Gratitude Reduces Consumption of Depleting Resources

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Abstract

Sustaining finite public resources presents a dilemma between acting in self-interest for present benefit versus working toward long-term collective gain. Given gratitude's links to prosociality and self-control, the present studies investigated whether gratitude would promote sustainable resource extraction under conditions of rapidly depleting resources. In Study 1 (N=155), participants were randomly assigned to experience an emotional state (gratitude or neutral) prior to playing a resource dilemma game where the common pool was manipulated to indicate either a sustained or depleting resource status. Neutral participants increased their point taking when the pool was depleting compared to when it was sustained, however this pattern was not observed for grateful participants. Study 2 (N=224) replicated these findings while also showing the effect of gratitude to be distinct from happiness. These findings show that gratitude, as opposed to a general positive emotional state, buffers against overtaking in resource dilemmas, and suggests that this emotion may be useful in promoting sustainable behavior.

Word count: 157

Maintaining stability of publicly available resources stands as one of the most vexing problems societies have historically faced. Since the Tragedy of the Commons – a phenomenon in which individuals rapidly consume common resources to their own short-term benefit but to a degree that ultimately depletes the resources for all – was first recognized, interest in finding factors that would mitigate people's tendency for overconsumption has grown (Hardin, 1968, 1998; Van Vugt, 2009). This is especially true in the present, both for long-standing problems related to deforestation, fishery stock depletion, and water scarcity, as well as more emergent ones stemming from societal shocks related to the COVID-19 epidemic. Runs on masks, and even toilet paper, reflect the same underlying dynamic: if everyone attempts to rapidly hoard resources, a breakdown in availability will ensue.

To examine this issue, researchers have typically employed public goods games in which players can choose to contribute or withdraw different amounts of resources from a common pool. Within a given round of such games, any remaining portion in the pool is replenished by a small factor. If everyone engages self-control to delay immediate profit, benefits can remain sustainable, as the rate of resource extraction doesn't overtake replenishment. However, due to inequity aversion and desires for immediate gratification, most games trend toward resource depletion as people increase their levels of extraction over rounds of the game.

Because emotions serve to inform the mind's predictions regarding adaptive behavior, we suspected that gratitude, given its links to increased cooperation and self-control (DeSteno, Li, Dickens, & Lerner, 2014; DeSteno, Duong, Lim, & Kates, 2019; DeSteno, Bartlett, Baumann, Williams, & Dickens, 2010; Smith, Pederson, Forster, McCullough, & Lieberman, 2017), might

serve to combat the tendency to increase resource extraction in the face of other people's selfish behavior. That is, feelings of gratitude, even when incidental to the decision at hand, might nudge people toward decisions that, if widely enacted, would reduce the tendency to deplete publicly available resources.

To examine this hypothesis, we adapted a commonly used resource dilemma game (e.g., Koole, Jagger, van den Berg, Vlek, & Hofstede, 2001; Kramer, McClintock, & Messick, 1986) that possessed two important features. The first was transparency: players' decisions to extract resources were public. The second was that only one player in each game was a true participant; behaviors of the other three were programmed to be cooperative (always extracting a small amount so that the pool would not deplete) or selfish (always extracting a larger amount so that the pool would clearly head toward depletion).

Given that transparency tends to produce ongoing, stable cooperation when the vast majority of people behave fairly (Rege & Telle, 2004), we expected that participants feeling gratitude would behave no differently than participants in a neutral state. When the majority of pre-programmed players acted selfishly, we expected that participants in a neutral state would generally extract more as well in order to avoid asymmetric losses (see Koole et al., 2001; Fiala & Seutens, 2017). However, we also anticipated that gratitude would combat this increase, with grateful participants showing no greater resource extraction in the resource depleting condition.

Here, we examine this hypothesis across two studies, with the second being a pre-registered extension of the first. In the second, we not only sought to replicate the initial finding, but to show, through the inclusion of a happiness condition, that any effect of gratitude was not due to valence. Indeed, past research on public goods games has suggested no difference in the behaviors of happy and neutral players (Knapp & Clark, 1991).

STUDY 1

Method

Open Practices and Ethics Statement

Materials and data for this experiment can be accessed at osf.io/j9zfp. The protocols for all experiments in this paper were approved by the Northeastern University Institutional Review Board (protocol #19-08-12).

Participants

Given that no previous work examined the question of interest, no previous estimates of effect size were available. Consequently, we used a medium effect of Cohen's f=.25 to determine the minimum sample size needed to achieve a power=.80 for the predicted interaction. Given the uncertainty attached to the effect size estimate, we used this result (N=128) as the lower bound for sample size and recruited as many people as possible within the time frame allotted for the study, with the proviso that no data would be analyzed until the study concluded. We were ultimately able to recruit 161 participants from Northeastern University's undergraduate pool and randomly assigned them to one of two emotion conditions: gratitude or neutral, and to one of two resource status conditions: sustained or depleting. After removing participants for computer malfunction/missing data, issues with English fluency, or suspicion of the study's true purpose, our final sample comprised of 155 participants (86 women, 68 men, 1 unreported, M_{age}=18.86, SD_{age}=1.74), which corresponded to an *a priori* power=.87.

Procedure

Participants were led to believe that they were one of four participants taking part in each experimental session. A confederate was present to pose as a second participant, and the "other participants" were said to be in a different experiment room. Because the experiment was advertised as examining cognitive abilities, memory, and decision-making, we first had participants complete a brief mental rotation test as a filler task. Next, they were asked to recall and write about a memory based on a topic that was randomly selected for them. As in DeSteno et al. (2014), this served as an emotion induction via autobiographical recall (see below). Participants were allotted 5 minutes to write about the event, and upon completion were given a manipulation check for their emotional states. Finally, participants completed the resource dilemma game, which was presented as a decision-making task that also involved the other participants in their session. At the end of the game, participants were given a manipulation check for resource status perceptions, in addition to suspicion and English fluency checks.

Manipulations and measures

Emotion Induction. We randomly assigned participants to recall and write about a past event involving a time they felt grateful or the events of their typical day (i.e., the neutral condition). See the Supplementary Online Materials for descriptions of gratitude inducing events. Following this 5-minute task, participants completed a manipulation check where they rated the extent to which they currently felt 14 different emotional states using a 7-point scale. Gratitude was calculated as a composite score of the items grateful and appreciative (Cronbach's $\alpha=.90$).

Resource Dilemma Game. Participants were informed that they would be playing a computer-based decision-making game with the "other participants." This game was modified from previous versions used to examine the role of sustained versus depleting resources (Kramer,

McClintock, & Messick, 1986). Prior to starting the game, we gave participants instructions concerning the game's rules and then assessed their understanding. Instructions stated that in this game, all of the players had access to a common pool of points. Each point was worth 1 lottery entry for a $200 cash prize to be drawn once data collection was complete. The pool would start with 200 points, and in each round individual players could extract anywhere from 0-10 points, which would then be collectively taken out of the common pool. Any points remaining in the pool after each round would be replenished by 10%. Participants would be able to see how many points were taken by the others after each round; however, each player's identity would remain hidden as they would each be assigned a color identifier.

Players also received feedback on their group's collective taking rate every three rounds of the game (i.e., average or high). They were told they could continue to extract points until the pool depleted to zero, or once they had played for 20 minutes. Participants were not told which strategy would be most advantageous, but were told the goal of the game was to accumulate as many points as possible.

Although participants were led to believe they would be playing the game with 3 "other participants," in reality there was only one participant playing the game in any given session. We manipulated the resource status of the game – sustained or depleting – by controlling the actions of the other "players" as well as feedback on the groups' collective point-taking rate (cf. Kramer, McClintock, & Messick, 1986). In the sustained condition, we programmed the other virtual players to take fewer points over the course of the game (*M=4.42*), which resulted in the common pool fluctuating between the initial 200 and 183 points. Participants were also informed that the group's extraction rate was average. By comparison, in the depleting condition the other players took a higher number of points on average (*M=6.58*), which resulted in the common pool

rapidly declining from 200 down to 20 points by the last round. Here, participants were told the group's extraction rate was high. Although participants believed the game would continue for longer, the game ended after 12 trials (approximately 5 minutes) in both conditions. Upon completion, participants were given a manipulation check for perceptions of the resource status, where they responded to the question: *"What is your estimate of the average number of points the other players took per round over the course of the game?"* using a 10-point scale.

Results

Manipulation Checks

To examine the efficacy of the emotion manipulation, we submitted participants' responses on the gratitude scale to an independent samples t-test by emotion condition. As predicted, participants in the gratitude condition (*M*=6.20, *SD*=1.10) reported feeling significantly more gratitude than did those in the neutral condition (*M*=3.88, *SD*=1.57), *t*(153)=10.61, *p* < .001, *d*=1.72.

To examine the efficacy of the resource status manipulation, we compared participants' estimates of the "other players" point-taking by resource status condition. An independent samples t-test indicated that participants in the depleting condition (*M*=6.92, *SD*=1.16) estimated the other players took significantly more points, compared to the sustained condition, (*M*=5.18, *SD*=0.95), *t*(153)=10.27, *p* < .001, *d*=1.64.

Resource Dilemma Behavior

To determine if gratitude reduced the tendency to extract greater resources from the common pool under conditions of rapid depletion, we conducted a 2(Emotion: Gratitude vs Neutral) x 2(Resource Status: Sustained vs Depleting) ANOVA. Confirming our prediction, a

significant interaction emerged, $F_{interaction}(1, 151)=5.32$, $p=0.022$, partial $\eta_p^2=.03$. Whereas neutral participants extracted significantly more points when resources were depleting compared to when they were sustained $t(78)=2.11$, $p=.038$, 95% CI [04, 1.46], $d=0.48$ (see Figure 1), grateful participants showed no difference in extraction levels between the two condition, $t(73)=$ -1.23, $p=.221$, 95% CI [-1.38, .32], $d=0.28$.

We expected that emotional states would not moderate behavior over time, as the game was limited to approximately 5 minutes in length. Subsequent analyses confirmed that emotional state did not moderate resource extraction as a function of rounds within or across resource status conditions (see Supplementary Materials).

STUDY 2

Method

Open Practices Statement

Materials and data for this experiment can be accessed at osf.io/j9zfp. This study was preregistered.

Participants

As noted in the preregistration, we set a target minimum final sample of 245. This target was calculated to achieve power=.80 for the planned interaction contrast using the effect size for the interaction of interest from Study 1. In an attempt to ensure we would reach that minimum after removing participants due to the preregistered exclusion criteria (i.e., having lived predominantly in the United States during their lives [to ensure English Fluency], no expression of suspicion of the experiment's true purpose), we intended to recruit 281 participants (a 15%

inflation). However, because of our university's suspension of lab-based research due to the

COVID-19 pandemic, which occurred while data were being collected, we ended recruitment

with a sample of 260 participants. After removing participants for the exclusion criteria or

missing data, our final sample consisted of 224 participants (109 women, 113 men, 1 other, 1

unreported, M_{age}=19.17, SD_{age}=1.84), which provided an *a priori* power=.76.

Procedure

The procedure used in Study 2 was almost identical to that in Study 1, with the addition

of a happiness condition. As part of the emotion induction, those in the happiness condition were

asked to describe a time they felt happy or amused. Happiness intensity was calculated as an

average of the items happy and amused (Cronbach's α=.70).

<div align="center">

Results

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Manipulation Checks

We submitted participants' responses on the gratitude and happiness scales to a

3(Emotion Condition: Gratitude, Happiness, Neutral) X 2(Emotion Intensity: Gratitude,

Happiness) mixed ANOVA. The emotion induction produced distinct states, as indicated by the

expected interaction, $F(2, 221)$=76.01, $p < .001$. A one-way ANOVA on gratitude intensity

followed by Fisher's LSD comparisons confirmed that participants who completed the gratitude

manipulation reported greater intensities of gratitude, (M=6.38, SD=0.93) than those who

completed the happiness (M=5.32, SD=1.75) and neutral (M=4.39, SD=1.67) manipulations,

$F(2, 221)$=31.39, $p < .001$, partial η_p^2=.22.

A one-way ANOVA on happiness intensity followed by Fisher's LSD comparisons

showed that participants who completed the happiness induction reported greater intensities of

happiness, (*M*=5.87, *SD*=0.99) than those who completed the gratitude (*M*=3.94, *SD*=1.37) and neutral (*M*=3.90, *SD*=1.43) inductions, $F(2, 221)=60.71$, $p < .001$, partial $\eta_p^2=.36$.

As in Study 1, we submitted participants' estimates of the other players average extraction to an independent samples t-test by resource status condition. As predicted, participants in the depleting condition (*M*=7.03, *SD*=0.89) estimated the other players extracted significantly more points compared to those in the sustained condition, (*M*=5.07, *SD*=0.87), $t(222)=16.70$, $p < .001$, $d=2.24$.

Resource Dilemma Behavior

As noted in the pre-registered analysis plan, we used an *a priori* interaction contrast (Abelson & Prentice, 1997) to assess whether gratitude would produce a significant reduction in the usual increased extraction of resources in the rapid depletion condition among those feeling neutral or happy. The doubly-centered contrast weights were as follows for the sustained and depletion conditions, respectively: (-1, 1) neutral, (-1, 1) happy, (2, -2) gratitude. Supporting our prediction, the contrast confirmed that while grateful participants did not increase point-taking when the resource was depleting, happy and neutral participants did not differ from one another (replicating past research; Knapp & Clarke, 1991), and demonstrated a similar increase in resource extraction in the depleting condition relative to the sustained one, $F(1, 218)=4.04$, $p=.046$, contrast value=2.08, 95% CI [0.05, 4.11], partial $\eta_p^2=.05$ (see Figure 2).

As in Study 1, we found that emotion condition did not moderate behavior over time within or across resource status (see Supplementary Materials for more detailed information).

Discussion

These studies provide initial evidence that gratitude tempers the normal urge to consume rapidly depleting resources. Of import, they also demonstrate that this effect cannot be attributed

simply to the experience of any positive emotional state. The effect of gratitude was distinct; happiness did not attenuate resource consumption. This pattern is consistent with past findings showing that happiness tends to focus people's decisions on acquiring immediate pleasures (Wegener & Petty, 1994) as well as refraining from cooperation when it is costly (Bartlett & DeSteno, 2006).

Even though the effects of gratitude and happiness diverge, we believe it important to note that gratitude's ability to foster sustainable resource use may not be unique. Closely aligned emotions like compassion or authentic pride that also foster sacrifice within social contexts might well function in a similar way, given their penchant to focus people's valuation more on future rewards (DeSteno, 2009; DeSteno, Condon, & Dickens, 2016). As opposed to valence, functional specificity is likely to be the determining factor. In a similar vein, while some degree of cultural variation might exist, we expect the effect of gratitude on resource use to be fairly robust. Indeed, Chang and Algoe (2019) have documented that while modes of expression for gratitude vary across cultures, the priority of its functional effects on reciprocity do not.

Finally, although the magnitude of gratitude's effect on resource extraction in our paradigm is not large, we remain encouraged that it might serve as a useful tool with which to enhance societal resilience. The utilized situation – one where the majority of actors were behaving selfishly – stands as a strong case for pushing people to conform. Nonetheless, gratitude prevented individuals from increasing their resource extraction. In addition, gratitude-induced prosocial behavior could not influence the behavior of other players here. In real-world situations, where all actors in a network are able to influence each other, we expect that gratitude might lead to adjustments of the cooperation equilibrium (Nowak & Roch, 2007). Consequently,

we believe that future investigation examining the spread of gratitude or its resulting cooperative

behavior within dynamic networks is a fruitful avenue to pursue.

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Author Notes

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Figure Captions

Figure 1. Average number of points taken as a function of emotional state and resource status in Study 1. Error bars represent 95% confidence intervals.

Figure 2. Average number of points taken as a function of emotional state and resource status in Study 2. Error bars represent 95% confidence intervals.
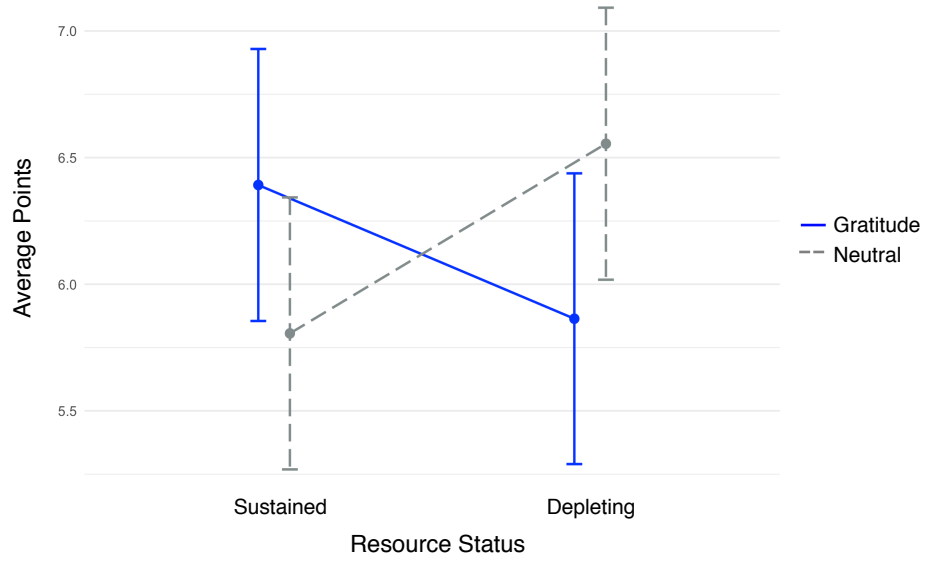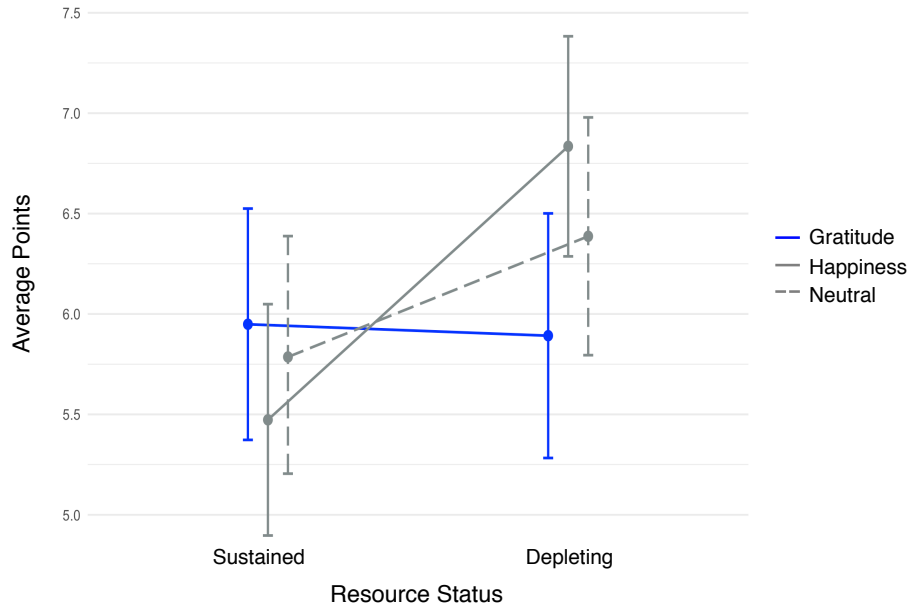
Supplementary Materials

Emotion Does Not Moderate Resource Extraction as a Function of Game Round

Although we did not expect that emotion conditions would moderate point-taking over time, we accounted for this possibility by conducting a 2(Emotion: Gratitude vs Neutral) x 2(Resource Status: Sustained vs Depleting) X 12(Game Round) mixed ANOVA. As expected, in Study 1 we found that emotion did not moderate behavior as a function of individual game rounds, $F(11, 1584)=1.57$, $p=0.102$, partial $\eta_p^2=.01$, or as a function of changing behavior in individual game rounds across resource status conditions (i.e., the Emotion X Condition X Game Round interaction), $F(11, 1584)=1.02$, $p=0.430$, partial $\eta_p^2=.00$. We replicated these findings in Study 2. Again, we found no evidence of interaction between emotion and individual game rounds, $F_{interaction}(22, 2233)=1.21$, $p=0.225$, partial $\eta_p^2=.01$, or of a higher-order interaction involving individual game rounds, $F_{interaction}(22, 2233)=0.46$, $p=0.985$, partial $\eta_p^2=.00$.

Figures S1 and S2. Average points taken across rounds and resource status conditions in Study 1.

Shaded areas represent 95% confidence intervals.
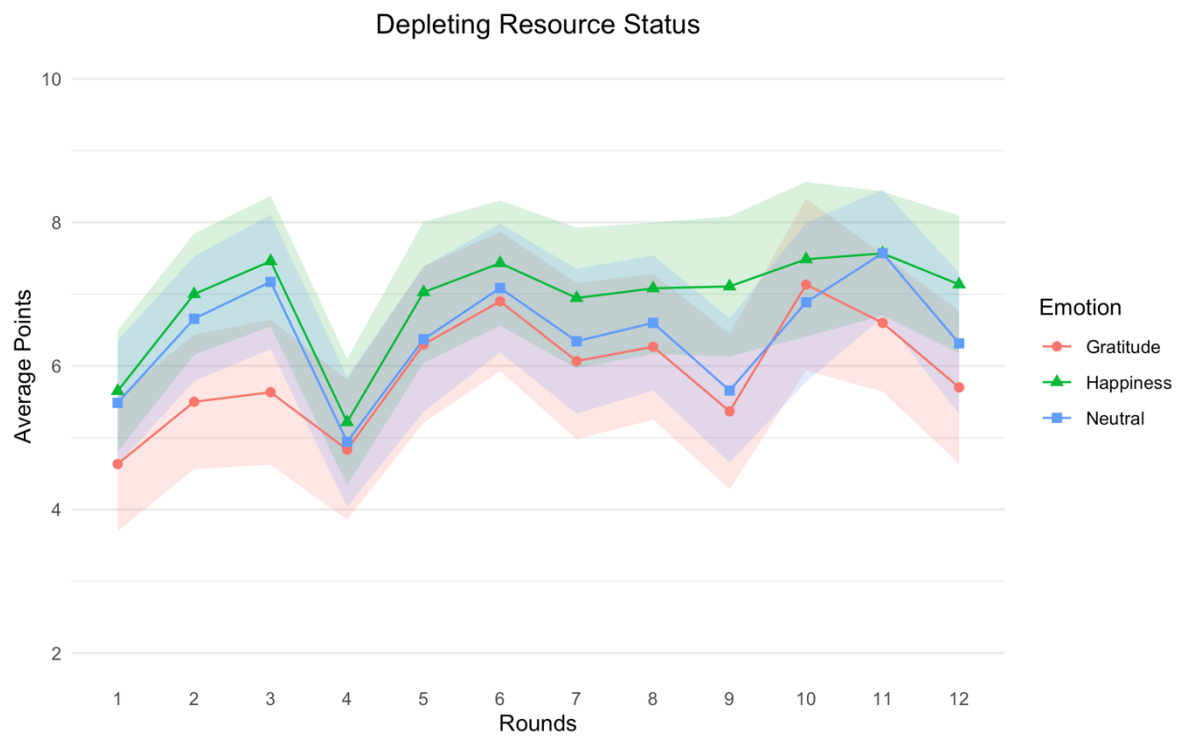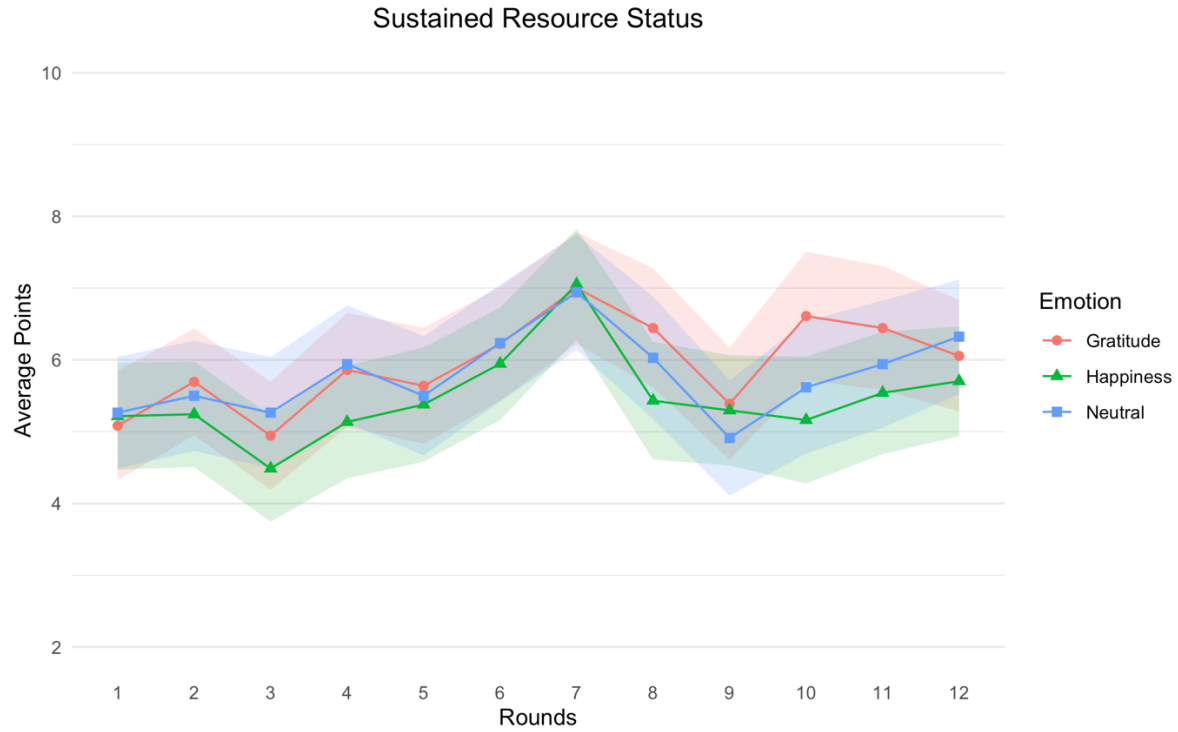
Figures S3 and S4. Average points taken across rounds and resource status conditions in Study 2.

Shaded areas represent 95% confidence intervals.

Categories of Gratitude Inducing Events

To examine the types of gratitude inducing events participants wrote about for the autobiographical recall tasks, the authors created six categories that covered the types of events described. The six categories were as follows: enjoyable event (e.g., vacation with loved ones), overcame/avoided negative event (e.g., survived a car accident), received support/assistance (e.g., received advice from a friend), goal attainment (e.g., landed dream job), material gain/gift (e.g., won concert tickets), general life state (e.g., good health). One of the authors and an independent coder then sorted the recalled events into one of these six categories, with discrepancies being decided by a second independent coder. Kappa was calculated to assess agreement levels, reaching a moderate level of agreement in Study 1 ($\kappa = .48$) and a substantial level of agreement in Study 2 ($\kappa = .70$). Frequencies for each category are displayed below in Tables S1 and S2, respectively. In each case, events describing the receipt of support or assistance were the most frequently recalled by far.

Table S1

Frequency Distribution of Gratitude Categories in Study 1

Category	N	%
Enjoyable event	7	8.97
Overcame/avoided negative event	10	12.82
Received support/assistance	34	43.59
Goal attainment	10	12.82
Material gain/gift	7	8.97
General life state	10	12.82

Table S2

Frequency Distribution of Gratitude Categories in Study 2

Category	N	%
Enjoyable event	8	9.76
Overcame/avoided negative event	8	9.76
Received support/assistance	41	50.00
Goal attainment	2	2.44
Material gain/gift	8	9.76
General life state	15	18.29