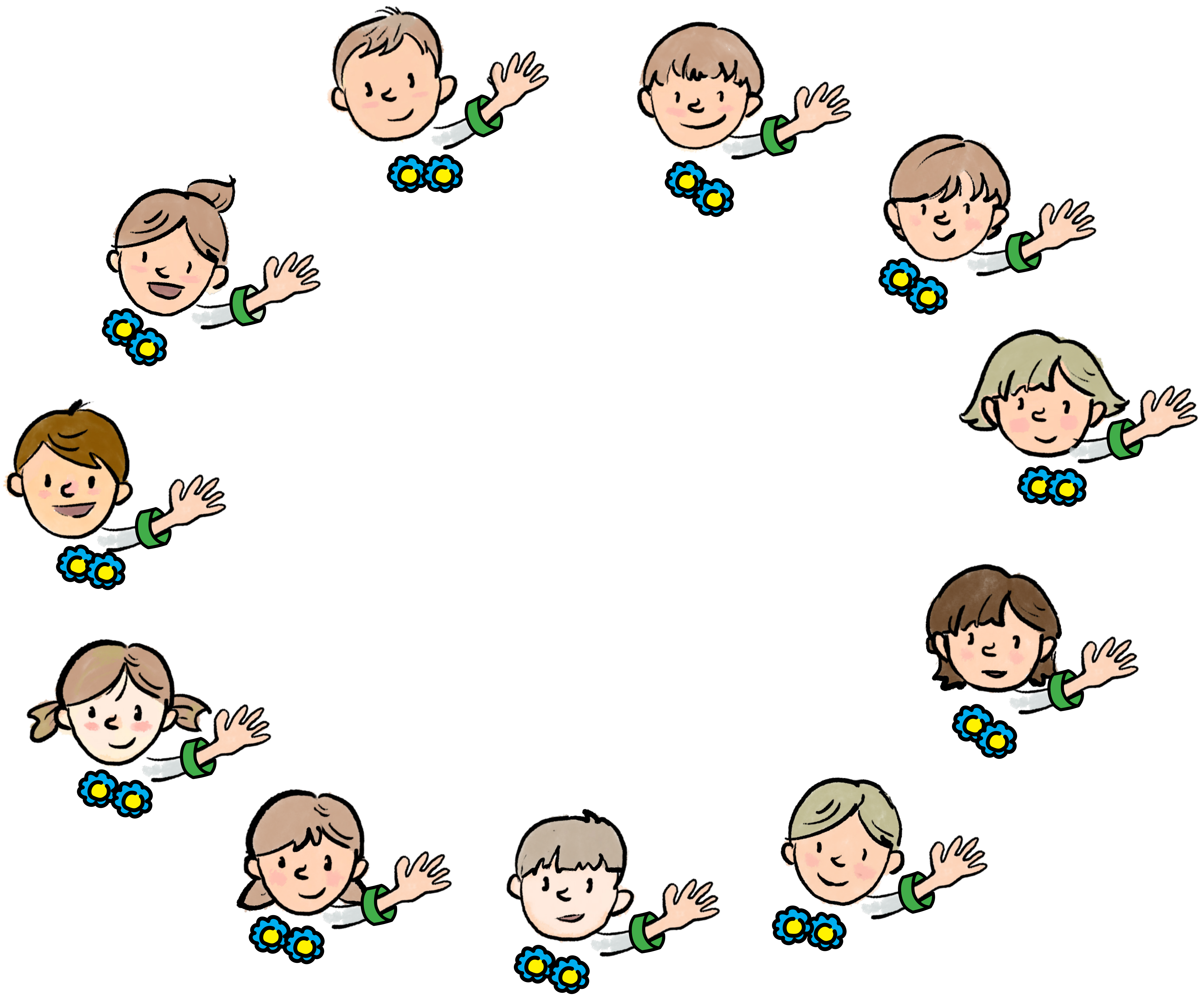


3RD ROUND: HISTOGRAM

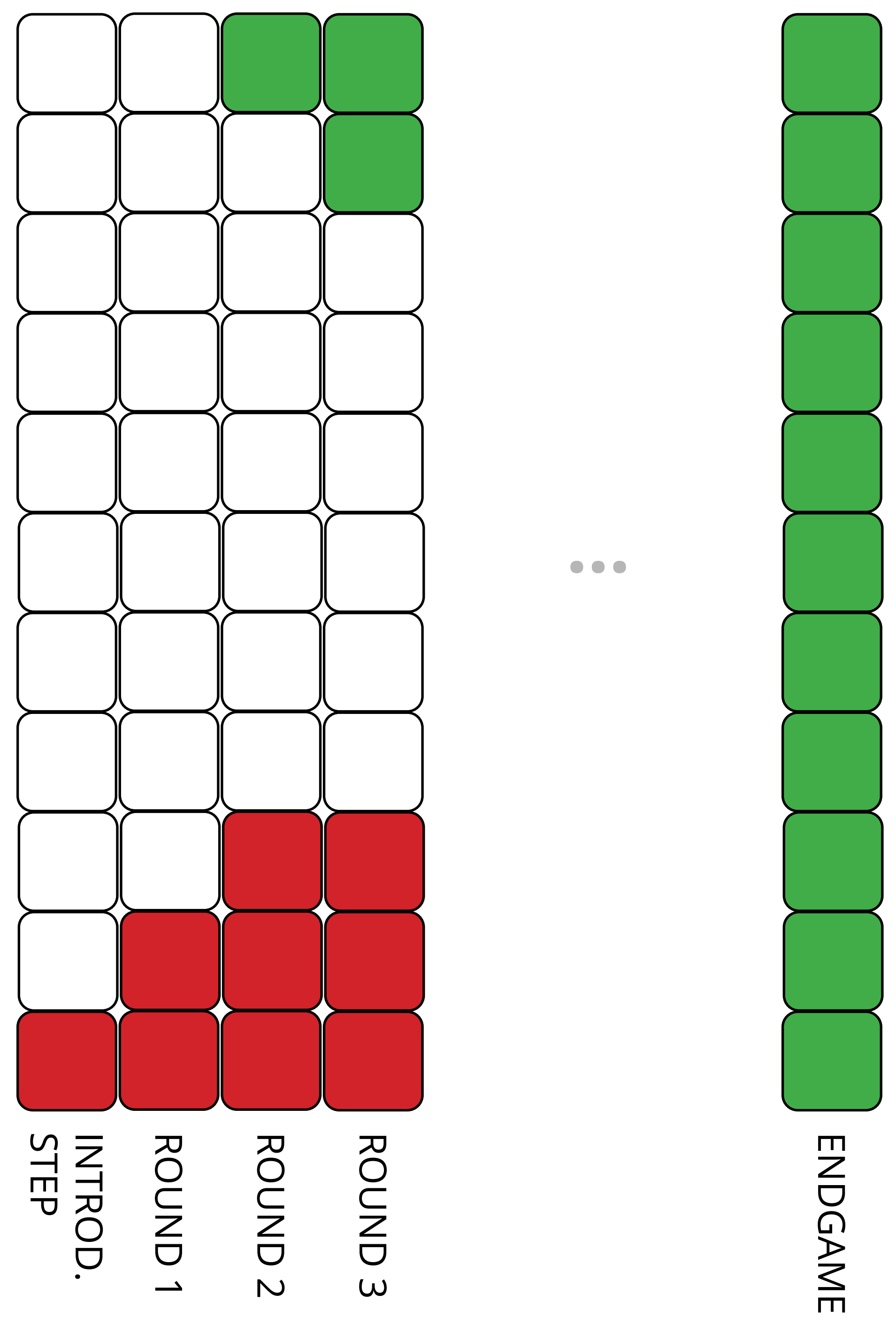
At the end of this round the number of green squares (recovered players) increases even more.



THE FINAL ROUND (ENDGAME): HISTOGRAM



At the end of the game, either all squares are green (each player is recovered) or the number of red squares (infected players) is zero.

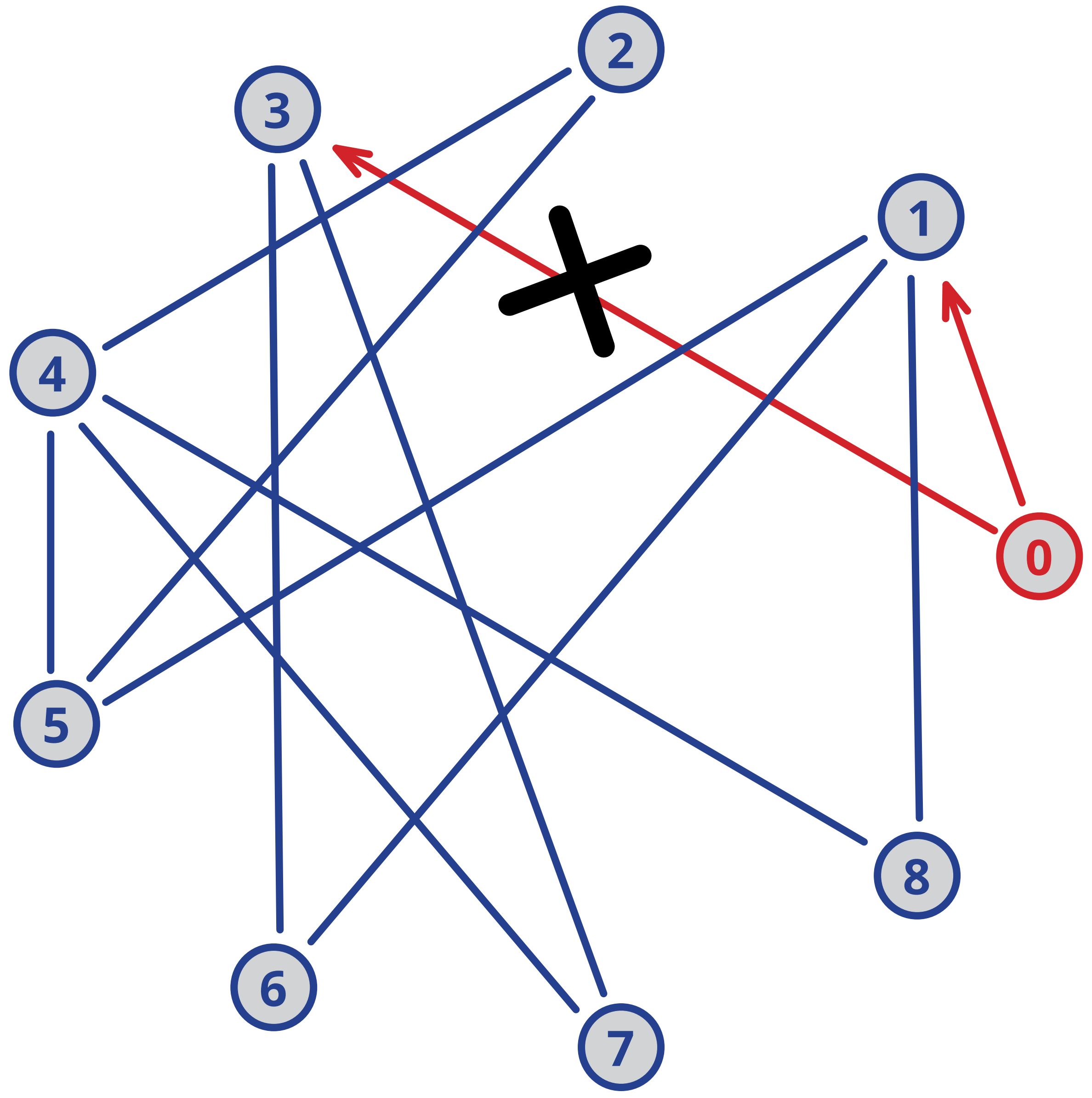


WHAT DID WE LEARN?

The importance of the network of contacts:
Spread of a infectious disease is made possible by the social contacts between the infected. The way we socialize and how often we socialize influence the spread of infectious diseases.

Coincidence and unpredictability:
Details can affect whether a disease will turn into an epidemic or not.
For example, ROUND 1 in the example of a playthrough could have ended without infecting person 3 and the spread would have been over in few turns just by chance. But we can also see how one infected person can cause a large epidemic.

Statistics and predictability:
In real life, situations like these are constantly taking place around us.
Therefore, when scientists study the spread of a disease, they play a lot of games like this one - using computers and observing possible outcomes and consequences of the disease spread, whether it is something fairly certain or unlikely. This allows them to make decisions about what needs to be done to curb and stop the spread.



WHAT DID WE LEARN?

If you have played only one sesion of game A:

The importance of the number of contacts: the disease spread quickly and infected many children because the number of contacts was large (number *P*). This is why during the pandemic we had to stay at home so as not to spread the infection to others.

Kindergartens and schools are places where children come into many contacts with other children (number *P*) and therefore infection can spread quickly in those places.

The importance of hygiene and masks: when we come in contact with an infected person, we want to protect ourselves by reducing the likelihood of transmitting the infection (number *K*).

The importance of the vaccine: vaccinated children would be given green bracelets at the beginning of the game and could not get infected, which would reduce both the total number of infected and slow the spread of the infection.

If you have additionally played one session of game B:

“Curve smoothing”: we want to avoid everyone getting sick at once because then hospitals cannot help all patients. That is why it is important to stay at home and reduce the number contacts P. Then the infected can transmit the disease only to a small number of other people, which reduces the number of infected, but the epidemic lasts longer.

If you have played either game A and/or game B multiple times:

The role of chance: each time we play the game, it is possible that the disease will spread in a different way through the network of contacts. We see how chance plays a big role, but also how such games explore possible outcomes of the spread of infection.

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