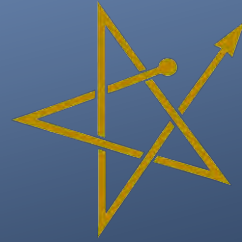# NPRST

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An Ultimatum Game Approach to Billet Assignments

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14. ABSTRACT

Personnel costs constitute a major component of the operations budget of the U.S. Navy. Transitioning to a more market oriented staffing model in which Commanding Officers (hereafter labeled the Assignment Officer or AO) are provided incentives to reduce personnel costs that may yield significant savings. An unintended consequence, increased separation rates on the part of sailors, would result in lower levels of readiness for the Navy missions. The essential features of the implemented labor market can be captured in the ultimatum game (UG) in which the proposer (AO) makes an offer and the responder (Sailor) accepts or reject. Since there are multiple billets in a command unit, the billet assignment problem can be modeled as multi-person UG. To investigate the effects of alternative incentives for the AO, we implement the features of the multi-person UG in a laboratory market setting in which an AO is tasked with filling three billets under different institutional rules designed to introduce components of a market based system of staffing billets.

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Foreword

As part of a research program funded by Capable Manpower Future Naval Capability (FNC), Navy Personnel Research, Studies, and Technology (NPRST) designed a series of laboratory experiments to investigate the benefits of using a labor market approach to assigning Sailors to billets. An experimental laboratory market is used to investigate the effects of different market incentives on the cost of filling billets and on ship readiness. This report explores the net-benefits and tradeoffs of using a more market oriented staffing model to reduce personnel costs.

This effort is supported by Navy Total Force, N15. The point of contact for this effort is Dr. Tanja Blackstone, Navy Personnel Research, Studies, and Technology, (901) 874-4633.

DAVID M. CASHBAUGH
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Summary

Personnel costs constitute a major component of the operations budget of the U.S. Navy. Transitioning to a more market oriented staffing model in which Commanding Officers (hereafter labeled the Assignment Officer or AO) are provided incentives to reduce personnel costs may yield significant savings. An unintended consequence, increased separation rates on the part of Sailors, would result in lower levels of readiness for the Navy missions. The essential features of the implemented labor market can be captured in the ultimatum game (UG) in which the proposer (AO) makes an offer and the responder (Sailor) accepts or reject. Since there are multiple billets in a command unit, the billet assignment problem can be modeled as multi-person UG. To investigate the effects of alternative incentives for the AO, we implement the features of the multi-person UG in a laboratory market setting in which an AO is tasked with filling three billets under different institutional rules designed to introduce components of a market based system of staffing billets. The laboratory market is used to investigate the effects of different market incentives on the cost of filling billets and on ship readiness (defined as all billets being filled) and group readiness (defined as the fraction of ready ships). We find that there is a tradeoff. As AOs respond to incentives to lower the cost of filling billets there are declines in overall readiness, arising from increased frequency of rejected offers by Sailors. There are unfilled billets and both measures of readiness decline. A range of incentives can be offered to the AO and, as we show, some are superior in both cost savings generated and having a lower negative impact on readiness.

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Introduction

1. Motivation and Objective

Available Navy billets will vary considerably in terms of attractiveness to the Sailor. Although the preference for some characteristics, such as location, will be individual-specific, there are certain billet characteristics that generally, or even universally, determine whether a billet is desirable or not. For example, an absence of promotion potential and training opportunities will render a billet generally bad while the presence of good opportunities for promotion and/or training will make a billet generally **attractive. Current billet assignment mechanisms and the nature of "cliff vesting"** provide Sailors that are assigned to unattractive billets little flexibility and the Navy little opportunity to offer inducements or to realize returns from Sailor preferences for attractive billets. The transitioning to a two-sided labor market setting for Sailors will introduce additional options for Sailors and incentives to economize on labor costs to the command unit responsible for filling the billets. A primary motivation for implementing incentives and options on both sides of the labor market is to obtain **reductions in labor costs for meeting the Navy's readiness requirement. This report** presents the results from an investigation of alternative incentive packages that can be offered to the Assignment Officer (AO), and how these incentives affect force readiness and labor costs. Force readiness is generated by filling required billets and the labor costs are the aggregate payments to the Sailors and the commander of the unit.

At the most basic level, an offer by an AO of a billet to a Sailor can be modeled as an Ultimatum Game (UG). In the UG, one agent (here the AO) makes an offer to a second agent (the Sailor). We can model the offer as a share of the amount the AO has budgeted for the billet. The budgeted amount can be set by an agent superior to the AO or by the AO.[1] In terms of the UG, the Sailor can accept the AO offer, in which case the AO and Sailor receive the proposed pay-offs, or the Sailor can reject the offer, in which case, the billet goes unfilled. Rejecting the billet will usually imply that the Sailor has chosen to separate from the Navy (resign) and/or retire.

Several elements make this setting more complex and more interesting when we move it to the Navy task of filling billets on a ship. First, the AO has multiple billets to fill; hence, the AO must present offers to multiple Sailors. Second, billet positions are functionally interdependent; one rejected offer from among multiple offers may substantially reduce the pay-off to the AO. Third, the consequences of the Sailor rejecting the offer have many more potential outcomes than in the standard UG where the proposer and the responder receive the zero pay-off if the responder rejects; in the Navy setting, this may not be the case. The AO may find that the ship fails to meet the readiness requirement (the AO receives a very low pay-off) while the Sailor may find that the outside option (separation from the Navy) pays less (or more) than anticipated.

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[1] The AO is expected to have some control over the allocation of the total personnel budget over billets. In the current setting, billet budgets are administratively set.

To investigate the effects of alternative incentives for the AO, we implement these features of the multi-person UG in a laboratory market setting in which an AO is tasked with filling three billets under different institutional rules designed to introduce components of a market based system of staffing billets. The laboratory market is used to investigate the effects of different market incentives on the cost of filling billets and on ship readiness (defined as whether all billets are filled) and group readiness (defined as the fraction of ready ships). We find that there is a tradeoff. As AOs respond to incentives to lower the cost of filling billets, there are declines in overall readiness. This arises from increased frequency of rejected offers by Sailors with the result that billets are unfilled and both measures of readiness decline. There is a range of incentives that can be offered to the AO. As we show, some are superior in both cost savings generated and having a lower impact on readiness.

We begin with a description of the Billet Assignment Game as we are calling the task facing the Navy. To investigate the properties of the Game, we construct a laboratory market setting and collect data from participant decisions in this experiment setting.[2] The structure of the experiment and the data analysis are presented in subsequent sections.

2. Properties of the Billet Assignment Game

We begin here with a brief discussion of the billet assignment game as implemented in the lab. The actual implementation is described in more detail in the following section.

- There are N command units (groups), command units are denoted by n and $n \in \{1, ..., N\}$.

- For each of the N command units, there is 1 Assignment Officer, denoted AO_n

- The ratio of available Sailors to Assignment Officers is 3:1. Sailors are denoted as s and $s \in \{1, ..., 3N\}$.

- For each command unit, there are 3 billets (jobs) of different rank that can be filled by Sailors. The billet rankings are *Red, Blue* and *Green* denoted as $b \in \{R, B, G\}$.

- For **each of the command unit's 3 billets, there are 3 accounts corresponding to** the billet ranking. The individual value of these accounts is denoted as p_{nb}.

- Each ship is given a total budget, P_n that is split between the **Red**, **Blue** and **Green** billet accounts. It is necessary that $p_{nR} + p_{nB} + p_{nG} = P_n$. It is also necessary that $p_{nR} \geq p_{nB} \geq p_{nG}$ denoting the relative importance of the individual billets in contributing to readiness.

- The Assignment Officer chooses how much from each of the 3 billet accounts to offer a Sailor in an attempt to fill the billet. The individual offers are denoted o_{nb} and $o_{nR} + o_{nB} + o_{nG} = O_n \leq P_n$.

- Each period, a Sailor is assigned to a single billet on a single command unit and can either accept their offer from the AO or reject that offer and take their outside option, denoted as l_{nb}.

- The AO can face 2 conditions regarding the requirement to fill billets. In the first, **all billets are deemed critical and the ship is deemed "not ready" if any billet is unfilled. In the second, no billets are deemed critical and the ship is "ready" if** any billets are filled.

- **If a Sailor rejects the offer, the ship may be deemed "not ready" if all billets are** critical. The Sailors who accept are assigned to the billet accepted at the offered wage.

- **Ships are members of a battle group. The group is deemed "not ready" if** less than stated fraction of the ships is not ready.

3. Experiment Environment

In the discussion that follows, we utilize a representative command unit consisting of an Assignment Officer (AO) and three Sailors. In general, we use the terms Red, Blue and Green to denote the hierarchy of attractiveness of the three billets (Red being the most desirable billet as well as the most valuable to the Navy, then Blue, then Green). There are interaction effects between the requirement that unattractive billets must be filled (readiness) and the objective of utilizing incentives at the AO level to reduce labor costs to the Navy. In an experiment session, there can be up to five command units (groups), each with one AO and three Sailors. The sessions run for a number of rounds and Sailors are regrouped and assigned to a new AO each period. The roles assigned to a participant, i.e., AO or Sailor, are maintained throughout the session to be consistent with the field setting.

3.1 An ultimatum game framework

As we discussed earlier, the interaction between an AO and an individual Sailor can be characterized as an UG. The AO has a budget (t**he "stake" in the classic UG) and**

takes the role of the proposer while the Sailor is the responder. In addition, as we argued, a simple variant of this UG can be used to implement the assignment game facing a ship captain and a set of Sailors being offered billets. In this variant, a single proposer (AO) makes offers to a set of responders (Sailors) each of whom can accept or reject. The readiness requirement can be imposed through requiring that some specified (could be all) billets be filled with a penalty imposed on an AO that fails to meet this requirement. Thus, we are setting up a job assignment game in which the Navy or the AO assigns billets and the Sailor can accept or reject the assignment. Both sides bear consequences of this rejection. The Navy has problems meeting readiness requirements while the Sailor(s) alters his/her or their career path(s).

Heterogeneous assignments can have an effect on the individual Sailor decision to accept the assignment or separate. Expanding the simple, UG to include four players, i.e., the proposer (AO) and three responders (Sailors), allows us to introduce heterogeneity across the billets, alternative means for compensating the proposer (AO), and heterogeneity across the Sailors. The source of the heterogeneity across the Sailors can be endogenous (ability) or exogenous (assigned).

A second extension to the classic UG allows us to introduce (asymmetric) costs of the responder rejecting the offer. There is a cost to both the Navy and the Sailor of early separation. Depending on the skills of the Sailor, the disagreement cost may be greater for the Navy or for the Sailor. For example, if the Sailor possesses skills valued in the civilian workplace, the costs of early separation (rejecting the assignment) may be very low.

A third extension is to introduce uncertainty regarding the pay-offs to both the proposer and responders. A fourth extension is to introduce either informational asymmetries in which it is the Navy that is better informed or the Sailor.

To **illustrate the basic elements of the game, an example of an AO's decision screen is** shown in Figure 1. To avoid any confusion, the positions in the experimental setting are described as Manager (for the AO) and Worker (for the Sailor). In the Figure, the total budget for this command unit is $P = 95$.[3] The billet account values are predetermined (in this example) by the Navy for the Red, Blue and Green billets and are 40, 30 and 25, respectively. Note that $p_R + p_B + p_G = P$. Here the AO must offer each Sailor an amount from the respective billet account. Each Sailor can accept or reject that offered amount. Rejecting an assignment in this setting implies that the Sailor separates from the Navy (resigns or retires) and earns his or her outside option value (l_b). For example, if a Sailor rejects an offer for the Red billet, that Sailor earns their outside option value $l_R \in (20, 21, 22)$.[4]

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[3] Throughout, the subscripts for the command units, n, are dropped.

[4] In this particular example, there is uncertainty about the actual value of the outside option. These outside options are for illustration only. In practice, we set the mean lower and the degree of uncertainty is typically higher to reflect the uncertainty associated with separation from the Navy.
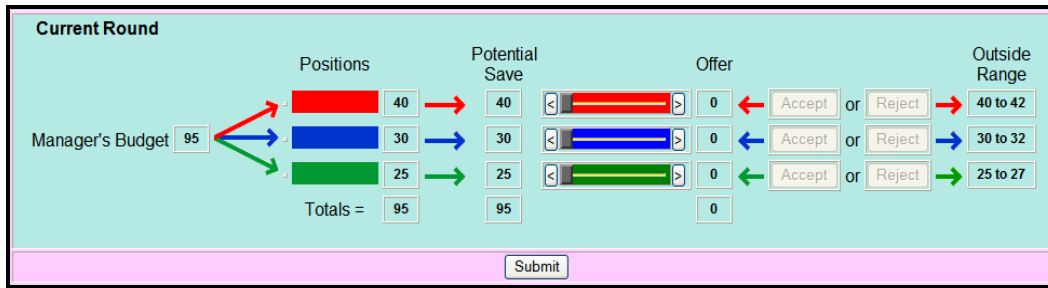
Figure 1. AO's decision set with heterogeneous Sailors and Exogenous billet budget

This setting imposes a fairly stringent set of conditions for the assignment game. Since there is a one-to-one match between available Sailors and billets, a rejection by a Sailor implies that the billet cannot be filled in the current period.

3.2 Discussion of treatments

From the discussion of the extensions to the basic UG, it follows that there are several experimental treatments that could be examined here. These can focus on factors affecting the behavior of the AO, as in Table 1, or factors affecting the behavior of the Sailor, as in Table 2.

Table 1
AO Treatment Properties

	Readiness Requirement: All Positions Critical	
AO Compensation	**Position Budget Values Exogenous**	**Position Budget Values Endogenous**
Fixed Payment	1 (Baseline)	5
Share Save Bonus	2	6
Tournament Bonus	3	7
Combined Share and Tournament Bonus	4	8
Group Ready Bonus with Tournament Bonus	N/A	9

As previously noted, a primary motivation for implementing a market for Sailor **assignments is to obtain reductions in labor costs for meeting the Navy's readiness**

requirement. The market components we investigate are the effects of performance incentives offered to the AO to reduce labor costs and the effects these have on force readiness and labor costs. Currently, the Navy offers no incentive to the AO to spend less than the budget allocated to fill the billets on the ship and the amounts allocated for each billet are administratively determined. In practice, under the present system, the Navy manpower and personnel (M&P) budget is set by Congress. That funding line is then pushed down to the Navy to allocate as necessary to meet mission requirements. Readiness levels are set by mission type (war vice peace operations). Once the mission/readiness combination is established, the required skills and number of bodies are determined by ship/department. The AO has no say in budget allocation, must meet minimum readiness as mandated by mission type[5] and Sailor/skill allocation is determined by Navy conditional on mission. The AO has little say over the mission and essentially accepts the labor that is allocated to him. Spending less than the budgeted **amount (underutilizing offered labor) is effectively penalized by reducing the AO's** budget for the following budget cycle.

Table 1 is organized to group categories for investigation. In our Baseline (Treatment 1), we preset the billet sizes so that the AO is unable to allocate the budget and only able to make offers to prospective Sailors. This simulates the current setting so the AO has no discretion over the allocation of the budget over billets. In Treatment 1, the AO has no incentive to spend less than the budget allocated to fill the billets. We introduce a market element here as we allow the AO to determine the offers to the Sailors to fill the billets. Within this setting, we investigate a range of possible incentive packages that could be offered to the AO as part of a market setting. We parallel the Treatment 1 setting in Treatment 5 but we allow the AO to first allocate the labor budget across the billets and then to make the Sailors offers from the budget.

A study of Table 1 suggests that a great many treatments are needed for this investigation. To conserve the subject pool and meet the budget, we elected to pursue treatments that covered salient features of the decision setting. Within this setting, we investigated broad categories of AO compensation – winner-take-all tournaments and the assignment of a share of the realized savings to the AO. To capture the joint requirement of reducing costs and meeting readiness requirements, we introduced **alternate readiness requirements as a treatment. We implemented the "all positions critical" setting by imposing a zero pay**-off to the AO if *any* position is unfilled (i.e., a Sailor rejects the offer made).

We introduced incentives to reduce labor costs through offering the AO a share of the wage budget that is saved (Treatments 2 and 6). Many share values are possible, of course, but we implemented a constant 25% share. Rank order tournaments are frequently proposed as a means of providing incentives for workers and managers. The pay-offs in such tournaments may take the form of a cash bonus, a promotion, or some non-cash prize (say an "all expenses paid vacation"). In the experimental setting, all values are induced (Smith, 1975) and this required that all pay-offs be monetized. Thus, the tournament pay-offs (Treatments 3 and 7) are in the form of money added to the

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[5] However, can exceed minimum readiness through overstaffing or assignment of over qualified Sailors. These actions, of course, increase costs to the Navy.

AO's base pay. The winner of the tournament is the AO filling the three billets at the lowest cost. Since behavior in tournaments has been shown to depend on the magnitude of the bonus, we implemented three bonus levels (different sessions). The **smallest bonus setting pays out approximately 20% of the AO's base pay as a bonus.** With five AOs competing, the expected pay-off from the small tournament is only about **5% of the AO's base pay. The medium tournament pays out a bit over 100% of the AO's** base pay and with five AOs competing, the expected value is about 20% making this comparable to the share of savings bonus of Treatments 2 and 6.

Participating in tournaments can impose risk on the players especially if losing implies a negative pay-off. In the billet assignment setting, the AO will earn zero payment for the round if any Sailor rejects and the probability of a rejection is likely increasing in the amount the AO attempts to save in order to enhance the chance of winning the tournament. To offset this risk, we coupled a share of saving bonus with a (reduced) tournament bonus in Treatments 4 and 8. The joint bonus was set such that the expected value of winning the tournament plus the share of savings bonus was equivalent to the medium tournament pay-off.

Finally, there is a group level effect that must be considered by the Navy. If one or more ships in a group are deemed to not meet readiness requirements, the entire group has a lower level of effectiveness for the mission. Thus, an AO aggressively competing to win the tournament and, thereby, increasing the probability of rejection of an offer may impose an externality on the other AOs in the group. One solution is to introduce a reward (or penalty) that captures this effect. We constructed the reward as if the AOs are playing the minimum contributing set (MCS) - public good game.[6] Thus, if the group meets the readiness requirement, as defined, all AOs receive a bonus pay-off. The AO with the lowest cost for successfully filling the billets receives the tournament bonus as well. If the group readiness requirement is not met, the AOs do not receive the group readiness bonus and the AO successfully filling the billets at the lowest cost does NOT receive the tournament bonus.

Complicating the objective of reducing labor costs is the requirement that the Navy fill billets of obviously differing qualities and comparisons by Sailors are inevitable. Such comparisons can potentially lead to increased rates of rejections by those offered less desirable billets. In the experiment setting, less desirable billets are implemented as billets labeled Green and these have lower values to the Navy and, hence, lower pay rates. Heterogeneity across billets can be partially offset through compensating wages (hedonic wages) and/or the potential of future superior assignments. In the simple UG, there is a fixed pot that is to be divided by the proposer. The analog in our assignment game is that there is a surplus value or total pay-off to filling a billet. The offer from the Navy constitutes a sharing of this surplus. With multiple billets, it is inevitable that Sailors will be assigned to billets of differing values. To the extent that Sailors assigned to less desirable billets are aware of this, previous research (Ponsko, 2007) has shown that rejections are more likely in the case of responders (Sailors) being assigned to the less desirable (smaller value) billet. To some extent, this higher rejection effect can be offset by offering a larger share of the pot to the responder assigned to the small pot.

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[6] Van de Kragt et al. 193; Dawes, et al, 1986; Erev and Rapoport 1990; Cooper and Stockman 2002.

For the Navy, this larger share can take many forms. A second objective of our investigations is toward understanding the means of reducing the costly rejections of those assigned to the less desirable billet. Since comparisons by Sailors require knowledge of offers made to others, we investigated the effect of such knowledge by varying the information provided to Sailors concerning the offers made to other Sailors within a unit.[7]

This may be a particularly relevant factor if changes occur to the cliff-vesting pension system. In effect, by removing cliff-vesting, the result is higher values on the options for the Sailors outside the Navy. Full exploration of this topic is beyond the scope of the present project. Our game setting could be modified to deal with this through linking period decisions and providing a capital asset (pension) based on number of rounds in Navy. Intuition suggests that the frequency of rejection will be very low in the final years under a cliff-vesting system even when such offers might well have been rejected **earlier in the Sailor's career**. However, the overall effect is an empirical question and worthy of further investigation.

The Sailor always has a non-zero pay-off outside option in our implementation of the **UG. While we can label this as "outside option" as it would pertain to the Sa**ilor choosing to separate from the Navy, this option may also be thought of as a competing offer from another AO to fill a similar billet on another ship. Since we allow Sailors to reject in one round and to sign in the next, either we are effectively implementing the outside option as an offer from another AO *or* we are implementing a non-cliff-vesting setting in which Sailors may choose to separate and to rejoin at their current classification.

As shown in Table 2, the treatments can be organized into some broad categories: assignment rules, information available, decision timing, and relative costs of disagreements (separation from the Navy). The first two rows reflect the alternative mechanism for assigning the budget of the AO and for assigning Sailors to billet classes (ranks or position importance). Sailors can be assigned to a low valued billet based on own performance or by a process that could be characterized as random.[8] Further, the AO may be able to set the amount of budget to allocate to the billets or the allocation may be based on rules.

A second class of treatment concerns the extent and symmetry of information regarding the outside options facing the Sailors. In the field, the relative pay-off to the billets may or may not be common knowledge (known to all players in the game). We can refine this information setting to include the possibility that uncertainty regarding the pay-off to the billets will introduce informational differences as some parties may

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[7] A question for further research is whether varying pays affect stay/leave decisions and next period offers/acceptances. There is a perception that varying pay offers (for example by merit or skill/education) would adversely affect retention rates.

[8] Assigning Sailors to billets based on their own performance is achieved through a simple number sorting game. Before the start of each round, each Sailor is randomly grouped with two other Sailors. Each Sailor tries to sort a mixed arrangement of numbers in order as fast as he or she can. The fastest to complete the sorting task is assigned to the Red billet and the slowest to the Green billet within the group of three Sailors assigned to an AO.

have superior information (less diffuse priors in the Bayesian sense). The number of Responders (Sailors) will also affect the level of information. With three Sailors offered billets, each knows more about the distribution of available assignments than if only two are offered billets at a given time. The results of experiments with these differing information regimes will inform us of the effects of alternative information settings that could be applied to this assignment game.

<div align="center">

Table 2
Sailor Treatment Properties

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Number	Treatment Condition	Treatment Values
1	Billet Assignment Mechanism for Sailor	Skill Test* Imposed Randomly
2	Billet Budget Assignment Mechanism for AO	AO Choice* Administrative Rule*
3	Information Concerning Outside Option Values for Sailor	Common* Private*
4	Pay-offs to Proposer and Responder	Certain* Uncertain*
5	Repeated Game	Yes No*
6	Number of Rounds	Known Unknown*
7	Rejection Costs	Symmetric* Asymmetric*
8	Range of billet values between Red (top) and Green (bottom)	Large* Small

*Implemented and investigated.

Repeated interactions offer additional learning (information) opportunities but also additional opportunities for compensation for assignment to the less desirable billet. The assignment game can be structured as a series of independent assignments (one shot game) or as a chain in which the set of possible future assignments is dependent on the current assignment. For the same reason, the end period may be known with certainty or only inferred. Under the current market configuration (or rules), a Sailor could potentially make conditional offers to accept assignments. This would allow a **Sailor to "buy" a superior billet (to gain the training advantage, for example) by offering** to accept a smaller share of the budget allocated to the billet.

Rejections of assignments are costly to both the Navy and the Sailor. For the Sailor, the rejection costs reflect foregone earning opportunities if he or she remains in the

Navy, the reduction in future retirement pay, the loss of potential future training, and the impact of these lost opportunities on potential civilian earnings. For the Navy, the rejection costs reflect the loss of the Sailor and the embodied human capital as well as potential failures to achieve readiness. Thus, a key setting is reported in line 7 of Table 2.

As with the exit timing problem discussed in Table 1, the range of possible treatments reported in Table 2 implies that one could conduct many treatments to fully investigate all aspects of this assignment game. Again, the central tenet of experimental design is that treatments must be varied orthogonally and, given the number of elements that could be varied as per the table, a complete experimental design would involve dozens of different treatments. Careful choice of treatments allows a simpler design and enables the investigation to be conducted with fewer sessions. Thus, for the present project we have elected to focus on a subset of settings indicated by the entries marked by an asterisk in Table 2. We elected to conduct sessions in which the number of rounds is unknown to the subjects; current manpower policy in the Navy allows for flexible separation dates. Similarly, we elected to concentrate on the setting in which the billets are assigned based on performance (merit).[9]

The UG setting provides data on the decisions of both the proposer and the responders in each game. Our setting is a single shot game (proposer/responders are reassigned each period) and we obtain a series of individual-level decisions that yields a panel dataset. The decision metrics we collect from these decisions are the allocations offered by the proposer (a more or less continuous variable) and the accept/reject decision of the responder (a binary variable). Thus, the econometric analysis will be designed to address the difference in the measurement of behavior.[10]

We can learn some important lessons from conducting a set of experiments in this setting. Given that the Navy will always be required to fill some billets having undesirable characteristics, can mechanisms be designed to reduce the costs of filling billets while limiting the frequency of rejected assignments? The experimental investigations allow us to test alternative mechanisms in a low cost manner. We are concerned with relative behavior across the alternative mechanisms and the lab provides the controls necessary for us to infer that differences in observed behavior are due to treatments imposed by the experimental design rather than potential confounding effects.

Since each group (1 AO and 3 Sailors) in a session represents a ship, we can evaluate the data at different levels. Each ship has an individual readiness requirement denoted by the billets that must be filled if the AO is to receive compensation. Further, a session consists of 4 or 5 ships (16 or 20 participants in the session) thus we can define the session as a Battle Group and the fraction of ships meeting individual readiness defines the BG readiness. In the baseline, setting the AO has a disincentive to save any of the payroll budget since the usual management office response would be to reduce the

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[9] Although many enlisted, personnel undoubtedly feel that assignments are random - this is generally untrue.

[10] That is, the responder (Sailor) data will be analyzed using a probit structure while the proposer (AO) data will be analyzed using a continuous dependent variable approach.

budget available in the next period. Thus meeting readiness is the only element on the AO pay-off function. In the alternative management settings, the AO does have an incentive to save on total payroll while still meeting readiness. While saving on the payroll may not lead to increased rejections of offers by Sailors (loss of readiness) this is an empirical question to be investigated. Our data will allow us to better understand the tradeoffs associated between savings and readiness across the alternative incentives mechanisms.

For the treatments reported in Table 1, all positions are deemed critical and the AO is not paid unless all three billets are filled. We focused attention on the settings in which all positions are critical to reflect the relative importance of fleet readiness. To explore **the effects of relaxing the readiness requirement, we implement a "no position critical"** setting by paying the AO for each position filled. The billet values to the Navy reflect the compensation paid the AO per billet filled. That is, the Red position pays the most and the Green position pays the least. The treatments implemented under this weaker readiness requirement are congruent with Treatments 1, 2 and 4, in Table 1.

4. Experiment Results Discussion

a) Aggregate results

Thirty-two sessions have been completed for the purposes of the project. Several pilot sessions were conducted to inform the selection of parameters and to conduct debriefing sessions with the subjects in order to refine the experimental instructions. These data are not included in the current analysis since the settings are not exactly what the subjects in the actual sessions experienced. In all, we collected data on decisions made by 149 subjects in the AO role and 447 subjects in the Sailor role. For the purposes of analysis here, we restrict our attention to the subset of the data covered **by treatments listed in Table 1 and the three treatments with the "no positions critical"** setting. Thus, we have a panel datasets consisting of 126 subjects in the AO role and 378 in the Sailor role. Sessions lasted a total of 20 rounds and the overall dataset has 10,080 observations in a panel dataset.

The summary results for the implemented sessions are reported in Table 3. In all sessions, the Sailors completed the sorting task, which determined the billet they were assigned to (Red, Blue or Green). In the *baseline,* setting the AO has an incentive to exhaust the budget since there is no pay-off to saving and, in fact, there is a penalty to saving reflecting the incremental budgeting rules currently in effect.[11] In Table 3, we report several metrics. Column (1) denoted reports the offered amounts by the AOs while column (2) reports the amounts actually paid. The difference is because Sailors may reject offers. Column (3) reports the percentage of ships deemed ready under the condition that all billets are critical. Column (4) reports the group level readiness. We

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[11] **This raises an interesting point for future research. From Navy's point of view – readiness costs –** so what other policies besides incentives can be adopted to reduce costs for a given level of readiness? Reduce the number of rotations? Is the readiness level (95% in most ships at peace time) set too high (inefficient level)?

define the group to be deemed ready if more than 75% of the ships are ready. (Other criteria could be analyzed.) Finally, column (5) reports the average cost of filling all three billets.

In the "incentive" settings, the AO is rewarded for reducing the costs of filling the billets. The reward was implemented in various ways. The AO receives a share of the saving from the budget (called *share of savings*) in one setting. Thus, the Navy obtains the residual share of the cost savings after it pays out the bonus to the AO. Since we set the share of saving paid to the AO at 25%, the potential cost reduction for the Navy is quite large. In an alternate incentive setting, we introduce a rank order tournament; AOs compete to a win a prize. The prize is awarded to the AO that successfully fills the required billets at the lowest cost relative to the other AOs (called *tournament bonus*). We elected to combine the tournament bonus with the share of savings (denoted *share of saving plus tournament bonus*) to provide a greater incentive for risk-averse decision makers to save since the tournament alone imposes a rather sharp incentive (zero pay-off versus the bonus). Finally, recognizing that an AO failing to achieve readiness imposes a cost on the group, we implemented a treatment that incorporates the public good element – all the AOs receive a bonus if the group meets the aggregate readiness target. While the share of the savings was held constant (25%) over all sessions implementing this incentive structure, the amount of the tournament bonus varied. As displayed in Table 3, three sessions used a small bonus amount (10 or 20), two sessions used a medium bonus (40 or 50), and two sessions used a large bonus (100). In aggregate, the results in Table 3 demonstrate that the AOs respond to the incentives by lowering the amount of their offers to Sailors, thus, saving on personnel costs.

However, there is a tradeoff. While the incentive types summarized in Table 3 are capable of generating a reduction in personnel costs, they also reduce the level of readiness at the ship and group level. Before we discuss this in detail, it is worth noting that introducing a tournament incentive with a big bonus pay-off does not reduce costs relative to the baseline. The average cost is 144.43 in the baseline setting and 144.96 in the big tournament setting. There is a substantial reduction in both ship and group readiness.

It is interesting that AOs offer less than 100% of their budgets in the baseline despite their being no motive to do so. Total wage offerings in the incentive treatments are generally in the range of 25% lower than in the baseline treatment. While all of the incentive mechanisms lead to a fall in ship and group readiness, the Medium Tournament and the Share of Savings treatments fare well overall in this comparison. The cost reduction is approximately 20 (significant at p<0.00) with the Share of Savings performing slightly better (not statistically significant) in the readiness metric.

We see a significant reduction in readiness for each incentive structure relative to the baseline ($p < 0.00$ for each pair-wise test comparing the unconditional percentages). Our prior expectation was that the blend of Share of Savings and tournament bonus would perform best since the share of savings would mitigate the risk inherent in a rank order tournament. In contrast, we find this to undoubtedly be the worst performing incentive mechanism. This incentive package results in a 27% reduction in readiness relative to the baseline and an insignificant level of savings compared to the baseline

when the billets are filled (144.43 vs. 140.30). We suspect that the added complexity of the dual-incentives overwhelms the potential risk spreading.

On average, the small and medium tournaments perform roughly the same as the share of savings, with similar reductions in payroll costs and similar reductions in readiness. These incentive packages clearly lead to reductions in the costs of filling the billets but at the cost of ship readiness. It is clear from our aggregate results that achieving higher levels of readiness imposes a cost for the Navy in terms of higher offers to Sailors to reduce the frequency of rejection. An especially intriguing result observed here is the poor performance of the large bonus incentive structure. While the increase in the cost of filling the positions is unsurprising given a large bonus, we observe a low readiness measure relative to both the baseline and the other tournaments and the share of savings incentive. We return to the discussion of the trade-off between cost savings and readiness later in this report.

Table 3
Summary Statistics by Incentive Mechanism

Treatment Conditions	Session Numbers from Dataset	Average amount offered by AO (% of budget)	Average amount paid by AO (% of budget)	Readiness by Ship % of Ships	Readiness by Battle Group	Average cost of filling all billets
		(1)	(2)	(3)	(4)	(5)
Baseline	1,15,22,11,3,17	86.53 (0.81) [540]	82.57 (0.99) [540]	81.85 (1.66) [540]	88.33 (2.94) [120]	144.43 (0.77) [442]
Share of Savings	2,16,20,4,18	60.46 (0.37) [460]	55.10 (0.69) [460]	74.35 (2.04) [460]	74.00 (4.41) [100]	123.80 (0.33) [342]
Tournament Bonus (Small) plus Public Good	25,26,27,28	62.59 (0.81) [400]	56.88 (1.06) [400]	70.25 (2.29) [400]	48.75 (5.62) [80]	123.36 (1.07) [281]
Tournament Bonus- very small	14	67.18 (1.43) [100]	59.12 (2.20) [100]	65.00 (4.79) [100]	35.00 (10.94) [20]	125.85 (1.99) [65]
Tournament Bonus- small	12,21	55.97 (0.72) [180]	50.54 (1.11) [180]	68.89 (3.46) [180]	55.00 (7.97) [40]	115.73 (0.83) [124]
Tournament Bonus- medium	5,6	59.54 (0.51) [180]	53.59 (1.13) [180]	73.89 (3.28) [180]	67.50 (7.50) [40]	125.54 (1.62) [133]
Tournament Bonus- big	13,32	61.04 (0.83) [200]	54.10 (1.32) [200]	66.50 (3.34) [200]	35.00 (7.64) [40]	144.96 (3.58) [133]
Share of savings plus Tournament Bonus	7,8,9,10,19	56.96 (0.28) [460]	48.53 (0.74) [460]	61.09 (2.28) [460]	51.00 (5.02) [100]	140.30 (1.71) [281]

Note.
Standard errors are in parentheses and the number of observations is in brackets.
Calculating the total cost to Navy of filling all billets:
(1) *Baseline*

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Total amount paid to AO when all positions were filled = 45
(2) *Share of savings*
Total amount paid to AO when all positions were filled = 45 + share of savings to AO
(3) *Tournament*
Total amount paid to AO when all positions were filled = 45 + tournament winnings
(4) *Tournament + share of savings*
Total amount paid to AO when all positions were filled = 45 + tournament winnings + share of savings
(5) Tournament + group bonus
Total amount paid to AO when all positions filled and Group readiness requirement met = 45 + tournament winnings + group readiness bonus

b) Econometric Modeling

The descriptive statistics reported and discussed above are useful, but conditional responses estimated via econometric modeling yield additional insights. The estimation results for the AO behavior are reported in Table 4 and for the Sailors in Table 5.[12]

For the AOs, we estimate results for three metrics. The first is the **Cost of Filling all Positions** which is the sum of the payments to Sailors accepting the AO offer and the payment to the AO (includes any incentive package in place). The second is **Ship Readiness**, which is a binary variable equaling one if all billets on a ship are filled and zero otherwise. The third is the **Group Readiness**, which is defined as 75% or more of the ships in the group being ready.

A number of variables are predicted to affect these metrics. **Limited Information** is a dummy variable equaling one if both the Sailors and AOs are uninformed of the outside options. When the information is available, it is fuzzy, through the use of the uniform distribution discussed above, the uncertainty being symmetric to the Sailor and the AO. Absent complete information regarding the value of outside options, the Sailors may be more likely to accept the offers made by the AOs and, to the extent, the AOs exploit this, the aggregate wage offers can be lowered.[13] **Pay per Position** is a dummy variable equaling one if the AO basic compensation is positive when any billet (Red, Blue, or Green) is filled. This represents a weaker readiness condition – the AO is compensated even when one or more billets are unfilled. **Tournament-Combined** is equal to one if any form of the tournament treatment is in effect. Thus, this variable is equal one if the small, medium or large tournament is in effect. In most of the sessions, the distribution of the budget across the billets is set by administrative fiat but to investigate the potential effect of allowing the AO to set the allocation we conduct sessions in which the AO first allocates the budget and then makes the offers to the Sailors. We denote this with a dummy variable **AO determines budget per position**. The **Share of Savings** is

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[12] For the regression analysis, we use the data from the sessions listed in Table 3 plus the sessions in which the AO sets the billet sizes and the sessions in which the AO faces the **"no positions critical" setting** (15 sessions in total). This yields 126 panels for AOs and 378 for Sailors.

[13] This is a complex issue. The Navy has several websites that provide information on outside employment opportunities. It would seem that the Navy is harming itself through such actions. On the other hand, the AO needs such information when making offers. Further, Sailors may be using this information to decide on training options while in the Navy and such information may improve retention and also availability of Sailors for demanding billets.

equal to one if the treatment incorporates a bonus to the AO based on the savings realized from the filled billets. All bonus variables are set at zero if any billet is unfilled – the bonus is conditional on meeting the readiness requirement. To investigate the effects of the different size tournaments we create dummy variables, *Tournament-large, Tournament-medium, Tournament-small and Tournament-very small*. When these variables are included, we drop the overall tournament dummy. We conduct a session using staff personnel from the university and denote this by dummy variable *Non-student participants*. Finally, the variable *Share of savings plus tournament bonus* is equal to one when this combined incentive structure is offered to the AO.

Table 4
AO Responses to Incentives

Independent Variables	Cost of Filling All Positions[*]	Cost of Filling All Positions[*]	Ship Ready (binary)[†]	Ship Ready (binary)[†]	Group Ready (binary)[†]	Group Ready (binary)[†]
constant (baseline)	143.71*** (3.76)	145.97*** (4.05)	1.13*** (0.18)	1.12*** (0.18)	1.81*** (0.184)	1.74*** (0.19)
Share of savings	-18.00*** (3.93)	-18.03*** (4.36)	-0.38** (0.16)	-0.38** (0.16)	-1.04*** (0.148)	-1.04*** (0.16)
Share of savings plus tournament bonus	1.94 (4.07)	0.55 (4.48)	-0.77*** (0.16)	-0.76*** (0.16)	-1.77*** (0.151)	-1.75*** (0.159)
Tournament – combined	---	-14.82*** (4.22)	---	-0.59*** (0.15)	---	-1.58*** (0.148)
Tournament plus public good	-20.68*** (4.50)	-23.01*** (4.94)	-0.52*** (0.18)	-0.51*** (0.17)	-1.46*** (0.182)	-1.54*** (0.188)
Tournament-very small	-18.22*** (6.84)	---	-0.71*** (0.26)	---	-1.95*** (0.218)	---
Tournament-small	-29.09*** (5.57)	---	-0.58*** (0.22)	---	-1.390*** (0.182)	---
Tournament-medium	-16.75*** (5.39)	---	-0.49** (0.21)	---	-1.23*** (0.183)	---

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Tournament-large	4.30 (5.39)	---	-0.64*** (0.21)	---	-1.96*** (0.181)	---
Limited information	0.99 (3.83)	-1.41 (4.06)	0.09 (0.15)	0.12 (0.14)	0.40*** (0.122)	0.55*** (0.125)
Pay per position	-10.25** (4.12)	-12.07*** (4.54)	-0.27* (0.15)	-0.25* (0.15)	0.95*** (0.151)	1.02*** (0.162)
AO determines budget per position	5.12 (4.62)	-2.52 (4.65)	0.05 (0.18)	0.06 (0.16)	-0.12 (0.146)	0.034 (0.141)
Non-student participants	4.90 (6.81)	2.59 (7.52)	-0.42 (0.26)	-0.41 (0.26)	-1.25*** (0.218)	-1.18*** (0.233)
observations	1801	1801	2520	2520	2520	2520
LR	77.37	52.02	57.06	56.19	373.46	336.69

Note.
Standard errors are in parentheses. *,**,*** denote 0.10, 0.05, and 0.01 significance levels, respectively.
*estimated using maximum likelihood with round-level fixed effects and subject-specific random effects (126 unique subjects)

In general, incentive packages decrease the cost of filling billets. The coefficients on the dummy variables representing the incentive packages are generally negative, indicating lower costs than in the baseline treatment, in the equations estimating the cost of filling billets. It is interesting to decompose some of the effects, though. The coefficient on Tournament-combined is negative and significant. However, this effect is not uniform and when we decompose the tournament effect an interesting result emerges. The coefficients for the small and medium (pay-off) tournaments are negative and significant as is the coefficient on the dummy variable representing a bonus based on the share of savings realized. However, as the results in Table 4 show, a large tournament does not reduce costs relative to the baseline and this is also the case for the combined incentive package consisting of the share plus a tournament (with the medium prize). Allowing the AO to set the amount of the budget allocated to the individual billets does not affect costs. The coefficient on AO determines budget per position is not significant. As expected, when the AO has information regarding outside options available to the Sailors, the allocated budget simply reflects these values.

Comparisons of the coefficients from the regression results in the first column of Table 4 indicate that the share of savings incentive results in equivalent reductions in the costs of filling billets compared to the very small and medium tournaments and the tournament with a group bonus. The small tournament setting resulted in significant cost savings relative to the baseline, the other tournament settings and the share of savings (p = 0.045). In short, the small tournament performed best in terms of reducing the cost to the Navy of filling all three billets.

The objective of the AO incentives is the reduction in costs but readiness conditions must also be met and this requires that the billets be filled – that Sailors accept offers from the AOs. We turn to the Sailor behavior shortly but we have analyzed the impact on readiness of the incentive packages that are offered to the AOs. In Table 4 we report the results for All Positions Filled which is equal to one if all billets are filled (the ship is ready) and zero otherwise. In general, all of the incentive packages reduce readiness at the ship and the group level as the AOs respond to the incentives by lowering offers and the Sailors respond by rejecting these offers.

Within this general result, some important findings emerge. While tournament incentives do reduce readiness, this effect is most prominent when the Tournament-large is in effect. Since the large tournament had an insignificant effect on costs of filling billets, it would appear that utilizing dramatically large pay-offs in tournaments is counterproductive. In the experiments, the large tournament prize was more than 200% of the baseline compensation to AOs.

Pair-wise tests of the coefficients from the readiness regression indicate that the share of savings and all tournament settings except the large tournament are statistically equivalent at the 0.05 level in terms of readiness reduction relative to the baseline. Overall, the incentive packages that emerge as being the best combination of cost reduction and impact on ship readiness are the small tournament and the share of savings bonus. In our setting, giving the AO the power to set the budget allocation across the billets has no effect on either cost savings or readiness.

Finally, in terms of group readiness, share of savings outperformed all other incentive settings except for the medium tournament ($p = 0.252$).

Since the response of Sailors to the offers directly affects the effectiveness of the incentive packages, the analysis must examine the determinants of the propensity of the Sailor to accept the offer. The results are reported in Table 5. We run separate models for each Sailor type as well as for all Sailors combined. When the AOs and Sailors have better (limited by the fuzzy setting) information of outside options, the Red Sailors are more likely to accept the offers the AOs make. Overall, the better information reduces acceptance probability (as shown by the negative coefficient in the All Sailors estimation). Overall, Green Sailors are less likely to accept the offer. In the All Sailors model, the omitted class is Green Sailor and the coefficients on the remaining classes (Red and Blue) are positive and significant. If the lowered value position (Green) is deemed less necessary to meet, readiness requirements then this finding may be combined with what we learn regarding the AO behavior to expand our analysis of the readiness-cost savings tradeoff.

Table 5
Sailor Acceptance

Independent Variables	All Sailors	Red Sailor	Blue Sailor	Green Sailor
constant	4.20*** (0.380)	3.46*** (0.553)	3.34*** (0.715)	2.14*** (0.311)
Lag Sailor Accept	-0.22*** (0.064)	0.24** (0.114)	-0.11 (0.118)	-0.20* (0.105)
Save per Position	---	-0.09*** (0.008)	-0.16*** (0.012)	-0.08*** (0.009)
Save Total	-0.05*** (0.003)	---	---	---
Blue Last Round	0.10* (0.056)	0.13 (0.099)	0.06 (0.102)	0.27*** (0.102)
Green Last Round	0.10* (0.058)	0.02 (0.105)	0.21* (0.107)	0.16 (0.099)
AO determines budget per position	0.09 (0.095)	0.19 (0.134)	0.23* (0.134)	-0.05 (0.128)
Limited Information	-0.12 (0.117)	0.09 (0.160)	-0.22 (0.159)	0.02 (0.162)
Cumulative Wealth	0.00 (0.001)	0.00 (0.001)	0.00 (0.001)	0.00* (0.001)
Task Time	-0.01 (0.020)	-0.22 (0.244)	-0.03 (0.166)	-0.01 (0.021)
Age	-0.06*** (0.016)	0.01 (0.030)	-0.06*** (0.023)	-0.05*** (0.020)
Male	-0.05 (0.077)	-0.22** (0.105)	-0.04 (0.105)	-0.00 (0.105)

Blue Sailor	-0.18*** (0.058)	---	---	---
Green Sailor	-0.28*** (0.070)	---	---	---
Observations	8454	2820	2818	2816
Wald (chi2)	453.56	154.11	201.76	140.69

<u>Note</u>.
1. estimated using panel probit model (fixed effects for rounds, random effects for subjects)
2. standard are errors in parentheses. *,**,*** denote 0.10, 0.05 and 0.01 significance levels, respectively

c) Cost versus Readiness Tradeoff

Reducing labor costs is the objective of transitioning to a more market oriented staffing process for the Navy. It appears, from our data and analysis, that a compensation mechanism for the AOs that provides incentives to reduce these costs can be effective. However, an unintended consequence may be lower levels of readiness. In our stylized setting ship, readiness is measured in terms of filling all three billets on the ship. We define group readiness to be that at least 75% of the ships be ready (all billets filled). Our setting does not allow for partial readiness of one ship to be compensated by partial or full readiness of another ship, hence our setting imposes a fairly rigorous standard for readiness. We summarize our comparison of the ship readiness-cost savings tradeoff in Figure 2.

A movement to the right from the Baseline position is unambiguously good – costs fall and readiness remains the same. Similarly, a movement directly below the Baseline is unambiguously bad – costs unchanged and the readiness level falls. Within this range, we see there is scope for tradeoffs. We do not know the underlying weights the Navy would seek to apply to these measures. If ship readiness is the more important objective, the Tournament (medium) and Share of Savings incentives do quite well. Cost saving exceed the percentage fall in readiness.

Given that cost savings are desired and readiness reduction is not, we can say that all **mechanisms yielding outcomes to the south west of "Share of Savings" in Figure 2 are** unambiguously less effective. This leaves for further consideration the Tournament (small) and Tournament PG mechanisms. However, both yield significantly lower readiness outcomes at both the ship and the group level.

Note that our setting is particularly stringent as far as measuring readiness targets. The AO has only as many Sailors available as there are billets. A rejected offer means the ship is not ready. Two ships failing to meet readiness means the group is not ready. In the field, there are likely to be Sailors available to accept offers that are rejected. That

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is, there is a pool of additional labor available. Thus, readiness measures will be much higher in the field setting.

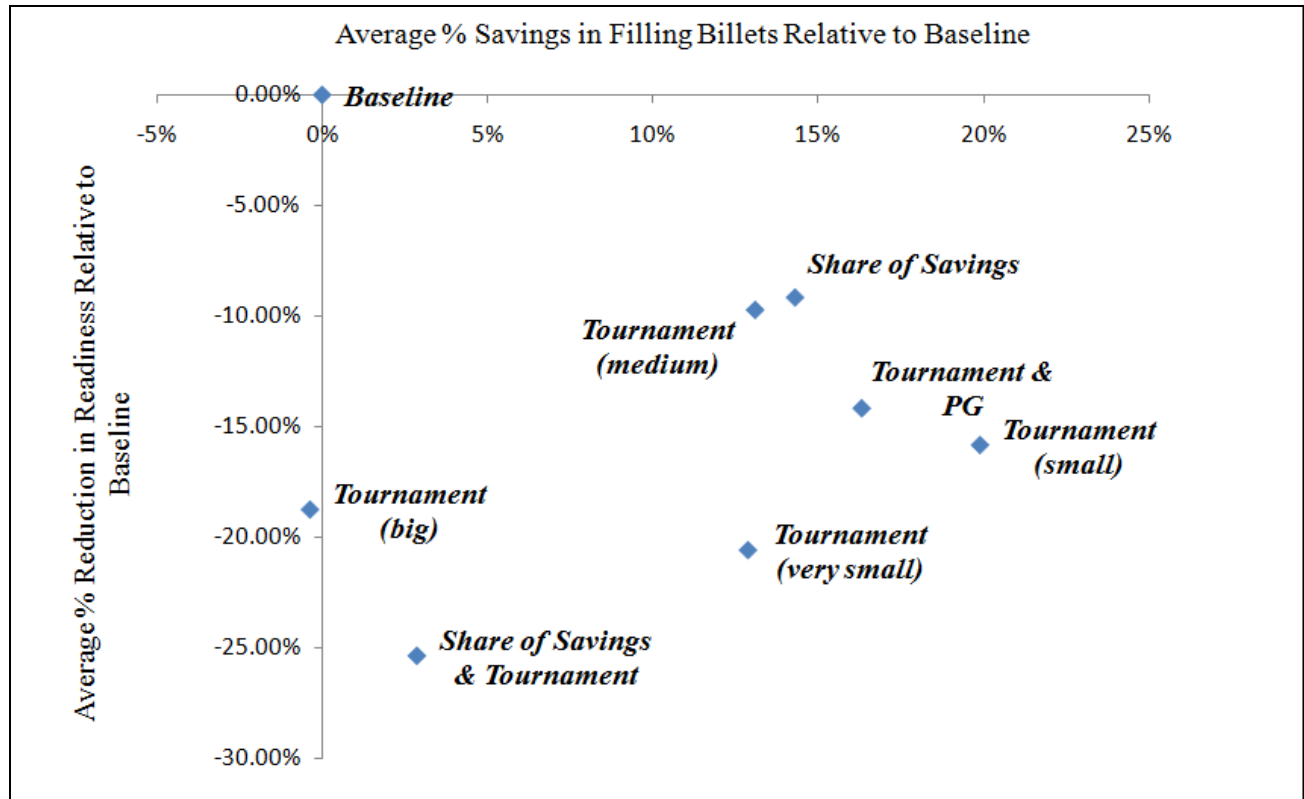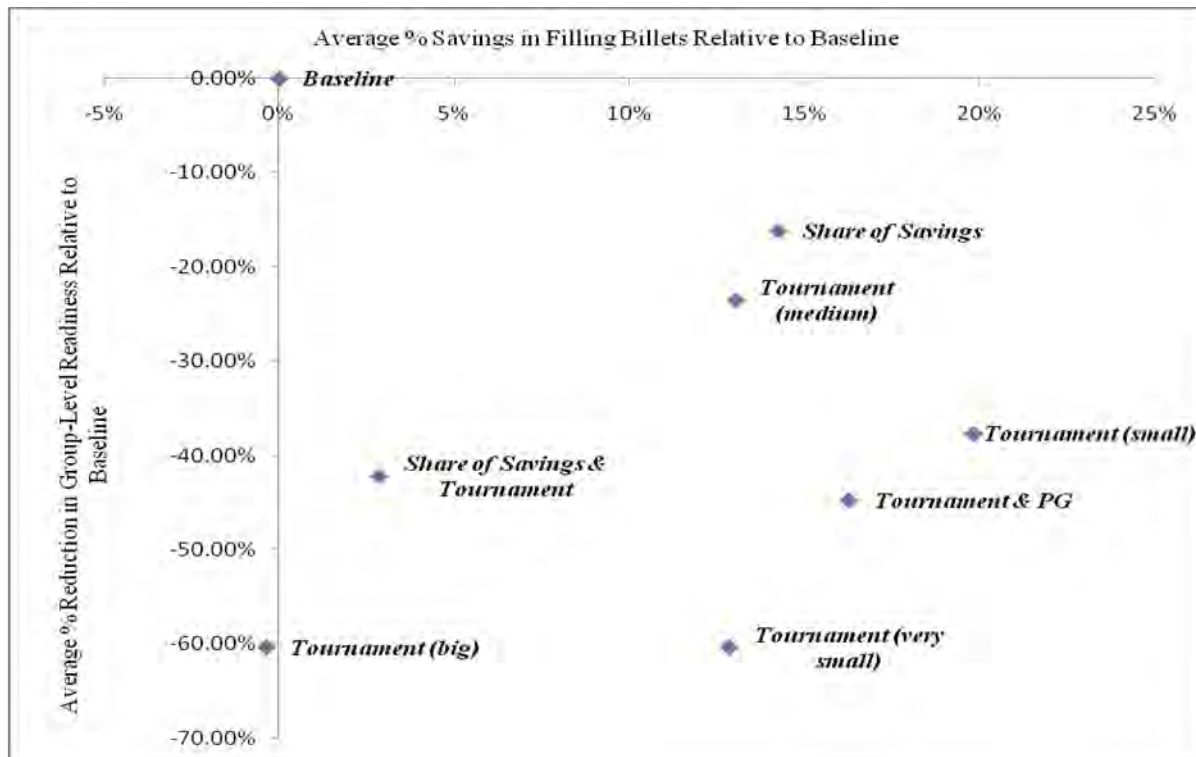**Figure 2. Comparing Ship Readiness vs. Cost Savings Across Incentive Mechanisms**

Average % Savings in Filling Billets Relative to Baseline

Figure 3. Comparing Group Readiness vs. Cost Savings across Incentive Mechanisms

5. Conclusions and Extensions

We designed a set of laboratory experiments to investigate the effects of AO incentives on readiness and cost savings while filling billets. Our setting is a strong test since there is little room for error on the part of the AO – there are no "spare" Sailors so a single rejection implies failure to meet readiness in the current period.

On the other hand, our environment mimics a fluid labor market. Sailors can leave (reject) and return without penalty in the form of lost seniority. In that sense, it can inform the policy debate concerning the effects of moving to a market system for staffing billets in the Navy.

Our results suggest that providing the AO incentives to lower labor costs can be effective. There are costs, measured as reduced readiness rates, but these can be mitigated through the choice of the incentive mechanism. We find that the small and medium sized tournament rewards and offering a share of the saving generate the most effective tradeoff between costs of filling billets and maintaining a level of readiness.

Since our setting imposes strict constraints on filling billets, through the absence of Sailors that may be in a pool of available personnel, we have likely overstated the readiness impacts associated with the introduction of incentive packages for the AO.

However, we feel that such a conservative approach is consistent with the Navy's objective of meeting readiness.

There are several avenues that could be explored based on the results we report here. An experiment could be set up where either Sailors > billets. In the current climate, skill specific, this is happening. As discussed above, this situation may affect readiness/costs combination of the mechanisms. We expect that the effect will occur across all mechanisms and is unlikely to affect the ranking of the relative performance across mechanisms. A related question is how the cost versus readiness tradeoff is affected when we hire an additional person beyond perhaps what is needed. This raises the question of the marginal effect on readiness and costs per each additional unit of labor hired.

In none of our settings is the AO budget constrained. That is the budget available is sufficient to meet all outside options available to the Sailors. Rejected offers arise solely when the AO attempts to save from this budget. Thus, allowing the AO a larger budget is unlikely to address the readiness effects. If the AOs continue to respond to the incentives introduced by the performance mechanisms we predict that readiness will decline. Far more likely to improve readiness are such factors as the availability of Sailors in excess of the number of billets available and greater uncertainty in the outside options available to the Sailors. There is also the question that we have not addressed as yet; does varying pay according to ability (broadly defined), as captured in our sorting task, adversely affect the rejection rate among Sailors?

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Appendix A:
Decision Sequence and Treatments in the Experiment

Appendix A: Decision Sequence and Treatments in the Experiment

Players: 1 *AO* (officer) and 3 *Sailors* per group.

Stage 1: Rank determination for Sailors / Determining billet values / Offers to Sailors

In each period, players are randomly assigned to a group consisting of 1 *AO* and 3 Sailors. Throughout, Sailors remain Sailors and *AO*s remain *AO*s.

In each period the total budget, *P*, is divided into three billet values p_R, p_G and p_B.

AO Treatments in effect this stage:

a. – *AO* chooses p_R, p_B and p_G such that $p_R + p_B + p_G = P$ and $p_R \geq p_B \geq p_G$.

b. – The values for p_R, p_B and p_G are predetermined.

c. – Compensation mechanism assigned to the AO (described in detail below).

Sailor Treatments in effect at this stage:

a. – Sailors earn assignment of rank through the timed number sorting task, earning either the Red, Blue or Green rank. The ranking defines the value of their outside option, l_b, where $l_R \geq l_B \geq l_G \geq 0$. A sailor's outside option is their payoff if they reject the offer from the *AO*.

b. – Sailors are randomly assigned to either the Red, Blue or Green rank. Again, the ranking defines the value of their outside option, *l*.

c. – The degree of precision (fuzziness) associated with the outside option.

While the *AO* is choosing the amount to offer each of the three Sailors (o_R, o_B, and o_G) and the budget allocated to the billets (if applicable) the Sailors are completing the rank assignment task (if in effect).

Stage 2: Sailors accept or reject / AO's payoffs are determined

Sailors are told their ranking; they can view all three billet values in the common knowledge setting but only their own in the limited information setting. They can view their individual offer from the *AO*.

Sailor treatments in effect at this stage:

a. – Sailors can view all three offers made by the *AO*

b. – Sailors can only view their individual offer from the *AO*

Each Sailor either accepts the offer and receives o_b or rejects the offer and earns l_b.

After the three Sailors have made their decisions, the *AO*'s payoffs are determined.

Treatments in effect at this stage:

a. *AO* earns \$*X* given that all billets are filled, or \$*Y* if billet(s) go unfilled, where $X > Y \geq 0$.

b. *AO* earns \$*xR* + \$*yB* + \$*zG* where *R, B* and *G* = 1 if the respective billets are filled.

c. *AO* earns $X given that all billets are filled (or based on a formula as in *b* above), *plus* a share, α, of the surplus from *P,* where $0 \geq \alpha \geq 1$.

d. *AO*s compete among themselves for efficiency in filling billets. To implement this we add a rank order tournament to the *AO* compensation scheme (which could be either of *g*, *h* or *i*. That is, with *N AO*s in a session, whoever fills the billet assignments at the least cost wins the tournament and earns an additional bonus. That bonus could be a larger share of the surplus.

Note: For each of these treatments, we vary whether the Sailors are aware of the *AO*'s compensation scheme.

At the end of the period Sailors and *AO*s are informed of their earnings. Here we will want to vary what information about the *other* players each Sailor receives.

Again, the positions in the experimental setting are described as Manager (for the AO) and Worker (for the Sailor).

The Readiness Requirement can take two forms: all billets must be filled or specific (essential) billets must be filled. We define Red to be essential to implement the latter setting. An AO filling only the Red billet will receive pay but less than if all billets are filled.

Sub-treatment (boundary conditions) components to be investigated in each of these treatments: Fuzzy outside option values; Information settings regarding outside options – full (symmetric) information, partial (asymmetric) information, no information; Information settings – Sailors know/not know AO compensation mechanism.

Appendix B:

Subject Interface Screens

Appendix B: Subject Interface Screens

<u>Note</u>. These screens report a set up for a particular treatment. The interface is essentially the same for all treatments but some of the specific settings change. We begin with the screens used by the experimenter (proctor) for the purposes of setting up the session. During the actual experiment the Windows browser frames are not seen on the screens.

The screens shown here are from the instruction phase of the experiment. This the pop-up boxes that inform the participants of the decision setting are shown.

Proctor's Screens

Billet Assignment Experiment Setup
fuzzy

DO NOT CHANGE ANYTHING ON THIS PAGE OR CLICK PROCEED UNTIL YOU HAVE SAVED THE RESULTS FROM THE PREVIOUS SESSION!

Set up the experiment then press "Proceed" button below when ready to configure the database and prior to subjects going past the first page.

Groups and Subjects
1 Groups (4 Subjects)

AO Compensation

Lump Sum / Position Multiplier

- 15.0 Red-Blue-Green Filled ($LAB)
- 10.0 Red-Blue Filled ($LAB)
- 5.0 Red Filled ($LAB)

OR

- 9.0 Red ($LAB)
- 7.0 Blue ($LAB)
- 5.0 Green ($LAB)

☑ AO Share Bonus 25.0 (% of Saved when Position filled)
☑ AO Least Cost Tournament Bonus 30.0 ($LAB)
☑ Critical Red Position (must be filled or zero compensation)

Institutions
- 5 Show Up Fee ($US)
- 100 Exchange Rate ($LAB to one $US)
- 90 AO Alert Time (seconds)
- 30 Sailor Alert Time (seconds)
- ☐ Trust Game w/Marginal Amount of ($US) 0.5
- ☐ Risk Aversion Test w/ Sure Bet ($US) 2.5

The Series Attributes

	5 Rounds	Sort	P	p_R	p_B	p_G	P_{USE}	O_R	O_B	O_G	Fzy	$\varepsilon(\%)$	$\pi o2s$	$\pi o2a$	$\pi \wp 2s$	$\pi \wp 2a$
Training	2	☑	95.0	40.0	30.0	25.0	☑	41.0	31.0	26.0	☑	3.0	☑	☑	☑	☑
Series 2	3	☑	100.0	40.0	35.0	25.0	☑	42.0	36.0	27.0	☑	2.0	☑	☑	☑	☑
Series 3	0	☐	99.0	33.0	33.0	33.0	☐	35.0	35.0	35.0	☐	3.0	☑	☑	☑	☑
Series 4	0	☐	94.0	35.0	31.0	28.0	☐	35.0	31.0	28.0	☐	2.0	☑	☐	☐	☐
Series 5	0	☐	103.0	40.0	34.0	29.0	☐	40.0	34.0	29.0	☐	4.0	☑	☐	☐	☐

Treatments
Delete Select A Treatment Save

Proceed

http://econlabdev/home/BilletAssignmentGame/startexperiment.cfm

File   Edit   View   Favorites   Tools   Help

Links   Adobe Connect   Aplia   BSC Email   Customize Links   Dept Test   Dictionary   Econlabdev   Google   Jones-O-Web   OBPC   Weather   Sec

Setup Menu for Experiment

| | | 90 | AO Alert Time (seconds) |
| | | 30 | Sailor Alert Time (seconds) |

☑ AO Share Bonus 25.0 (% of Saved when Position filled)
☑ AO Least Cost Tournament Bonus 30.0 ($LAB)
☑ Critical Red Position (must be filled or zero compensation)

☐ Trust Game w/Marginal Amount of ($US) 0.5
☐ Risk Aversion Test w/ Sure Bet ($US) 2.5

The Series Attributes

	5 Rounds	Sort	P	p_R	p_B	p_G	P_{USE}	O_R	O_B	O_G	Fzy	$\varepsilon(\%)$	$\pi o2s$	$\pi o2a$	$\pi p2s$	$\pi p2a$
Training	2	☑	95.0	40.0	30.0	25.0	☑	41.0	31.0	26.0	☑	3.0	☑	☑	☑	☑
Series 2	3	☑	100.0	40.0	35.0	25.0	☑	42.0	36.0	27.0	☑	2.0	☑	☑	☑	☑
Series 3	0	☐	99.0	33.0	33.0	33.0	☐	35.0	35.0	35.0	☐	3.0	☑	☑	☑	☑
Series 4	0	☐	94.0	35.0	31.0	28.0	☐	35.0	31.0	28.0	☐	2.0	☑	☐	☐	☐
Series 5	0	☐	103.0	40.0	34.0	29.0	☐	40.0	34.0	29.0	☐	4.0	☑	☐	☐	☐

Treatments

Delete   Select A Treatment ▾   Save

Proceed

The Series Attributes Legend

$Sort$ = use Sort Task for positions

P = manager's budget

p_R = position red

p_B = position blue

p_G = position green

P_{USE} = use the values for p_{RED}, p_{BLUE}, p_{GREEN}

O_R = outside red

O_B = outside blue

O_G = outside green

Fzy = use random value within margin of error

ε = % margin of error

$\pi o2s$ = show all offers to sailors

$\pi o2a$ = show all offers to aos

$\pi p2s$ = show all payoffs to sailors

$\pi p2a$ = show all payoffs to aos

Done   Trusted sites

Proctor's Pre-session Monitor

Subjects Are Not Finished With Basic Instructions!

The database has been started and is ready for the session to start. Now is the time to have subjects begin reading instructions on their laptops. As soon as everyone has gotten past the basic instructions and games (if included), the monitor page will appear and the session will be underway.

Configuration
Treatment Name: fuzzy

Groups and Subjects
Groups: **1**

Institutions
Show Up Fee ($US): **5**
Exchange Rate ($LAB to one $US): **100**
AO Alert Time (seconds): **90**
Sailor Alert Time (seconds): **30**
Trust Game: **no** w/Marginal Amount of ($US) **0.5**
Risk Aversion Test: **no** w/ Sure Bet ($US) **2.5**

AO Compensation

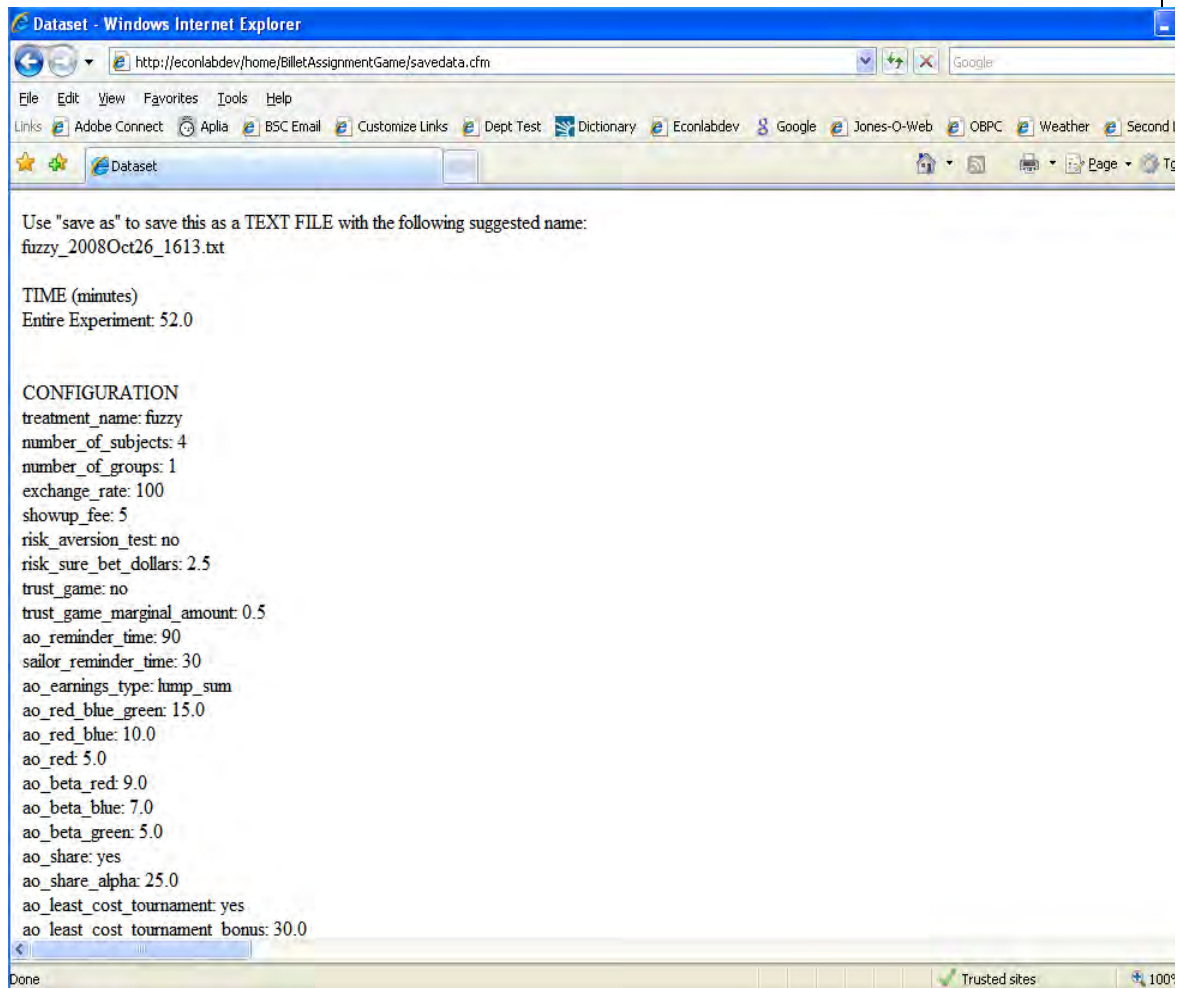| Lump Sum		Position Multiplier
Red-Blue-Green Filled: **15.0** ($LAB)	OR	Red: **9.0** ($LAB)
Red-Blue Filled: **10.0** ($LAB)		Blue: **7.0** ($LAB)
Red Filled: **5.0** ($LAB)		Green: **5.0** ($LAB)

AO Share Bonus: **yes** Bonus= **25.0** (% of Saved when Position filled)

AO Least Cost Tournament Bonus: **yes** Bonus= **30.0** ($LAB)

Critical Red Position: **yes**

The Series Attributes

	5 Rounds	Sort	P	p_R	p_B	p_G	P_{USB}	O_R	O_B	O_G	Fzy	$\varepsilon(\%)$	$\pi o2s$	$\pi o2a$	$\pi p2s$	$\pi p2a$
Training	2	yes	95.0	40.0	30.0	25.0	yes	41.0	31.0	26.0	yes	3.0	show	show	show	show
Series 2	3	yes	100.0	40.0	35.0	25.0	yes	42.0	36.0	27.0	yes	2.0	show	show	show	show
Series 3	0	no	99.0	33.0	33.0	33.0	no	35.0	35.0	35.0	no	3.0	show	show	show	show
Series 4	0	no	94.0	35.0	31.0	28.0	no	35.0	31.0	28.0	no	2.0	show	noshow	noshow	noshow
Series 5	0	no	103.0	40.0	34.0	29.0	no	40.0	34.0	29.0	no	4.0	show	noshow	noshow	noshow

Subject Role Ready

1	AO	NO
2	W	NO
3	W	NO
4	W	NO

http://econlabdev/home/BilletAssignmentGame/postmonitor.cfm   Google

File   Edit   View   Favorites   Tools   Help

Links   Adobe Connect   Aplia   BSC Email   Customize Links   Dept Test   Dictionary   Econlabdev   Google   Jones-O-Web   OBPC   Weather   Second Life

postmonitor.cfm   Page   Tools

Post Session Monitor

Subjects are reviewing the results of the risk and trust games (if they existed) and entering their answers to the demographics.

Configuration
Treatment Name: fuzzy

Subject Finished

1	NO
2	NO
3	NO
4	NO

Groups and Subjects
Groups: **1**

Institutions
Show Up Fee ($US): **5**
Exchange Rate ($LAB to one $US): **100**
AO Alert Time (seconds): **90**
Sailor Alert Time (seconds): **30**
Trust Game: **no** w/Marginal Amount of ($US) **0.5**
Risk Aversion Test: **no** w/ Sure Bet ($US) **2.5**

AO Compensation

Lump Sum	OR	Position Multiplier
Red-Blue-Green Filled: **15.0** ($LAB)		Red: **9.0** ($LAB)
Red-Blue Filled: **10.0** ($LAB)		Blue: **7.0** ($LAB)
Red Filled: **5.0** ($LAB)		Green: **5.0** ($LAB)

AO Share Bonus: **yes** Bonus= **25.0** (% of Saved when Position filled)
AO Least Cost Tournament Bonus: **yes** Bonus= **30.0** ($LAB)
Critical Red Position: **yes**

The Series Attributes

	5 Rounds	Sort	P	p_R	p_B	p_G	P_{USE}	O_R	O_B	O_G	Fzy	$\varepsilon(\%)$	$\pi o2s$	$\pi o2a$	$\pi p2s$	$\pi p2a$
Training	2	yes	95.0	40.0	30.0	25.0	yes	41.0	31.0	26.0	yes	3.0	show	show	show	show
Series 2	3	yes	100.0	40.0	35.0	25.0	yes	42.0	36.0	27.0	yes	2.0	show	show	show	show
Series 3	0	no	99.0	33.0	33.0	33.0	no	35.0	35.0	35.0	no	3.0	show	show	show	show
Series 4	0	no	94.0	35.0	31.0	28.0	no	35.0	31.0	28.0	no	2.0	show	noshow	noshow	noshow
Series 5	0	no	103.0	40.0	34.0	29.0	no	40.0	34.0	29.0	no	4.0	show	noshow	noshow	noshow

Done   Trusted sites   100%

Use "save as" to save this as a TEXT FILE with the following suggested name:
fuzzy_2008Oct26_1613.txt

TIME (minutes)
Entire Experiment: 52.0

CONFIGURATION
treatment_name: fuzzy
number_of_subjects: 4
number_of_groups: 1
exchange_rate: 100
showup_fee: 5
risk_aversion_test: no
risk_sure_bet_dollars: 2.5
trust_game: no
trust_game_marginal_amount: 0.5
ao_reminder_time: 90
sailor_reminder_time: 30
ao_earnings_type: lump_sum
ao_red_blue_green: 15.0
ao_red_blue: 10.0
ao_red: 5.0
ao_beta_red: 9.0
ao_beta_blue: 7.0
ao_beta_green: 5.0
ao_share: yes
ao_share_alpha: 25.0
ao_least_cost_tournament: yes
ao_least_cost_tournament_bonus: 30.0

Note. The first part of the dataset generated by the experiment. All treatment elements are recorded.

PAYOFF SCHEDULE
Subject,Total_Payoff_in_$US,Total_Payoff_in_$LAB,Earnings_in_$LAB,Risk_Game_in_$LAB,Trust_Game_in_$LAB
1,$1.00, 86, 86, -1, -1
2,$1.00, 76, 76, -1, -1
3,$1.25, 105, 105, -1, -1
4,$1.25, 106, 106, -1, -1
SESSION_PAYOFF=$4.50

SUBJECT DATASET
round_number,round_number_for_series,series,subject_number,group_number,subject_role,subject_position,earnings_task_time,managers_budget,position_red,posi
1,1,1,1,1,1,ao,na,-1.0,95.0,40.0,30.0,25.0,95.0,70.0,5.0,5.0,2.0,12.0,10.0,35.0,25.0,23.0,83.0,60.0,41.0,41.0,31.0,32.0,26.0,27.0,tbd,10.0,33.0,43.0,-
1.0,43.0,tbd,tbd,tbd,tbd,tbd,tbd,-1.0,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,-1,-1,-1
1,1,1,1,2,1,sailor,blue,4.08,95.0,40.0,30.0,25.0,95.0,70.0,5.0,5.0,2.0,12.0,10.0,35.0,25.0,23.0,83.0,60.0,41.0,41.0,31.0,32.0,26.0,27.0,accept,10.0,33.0,43.0,2
-1.0,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,-1,-1,-1
1,1,1,1,3,1,sailor,green,4.29,95.0,40.0,30.0,25.0,95.0,70.0,5.0,5.0,2.0,12.0,10.0,35.0,25.0,23.0,83.0,60.0,41.0,41.0,31.0,32.0,26.0,27.0,reject,10.0,33.0,43.0,
-1.0,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,-1,-1,-1
1,1,1,1,4,1,sailor,red,3.95,95.0,40.0,30.0,25.0,95.0,70.0,5.0,5.0,2.0,12.0,10.0,35.0,25.0,23.0,83.0,60.0,41.0,31.0,32.0,26.0,27.0,accept,10.0,33.0,43.0,3
-1.0,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,-1,-1,-1
2,2,2,1,1,1,ao,na,-1.0,95.0,40.0,30.0,25.0,95.0,65.0,17.0,3.0,0.0,0.0,20.0,17.0,23.0,27.0,25.0,75.0,48.0,41.0,42.0,31.0,31.0,26.0,25.0,tbd,5.0,34.0,39.0,-
1.0,39.0,tbd,tbd,tbd,tbd,tbd,tbd,-1.0,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,-1,-1,-1
2,2,2,1,2,1,sailor,blue,4.24,95.0,40.0,30.0,25.0,95.0,65.0,17.0,3.0,0.0,0.0,20.0,17.0,23.0,27.0,25.0,75.0,48.0,41.0,42.0,31.0,31.0,26.0,25.0,reject,5.0,34.0,39.0,3
-1.0,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,-1,-1,-1
2,2,2,1,3,1,sailor,green,6.84,95.0,40.0,30.0,25.0,95.0,65.0,17.0,3.0,0.0,0.0,20.0,17.0,23.0,27.0,25.0,75.0,48.0,41.0,42.0,31.0,31.0,26.0,25.0,accept,5.0,34.0,39.0
-1.0,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,-1,-1,-1
2,2,2,1,4,1,sailor,red,4.13,95.0,40.0,30.0,25.0,95.0,65.0,17.0,3.0,0.0,0.0,20.0,17.0,23.0,27.0,25.0,75.0,48.0,41.0,42.0,31.0,31.0,26.0,25.0,accept,5.0,34.0,39.0,2
-1.0,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,-1,-1,-1
3,3,1,2,1,1,ao,na,-1.0,100.0,40.0,35.0,25.0,100.0,100.0,17.0,0.0,0.0,0.0,17.0,17.0,23.0,35.0,25.0,83.0,83.0,42.0,42.0,36.0,37.0,27.0,27.0,tbd,15.0,34.0,49.0,-
1.0,49.0,tbd,tbd,tbd,tbd,tbd,tbd,-1.0,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,NA,-1,-1,-1
3,3,1,2,2,1,sailor,red,3.93,100.0,40.0,35.0,25.0,100.0,100.0,17.0,0.0,0.0,0.0,17.0,17.0,23.0,35.0,25.0,83.0,83.0,42.0,42.0,36.0,37.0,27.0,27.0,accept,15.0,34.0,4

Note. The first part of the dataset generated by the experiment. Payoffs are shown as are the first rows of the data recording participant decisions.

Manager's Screens (We labeled the AO as Manager for the experiment session)

Hello! Please Read This

Hello, please take your seat and wait for instructions from the proctor. Do not touch the mouse, keyboard, or any other part of the computer until instructed. In a few minutes the proctor will tell you how the session will proceed.

Please wait quietly!

Proceed

Welcome to the Experiment

You are about to participate in a series of market decisions. By following the instructions carefully and making good decisions you may earn considerable money, which will be paid to you in cash at the end of the session. The currency we will use today will be lab dollars. These lab dollars ($LAB) will be exchanged for US dollars at the end of the session.

Previous   Proceed

What This Is All About

Throughout this experiment you will be a Manager. At the beginning of each period you will be randomly assigned with three workers. You will be assigned with a different group of three workers each period.

Your task is to fill three open positions, called the Red Position, Blue Position and Green Position.

During each period you will be provided with a total budget that is divided into three accounts for the Red, Blue and Green Positions. From each of the three accounts you must decide how much money to offer a potential worker to fill each position. For each of the three positions there is one available worker that can decide whether or not to accept your offer and fill the position.

If the worker accepts the offer he or she earns the offer amount. Your earnings will be described later.

[Previous] [Proceed]

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Your Decision

The three workers first participate in a sorting task and their performance determines their value for an outside job. The worker that completes the sorting task the fastest gets the highest outside value, the next fastest gets a lower outside value, and the slowest gets the lowest outside value.

They will get matched with your offer for the Red Position, Blue Position or Green Position. The worker that completes the sorting task the fastest gets the offer for the Red Position, the next fastest worker gets the offer for the Blue Position and the slowest worker gets the offer for the Green Position.

If the worker accepts the offer he or she earns the offer amount. If the worker rejects the offer, he or she earns their outside option.

You will be shown the worker's outside value while you are deciding how much to offer.

[Previous] [Proceed]

Done   Trusted sites   100%

Note. The experiment utilized fairly neutral language; "Managers" instead of AOs and "Workers" instead of Sailors. This is common practice in the setup of lab experiments.

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How You Will Earn Money

Your earnings for each round are determined by the offers you make to workers and your success in staffing the positions each period. The exact compensation formula will be explained in detail just prior to starting the first period.

At the end of the experiment, you will receive the total amount you have accumulated from each period. There might be other opportunities for money as well.

Therefore, your earnings for the entire session are calculated as follows:

Total Earnings = Cumulative earnings from all rounds
+ earnings from other opportunities

The computer will keep track of your earnings.

[Previous]   [Proceed]

Done   Trusted sites   100%

Your Decisions

Your total budget of $95.00 has been divided into the Red position account, Blue position account and Green position account.

As the manager, you must decide how much money to offer each available worker for each of the three positions. When making this decision you are NOT allowed to offer a worker more money than you have in the position account. For example if there is $40 in the Red position account you can offer the available worker for the Red position from $0 to $40.

All managers have the same total budget and position account amounts for the round.

Proceed

B-11

Your Payoff

Your payoff for a round will be determined by the combination of required positions that are filled.

Positions Required	Payoff When Filled
Red, Blue, Green	$45.00

BONUS: In addition, you receive 25% of the amount Saved for **each position filled**. The amount Saved is equal to the amount in the Position account minus the Pay offered to the worker.

[Previous] [Proceed]

[Skip Ahead]

Note. Here the Manager (AO) is informed of the calculation of the payoff to his/her decisions. In the setting shown, the Manager receives a base pay only if all three billets are filled and a bonus equal to 25% of the amount saved (budget minus aggregate wage offers for the 3 billets).

Note. In this and the following screens the budget has been allocated across the billets and the AO is now ready to enter offers that will be made to the Sailors assigned to a Red, Blue, or Green billet. The offers (as well as the billet budget allocation) are made by moving the sliders.

B-17

Note. At end of round Manager (AO) learns results. Whether offers were accepted and round payoff depending in the setting in effect (baseline, share of savings **bonus, tournament, and so on). The setting shown is for "no positions critical" and a "share of savings bonus" paid for amount saved from billet allocation.**

Your Demographic Information

The experiment is over. While you are waiting for the final payoffs to be calculated, please answer these questions...

Age:	No Answer
Gender:	No Answer
Race:	No Answer
Political Party Affiliation:	No Answer
Father's Education (Please provide the highest DEGREE level completed):	No Answer
Mother's Education (Please provide the highest DEGREE level completed):	No Answer
Academic Year:	No Answer
Major:	No Answer
Grade Point Average (GPA) Overall:	No Answer
Grade Point Average (GPA) for Major:	No Answer
ACT Test Score (if taken):	No Answer
SAT Test Score (if taken):	No Answer

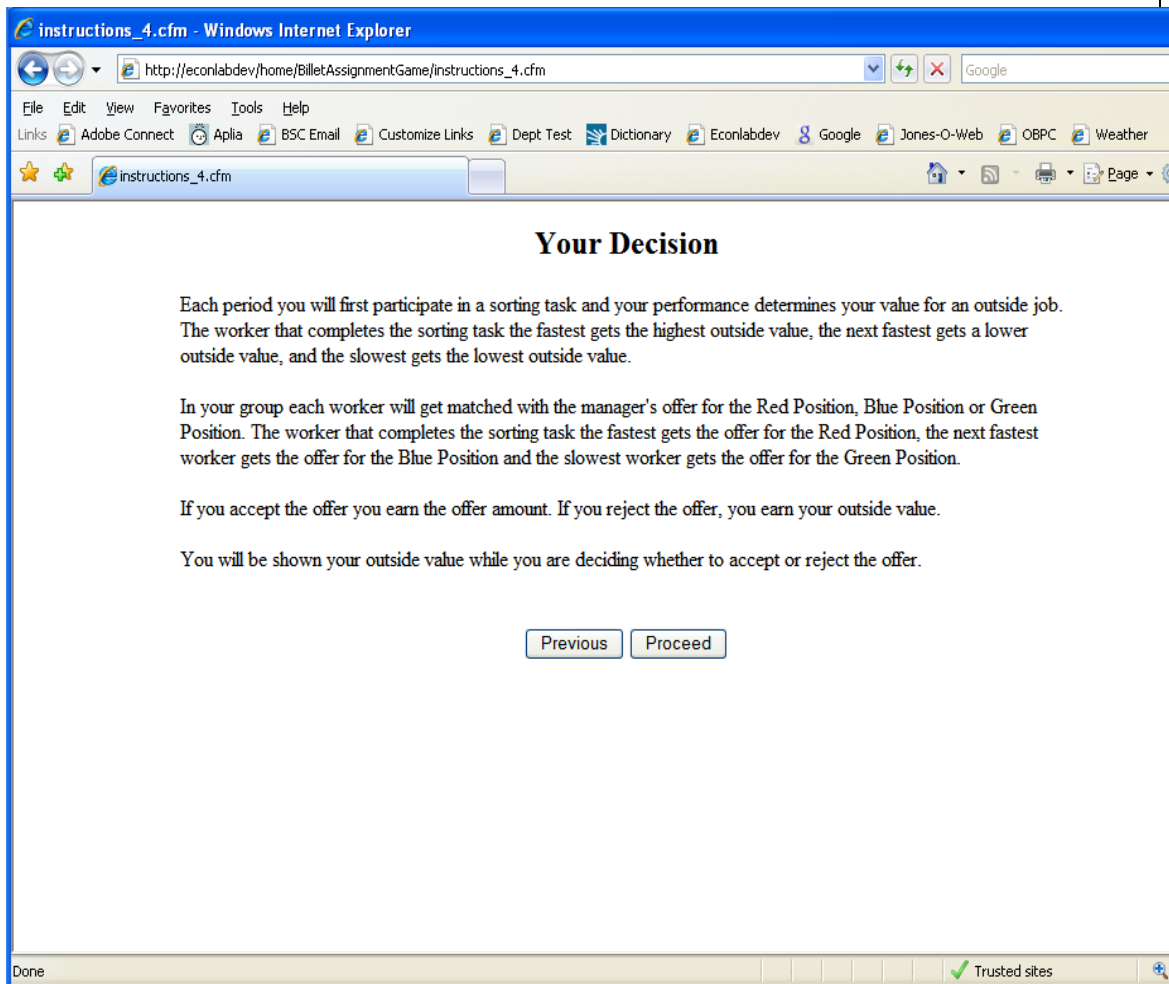Press "Proceed" when finished filling out this form.

[Proceed]

Note. some demographic information was collected at the end of the session prior to the participant being informed of earnings from the session. In accordance with IRB requirements for human subjects research, the participants are free to skip any (or all) of the questions by choosing the "No Answer" option.
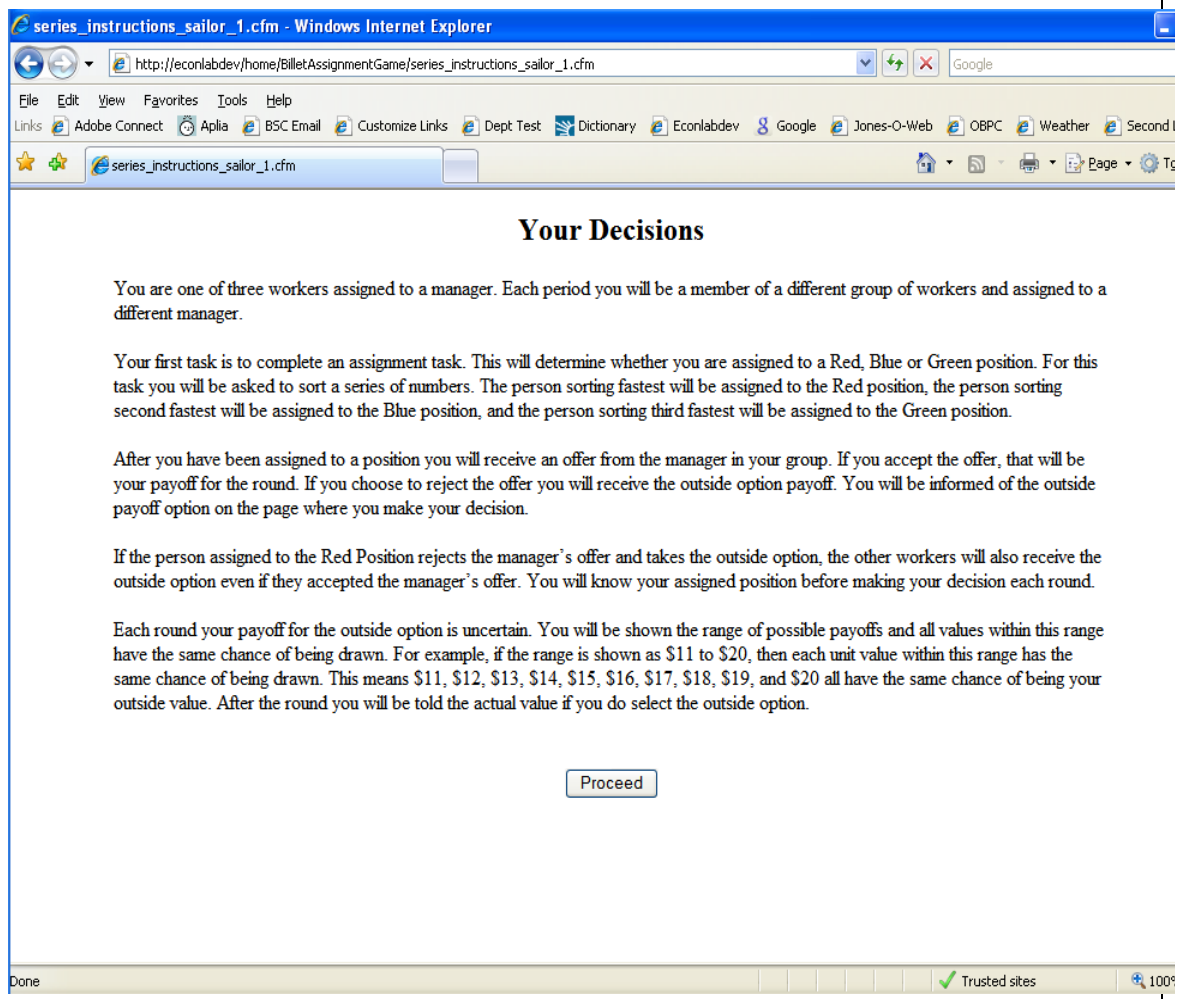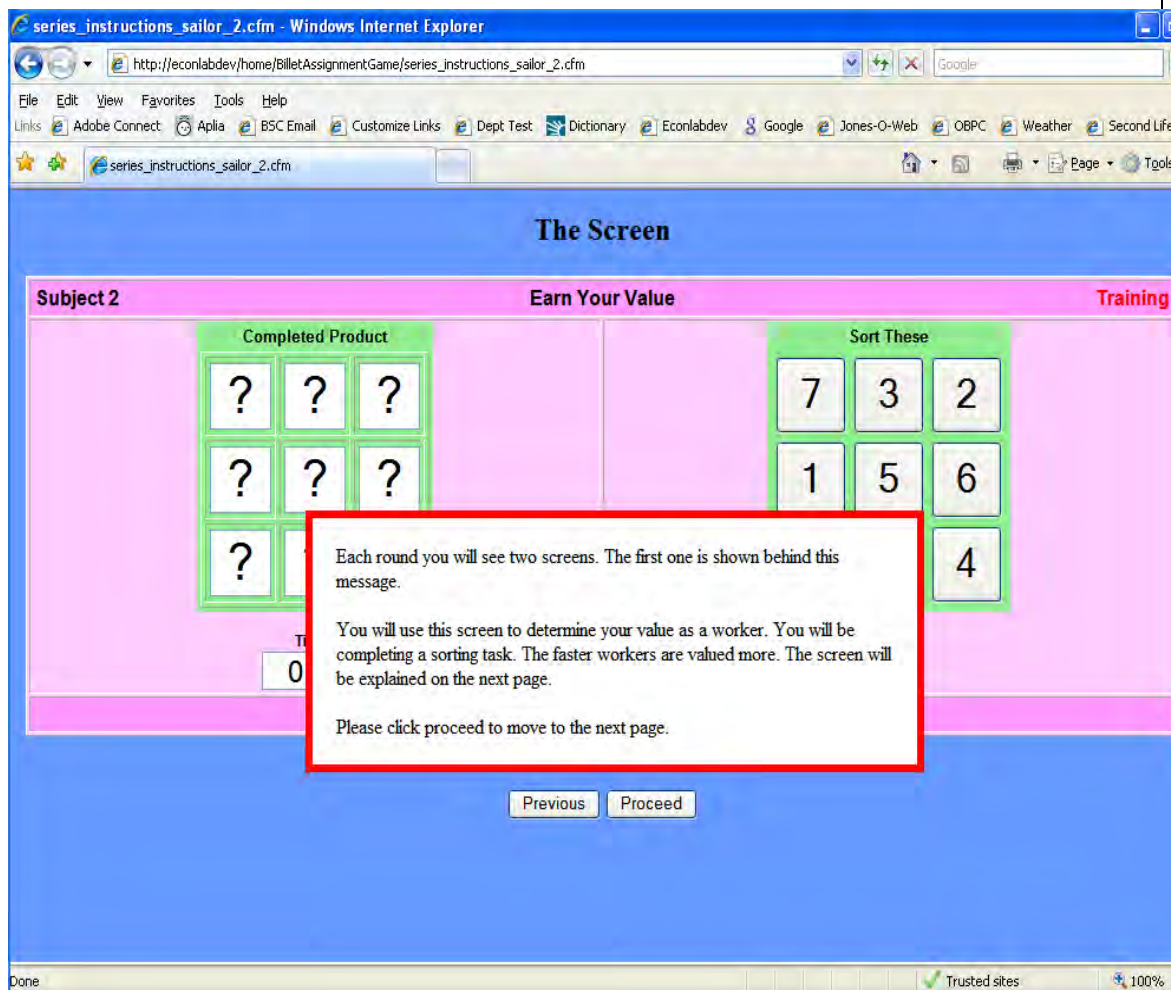
Note. Final earnings screen prior to being paid for earnings during the session. This is a screen from a pseudo run to obtain screen images. Hence the low payoff.
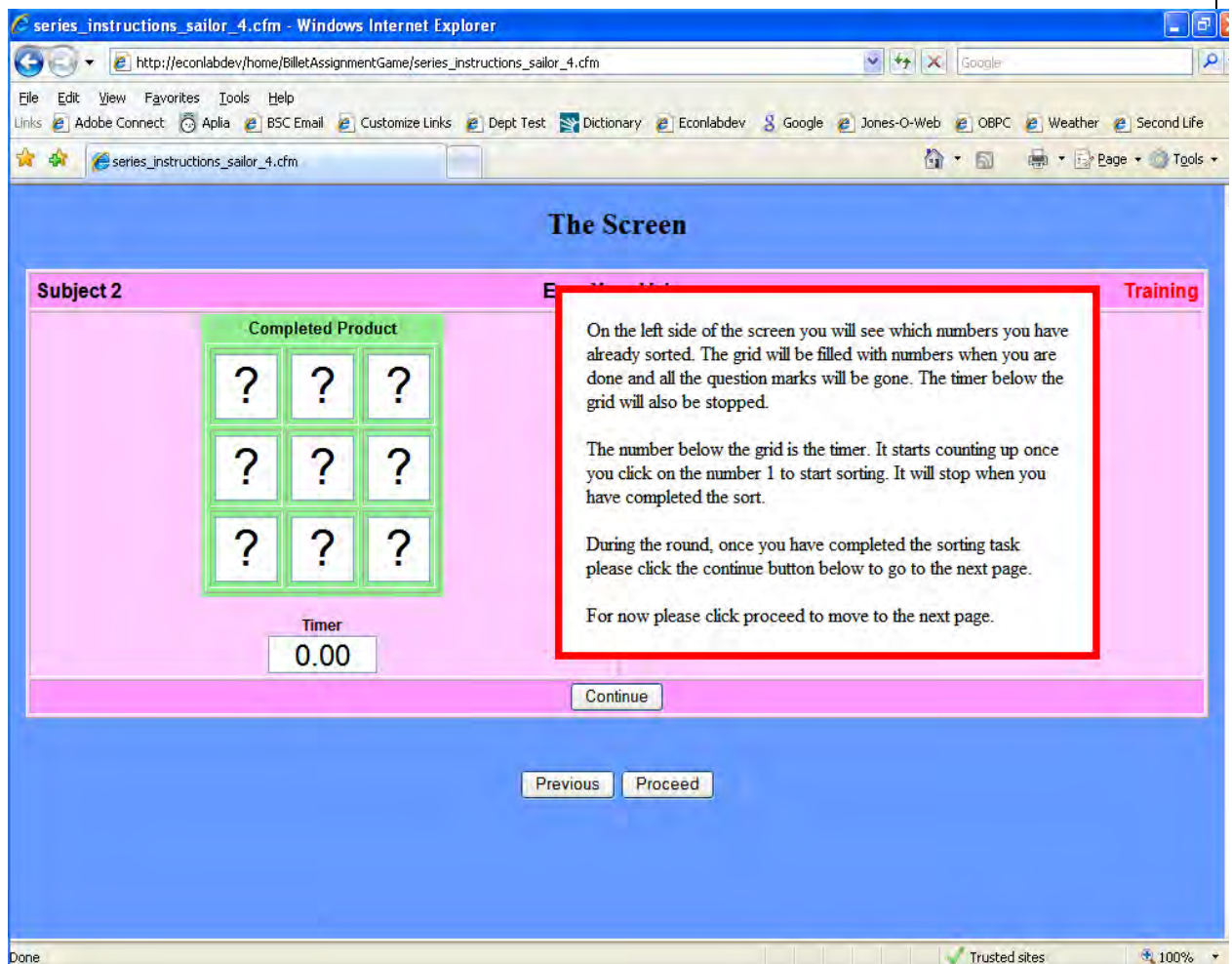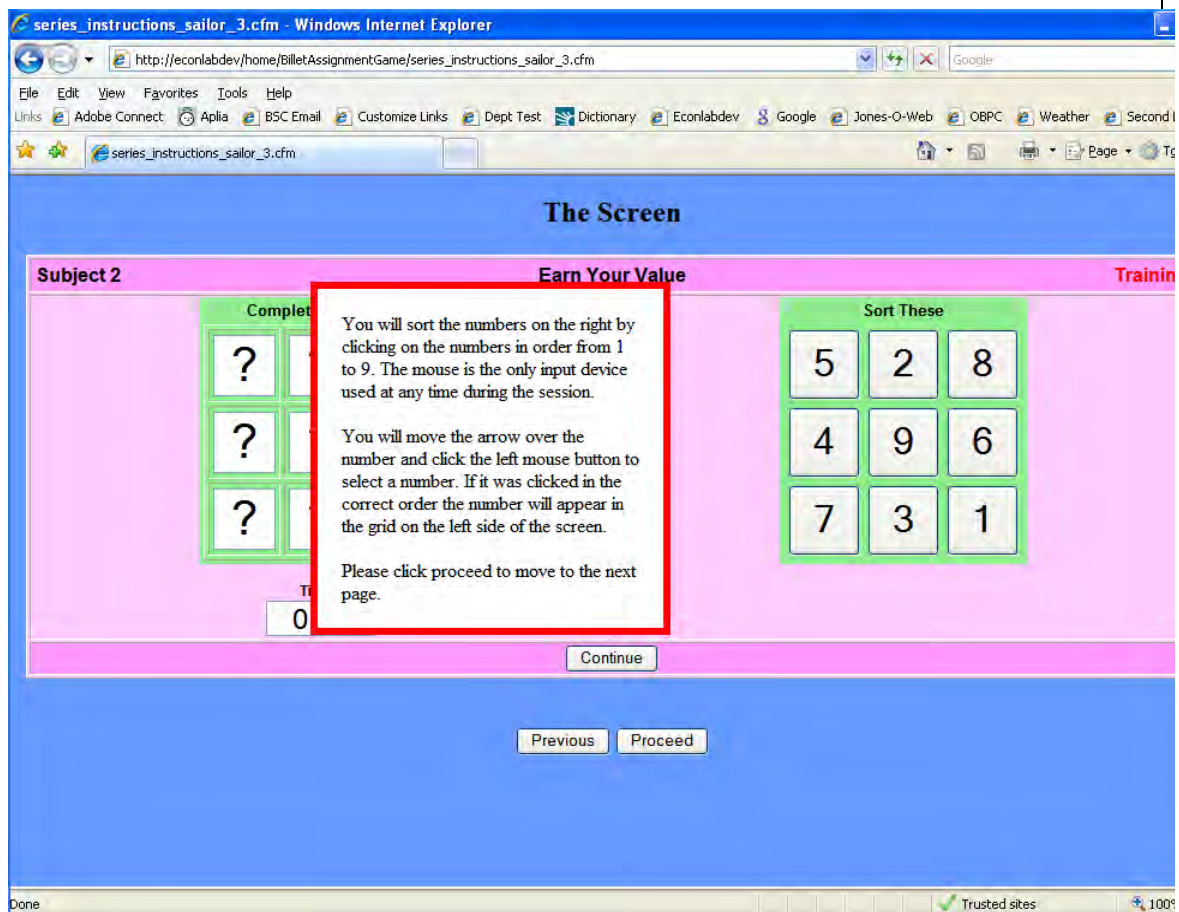
What This Is All About

Throughout this experiment you will be a Worker. You are one of three workers assigned to a manager. Each period you will be a member of a different group of three workers and assigned to a different manager.

You will be qualified for one of three possible job positions known as Red, Blue or Green. During each period you will have the opportunity to accept or reject pay offers made by a manager.

[Previous] [Proceed]

Your Decision

Each period you will first participate in a sorting task and your performance determines your value for an outside job. The worker that completes the sorting task the fastest gets the highest outside value, the next fastest gets a lower outside value, and the slowest gets the lowest outside value.

In your group each worker will get matched with the manager's offer for the Red Position, Blue Position or Green Position. The worker that completes the sorting task the fastest gets the offer for the Red Position, the next fastest worker gets the offer for the Blue Position and the slowest worker gets the offer for the Green Position.

If you accept the offer you earn the offer amount. If you reject the offer, you earn your outside value.

You will be shown your outside value while you are deciding whether to accept or reject the offer.

[Previous] [Proceed]

How You Will Earn Money

Your earnings for each round are determined by the value of accepting or rejecting offers each period.

At the end of the experiment, you will receive the total amount you have accumulated from each period. There might be other opportunities for money as well.

Therefore, your earnings for the entire session are calculated as follows:

Total Earnings = Cumulative earnings from all rounds
+ earnings from other opportunities

The computer will keep track of your earnings.

[Previous] [Proceed]

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Your Decisions

You are one of three workers assigned to a manager. Each period you will be a member of a different group of workers and assigned to a different manager.

Your first task is to complete an assignment task. This will determine whether you are assigned to a Red, Blue or Green position. For this task you will be asked to sort a series of numbers. The person sorting fastest will be assigned to the Red position, the person sorting second fastest will be assigned to the Blue position, and the person sorting third fastest will be assigned to the Green position.

After you have been assigned to a position you will receive an offer from the manager in your group. If you accept the offer, that will be your payoff for the round. If you choose to reject the offer you will receive the outside option payoff. You will be informed of the outside payoff option on the page where you make your decision.

If the person assigned to the Red Position rejects the manager's offer and takes the outside option, the other workers will also receive the outside option even if they accepted the manager's offer. You will know your assigned position before making your decision each round.

Each round your payoff for the outside option is uncertain. You will be shown the range of possible payoffs and all values within this range have the same chance of being drawn. For example, if the range is shown as $11 to $20, then each unit value within this range has the same chance of being drawn. This means $11, $12, $13, $14, $15, $16, $17, $18, $19, and $20 all have the same chance of being your outside value. After the round you will be told the actual value if you do select the outside option.

[Proceed]

Note. Workers are assigned to Red, Blue, or Green jobs (Red is highest outside option and Green the lowest) based on relative speed of completion of the sorting task. This is an implementation of an ability ranking. This task is completed each round of the experiment.

The Screen

Subject 2   **Earn Your Value**   Trainin...

Complet...   **Sort These**

5	2	8
4	9	6
7	3	1

You will sort the numbers on the right by clicking on the numbers in order from 1 to 9. The mouse is the only input device used at any time during the session.

You will move the arrow over the number and click the left mouse button to select a number. If it was clicked in the correct order the number will appear in the grid on the left side of the screen.

Please click proceed to move to the next page.

Continue

Previous   Proceed

The Screen

Subject 2   Training

Completed Product

?	?	?
?	?	?
?	?	?

Timer

0.00

On the left side of the screen you will see which numbers you have already sorted. The grid will be filled with numbers when you are done and all the question marks will be gone. The timer below the grid will also be stopped.

The number below the grid is the timer. It starts counting up once you click on the number 1 to start sorting. It will stop when you have completed the sort.

During the round, once you have completed the sorting task please click the continue button below to go to the next page.

For now please click proceed to move to the next page.

Continue

Previous   Proceed

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Note. When the instructions are completed there is a training round (or rounds). The pop-up boxes are gone and the participants make decisions exactly as would be seen in the real rounds that determine the earnings. This is true for the participants in both roles (Sailor and AO).

Note. At the end of the round, the Workers (Sailors) are informed of the decisions of the three Workers assigned to the Manager (AO).

The participants assigned the Worker (Sailor) role respond to the same demographic questionnaire as those assigned the Manager (AO) role and receive the same final screen showing earnings. All earnings are private information in accordance with the precepts of experimental economics.

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