

## SUPPLEMENTS

### Section A: Optimization Results and Experiment Instructions

#### Overview of Resource Environment

We present the results of an optimization analysis to determine the social optimum of performance in the dilemma under different starting conditions and constraints.

Forty groups of four individuals each participated in this experiment. Our experiment created a real-time, renewable common-pool resource (CPR) environment. Group members see one another, and all of their actions (e.g., harvests, sanctions), on screen in real time. They can collect tokens worth \$0.02 each by moving their avatar over a token and pressing spacebar. The CPR itself was represented by a  $26 \times 26$  grid of cells, and the tokens occupy cells within the grid. Participants' payment was determined by how many tokens they harvested during the experiment, plus a \$5 show-up fee and minus any costs of punishment (as described in the manuscript). The experiment consisted of nine rounds, in which participants harvested tokens from their group's CPR. Each round lasted four minutes. The experiment was organized into four experimental treatments (Voted-Enforced, Voted, Imposed-Enforce, and Imposed), with three phases (baseline, treatment, cessation).

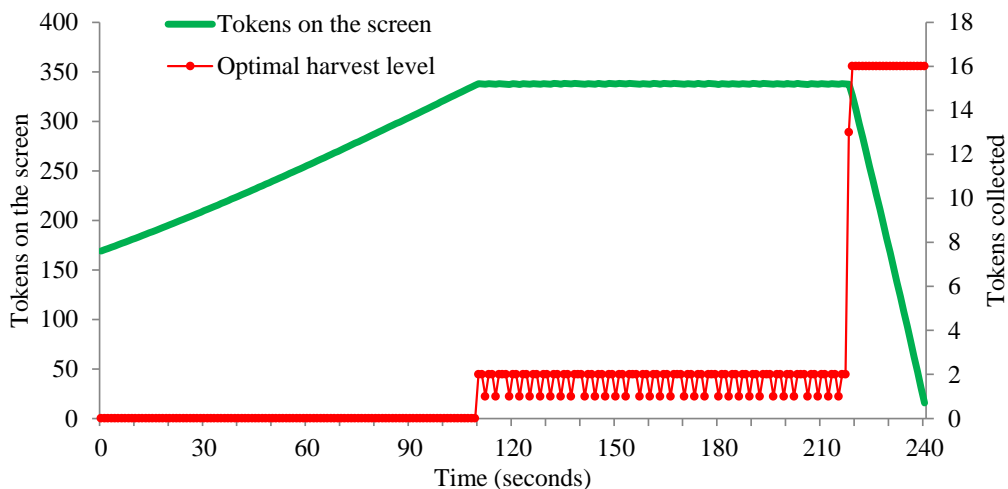
Participants' avatars began each round lined up horizontally in the middle row (13<sup>th</sup> cell) of the screen. The avatars and tokens were displayed on the screen for each group member to see. Therefore, group members (a) had complete information on the spatial location of the tokens (i.e., CPR), (b) knew how many tokens had been collected by each group member (this information was displayed in the upper portion of the screen), and (c) could clearly see each person's movements and harvesting actions. This information was displayed in real time. There was also a timer counting down how much time was left in each period displayed on the screen.

**Resource Characteristics.** The design features of this CPR environment—probabilistic distribution and renewal of tokens, with collapsibility—capture some key characteristics of many spatially dependent renewable resources (Janssen, 2008). At the beginning of each round 25% of the  $26 \times 26$  CPR grid was occupied by tokens (for a total of 169 tokens); the location of these tokens was randomly generated. The CPR is renewable because CPR tokens can regenerate (or grow). The probability that any particular empty cell on the CPR grid generates a new token is dependent on the number of adjacent cells that are still occupied by a tokens. Thus, regrowth is density dependent. Specifically, the probability  $p_t$  is linearly related to the number of neighboring tokens:  $p_t = p * n_t / N$ , where  $n_t$  is the number of neighboring cells containing a token, and  $N$  is the number of neighboring cells ( $N = 8$ , because we use a Moore neighborhood with a range of 1, and  $p = 0.01$ ). Therefore, empty cells that are completely surrounded (by eight tokens) regenerate with higher probability than empty cells with fewer abutting tokens.

The CPR is finite because there must be at least one CPR token on the screen (i.e., adjacent to an empty cell) for that cell to regenerate a new token. When participants harvest every token on the grid, they exhaust the resource, and it will produce no additional tokens for that period. Groups that harvest all of the tokens on the screen must wait for time to expire before continuing to the next period. These conditions reset at the beginning of each period, providing participants with a new CPR environment to govern.

## Optimization Results

In our experiment, the optimum level of harvests to generate the greatest individual earnings for all players, while perpetuating the CPR, depends on the initial starting conditions, the rate and locations at which individuals harvest tokens, and the subsequent rate of regrowth. However, if we ignore spatial variability (essentially averaging across initial states), then the optimal harvesting strategy is to wait two minutes before harvesting, to let the CPR cover 50% of the CPR grid. After two minutes, participants should use selective harvesting to maintain this same level of coverage until the last 30 seconds of the period; at that time, they can harvest as many tokens as possible (to yield an estimated 548 total tokens overall). If participants do this, and they each get an equal share of the CPR, then each person can harvest about 137 tokens (\$2.74) each period, for a total of 1233 tokens, or \$24.66 (plus \$5 show-up fee), over the course of the experiment. Researchers have demonstrated that similar estimates, which instead calculate the average harvests from simulations that incorporate spatial variability of token distributions and their renewal, closely approximated the simplified situation we just described (Janssen, 2008; Janssen et al., 2010). Hence, 548 tokens can be used as a benchmark for the social optimum in a given period.



**Figure A1.** Optimal harvest strategy and resource level in an idealized spatial configuration of the tokens.

Here are the estimated Nash and social optimum for each of the four CPR governance rules in our experiment when there is perfect cooperation or compliance:

- **Private Property Rule:** Nash 548 tokens (social optimum 548 tokens)
- **60 Second Rule:** Nash 274 tokens (social optimum 548 tokens)
- **40 Token Rule:** Nash 184 tokens (social optimum 480 tokens)
- **10-10 Rule:** Nash 177 tokens (social optimum 524 tokens)
- **Default (no rule):** Nash 177 tokens (social optimum 548 tokens)

## Experiment Instructions

*Our experiment software is available at <https://bitbucket.org/virtualcommons/foraging>. Participants received the same instructions during Phase 1 (Rounds 1-3); their instructions then diverged, depending on condition and phase. We show the instructions for the Voted-Enforce and Imposed-Enforce conditions here. Instructions about enforcement were omitted in the Voted and Imposed conditions.*

[PHASE 1]

### Welcome [Screen 1]

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Welcome to the experiment. The experiment will begin shortly after everyone has been assigned a station.

Please **wait quietly**, and **do not close this window, open any other applications, or communicate with any of the other participants** unless you are told to do so.



### General Instructions [Screen 2]


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#### Your Earnings

You have already earned \$5 by showing up at this experiment. You can earn more, up to a maximum of about \$15-\$40, by participating in this experiment which will take about 90 minutes. The amount of money you earn depends on your decisions, as well as the decisions of your group members during the nine rounds of the experiment.

#### The Token Task

Today's experiment is on the computer. In the experiment, you can collect green, diamond-shaped tokens , and you will earn **\$0.02** for each token you collect. When the token task begins, you will appear on the screen as a yellow dot . To collect a token, move your yellow dot over a green token and **press the space bar**. If you move over a token without pressing the space bar you will NOT collect that token. You can move either up, down, left, or right. You have to press an arrow key for every move of your yellow dot.

Later, you will be assigned to a group. The other group members will appear as blue dots .

#### Tokens

The tokens that you collect have the potential to regenerate. After you have collected a green token, a new token can reappear on that empty cell. The rate at which new tokens appear is dependent on the number of adjacent cells that still have tokens. The more tokens there are in the eight cells around an empty cell, the faster a new token will appear on that empty cell.

Tokens generate new tokens. Thus, the middle cell, which is denoted with X in Image 1 will be regenerated at a faster rate than the middle cell in Image 2. When all neighboring cells are empty, there is no renewal.

Image 1

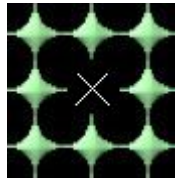
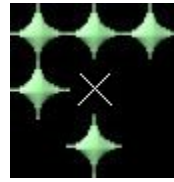


Image 2



If you have any questions at this time, please raise your hand and someone will come over to your station and answer it. If you have no questions, continue to the quiz below.

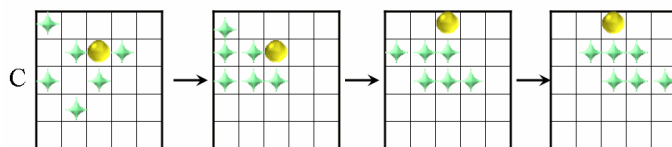
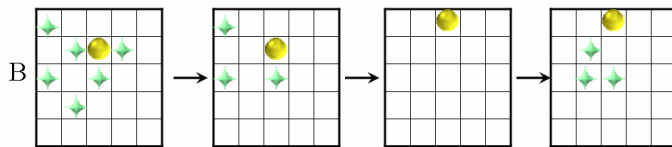
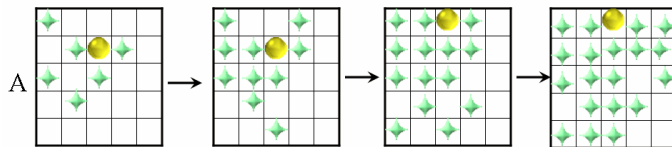
### Quiz

In a moment, you will do a practice round of the token task. Before we go to the practice round, answer the following questions to make sure you understand the instructions. You will earn \$0.50 for each correct answer.

Q1. Which of the statements is incorrect:

- A Your decisions where to collect tokens affect the regeneration of tokens.
- B When you have collected all tokens on the screen, no new tokens will appear.
- C Tokens grow from the middle of the screen.
- D When you collect a token you need to press the [SPACEBAR] when your avatar is on a cell with a token.

Q2. Which sequence of situations is not possible?



- A
- B
- C

## Quiz Results [Screen 3]

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### *If Correct:*

You have answered all the questions correctly and earned **\$1.00**.

### *If Incorrect:*

You answered [0 or 1] out of 2 questions correctly and earned [**\$0.00 or \$0.50**]. Questions you've answered incorrectly are highlighted in red. Please see below for more details.

[Question 1 repeated here]

*Participant's incorrect response shown here.*

In this question, "A", "B", and "D" are all true. "C" is false. Tokens only regenerate when there are other tokens present in their immediately neighboring cells. They do not spontaneously generate from the middle of the screen.

[Question 2 repeated here]

*Participant's incorrect response shown here.*

In this question, sequence "B" is not possible. Tokens cannot regenerate on an empty screen as shown in sequence B.

## Practice Round Instructions\* [Screen 4]

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Once everyone has finished the quiz, we will start a practice round of the token task.

During the practice round, you will have four minutes to practice with the experimental environment. The decisions you make in this round will NOT influence your earnings. At the beginning of the practice round half of the cells are occupied with green tokens. The environment is a  $13 \times 13$  grid of cells.

During this practice round, and **only during** this practice round, you are able to reset the tokens displayed on the screen. When you push the **R** key you will reset the distribution of the tokens to randomly occupying half of the cells with green tokens.

### **Do you have any questions?**

If you have any questions at this time please raise your hand and someone will come over to your station and answer it.

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\* We use the term "rounds" in the instructions of the experiment. Because the term is used differently in experimental economics, we use the term "period" in the discussion of the results. In experimental economics participants typically make one decision in a round before moving to the next round. In our experiment, the round is a period of four minutes, in which participants can make as many decisions as they want in real time.

## Round 1 Instructions [Screen 5]

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The first round of the experiment will begin in a moment. The length of the round is four minutes. As in the practice round you can collect green tokens. This time you will earn **\$0.02** for each token collected. This time you **cannot** reset the distribution of green tokens.

### Groups

In this round the renewable resource will become five times bigger. You will share this larger environment with three other random players in this room. In particular, **each of you in this room has been randomly assigned to one of several four person groups**. And everyone in your group has been randomly assigned a number from 1 to 4. **You will stay in the same group for the entire experiment**, and each person's number from 1 to 4 will remain the same throughout the experiment. The other members of your group will appear on the screen as blue dots  with a white number embedded in the dot.

In each round of the token task, you can see how many tokens each player has collected at the top right corner of the screen. On the top left corner of the screen, you will see the remaining time in the round.

### Anonymity

Because group membership was randomly assigned by the computer, neither you nor the experimenter will be able to identify which person in the room has been assigned to a particular group or number within a group. Your anonymity is guaranteed.

### Tokens

Each group has its own set of token resources.

**Do you have any questions so far?** If you have any questions at this time, raise your hand and someone will come over to your station and answer it.

## Round 2 Instructions [Screen 6]

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Round 2 is the same as the previous round. The length of this round is four minutes.

**Do you have any questions?** If you have any questions at this time please raise your hand and someone will come over to your station and answer it.

## Round 3 Instructions [Screen 7]

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Round 3 is the same as the previous round. The length of this round is four minutes.

**Do you have any questions?** If you have any questions at this time please raise your hand and someone will come over to your station and answer it.

[VOTING PROCEDURE]

*Individuals in the Vote-Enforce (and Vote) conditions voted immediately after Phase 1.*

**Strategies for Managing How Players Collect Tokens for the Rest of the Experiment** [Screen 8]

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**Important New Instructions!**

In a moment, you will have the option to implement one of five strategies for how you and the three other people in your group collect tokens for the rest of the experiment.

**Procedure for Deciding the Strategy**

Each of the people in your group can nominate one of the five potential strategies. The single strategy that receives the most nominations wins.

If there is a tie, one of the tied options will be selected at random by the computer. Each of the tied strategies will have an equal chance of being selected.

**Implementation**

Neither the computer nor the experimenter will intervene to implement the strategy.

Do you have any questions? If you have any questions at this time, raise your hand and someone will come over to your station and answer it.

**Strategy Nomination Instructions** [Screen 9]

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To nominate a strategy, click the radio button that is to the right of the one you choose; then click "submit". The computer will tally the nominations and then report the results on the next screen. The results will be presented to each person in your group.

**Your Selection will be Anonymous**

The identity of people who nominated a particular strategy will NOT be revealed. Therefore, neither you nor the experimenter will know who nominated a particular strategy.

Strategy Options	
• Wait 60 seconds for the screen to fill up with tokens (the timer will be have 180 seconds left). Then everyone collect tokens for the remaining amount of time.	<input type="checkbox"/>
• Collect 40 tokens, then wait 30 seconds. Repeat this process until time runs out or the tokens are all gone.	<input type="checkbox"/>
• Players “divide” the field up into four equally-sized areas and can do whatever they want within their area. So with four people, each person takes an area around one of the four corners.	<input type="checkbox"/>
• Collect tokens for 10 seconds, then wait 10 seconds before collecting again. Repeat this process until time runs out or the tokens are all gone.	<input type="checkbox"/>
• Everyone can do whatever they want.	<input type="checkbox"/>

**Submit**

**Nomination Results** [Screen 10]

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*In the example shown here, two participants nominated the 60-Second rule, one the Private Property rule, and one the 10-10 Rule.*

Strategy Nominations	
• Wait 60 seconds for the screen to fill up with tokens (the timer will be have 180 seconds left). Then everyone collect tokens for the remaining amount of time.	2
• Collect 40 tokens, then wait 30 seconds. Repeat this process until time runs out or the tokens are all gone.	0
• Players “divide” the field up into four equally-sized areas and can do whatever they want within their area. So with four people, each person takes an area around one of the four corners.	1
• Collect tokens for 10 seconds, then wait 10 seconds before collecting again. Repeat this process until time runs out or the tokens are all gone.	1
• Everyone can do whatever they want.	0

**Selected Strategy**

*In this example, the 60-Second rule would be the chosen rule for the group.*

Wait 60 seconds for the screen to fill up with tokens (there will be 180 seconds left on the timer). Then everyone collect tokens for the remaining amount of time.

[If there was a tie:]

There was a tie and the selected strategy listed here was randomly selected as the winner.



[IMPOSED RULE PROCEDURE]

Individuals in the Imposed-Enforce (and Imposed) conditions were assigned a rule immediately after Phase 1.

**Strategies for Managing How Players Collect Tokens for the Rest of the Experiment** [Screen 8]

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**Important New Instructions!**

Below is a list of five possible strategies for managing how you, and the other members of your group, collect tokens for the rest of the experiment.

Please carefully read and consider each of the options on the list. Press "Submit" once you have finished reviewing the strategies.

**Any questions?**

If you have any questions while you are on this screen, raise your hand and someone will come over to your station and answer it.

<b>Strategy Options</b>
<ul style="list-style-type: none"> <li>• Wait 60 seconds for the screen to fill up with tokens (the timer will be have 180 seconds left). Then everyone collect tokens for the remaining amount of time.</li> </ul>
<ul style="list-style-type: none"> <li>• Collect 40 tokens, then wait 30 seconds. Repeat this process until time runs out or the tokens are all gone.</li> </ul>
<ul style="list-style-type: none"> <li>• Players “divide” the field up into four equally-sized areas and can do whatever they want within their area. So with four people, each person takes an area around one of the four corners.</li> </ul>
<ul style="list-style-type: none"> <li>• Collect tokens for 10 seconds, then wait 10 seconds before collecting again. Repeat this process until time runs out or the tokens are all gone.</li> </ul>
<ul style="list-style-type: none"> <li>• Everyone can do whatever they want.</li> </ul>

**Submit**

**The Assigned Strategy** [Screen 9]

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*In this example, the 60-Second rule would be yoked from the Vote-Enforce group to the Impose-Enforce group shown here.*

Wait 60 seconds for the screen to fill up with tokens (there will be 180 seconds left on the timer). Then everyone collect tokens for the remaining amount of time.

**Implementation**

Neither the computer nor the experimenter will intervene to implement the strategy.

Do you have any questions? If you have any questions at this time, raise your hand and someone will come over to your station and answer it.

[SURVEY 1]

**Survey [Launch Screen]**

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*This is the survey launch screen, which directs participants to the automated Qualtrics survey.*

Before we continue to the next round of the token task, we would like to ask you some quick questions. Please **click here** to begin the survey.

We will continue with the rest of the experiment after all of the surveys have been completed by all the participants in the room. Please press the "Continue" button at the bottom of the screen after you have successfully completed the survey.

If you encounter any problems with the survey **please inform the experimenter.**

Continue

*\*Our experiment software automatically reminds participants to complete the survey if they accidentally click "Continue" before launching the survey. The experimenter also checks that everyone successfully started the survey a few moments after displaying the launch screen.*

[PHASE 2]

*Individuals in the non-enforcement conditions (Voted and Imposed) did not see the information about reducing other players' earnings. All other aspects are the same for all conditions.*

**Round 4 Instructions [Screen 1]**

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**Important Instructions!**

Round 4 is about to begin.

**Reducing Other Players' Earnings.**

You will now have the option to reduce the earnings of another participant at a cost to your own earnings by typing that participant's number key from 1 to 4.

- Each player in your group has a number from 1 to 4. If you press a number key 1-4, you will reduce the number of tokens that player has collected during the round by 2 tokens. This will also reduce your own token amount by 1 token. The decision whether or when to use this option is up to you.
- When you reduce the number of tokens of another participant, they will receive a message stating that you have reduced their tokens. Likewise, if another participant reduces your number of tokens, you will also receive a message. These messages will be displayed on the bottom of your screen.
- If your tokens are being reduced or you are reducing another participant's tokens, you will receive some visual cues. When your tokens are being reduced your yellow dot will turn red briefly with a blue background. The participant currently reducing your tokens will turn purple with a white background.

- You may reduce the earnings of other participants as long as (1) there are tokens remaining on the screen and (2) both you and the other participant have a positive number of tokens collected during the round. **Each time you press the numeric key corresponding to another participant your token amount is reduced by 1**, and their token amount is reduced by 2.

The length of this round is four minutes.

**Reminder:**

Wait 60 seconds for the screen to fill up with tokens (there will be 180 seconds left on the timer). Then everyone collect tokens for the remaining amount of time. *[Example]*

**Do you have any questions?** If you have any questions at this time, raise your hand and someone will come over to your station and answer it.

**Round 5 Instructions** *[Screen 2]*

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Round 5 is the same as the previous round. The length of this round is four minutes.

**Do you have any questions?** If you have any questions at this time, raise your hand and someone will come over to your station and answer it.

**Round 6 Instructions** *[Screen 3]*

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Round 6 is the same as the previous round. The length of this round is four minutes.

**Do you have any questions?** If you have any questions at this time, raise your hand and someone will come over to your station and answer it.

[SURVEY 2]

**Survey** *[Launch Screen]*

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We would again like to ask you some quick questions. Please **click here** to begin the survey.

We will continue with the rest of the experiment after all of the surveys have been completed by all the participants in the room. Please press the "Continue" button at the bottom of the screen after you have successfully completed the survey.

If you encounter any problems with the survey **please inform the experimenter.**

Continue

[PHASE 3]

*Individuals in the non-enforcement conditions (Vote and Impose) did not see the information about reducing other players' earnings. All other aspects are the same for all conditions.*

**Round 7 Instructions** [Screen 1]

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Round 7 is about to begin.

**Important New Instructions!**

**From this point forward, participants will NOT have the option to reduce the earnings of another participant.**

Round 7 is the same as the previous round. The length of this round is four minutes.

**Do you have any questions?** If you have any questions at this time, raise your hand and someone will come over to your station and answer it.

**Round 8 Instructions** [Screen 2]

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Round 8 is the same as the previous round. The length of this round is four minutes.

**Do you have any questions?** If you have any questions at this time, raise your hand and someone will come over to your station and answer it.

**Round 9 Instructions** [Screen 3]

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Round 9 is the same as the previous round. The length of this round is four minutes.

**Do you have any questions?** If you have any questions at this time, raise your hand and someone will come over to your station and answer it.

[SURVEY 3]

**Survey** [Launch Screen]

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We would again like to ask you some quick questions. Please **click here** to begin the survey.

We will continue with the rest of the experiment after all of the surveys have been completed by all the participants in the room. Please press the "Continue" button at the bottom of the screen after you have successfully completed the survey.

If you encounter any problems with the survey **please inform the experimenter.**

Continue

## Section B: Psychological Measures

Psychological measures used in the experiment are listed here. Subscales were presented in the order shown. Individual items were presented in randomized order, to counteract order effects. Unless noted otherwise, participants responded to all items on a 7-point response scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). We did not show survey titles, subscale names, or item names to participants. Survey 3 measured standard demographic information (e.g., gender, age, race/ethnicity, education, and household income) and is therefore not shown.

### Survey 1

#### Rule Acceptance

**Instructions:** In the experiment, a strategy<sup>†</sup> was just established for managing how you and the three other people in your group collect tokens today. We would like to begin by asking you about your perceptions of the strategy. We are interested in your honest opinion. There are no right or wrong answers. Your responses are anonymous. Other participants will not know your responses, and the experimenter cannot trace them specifically back to you.

*Item prompt:* Indicate how much you agree or disagree with the statement below at this time.

1. I approve of the strategy.
2. I am satisfied with the strategy.
3. I support the strategy.

Allen, M., & Meyer, J. (1990). The measurement and antecedents of affective, continuance and normative commitment to the organization. *Journal of Occupational Psychology*, 63, 1-18.

Colquitt, J. (2001). On the dimensionality of organizational justice: a construct validation of a measure. *Journal of Applied Psychology* 86(3):386-400.

#### Psychological Needs (Voting)

*Instructions [Voted-Enforce and Vote conditions]:* Today you were able to nominate a strategy from a list of options to help decide whether or not to have a strategy, and what that strategy should be. Next we would like to ask you how this made you feel.

*Instructions [Imposed-Enforce and Impose conditions]:* Today you were shown a list of five possible strategies for managing how you and the three other people in your group collect tokens. And one of those strategies was assigned to your group. Next we would like to ask you how this made you feel.

#### Procedural Justice

*Item prompt:* The procedures used to select/decide the strategy today made me feel...

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<sup>†</sup> During the experiment, we referred to rules as strategies to avoid biasing participants' perceptions.

1. able to exercise my views and desires.
2. as if I was able to influence what strategy was established.
3. as if the procedures were fair.
4. as if the procedures were just.

Colquitt, J. (2001). On the dimensionality of organizational justice: a construct validation of a measure. *Journal of Applied Psychology, 86*(3), 386–400.

Prooijen, J.-W. (2009). Procedural justice as autonomy regulation. *Journal of Personality and Social Psychology, 96*(6), 1166–1180.

## **Self-Determination**

*Item prompt:* The procedures used to select/decide the strategy today made me feel...

1. free to do things that agree with my true interests and values.
2. free to do things that express, or exercise, my “true self.”
3. free to be myself (free to be who I am).
4. a sense of freedom and self-determination.
5. as if I could determine what to do.
6. as if my desires were a determining factor behind what I could do.
7. as if I had some choice about what to do.
8. a genuine sense of choice.

Levenson, H. (1981). Differentiating among internality, powerful others, and chance. In Herbert M. Lefcourt (Ed.), *Research with the Locus of Control Construct*, eds Lefcourt H (Academic Press, New York), pp 15-63.

Ryan, R. (1982). Control and information in the intrapersonal sphere: an extension of cognitive evaluation theory. *Journal of Personality and Social Psychology, 43*, 450-461.

Sheldon, K., Elliot, A., Kim, Y., & Kasser, T. (2001). What is satisfying about satisfying events? Testing 10 candidate psychological needs. *Journal of Personality and Social Psychology, 80*(2), 325–339.

## **Belonging**

*Item prompt:* The procedures used to select/decide the strategy today made me feel...

1. like I am seen as a valuable person.
2. like I am seen as worth taking the time to understand.
3. like I am seen as a worthwhile person.
4. a sense of contact with people who care for me, and whom I care for.
5. close and connected with other people who are important to me.
6. a sense of fulfillment and intimacy from the people I am spending time with.

Leary, M., Kelly, K., Cottrell, C., Chreindorfer, L. (2013). Construct validity of the need to belong scale: mapping the nomological network. *Journal of Personality Assessment, 95*(6), 610-624.

Sheldon, K., Elliot, A., Kim, Y., and Kasser, T. (2001). What is satisfying about satisfying events? Testing 10 candidate psychological needs. *Journal of Personality and Social Psychology, 80*(2), 325–339.

## **Competence**

*Item prompt:* The procedures used to select/decide the strategy today made me feel...

1. smart.
2. intelligent.
3. competent.
4. as if I was taking on and mastering important challenges.
5. as if I was handling important obstacles and opportunities.
6. as if I was meeting the challenge of performing well in the token task.

Ryan, R. (1982). Control and information in the intrapersonal sphere: an extension of cognitive evaluation theory. *Journal of Personality and Social Psychology, 43*, 450-461.

Sheldon, K., Elliot, A., Kim, Y., & Kasser, T. (2001). What is satisfying about satisfying events? Testing 10 candidate psychological needs. *Journal of Personality and Social Psychology, 80*(2), 325-339.

### Interpersonal Justice

*Item prompt:* The procedures used to select/decide the strategy today made me feel...

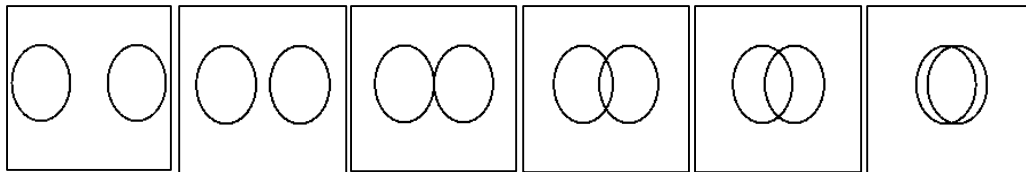
1. like I was treated in a polite manner.
2. like I was treated with dignity.
3. like I was treated with respect.
4. like I was treated properly.

Colquitt, J. (2001). On the dimensionality of organizational justice: a construct validation of a measure. *Journal of Applied Psychology, 86*(3), 386-400.

### Self-Other Merging

*Instructions:* For these next questions, we would like to ask about your perception of the other people in your group. We are interested in your honest opinion. There are no right or wrong answers. Your responses are anonymous. Other participants will not know your responses, and the experimenter cannot trace them specifically back to you.

1. Below you see six pairs of circles. One circle represents yourself, and the other circle represents the other group members. At this moment, which pair of circles best reflects how you feel towards the other people in your group?



Karremans, J. (2002). *Forgiveness: Examining its consequences*. Doctoral dissertation, Free University Amsterdam, the Netherlands.

*Item prompt:* Indicate how much you agree or disagree with the statement below at this time.

2. I feel good about the other people in my group.
3. I feel positively towards the other people in my group.

4. I feel like I really “fit in” with the other people in my group.
5. This group really makes me feel like I belong.

Cameron, J. E. (2004). A three-factor model of social identity. *Self and Identity*, 3, 239-262.

### **Rule Effectiveness**

*Instructions:* We would like to show you some strategies ask your opinion on how effective they seem to be. We are interested in your honest opinion. There are no right or wrong answers. Your responses are anonymous. Other participants will not know your responses, and the experimenter cannot trace them specifically back to you.

*Item Prompt:* In your opinion, how effective would the following strategy be for managing the collection of tokens?

*Response scale:* 1 (very ineffective) to 7 (very effective).

1. [60 Second Rule] Wait 60 seconds for the screen to fill up with tokens (the timer will be have 180 seconds left). Then everyone collect tokens for the remaining amount of time.
2. [40 Token Rule] Collect 40 tokens, then wait 30 seconds. Repeat this process until time runs out or the tokens are all gone.
3. [Private Property Rule] Players “divide” the field up into four equally-sized areas and can do whatever they want within their area. So with four people, each person takes an area around one of the four corners.
4. [10-10 Rule] Collect tokens for 10 seconds, then wait 10 seconds before collecting again. Repeat this process until time runs out or the tokens are all gone.
5. [Default] Everyone can do whatever they want.

## **Survey 2**

### **Rule Acceptance**

*Instructions:* Earlier in the experiment, a strategy was established for managing how you and the three other people in your group collect tokens today. We would again like to ask you a few questions about your perception of the strategy. We are interested in your honest opinion. There are no right or wrong answers. Your responses are anonymous. Other participants will not know your responses, and the experimenter cannot trace them specifically back to you.

*These items were the same as in Survey 1.*

### **Reasons for Rule Compliance**

*Instructions:* People use or follow strategies for different reasons. We would like to ask you about your reasons for following the strategy.

*Item prompt:* The reason I followed the strategy was because...



## **Social Pressure**

1. somebody else wanted me to.
2. the situation seemed to require or compel it.

## **Guilt**

1. I would have felt guilty if I did not follow it.
2. I would have felt anxious if I did not follow it.

## **Internalized Motivation**

1. I really believed that it was an important strategy to have.
2. I felt that the strategy matched with my desires and values.

## **Anticipated Earnings**

1. I felt that the strategy would help me get more tokens (more money).
2. I felt that the strategy would increase the number of tokens (amount of money) I could get.

## **Security**

1. I felt that the strategy made the token task more structured and predictable.
2. I felt that the strategy kept me safer from uncertainties.

Sheldon, K., Houser-Marco, L. (2001). Self-concordance, goal attainment, and the pursuit of happiness: can there be an upward spiral? *Journal of Personality and Social Psychology*, 80(1), 152-165.

Sheldon, K., Elliot, A., Kim, Y., & Kasser, T. (2001). What is satisfying about satisfying events? Testing 10 candidate psychological needs. *Journal of Personality and Social Psychology*, 80(2), 325–339.

Sheldon, K., Elliot, A. (1998). Not all personal goals are personal: comparing autonomous and controlled reasons for goals as predictors of effort and attainment. *Personality and Social Psychology Bulletin*, 24(5), 546-557.

Soenens, B., Vansteenkiste, M., & Niemec, C. (2009). Should parental prohibition of adolescents' peer relationships be prohibited? *Personal Relationships*, 16, 507–530.

## **Instructions (Perceptions of Enforcement)**

### **IMPORTANT INSTRUCTIONS!**

Please read fully and carefully. If you have questions, ask the experimenter before continuing.

Sometimes in experiments like this one, participants can use some of their tokens (money) to remove/subtract tokens from people in their group. (When that happens, the person does not get the other person's money. The money is just gone).

For example, Player "1" might pay 1 token (\$0.02) to remove 2 tokens (\$0.04) from Player "2", "3", or "4's" total earnings. Player "A" would be able to do this as often as he or she wants. Moreover, everyone else in the group would also have this ability. Thus, participants sometimes have some of their money

(tokens) removed by the other people in their group. This may have happened to you at some point (or it might not have happened to you at all).

For these next questions, we would like to ask 1) whether or not this happened to you and 2) how that made you feel.

### **Screening Question**

Please read this question fully and carefully. If you have a question about it, ask the experimenter for help.

Did someone pay money (tokens) to subtract money (tokens) from you? If someone did that to you, you would have known it because you would have received a message on the bottom of the screen during the token task, announcing that a Player (e.g., 1, 2, 3, or 4) paid to remove some of your tokens (money).

*Response scale:* No Yes

### **Psychological Needs (Enforcement)**

These items were the same as Survey 1, except that they were tailored to refer to enforcement, and participants received different prompts depending on their response to the screening question.

*Prompt [Sanctioned]:* How did it make you feel when the individual(s) in your group used their money (tokens) to subtract some of your money (tokens)?

*Prompt [Not Sanctioned]:* How does it make you feel to know that the people in your group did NOT use their money (tokens) to subtract some of your money (tokens)?

## **Section C: Supplemental Analyses**

Supplemental analyses, including primarily tables for the analysis of outcome favorability (e.g., winning or losing the vote) are presented here.

### **Winning or Losing the Vote**

**Rule Acceptance.** Here we present tabled results of a hierarchical linear regression (HLR) analysis of how individuals' rule acceptance changed differently before and after Phase 3, depending on experimental condition (e.g., Voted-Enforce condition versus Voted condition) and whether or not individuals received a rule they felt would be effective (e.g., winning voters) or ineffective (e.g., losing voters). In the following analyses, perceived rule effectiveness is used as a substitute for outcome favorability, as described in the main text.

**Table C1:** Change in Rule Acceptance Before and After Phase 2 as a Function of Anticipated Rule Effectiveness and Experimental Treatment.

Intercept	4.78(.10)
Vote	-0.21(.20)
Enforce	0.06(.20)
Effectiveness	0.69(.06)***
Vote × Enforce	0.02(.39)
Vote × Effectiveness	0.41(.12)***
Enforce × Effectiveness	-0.07(.12)
Vote × Enforce × Effectiveness	0.15(.23)
Time	-1.09(.14)***
Time × Vote	0.75(.29)**
Time × Enforce	0.64(.29)*
Time × Effectiveness	-0.34(.09)***
Time × Vote × Enforce	0.68(.58)
Time × Vote × Effectiveness	-0.27(.18)
Time × Enforce × Effectiveness	0.39(.18)*
Random Effects	Variance
Group $u_{00j}$	0.00
Residual $r_{0ij}$	0.76***
Before $\varepsilon_{1ij}$	0.72***
After $\varepsilon_{2ij}$	2.55***
ICC Group=0.00	
ICC Residual=0.19*	
ICC Phase=0.81***	

*Note:* Slopes represent unstandardized regression coefficients (standard errors in parentheses). Dichotomous predictors are effects coded (e.g., Vote: -1 rule imposed, 1 rule decided by vote). The continuous predictor Effectiveness is grandmean centered. Vote = Predictor for voting. Enforce = Predictor for enforcement. Effectiveness = Anticipated rule effectiveness. Time = Change in rule acceptance before and after Phase 2 (coded: 0, 1). \* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$

**Individual Harvests.** Here we present tabled results of a HLR, examining individual harvesting behavior (mean number of tokens collected) as a function of anticipated rule effectiveness, phase, and experimental condition. The model (Table C2) is the same as before (see Table C1), except we now include both a linear predictor for Phase (coded: 0 = Phase 1, 1 = Phase 2, 2 = Phase 3), to capture linear changes in tokens harvested across all three phases of the experiment, and a curvilinear PhaseSQ predictor (coded: 0 = Phase 1, 1 = Phase 2, 2 = Phase 3), to capture potential quadratic or non-linear changes (e.g., rapid increase in harvests followed by decrease). There was significant correlated error in individual harvests caused by interdependent decision making within groups, so we used HLR to examine individual harvesting behavior, controlling for group context (Raudenbush & Bryk, 2003). Effects are described in the main text.

**Table C2: Mean Tokens Harvested by Individuals Across Phases as A Function of Anticipated Rule Effectiveness and Experimental Condition.**

Intercept	57.64(1.79)
Vote	0.05(3.58)
Enforce	-4.34(3.58)
Effectiveness	-1.09(0.88)
Vote × Enforce	1.89(7.16)
Vote × Effectiveness	-0.44(1.76)
Enforce × Effectiveness	2.53(1.76)
Vote × Enforce × Effectiveness	-2.40(3.52)
Phase	15.19(2.15)***
Phase × Vote	14.38(4.30)***
Phase × Enforce	8.25(4.30) <sup>†</sup>
Phase × Effectiveness	-0.13(1.34)
Phase × Vote × Enforce	21.85(8.59)**
Phase × Vote × Effectiveness	0.83(2.68)
Phase × Enforce × Effectiveness	1.01(2.68)
Phase × Vote × Enforce × Effectiveness	11.59(5.36)*
PhaseSQ	-6.21(0.98)***
PhaseSQ × Vote	-5.31(1.96)**
PhaseSQ × Enforce	-3.72(1.96) <sup>†</sup>
PhaseSQ × Effectiveness	0.50(0.61)
PhaseSQ × Vote × Enforce	-6.17(3.91)
PhaseSQ × Vote × Effectiveness	-0.34(1.22)
PhaseSQ × Enforce × Effectiveness	0.89(1.22)
PhaseSQ × Vote × Enforce × Effectiveness	-4.43(2.44) <sup>§</sup>
Random Effects	Variance
Group $u_{00j}$	0.05*
Residual $r_{0ij}$	43.10
Phase 1 $\varepsilon_{1ij}$	240.79***
Phase 2 $\varepsilon_{2ij}$	201.10***
Phase 3 $\varepsilon_{3ij}$	174.38**
Correlation	0.42**
ICC Group=0.13*	
ICC Residual=0.10*	
ICC Phase=0.77***	

*Note:* Slopes represent unstandardized regression coefficients (standard errors in parentheses). Dichotomous predictors are effects coded (e.g., Vote: -1 rule imposed, 1 rule decided by vote). The continuous predictor Effectiveness is grandmean centered. Vote = Predictor for voting. Enforce = Predictor for enforcement. Effectiveness = Anticipated rule effectiveness. Phase = Linear change across phases (coded: 0, 1, 2). PhaseSQ = Curvilinear change across phases (coded: 0, 1, 4). \* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$ . <sup>†</sup> $p < 0.059$ . <sup>§</sup> $p < 0.071$ .

**Individual Rule Compliance.** Here we present tabled results of a HLR, examining individual rule compliance behavior (mean percentage rule compliance) as a function of anticipated rule effectiveness, phase, and experimental condition. The model (Table C3) is the

same as before (see Table C2), except we now include only a linear predictor for Phase (coded: 0 = Phase 2, 1 = Phase 3), which captures linear changes in compliance from Phase 2 to 3.

**Table C3:** Individual rule compliance across Phase 2 and 3 as function of Anticipated Rule Effectiveness and experimental condition.

Intercept	0.67(0.04)
Vote	0.09(0.07) <sup>***</sup>
Enforce	0.04(0.07)
Effectiveness	0.01(0.01) <sup>†</sup>
Vote × Enforce	0.11(0.15)
Vote × Effectiveness	-0.00(0.01)
Enforce × Effectiveness	-0.00(0.01)
Vote × Enforce × Effectiveness	-0.04(0.03) <sup>§</sup>
Phase	-0.08(0.01) <sup>***</sup>
Phase × Vote	0.04(0.03)
Phase × Enforce	-0.10(0.03) <sup>***</sup>
Phase × Effectiveness	-0.00(0.01)
Phase × Vote × Enforce	0.14(0.06) <sup>**</sup>
Phase × Vote × Effectiveness	0.01(0.02)
Phase × Enforce × Effectiveness	-0.01(0.02)
Phase × Vote × Enforce × Effectiveness	0.02(0.04)
Random Effects	Variance
Group $u_{00j}$	0.05 <sup>***</sup>
Residual $r_{0ij}$	0.01 <sup>***</sup>
Correlation	-0.16 <sup>†</sup>
ICC Group=0.83 <sup>***</sup>	
ICC Residual=0.17 <sup>**</sup>	

*Note:* Slopes represent unstandardized regression coefficients (standard errors in parentheses). Dichotomous predictors are effects coded (e.g., Vote: -1 rule imposed, 1 rule decided by vote). The continuous predictor Effectiveness is grandmean centered. Vote = Predictor for voting. Enforce = Predictor for enforcement. Effectiveness = Anticipated rule effectiveness. Phase = Linear change across phases 2 and 3 (coded: 0, 1). \* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$ . <sup>†</sup> $p < 0.069$ . <sup>§</sup> $p < 0.100$ .