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When the Equality Rule is Violated: Factors Affecting the Consumption of Physical, Spatial, and Temporal Resources

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Running head: FACTORS AFFECTING ALLOCATION OF SHARED RESOURCES
Abstract

Three studies explored the processes by which different types of shared resources were consumed by group members. Subjects shared physical, spatial, and temporal resources. The resources were arranged in either a partitioned or nonpartitioned form. Subjects did so with an implied withdrawal of either one-third or one-twelfth and while participating in either a sharing or an accuracy instruction. Results for each resource provided partial support for a deliberate motive of greed and an inadvertent overestimation bias affecting subjects' withdrawals. The results also suggest that different types of resources may be consumed according to different criteria. Suggestions are made for methodological changes and further analyses which may increase support for the factors shown to affect people's resource consumption decisions.
When the Equality Rule is Violated: Factors Affecting the Consumption of Physical, Spatial, and Temporal Resources

Most Americans are aware that our country is facing an energy crisis (Samuelson, 1990; Costanzo, Archer, Aronson, & Pettigrew, 1986). Although energy conservation appears to be one solution to the impending energy crisis (Samuelson, 1990), there is no apparent relationship between the general attitude held about conservation and personal conservation practices (Costanzo et al., 1986; Edney, 1980). One reason for the lack of this relationship is that people are less likely to conserve if they believe that the cause of a resource shortage is due to human actions as opposed to uncontrollable environmental factors (Rutte, Wilke, & Messick, 1987; Samuelson, Messick, Rutte, & Wilke, 1984; Messick, Wilke, Brewer, Kramer, Zemke, & Lui, 1983; Olsen, 1981). A lack of personal responsibility, the anonymity of people's choices, a misconception that individual use has only a very minor effect on the world energy supply (Samuelson, 1990), and the delayed consequences of non-conservative usage for self and society (Cross & Guyer, 1980; Platt, 1973) have developed the energy crisis into a "tragedy of the commons" (Hardin, 1968) in which the lack of individual conservation is threatening the future energy supply (Edney, 1980). In addition, failing to conserve resources not only depletes the total amount of resources available but also deprives others of their fair shares.

Research on the social dilemmas surrounding energy conservation has
shown that while programs increasing communication (Messick & Brewer, 1983), identifiability (Jorgenson & Papciak, 1981; Fox & Guyer, 1978; Bixenstine, Levitt, & Wilson, 1966), financial incentives (Komorita, Sweeney, & Kravitz, 1980; Bonacich, Shure, Kahan, & Meeker, 1976; Kelley & Grzelak, 1972), public commitment (Pallack, Cook, & Sullivan, 1980), and group consciousness (Kramer & Brewer, 1984; Olsen, 1981; Edney, 1980; Brewer, 1979) may slightly and temporarily increase conservation efforts, the benefits lessen over time or disappear altogether when the program is complete. One reason for this situation may be that personal comfort outweighs other factors when partaking of resources. A study that surveyed home energy use over a summer found that personal comfort outweighed efforts to conserve, monetary savings, and the role of the energy crisis in energy usage (Seligman, Kriss, Darley, Fazio, Becker, & Pryor, 1979). Edney (1980) points to the American system of democracy as one problem in the effort to conserve. The very system that ensures the right of free choice prohibits the government from implementing a forced conservation program to ensure that all people receive their fair share of resources.

Social psychologists have long been interested in the decision making processes involved in resource sharing. Deutsch (1975), for example, focused on the topic of distributive justice. He argued that there exist circumstances where either equality, equity, or need is likely to be the prevalent factor in resource allocation. However, social cooperation is essential to justice and
concerns the individual well-being of group members. Furthermore, the applicability of social justice can only apply as far as group boundaries can be assessed, and, as Kramer & Brewer (1984) have shown, group identity can be perceived. Deutsch believes that just group relations depend heavily on group loyalty, mutual respect, personal equality, cooperation, and face to face contact.

While Deutsch's description of distributive justice in group situations is valuable, there are many real world situations in which group identity and loyalty are not deciding factors in how decisions involving resources are made. In Messick and Sentis's (1979) study of a hypothetical work situation, one subject was responsible for deciding what fair and actual payments would be for his or her own and a hypothetical partner's payment. They found that the subjects favored equal monetary payments when their payments were set and they were deciding the other workers' payments, but favored higher, more egocentric payments when the others' payments were set and their payments were negotiable. Relating this finding back to Deutsch's ideas on group distributive justice, the other worker in this study was unknown, unseen, and not part of the subject's group or community, thus removing the worker from the subject's realm of social distributive justice.

While social justice and group identification may play a role in decision making, McClintock and Allison (1989) identified individual differences that affect how subjects perform. After indentifying subjects as cooperaters, individualists, or competitors, they mailed a questionnaire asking them to
When the Equality 6

contribute their time to a worthy cause. The finding was that these individual differences did play a major role in decision making, with individuals classified as cooperaters donating twice as many hours as individuals classified as individualists and competitors.

Another factor that influences the way in which resources are allocated is a social decision heuristic called the equality rule that is commonly implemented when group members learn they must share a common resource. The equality heuristic prescribes that people adopt an even division strategy (Rutte, Wilke, & Messick, 1987). This heuristic is derived from the social norm of equality and provides people with a quick, efficient strategy by which to guide their own behavior as well as evaluate the behaviors of others. Harris and Joyce (1980) discovered that people often apply the equality heuristic mindlessly when making social choices. Messick (1992) calls equality the most prominent of all social decision heuristics.

The equality heuristic tends to be more readily adopted in cases of greater identifiability and verifiability. Allison and Messick (1990) and Allison, McQueen, and Schaerfl (1992) designed their experiments so that subjects did not have the benefit of adopting the equality norm set by previous hypothetical subjects. In both of these experiments, the subject was the first person to withdraw from a shared physical resource, thus making the subject an identifiable norm setter. When the shared resources were partitioned or presented in an amount easily divisible by the number of members in the group,
subjects tended to adopt the equality rule because their withdrawals were also verifiable. In other conditions, when the resource was either nonpartitioned or not easily divisible, the equality rule was violated despite the identifiability due to the subject's position. Allison & Messick (1990) found that as they increased the temptations to violate the equality rule (e.g. higher payoffs), subjects' adherence to the rule dropped sharply, indicating that subjects are more likely to exhibit selfish behavior when the equality rule is only one of several choices and is not the most salient choice.

Of particular interest, with respect to the proposed study, are the methodology employed and the trends uncovered by Allison, et al. (1992). In their first study, the experimenters varied the numbers of people in the subjects' groups (3 vs. 12) and the partitionment (partitioned vs. nonpartitioned) from which the subject withdrew. The amount of the resource was proportioned to the group size, so that if the equality rule was followed, all subjects would withdraw the same amount. They found that subjects who believed they were the first member in a group of 12 withdrawing from a nonpartitioned resource took over twice as much as subjects in the other three conditions. In the second study, when both the groups of 3 and 12 withdrew from both amounts of only the nonpartitioned resource, it was discovered that members of the larger group violated the equality rule based on group size rather than resource size. In a final study, Allison, et al. investigated whether or not the subjects' larger withdrawals were a function of a faulty perception of amounts by employing an
When the Equality accuracy task. They found that when asked to withdraw accurately, subjects withdrew close to the requested amount but did slightly overestimate in the 12 person group. In the resource sharing task when subjects were 1 of 3 individuals sharing a resource, they tended to divide equally. Subjects in the group of 12, however, took almost three times their fair share. These results indicate that there are two processes guiding the actions of the subjects. The first is an unintentional overestimation bias exhibited when subjects are withdrawing from a large resource. The second is the appearance of deliberate greed. Subjects may believe that when withdrawing from a larger nonpartitioned resource, their greedy withdrawal will not be detected and that because they don't know their other group members, they are not subject to the distributive justice ideas set forth by Deutsch (1976).

One of the shortcomings of prior research is that it has only addressed the question of how people share physical resources. Resources are not always physical, however, as people also share space and time. There exists a great body of research concerning the spatial and temporal variables which are included as the second and third resources under consideration in this paper. Previous research on temporal variables deals mainly with the conditions concerning its perception and overestimation (Loftus, Schooler, Boone, & Kline, 1987; Hogan, 1978; Meade, 1966; Fraisse, 1984; Schiffman & Bobko, 1974; Sarason & Stoops, 1978). The research of a spatial nature is heavily concentrated on crowding and spatial density (O'Brien, 1990; Oldham, 1988; Pedersen, 1983;
When the Equality

Prerost, 1981; Lange, Mueller, & Donnerstein, 1979; McClelland & Auslander, 1978; Jain, 1987). It seems unfortunate that social psychologists have failed to explore the processes by which people share spatial and temporal resources. Time becomes a shared resource when people must decide how much phone or computer time they may use when others are also waiting their turns. Similarly, when people share land or air space they must decide how much of the space constitutes their fair share. Temporal and spatial resources would seem to be as common as physical resources and deserve to be included in the study of shared resources.

In this experiment, the aforementioned shortcomings in the literature concerning resource sharing will be studied by including partitioned and nonpartitioned physical, spatial, and temporal resource in instructions of both resource sharing and accuracy while varying the fraction of equal withdrawal. Each resource will be subjected to the same methodological design but treated independently in the results. The research hypotheses are identical for each type of resource. It is predicted that an overestimation bias will be found when subjects withdraw from larger amounts of the nonpartitioned resource. In addition, greater withdrawals of the resource are expected when the verifiability of subjects' withdrawals are low (large group, nonpartitioned resource, sharing instruction) due to both an inadvertent overestimation bias and deliberate greed resulting in the violation of the equality rule.
Study 1: Physical Resources

The goal of Study 1 is to compare differences between withdrawals of physical resources as a function of fraction of equality (one-third, one-twelfth)/group size (3 or 12), partitionment (partitioned or nonpartitioned), and type of instruction (resource or accuracy). It is expected that in the resource sharing instruction, subjects withdrawing from the partitioned resource will adopt the salient equality rule as will subjects withdrawing from the smaller, nonpartitioned resource. When withdrawing from the larger, nonpartitioned resource, a tendency to take more than one's fair share is expected due to an inadvertent overestimation bias and deliberate greed. The results of the accuracy instruction will likely show that the accurate withdrawal of a partitioned resource is quite easy but is hampered by overestimation when the resource is nonpartitioned and as the amount of the resource increases.

Methods

Subjects. Ninety introductory psychology students served as participants and received course credit for their participation. Each subject was randomly assigned to one of the eight conditions.

Design. The experiment used a 2 (instruction: accuracy, resource sharing) X 2 (resource: partitioned, nonpartitioned) X 2 (equality fraction: one-third, one-twelfth) between subjects factorial design. Half of the subjects were told that they were participating in an accuracy of measurement task while the other half were told that they were participating in a resource sharing task.
In each of these instructions, half of the subject took from the partitioned resource (blocks) while half took from the nonpartitioned resource (sand). Finally, for half of the subjects in each of these conditions, the instructed or implied amount of the withdrawal was one-third while the instructed or implied amount of the other half's withdrawal was one-twelfth of their resource.

Materials. The resource used in the partitioned resource condition of both the resource sharing and accuracy instructions was blocks. Six blocks were used in the one-third condition and 24 blocks were used in the one-twelfth condition. In the nonpartitioned resource conditions of both the resource sharing and accuracy instructions, the resource from which the subjects will withdraw was sand. Twenty-four pounds were used in the one-twelfth condition and 6 pounds were used in the one-third condition. Both the sand and the blocks were placed in an open rectangular box on a table in front of the subjects. Using their hands, the subjects placed their withdrawals in a separate box on the table next to the first box.

A questionnaire assessed the subjects' understanding of their instructions, the amount of the resource that they believe they withdrew, and how much fun they had in this part of the experiment. The amount of fun was measured on a one to seven Likert scale with one indicating no fun at all and seven indicating a lot of fun.

Procedure. Subjects were tested individually. Subjects in the accuracy condition were read instructions explaining that it is sometimes necessary to
estimate amounts accurately when the proper measuring tools are not available. The subjects withdrawing from the resource of 6 resource units (either 6 blocks or 6 pounds) were instructed to withdraw one-third of the resource. In the accuracy conditions where 24 units of the resource were present, the subjects were instructed to remove one-twelfth. Thus, subjects in all four conditions should have been accurately attempting to withdraw 2 units of their resource. In each of the four conditions, subjects were told that the subject withdrawing closest to the accurate amount would receive a $5 prize. In the partitioned accuracy conditions, one subject of those indicating the correct amount of time was chosen at random to receive the prize.

Subjects in the resource sharing condition were introduced to the concept of resource sharing through real world examples of resource sharing. They were also told that they were the first member of a group of 3 (6 resource units) or 12 (24 resource units) to withdraw from their particular resource and that the other group members would be withdrawing from the same resource after them. By telling subjects the number of members in their group and the total amount of the resource available to their group, it was implied that each member's fair share was 2 units (2 blocks or 2 pounds of sand) of the resource. Subjects were also told that one member of their group would be randomly selected at the end of the experiment and paid $2 for each entire pound or block and fraction of this amount in the nonpartitioned conditions for partial pounds of sand. In actuality, one subject in each of the resource sharing instructions was randomly selected.
and paid $5.

After the instructions were read, the experimenter answered any questions. Once the subject had begun the task, the experimenter did not answer questions. The subject then participated in the task. Upon the completion of the task, the subject was given and asked to complete the questionnaire. After the subject had finished the experiment, the number of blocks or the amount of sand withdrawn was recorded. Provided that the subject answered the items on the questionnaire concerning his or her understanding of the instruction correctly, the subject’s data was analyzed.

**Dependent variables.** The main dependent variables are the actual and perceived amounts of the sand or blocks withdrawn. The responses to the fun question were not used in this study. This question was designed specifically for Study 3 but was included on the questionnaires in each study to appear consistent.

**Results and Discussion**

Preliminary analyses were performed on the data to see if the order in which subjects were exposed to the three resources influenced their withdrawals. A 2 (partitionment: partitioned, nonpartitioned) X 2 (instruction: accuracy, sharing) X 2 (equality fraction: one-third, one-twelfth) X 3 (order: first, second, third) analysis of variance was performed on the perceived and actual physical resource withdrawals. This analysis failed to reveal any effects associated with order, indicating that subjects' withdrawal of the physical resource units was not affected by the position of the resource in the overall
A 2 (partitionment: partitioned, nonpartitioned) X 2 (instruction: accuracy, sharing) X 2 (equality fraction: one-third, one-twelfth) X 2 (type of withdrawal: perceived, actual) between subjects analysis of variance with repeated measures on the final variable failed to reveal the predicted 4-way interaction. $F (1, 82) = .29$, $p = .59$. The means for the experimental conditions are presented in Table 1.

The overestimation bias appears in the accuracy instruction conditions where subjects perceived to take the correct amount in each equality fraction and partitionment condition but actually withdrew more when a large amount of the resource was presented in a nonpartitioned form. However, in the resource sharing instruction conditions, subjects not only perceived they took less of the resource in the one-twelfth, nonpartitioned condition than in the partitioned condition, they did indeed take almost an entire resource unit less. While subjects in the one-twelfth, nonpartitioned condition did overestimate their withdrawals, this overestimation is overshadowed by the unexpected low withdrawal in this condition.

These findings support the existence of the overestimation bias but fail to uncover deliberate greed when the withdrawals are low in verifiability.
However, subjects sharing the larger, partitioned resource took one resource unit more than their fair share indicating deliberate greed in an unexpected condition. One possible reason for this is the ease with which subjects could withdraw the partitioned resource, blocks. Many of the subjects were not pleased that they were expected to withdraw the nonpartitioned resource, sand, with their hands. When presented with a large amount of sand, subjects' desire to keep their hands clean may have overridden the desire to dig in and possibly be compensated with the money. Conversely, the blocks were much easier to withdraw and the verifiability of the subjects' withdrawals may not have appeared to be as high as it was intended. The subjects were not told that their identity would be revealed to the next group member.

The analyses did yield several significant results. The partitionment by equality fraction by type of withdrawal interaction ($F (1, 82) = 4.28, p \leq .05$) indicates that subjects both perceived they took and actually took virtually the same amount when the resource was in a small partitioned or nonpartitioned form.

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Insert Table 2 about here

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This was expected and is consistent with the findings of Allison, et al. (1992). When more of the resource was present, in the partitioned form the perceived and actual withdrawals were still equal but a greater amount had been taken. In
the nonpartitioned form, subjects actually took about the same as in the
partitioned conditions but perceived that they had taken far less. The last finding
is supportive of the overestimation bias. The means are presented in Table 2.

This interaction is supported by an equality fraction by type of
withdrawal interaction \( F(1, 82) = 4.28, p \leq .05 \) and a partitionment by type
of withdrawal interaction, \( F(1, 82) = 4.42, p \leq .05 \). Subjects perceived to take
virtually the same amount in the one-third \((M = 2.15, sd = .71)\) and one-
twelfth \((M = 2.14, sd = 1.17)\) equality fraction conditions and actually took that
amount in the one-third condition \((M = 2.15, sd = .77)\). Subjects actually took a
mean of 2.61 resource units \((sd = 1.56)\) in the one-twelfth condition, almost
half a resource unit more than in each of the other conditions. This finding is
somewhat supportive of the deliberate greed hypothesis but a look at the means
displayed in Table 1 shows that subjects were only deliberately greedy in one of
the four larger resource conditions. Figure 1 displays the interaction.

\[ \text{Insert Figure 1 about here} \]

In the partitionment by type of withdrawal interaction, subjects perceived they
withdrew and actually withdrew the same amount in the partitioned condition \((M
= 2.39, sd = 1.15)\). They perceived they withdrew less of the resource in the
nonpartitioned condition \((M = 1.98, sd = .76)\), while they actually withdrew
almost the same amount as in the partitioned condition \((M = 2.35, sd = 1.27)\).
When the resource was nonpartitioned, estimating the withdrawal seems to have been more difficult than when subjects could count how many partitioned resource units they had withdrawn. The effect may be visualized in Figure 2.

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Insert Figure 2 about here

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A main effect for type of withdrawal supports each of the significant interactions, $E (1, 82) = 4.42, p \leq .05$. Subjects perceived that they withdrew a mean of 2.14 resource units ($sd = .95$) while they actually withdrew 2.37 resource units ($sd = 1.22$). Surprisingly, this effect in combination with a significant equality fraction by partitionment by instruction interaction ($E (1, 82) = 4.52, p \leq .05$) did not force the overall analysis to significance. The means for the equality fraction by partitionment by instruction interaction are presented in Table 3.

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Insert Table 3 about here

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Separate analyses were also performed with the three independent variables on each type of withdrawal. The three-way interaction for the perceived withdrawal was significant ($E (1, 82) = 4.08, p \leq .05$) indicating that subjects had tried to take less than their fair share of the larger nonpartitioned resource. The three-way interaction on the actual withdrawal was found to be marginally
significant, $F(1, 82) = 3.614, p = .06$. The greatest actual withdrawals were found in the sharing partitioned and accuracy nonpartitioned conditions of the larger resource. The means in both the perceived and actual withdrawal interactions may be found in Table 1.

Study 1 provides partial support for both the existence of the overestimation bias and deliberate greed. However, subjects’ withdrawals may have been confounded by the desirability of the nonpartitioned resource and the degree of verifiability.

Study 2: Spatial Resources

The goal of Study 2 is similar to that of Study 1 but involves a spatial resource. This study will compare differences between withdrawals due to fraction of equality/group size and partitionment or nonpartitionment of a shared spatial resource to amounts withdrawn when accuracy is the instruction. The subjects will be placed into conditions varied by instruction, partitionment or nonpartitionment of the spatial resource, and fraction of equality. It is expected that in the resource sharing instruction, subjects withdrawing from the partitioned resource will adopt the salient equality rule as will subjects withdrawing from the smaller nonpartitioned resource. When withdrawing from the larger nonpartitioned resource, a tendency to take more than one’s fair share is expected due to deliberate greed and an inadvertent overestimation bias. The results of the accuracy instruction will likely show that while the accurate withdrawal of partitioned resources is quite easy, it becomes more difficult due
to the overestimation bias when the resource is nonpartitioned and as the amount of the resource increases.

**Methods**

**Subjects.** The same 90 subjects used in Study 1 also served as participants for Study 2. The experimental conditions paralleled those of Study 1, and the subjects served in the same experimental conditions.

**Design.** The experiment used the same design as found in Study 1, a 2 (instruction: accuracy, resource sharing) X 2 (resource: partitioned, nonpartitioned) X 2 (equality fraction: one-third, one-twelfth) between subjects factorial design. Half of the subjects were told that they were participating in an accuracy of measurement task, while the other half were told that they were participating in a resource sharing task. In each of these instructions, half of the subjects took from the partitioned resource (sectioned areas of space) while half took from the nonpartitioned resource (a nonsectioned area of space). Finally, for half of the subjects in each of these conditions, the instructed or implied amount of the withdrawal was one-third, while the instructed or implied amount of the other half's withdrawal was one-twelfth of their resource.

**Materials.** The resource used in the partitioned resource conditions of both the resource sharing and accuracy instructions were blocks of space. Six blocks of space (total area = 5766 square inches, block area = 961 square inches) were used in the one-third conditions. Due to facility constraints, the
area used in the one-twelfth condition was not large enough to allow for the same size blocks as in the one-third condition. The blocks were only slightly smaller (block area = 929 square inches) and 24 blocks of space (total area = 23064 square inches) were used. Masking tape was used to designate the total area and the individual blocks in each condition.

In the nonpartitioned condition, an area of 5766 square inches of space was used in the one-third conditions of both the resource sharing and accuracy instructions. An area of 22302 square inches of space was used in the one-twelfth conditions of both the resource sharing and accuracy instructions. While these areas were designated by masking tape, they were not partitioned into individual blocks.

The spatial areas used were lab rooms in an academic building. The subjects were given a ball of string to mark off the area they believed to be the accurate amount or the area they wished to take depending on their instruction condition. The subjects filled out the same questionnaire as in Study 1.

**Procedure.** The subjects were read the instructions by the experimenter and given a chance to ask questions. The instructions were very similar to the instructions read in Study 1 with respect to the idea of accuracy or resource sharing. In the accuracy conditions, the subjects were either instructed to block off one-third or one-twelfth of the total area. Thus, if subjects were accurate, in the one-third accuracy conditions an area of 1922 square inches should have been blocked off while in the one-twelfth accuracy conditions an area of 1859
square inches should have been blocked off. The accurate withdrawal in the partitioned conditions was equal to two blocks of the resource. Prizes of $5 were awarded to the subject in each accuracy condition who blocked off closest to the instructed amount. In the partitioned accuracy conditions, one subject of those marking off the correct amount of space was chosen at random to receive the prize.

Subjects in the resource sharing conditions were told that they were the first member of their group to withdraw from an amount of a resource and that the other members of their group would withdraw after them. In each of the one-third conditions, the subject's equal share of the resource was 1922 square inches and in the one-twelfth conditions was 1859 square inches. The subject's equal share was equivalent to two blocks in the partitioned resource conditions. Subjects were told that one member of their group would be chosen at random and paid $2 for each entire square yard and, in the nonpartitioned conditions, a fraction of that amount for each partial square yard taken. In actuality, at the end of the experiment, one subject in each of the four conditions was chosen at random to receive a prize of $5.

After the subjects marked an area using the string, they completed the questionnaire. After the subject had left the experiment, the area enclosed by the string was measured and recorded. The data for each subject was analyzed only if the subject accurately demonstrated an understanding of his or her instructions on the questionnaire.
**Dependent variables.** The main dependent variables are the actual and perceived amounts of space withdrawn. In each of the nonpartitioned conditions, the amounts withdrawn were divided by the area of an individual block in the corresponding partitioned conditions. By doing this, the amounts withdrawn in each condition could be perceived as comparable resource units. The number of resource units withdrawn was used in the analyses. The responses to the fun question were not used in this study. This question was designed specifically for Study 3 but was included on the questionnaires in each study to appear consistent.

**Results and Discussion**

An analysis to detect order effects was performed on the data collected in Study 2 and failed to reach any significant effects associated with order. As in Study 1, this finding shows that the position of the spatial resource in the overall experiment did not effect either the subjects' perceived or actual withdrawals.

A 2 (partitionment: partitioned, nonpartitioned) X 2 (instruction: accuracy, sharing) X 2 (equality fraction: one-third, one-twelfth) X 2 (type of withdrawal: perceived, actual) between subjects analysis of variance with repeated measures on the final variable failed to reveal the predicted 4-way interaction, \( F (1, 82) = 1.71, p = .19 \). The means of the experimental conditions are presented in Table 4.

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Insert Table 4 about here

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Subjects perceived they withdrew and actually withdrew close to the desired amount, two resource units, in the each condition of the accuracy instruction and in the one-third equality fraction conditions of the sharing instruction. In the one-twelfth sharing conditions, subjects withdrew half a resource unit to a whole resource unit more but the increase was not enough to bring the analysis to significance.

The pattern in the one-twelfth, sharing conditions indicates that subjects were being deliberately greedy but the overestimation bias is not supported by the means in the larger resource conditions of the accuracy task. A slight overestimation is obvious when subjects shared the larger, nonpartitioned spatial resource but because the same overestimation is not found in the accuracy condition, it is possible that the subjects wrote down a smaller perceived amount taken than they truly believed had been withdrawn. Another possible reason for the high degree of accuracy was the size of the spatial resource. Due to facility constraints, the areas used in the study were fairly small. The area in the one-third equality fraction was small enough the subjects could easily visualize one-third of the area. In addition, many subjects in effect partitioned the resource with the string. By giving the subjects unlimited time to make their withdrawals, they were able to measure out an accurate space. Subjects in the sharing conditions did not take the time to measure out their withdrawals accounting for their slight overestimation when the larger nonpartitioned area was the resource.
None of the within subjects analyses reached significance. When the data were collapsed across type of withdrawal, the equality fraction by instruction analysis was found to be significant, $F(1, 82) = 5.07, p \leq .05$. The means of the sharing ($M = 2.01$, $sd = .37$) and accuracy ($M = 2.00$, $sd = .04$) instructions in the one-third equality fractions condition are virtually equal. In the one-twelfth accuracy instruction condition, the mean is also virtually equal ($M = 2.02$, $sd = .20$). However, in the one-twelfth sharing condition, the mean increased by over two-thirds of a resource unit ($M = 2.69$, $sd = 1.20$) indicating that subjects were most likely to withdraw more of the resource when it was presented in a large amount and when accuracy was not the goal. Type of withdrawal does not significantly influence this interaction suggesting that subjects in this experiment are good estimaters of spatial amounts. The effect can be visualized in Figure 3.

When just the subjects' actual withdrawals were analyzed, a similar equality fraction by instruction interaction proved to be significant, $F(1, 82) = 6.93, p \leq .01$. This interaction shows that subjects actually took more when they were sharing a large amount of a resource. The pattern of means for this interaction is very similar to the graph of the means in the equality fraction by instruction interaction presented in Figure 3 and is, therefore, not presented.
A marginally significant instruction by partitionment interaction for subjects' perceived withdrawals ($F(1, 82) = 3.70, p = .06$) presents some interesting findings. The means of this interaction, presented in Table 5, indicate that subjects in the sharing conditions perceived they were taking more than the expected two resource units. This increase was more pronounced in the nonpartitioned condition which shows that while subjects perceived they were being greedy in the sharing conditions, they were more likely to exhibit greedy behavior when the resource was not easily divisible.

These interactions are supported by two significant main effects. The main effect for equality fraction ($F(1, 82) = 5.53, p \leq .05$) shows an increase in the number of mean resource units taken from 2.01 ($sd = .29$) in the one-third condition to 2.40 ($sd = .97$) in the one-twelfth condition. This effect is also reflected in significant perceived ($F(1, 82) = 5.50, p \leq .05$) and actual ($F(1, 82) = 10.77, p \leq .01$) main effects for equality fraction, both of which have very similar means. Overall, these three effects combine to demonstrate an increase in withdrawal when a larger amount of the spatial resource was presented. The second main effect for instruction ($F(1, 82) = 4.92, p \leq .05$) shows a larger mean withdrawal in the sharing conditions ($M = 2.31, sd = .90$) than in the accuracy conditions ($M = 2.01, sd = .14$). This effect is similarly
reflected in significant perceived ($E(1, 82) = 3.94, p \leq .05$) and actual ($E(1, 82) = 6.18, p \leq .05$) instruction main effects, both with comparable means. These effects show that subjects believed they withdrew and actually did withdraw more when they were sharing a resource than when they were accurately attempting to estimate an amount.

Study 2 provides evidence of a deliberate greed in subjects' withdrawals of the larger shared resource. The overestimation bias is not strongly supported due to the ease with which accurate withdrawals could be made.

Study 3: Temporal Resources

While the goal of Study 3 is similar to the goals of the previous two studies, it involves a temporal resource. This study will compare differences between withdrawals due to group size, partitionment or nonpartitionment of a shared temporal resource, and amounts withdrawn when accuracy is the instruction. In this study, however, a fourth independent variable will be included in the design. The subjects will be assigned conditions varied by instruction, partitionment or nonpartitionment of temporal resource, fraction of equality, and enjoyability of the activity. Subjects will be given an activity to engage in while estimating an amount of time. Although the addition of the fourth condition is a deviation from the established methodology of the previous two studies, it is necessary to provide subjects with something to do during their time estimations because a temporal resource is the amount of time invested in the completion of a project or goal, not just the time itself (Jones, 1993).
Hence, to make the instructions more realistic, an activity must be added to the study.

Anticipated enjoyability of the activity is varied in order to determine if the enjoyability of the activity affects the amount of time consumed. In addition, the final question on the questionnaire will serve as a check to see if the activities designated as enjoyable and not enjoyable were viewed in the same manner by the subjects. It is expected that in the resource sharing instruction, subjects withdrawing from the partitioned resource will adopt the salient equality rule, as will subjects withdrawing from the smaller, nonpartitioned resource. When withdrawing from the larger nonpartitioned resource, a tendency to take more than one's fair share is expected due to deliberate greed and an inadvertent overestimation. The results of the accuracy instruction will likely show that the accurate withdrawal of partitioned resources is quite easy, but is subject to the overestimation bias when the resource is nonpartitioned and as the amount of the resource increases. By balancing the enjoyability of the activity across subjects, the type of activity is not expected to effect the results of the study.

Methods

Subjects. The same 90 subjects used in Study 1 and Study 2 also served as participants for Study 3. The experimental conditions were similar to those of Study 1 and Study 2, and the subjects served in the same experimental condition. In addition, half of the subjects served in each of the resource enjoyability
Design. The experiment used a design similar to those found in Study 1 and Study 2, a 2 (instruction: accuracy, resource sharing) X 2 (partitionment: partitioned, nonpartitioned) X 2 (equality fraction: one-third, one-twelfth) X 2 (enjoyability: Tetris, questions) between subjects factorial design. Half of the subjects were told that they were participating in an accuracy of measurement task, while the other half were told that they were participating in a resource sharing task. In each of these instructions, half of the subjects took from the partitioned resource (sectioned amounts of time) while half will took from the nonpartitioned resource (a nonpartitioned amount of time). For half of the subjects in each of these conditions, the instructed or implied amount of the time to be claimed was one-third, while the instructed or implied amount of time to be claimed by the other half was one-twelfth. Finally, half of the subjects were given a video game to play while estimating the temporal resource while the other half answered a set of questions.

Materials. The resource used in the partitioned resource conditions of both the resource sharing and accuracy instructions were 1 minute blocks of time. Six blocks of time (total time = 6 minutes) were used in the one-third conditions while 24 blocks of time (total time = 24 minutes) were used in the one-twelfth conditions.

In the partitioned time conditions, the experimenter verbally signaled the passage of a 1 minute block of time. In the nonpartitioned conditions, the subject
had no indication of the amount of time that was passing. During the temporal estimations, the subjects in the video game conditions played the game Tetris. The game was set on level three because, when set on this low difficulty level, a single game may be played for an almost indefinite amount of time. The subjects in the question condition were given a lengthy set of questions to work on while estimating time. The number and difficulty of the questions in both the one-third and one-twelfth conditions was set so that the subjects could not finish in under two minutes.

The subjects completed the same questionnaire as in Study 1 and Study 2. The experimenter used a stopwatch to measure the amount of time indicated by the subject to the nearest second.

**Procedure.** The instructions read to the subjects were, again, similar to those used in the first two studies with respect to either sharing a common resource or attempting to withdraw an accurate amount. During this study, the subjects either played a video game, Tetris, or answered questions as part of their task.

In the accuracy conditions, subjects were instructed to indicate verbally when either one-third or one-twelfth of the total time block had elapsed. The accurate estimate of time in the accuracy conditions was 2 minutes (two of the 1 minute blocks of time). Prizes of $5 were awarded to the subject in each accuracy condition who indicated closest to the instructed amount. In the partitioned accuracy conditions, one subject of those indicating the correct
amount of time was chosen at random to receive the prize.

The subjects in the resource sharing conditions were told that they were the first member in their group of 3 or 12 to claim portions of playing time and that the other members of their group would be claiming amounts of time after them. In each condition, the subject's equal share of the resource based on the number of members in the group and the total amount of time available was 2 minutes. Subjects were told that one member of their group would be chosen at random and paid $2 for each 1 minute block claimed and, in the nonpartitioned conditions, a fraction of that amount for each partial block of time claimed. In actuality, at the end of the experiment one subject in each of the four conditions was chosen at random to receive a prize of $5.

The subject then completed the questionnaire used in both Study 1 and Study 2. The amount of time that the subject either indicated as the accurate amount or claimed as their own was recorded after the subject had left the experiment.

**Dependent variables.** The main dependent variables are the actual and perceived amounts of space withdrawn. In each of the nonpartitioned conditions, the amounts withdrawn were divided by sixty, the number of seconds in a minute. Sixty seconds constituted one block of time in the partitioned resource conditions. By dividing the nonpartitioned withdrawals, the amounts withdrawn in each condition could be perceived as comparable resource units. The number of resource units withdrawn was used in the analyses. The responses to the fun
question were used to determine if the subjects' enjoyment of their activity caused them to withdraw a larger portion of the resource than in the other activity condition.

Results and Discussion

An analysis to detect order effects was performed on the data collected in Study 3 and failed to reach any significant effects associated with order. This shows, as in Study 1 and Study 2, that the order in which the resource were presented to the subjects did not effect their perceived or actual withdrawals of the resource units.

A 2 (partitionment: partitioned, nonpartitioned) X 2 (instruction: accuracy, sharing) X 2 (equality fraction: one-third, one-twelfth) X 2 (type of withdrawal: perceived, actual) between subjects analysis of variance with repeated measures on the final variable failed to reveal the predicted 4-way interaction, $F (1, 82) = .42$, $p = .52$. The pattern of means presented in Table 6 shows that subjects were fairly accurate in their attempts to withdraw two resource units in each of the accuracy conditions and perceived to withdraw amounts quite similar to their actual withdrawals.

Insert Table 6 about here

In the sharing conditions, subjects withdrew more of the temporal resource, especially in the one-twelfth nonpartitioned condition. In this condition,
subjects withdrew three times their fair share of the temporal resource and fairly accurately acknowledged doing so. However, subjects sharing a smaller amount of nonpartitioned time perceived themselves to be somewhat greedy and displayed the overestimation bias.

In Study 3, a fourth independent condition was added to the design. Enjoyability of resource was added because what can be done with an amount of time, more so than the time entity itself, is valuable (Jones, 1993). An analysis of variance was performed on subjects' indications of their enjoyability of the temporal resource. The analysis yielded a significant difference (\( F(1, 88) = 26.92, p \leq .001 \)) indicating that subjects enjoyed playing Tetris (\( M = 5.71, sd = 1.10 \)) more than they did answering questions (\( M = 4.97, sd = 1.55 \)) while estimating time.

It was then questioned whether or not the enjoyment of the temporal resource would effect subjects' perceived and actual withdrawals. An analysis of variance was performed on the types of withdrawal adding enjoyability of resource as a fourth independent variable. The analysis did not yield any significant results indicating that while Tetris may have caused subjects to enjoy their participation in the experiment, it did not cause them to withdraw more than those subjects who answered questions. In fact, the questions did not produce the desired low fun rating. The fun mean for the questions fell above the median of the scale used. This may, in part, account for the greed found in all of the sharing conditions. Subjects' enjoyment of the resource may have outweighed
the salience of the equality rule. Without an incentive to stop playing or working on their activity, as was provided in the accuracy condition, subjects may have continued knowing, somewhat, the extent to which they were being greedy.

As in Study 2, the analyses on the within subjects withdrawals of the temporal resource did not prove to be significant. There are, however, many significant effects to report. Collapsed across type of withdrawal, the partitionment by instruction interaction was found to be significant, $F(1, 82) = 6.96, p \leq .01$. When sharing a nonpartitioned amount of time, subjects took a mean of 4.44 resource units ($sd = 3.50$) while taking a mean of 2.42 ($sd = .78$), two resource units less, when the resource was partitioned. Subjects took the desired amount in both the partitioned ($M = 2.00, sd = .00$) and nonpartitioned ($M = 2.08, sd = .42$) accuracy conditions. The effect may be visualized in Figure 4.

This effect is reflected in significant partitionment by instruction interactions resulting for analyses of perceived ($F(1, 82) = 7.36, p \leq .01$) and actual ($F(1, 82) = 5.22, p \leq .05$) withdrawals of the temporal resource. The patterns of means for both of these interactions are very similar to that presented in Figure 4 and, therefore, are not presented. Together, these significant interactions show that subjects were far more likely to take a large amount of a shared
nonpartitioned resource than a shared partitioned resource and to be aware of their greedy actions. This finding also supports the existence of a deliberate greed when sharing a nonpartitioned temporal resource.

Subjects also perceived that other factors affected their withdrawals, although, in actuality they did not appear to. Further analyses of subjects' perceived withdrawals yielded a significant partitionment by equality fraction interaction ($E(1, 82) = 5.92, p \leq .05$) and a significant equality fraction by instruction interaction, $E(1, 82) = 8.32, p \leq .01$. The means of the partitionment by equality fraction interaction indicate that subjects perceived they took more in the one-twelfth, nonpartitioned condition ($M = 4.15, sd = 3.71$) than in the one-third, nonpartitioned condition ($M = 2.57, sd = 1.19$), or in either the one-third ($M = 2.17, sd = .51$) or one-twelfth ($M = 2.39, sd = .78$) partitioned conditions. This indicates an unfulfilled motive of deliberate greed on the part of the subjects withdrawing from the larger, nonpartitioned temporal resource. The effect may be visualized in Figure 5.

The means associated with the equality fraction by instruction interaction show that subjects perceived they withdrew more when sharing a large amount of a temporal resource ($M = 4.44, sd = 3.60$) than a smaller amount ($M = 2.67, sd = 1.21$) or when attempting to accurately withdraw one-third ($M = 2.01, sd = ...
.04) and one-twelth (M = 2.00, sd = .00) of the resource. The effect may be visualized in Figure 6.

 Insert Figure 6 about here

This interaction also suggests that subjects perceived they were being greedy in their withdrawals when sharing a large amount of a resource.

The three significant interactions on subjects perceived temporal withdrawals are somewhat qualified by a marginally significant equality fraction by partitionment by instruction interaction, $F (1, 82) = 3.67, p = .06$. The means of this interaction are presented in Table 7 and indicate that subjects attempted to withdraw an amount of the temporal resource according to different criteria when they believed that were sharing the resource than when they were asked to accurately estimate an amount.

 Insert Table 7 about here

Finally, the interactions are supported by three significant main effects. Each of the effects is significant when collapsed across perceived and actual withdrawals, and when the perceived and actual withdrawals were analyzed separately. The main effect for equality fraction on the collapsed data ($F (1, 82) = 4.66, p \leq .05$) indicates that subjects withdrew more when the resource was
large ($M = 3.46$, $sd = 3.13$) than when it was smaller ($M = 2.50$, $sd = 1.06$). This is consistent with the patterns found in the means of the perceived effect ($E(1, 82) = 9.12$, $p \leq .01$) and the actual effect, $E(1, 82) = 5.64$, $p \leq .05$. The main effect for partitionment on the collapsed data ($E(1, 82) = 8.00$, $p \leq .01$) shows that subjects took more from a nonpartitioned temporal resource ($M = 3.39$, $sd = 2.86$) than a partitioned temporal resource ($M = 2.28$, $sd = .66$). The means associated with the perceived withdrawal effect ($E(1, 82) = 10.53$, $p \leq .01$) and the actual withdrawal effect ($E(1, 82) = 9.49$, $p \leq .01$) are consistent with those of the means of the collapsed effect. The main effect for instruction on the collapsed data ($E(1, 82) = 13.03$, $p \leq .01$) indicates that subjects took more of the resource when they believed they were sharing it with others ($M = 3.54$, $sd = 2.83$) than when they were accurately attempting to withdraw a specific amount ($M = 2.05$, $sd = .34$). The means of the perceived withdrawal effect ($E(1, 82) = 18.64$, $p \leq .01$) and the actual withdrawal effect ($E(1, 82) = 13.08$, $p \leq .01$) are consistent with the pattern of means shown in this effect.

Study 3 provides strong support for the existence of deliberate greed in the subjects' withdrawals and some support for the overestimation bias. However, when sharing the temporal resource, the violation of the equality rule in the larger, nonpartitioned resource condition does not appear to be the results of the overestimation bias found in the corresponding accuracy condition. In the smaller nonpartitioned resource condition, an overestimation bias appears when
the subjects shared the resource but this finding is not supported by an overestimation bias in the corresponding accuracy condition. These discrepant findings limit the interpretation of the overestimation bias in the consumption of temporal resources.

General Discussion

The goal of this experiment was to extend previous research on resource consumption to new types of resources: spatial and temporal. The findings of each individual study provide some support of a deliberate greed motive and an inadvertent overestimation bias in the withdrawals of shared resources. A comparison of subjects' withdrawals in each resource condition suggests that different types of resources are not necessarily shared in the same manner. However, these differential consumption may be due to the methodology of the experiment. Changes made in portions of the methodology may alter the results.

Of primary concern is the perceived value of the monetary incentives offered versus the value of consuming the actual resource. Alone, the incentive offered for the shared resources was not enough to override the equality heuristic. The value of the resource itself may come into play. In the physical resource study, as previously mentioned, a small monetary incentive may not have overridden the subjects' distaste for a large box of fairly dirty sand. By offering subjects gloves to use when making their withdrawals, this concern would be addressed without offering a physical withdrawing device (e.g. shovel) that could serve as a measuring heuristic.
In the temporal resource study, the monetary incentive in conjunction with an enjoyment of the activity may account for the violation of the equality rule in each of the sharing conditions. The subjects indicated that they enjoyed both Tetris and answering the questions. The questions were intended to be an unpleasant activity and it is possible that a truly unpleasant activity given to half of the subjects would lower the mean of the shared, nonpartitioned, one-twelfth equality fraction condition. In this experiment, since subjects served in the same experimental conditions throughout the experiment and order effects were non-significant, the means show that subjects sharing a large nonpartitioned resource may have valued the resources quite differently to account for their fluctuating withdrawals. The value of the temporal resource may have increased the temptation to withdraw and, as Allison & Messick (1990) found, when tempted, subjects will violate the equality rule. Asking subjects how much they value the resource from which they have just withdrawn would be a question to add to the subjects' questionnaire.

In Study 2, the spatial resource provided many confounds. Primarily, the size of the larger spatial resource was too small. The area was small enough that subjects could fairly accurately visualize where to place the string indicating one-twelfth of the area. In addition, the string served as a measuring heuristic which aided the subjects in their accuracy. Replicators of this study would want to use a much larger spatial area and avoid letting subjects use the string as a measuring device. One possible way to avoid this is by having the experimenter
hold the string and have the subjects indicate where they would like it placed.

Another concern, one which has not been addressed by previous researchers (Allison & Messick, 1990; Allison, et al., 1992), is whether or not the subjects in the partitioned sharing conditions actually believe that their withdrawals are verifiable. Or, in effect, is the equality rule the main limitation of their withdrawals. By either telling the subjects they would be identified to their next group member or remain completely anonymous, this could be manipulated. In this experiment, subjects were told merely that they were the first member in their group to withdraw. This indicates that the next group member would see the amount left by the first subject but does not indicate that he or she would know who the first subject was.

Other interesting manipulations would be to look at individual differences in relation to how different types of people share resource. McClintock & Allison (1989) studied how cooperaters, individualists, and competitors decided to contribute time to a worthy cause. By including this type of manipulation, consumption rather than contribution by differing individual personality types could be assessed. A final manipulation would be to assess subjects attitudes about resource conservation prior to their participation in the experiment. It has been shown that there is no relationship between conservation attitudes and personal conservation practices (Costanzo et al., 1986; Edney, 1980) but questioning subjects about their attitudes immediately preceding their participation could increase the salience of the equality rule.
Once the methodological concerns of this experiment are addressed, it would be possible to run an analysis including type of resource as an independent variable. This would provide more insight into whether or not the consumption of different resources is determined by the same criteria. If resources are shared in the same manner, than further research may target how to make the equality rule more salient. However, if resources are not shared in the same fashion, the study of shared spatial and temporal resources must increase or indeed, the deliberate greed found here in the consumption of shared resources, will lead the world resource supply to a "tragedy of the commons."
References


Table 1

Mean Perceived and Actual Physical Resource Units Withdrawn as a Function of Instruction, Equality Fraction, and Partitionment

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Sharing Partitioned</th>
<th>Sharing NonPartitioned</th>
<th>Accuracy Partitioned</th>
<th>Accuracy NonPartitioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-Third</td>
<td>2.17 (.72)</td>
<td>2.28 (1.02)</td>
<td>2.00 (.00)</td>
<td>2.00 (.00)</td>
</tr>
<tr>
<td></td>
<td>2.17 (.72)</td>
<td>2.31 (1.11)</td>
<td>2.00 (.00)</td>
<td>1.98 (.22)</td>
</tr>
<tr>
<td>One-Twelfth</td>
<td>3.00 (1.76)</td>
<td>1.49 (.87)</td>
<td>2.00 (.00)</td>
<td>2.00 (.00)</td>
</tr>
<tr>
<td></td>
<td>3.00 (1.76)</td>
<td>2.13 (1.20)</td>
<td>2.00 (.00)</td>
<td>3.02 (1.94)</td>
</tr>
</tbody>
</table>

Note. The numbers in normal type represent mean perceived resource units withdrawn. The numbers in bold type represent mean actual resource units withdrawn. Standard deviations are in parentheses.
Table 2

Mean Perceived and Actual Physical Resource Units Withdrawn as a Function of Equality Fraction and Partitionment

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Partitioned</th>
<th>NonPartitioned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Perceived</td>
<td>Actual</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>Standard Deviation</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>One-Third</td>
<td>2.11</td>
<td>2.17</td>
</tr>
<tr>
<td></td>
<td>(.58)</td>
<td>(.79)</td>
</tr>
<tr>
<td>One-Twelfth</td>
<td>2.67</td>
<td>1.75</td>
</tr>
<tr>
<td></td>
<td>(1.50)</td>
<td>(.65)</td>
</tr>
</tbody>
</table>

Note. The numbers in normal type represent mean perceived resource units withdrawn. The numbers in bold type represent mean actual resource units withdrawn. Standard deviations are in parentheses.
Table 3

**Mean Physical Resource Units Withdrawn as a Function of Instruction, Equality Fraction, and Partitionment**

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Sharing</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Partitioned</td>
<td>NonPartitioned</td>
</tr>
<tr>
<td>One-Third</td>
<td>2.17 (.72)</td>
<td>2.29 (1.04)</td>
</tr>
<tr>
<td>One-Twelfth</td>
<td>3.00 (1.76)</td>
<td>1.81 (.82)</td>
</tr>
</tbody>
</table>

**Note.** Standard deviations are in parentheses.
Table 4

Mean Perceived and Actual Spatial Resource Units Withdrawn as a Function of Instruction, Equality Fraction, and Partitionment

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Partitioned</th>
<th>NonPartitioned</th>
<th>Partitioned</th>
<th>NonPartitioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-Third</td>
<td>1.92</td>
<td>2.08</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td>(.29)</td>
<td>(.35)</td>
<td>(.00)</td>
<td>(.00)</td>
</tr>
<tr>
<td>One-Twelfth</td>
<td>2.50</td>
<td>2.62</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td>(1.00)</td>
<td>(1.40)</td>
<td>(.00)</td>
<td>(.00)</td>
</tr>
</tbody>
</table>

Note. The numbers in normal type represent mean perceived resource units withdrawn. The numbers in bold type represent mean actual resource units withdrawn. Standard deviations are in parentheses.
Table 5

Mean Perceived Spatial Resource Units Withdrawn as a Function of Instruction and Partitionment

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Partitioned</th>
<th>NonPartitioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharing</td>
<td>2.21 (.78)</td>
<td>2.30 (.94)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>2.00 (.00)</td>
<td>2.00 (.00)</td>
</tr>
</tbody>
</table>

Note. Standard deviations are in parentheses.
Table 6

Mean Perceived and Actual Temporal Resource Units Withdrawn as a Function of Instruction, Equality Fraction, and Partitionment

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Sharing</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fraction</td>
<td>Partitioned</td>
<td>NonPartitioned</td>
</tr>
<tr>
<td>One-Third</td>
<td>2.25 (.62)</td>
<td>2.94 (1.43)</td>
</tr>
<tr>
<td></td>
<td>2.25 (.62)</td>
<td>3.40 (1.66)</td>
</tr>
<tr>
<td>One-Twelfth</td>
<td>2.58 (.90)</td>
<td>6.29 (4.33)</td>
</tr>
<tr>
<td></td>
<td>2.58 (.90)</td>
<td>6.42 (5.53)</td>
</tr>
</tbody>
</table>

Note. The numbers in normal type represent mean perceived resource units withdrawn. The numbers in bold type represent mean actual resource units withdrawn. Standard deviations are in parentheses.
Table 7

Mean Perceived Temporal Resource Units Withdrawn as a Function of Instruction.

Equality Fraction, and Partitionment

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Instruction</th>
<th>Sharing</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Partitioned</td>
<td>NonPartitioned</td>
<td>Partitioned</td>
</tr>
<tr>
<td>One-Third</td>
<td>2.25</td>
<td>2.94</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td>(.62)</td>
<td>(1.43)</td>
<td>(.00)</td>
</tr>
<tr>
<td>One-Twelfth</td>
<td>2.58</td>
<td>6.29</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td>(.90)</td>
<td>(4.33)</td>
<td>(.00)</td>
</tr>
</tbody>
</table>

Note. Standard deviations are in parentheses.
Figure Captions

**Figure 1.** Mean perceived and actual physical resource units withdrawn as a function of equality fraction.

**Figure 2.** Mean perceived and actual physical resource units withdrawn as a function of partitionment.

**Figure 3.** Mean spatial resource units withdrawn as a function of equality fraction and instruction.

**Figure 4.** Mean temporal resource units withdrawn as a function of partitionment and instruction.

**Figure 5.** Mean perceived temporal resource units withdrawn as a function of partitionment and equality fraction.

**Figure 6.** Mean perceived temporal resource units withdrawn as a function of equality fraction and instruction.
Figure 1

Mean Units

Withdrawn

One-Third One-Twelfth

• Perceived □ Actual
Figure 2

Mean Units Withdrawn

Partitioned Non-Partitioned

○ Perceived □ Actual
Figure 3

![Graph showing Mean Units Withdrawn with One-Third and One-Twelfth distances, with symbols for Sharing and Accuracy.]
Figure 4

Mean Units Withdrawn

0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

Sharing Accuracy

○ Partitioned □ Non-Partitioned
Figure 6

- Sharing
- Accuracy