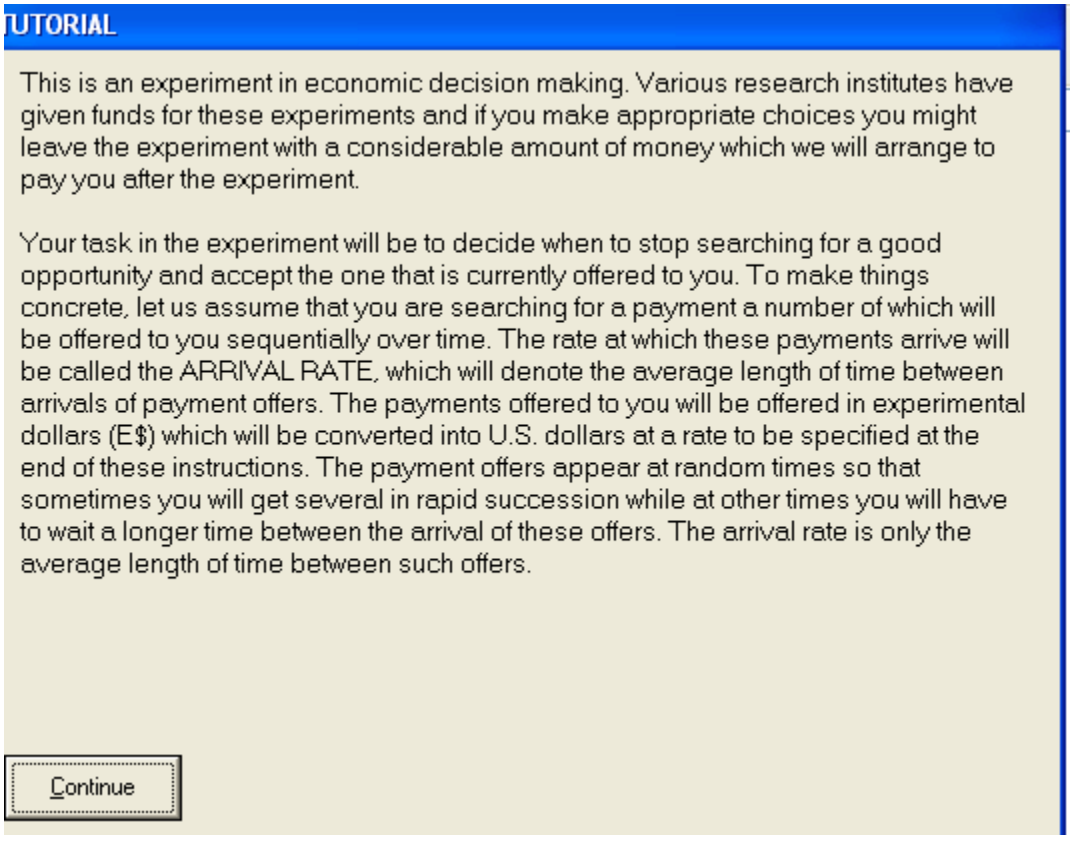
INSTRUCTIONS (Screen Shots) FOR:
"Real Time Search in the Laboratory and the Market", Meta Brown , Christopher Flinn and Andrew Schotter

These are the screen shots from the tutorial given to subjects before they begin the search experiment. After the tutorial (instructions) the experiment begins. If you want to run the program for this experiment and see the inter-active instructions given to the subjects go to the program provided on this web site.



THE COST OF SEARCHING

For every second you wait before accepting a payment, there will be a constant search cost so that as time proceeds you will be accumulating search costs however, every second you delay your search costs will increase at the same rate.

For example, let the search cost be 0.028 per a second. Then if you wait 60 seconds before accepting a job offer, you will incur a search cost of 1.68 E$. If you wait 100 seconds before accepting a job offer, you will incur a search cost of 2.80 E$. These search costs, depreciated in a manner to be described soon, will ultimately be subtracted from the payment you receive when you stop searching and decide to accept a payment in a manner to be described later.

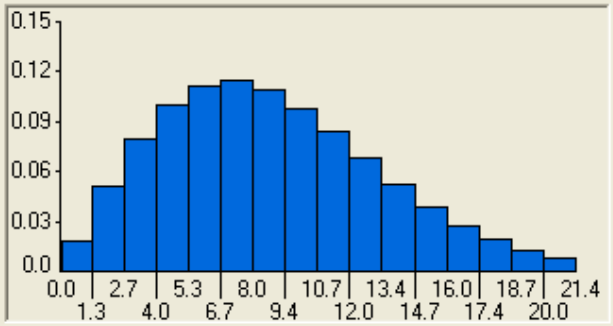
Continue

PAYMENT OFFERS AND THE PAYMENT DISTRIBUTION

Every time a payment is offered to you, you will be given an opportunity to reject it and keep searching or accept it and get a payoff. While the payments that will be offered to you will be random, they are generated systematically with different payments having different probabilities of being offered. To illustrate what we mean by payment offers being random but systematic consider the graph below.

The payments that you see offered to you will be drawn from some PAYMENT DISTRIBUTION which will look similar to the one above. This diagram can be used to tell you what the chance is that a payment will be drawn from any interval of payments over which you can receive a payment.

Payment Distribution



For example, if you want to know what is the chance that you will receive a payment in the interval between 4.0 and 5.3 all we need to do is look on the horizontal axis for the location of that interval and then look at the height of the bar over that interval on the vertical axis. In the graph depicted here we see that the bar is at height 0.1 which means that there is a 10% chance that when we receive a payment it will come from the interval 4.0 - 5.3.

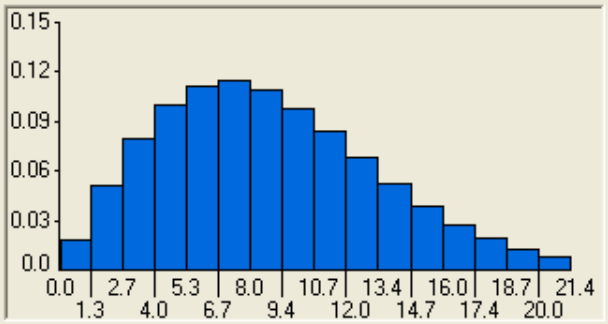
Continue

PAYMENT OFFERS AND THE PAYMENT DISTRIBUTION

Likewise, there is a 3% chance that we will receive a payment from the interval 16.0 - 17.4 since that is the height of the bar over that interval. Furthermore, this graph can tell us what the chance is that you will receive a payment offer greater than say 16 by adding the probabilities of getting a payment in the interval 16.0 - 17.4 to the chance of getting one in the interval 17.4 - 18.7 etc.

In this example, since there is a 2% chance of getting a payment in the interval 17.4 - 18.7, a 1.5% chance of getting one in the interval between 18.7 and 20.0, and a 1% chance of getting a payment above 20.0, we can conclude that the chance of getting a payment offer greater than 17.4 = (chance of getting a payment offer between 17.4 and 18.7) + (chance of getting a payment offer between 18.7 and 20.0) + (chance of getting a payment above 20.0) = 2%+ 1.5% + 1%.

Payment Distribution



Using this logic note that in this distribution there is a 75% chance of getting a payment greater than 5.3, a 53% chance of getting one greater than 8.0, a 32% chance of getting one greater than 10.7, and only a 7.5% chance of ever getting one greater than 16.0.

Continue

TUTORIAL

There are two key pieces of information to keep in mind during the experiment when you search:

1) Every time you receive a payment it will come from the PAYMENT DISTRIBUTION specified for that experiment and each payment offered is independent of any payment offered in the past. This means that every time you are offered a payment the chance of receiving any payment will be described by the PAYMENT DISTRIBUTION no matter what payments you received in the past.

2) If you reject a payment when it is offered to you it is no longer available to you to accept in the future unless it is again randomly offered to you in the future.

Continue

TIME AND THE DEPRECIATING VALUE OF COSTS AND PAYMENTS

Time plays a special role in this experiment for two reasons. First, as we have seen above, as time goes on you accumulate search costs which will be subtracted from your eventual earnings. Second, it will be assumed that dollars earned or spent searching in the future during the experiment will be less valuable than those same dollars earned or spent in the present so that when we calculate your final payoff in the experiment that payment will be less if you accept a payment after waiting say 100 seconds than if you accepted that exact same payment after only 20 seconds.

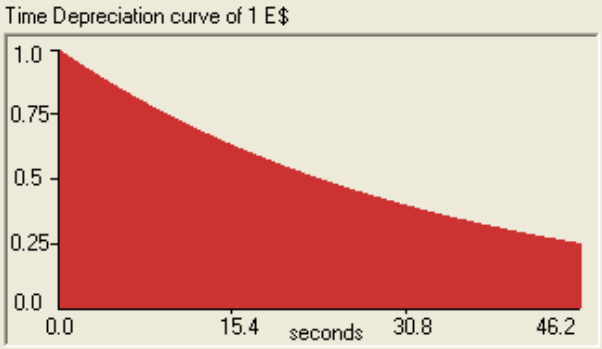
Similarly, the experimental dollars spent by waiting longer to accept a payment will depreciate at the same rate so that while waiting causes payments received in the future to be less valuable the costs of doing so are also depreciating at the same rate. In all of the experiments you engage an E$ will depreciate by a factor of 0.030 every second. So 1 E$ will be worth 0.97 E$ in a second, 0.94 E$ in 2 seconds and 0.03 E$ in 2 minutes. 1 E$ today will be worth 0.50 E$ in 23.1 seconds.

Continue

PAYMENT AND COST DEPRECIATION

To illustrate what we mean here, consider the following PAYMENT AND COST DEPRECIATION CURVE for experimental dollar payments. What this diagram shows is how the value of a experimental dollar PAYMENT or cost shrinks when it is earned at different times during the experiment.

For example, on the horizontal axis we have time while on the vertical axis we have the value of a dollar payment. As we see, at time zero if you earn or spent an experimental dollar in the experiment it will be worth 1 experimental dollar. However, if you wait 30 seconds and earn or spend that same experimental dollar then, it will only be worth 0.41 experimental dollars to you.



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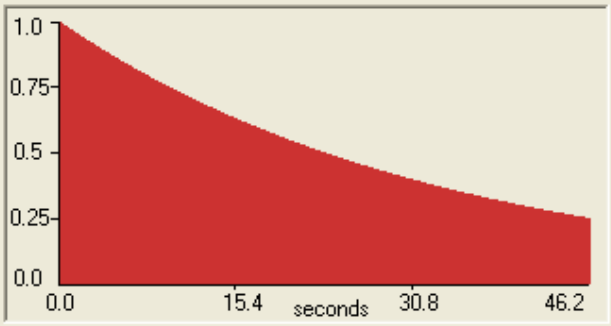
PAYMENT AND COST DEPRECIATION

When we say that the value of an experimental dollar decreases at a constant rate we mean the following. Say you have searched for 20 seconds and are deciding whether to accept a $1 experimental dollar of payment. (or spend another second searching). For simplicity let's just look at payments. As we see from the graph, the value of one experimental dollar earned 20 seconds from the beginning of the experiment is 0.549. The value of that same dollar earned 21 seconds into the experiment is 0.533. Note that (0.549-0.533)/(0.549)X 100% = 3.0%.This is the rate of depreciation of that dollar at the 20 second point.

Now let's do the same thing at the 60 second point. Looking at the graph the value of a dollar at the 60 second point is 0.165 while at the 61 second point it is 0.160.

Time Depreciation curve of 1 E$



Hence (0.165-0.160)/(0.165)X 100% = 3.0% which is the rate of depreciation of an experimental dollar at the 60 second point. Note it is the same at the 60 second point as it was at the 20 second point. It is in this sense that we mean that the depreciation rate of dollars spent and earned is constant.

Continue

PAYMENT AND COST DEPRECIATION

Note that this depreciation of the value of an experimental dollar works in two ways. First it decreases the value to me of accepting a payment at any time in the future (since that PAYMENT will be paid to me in depreciated dollars). However, the dollars I spend in searching are also less costly to me since search costs (while constantly increasing with time) are also depreciated. This means that although each second I wait before accepting a payment will cost me a fixed amount in experimental dollars, waiting an additional second after I have already searched for say 30 seconds is less costly to me than waiting an additional second after having searched only 10 seconds. In depreciated dollars my search cost decreases the longer I wait to accept a payment.

In the experiment then, your payoff from accepting a payment W at time t is: Payoff (accepting payment W at time t) = (Depreciated value of the PAYMENT attached to accepting payment W at time t) minus (Depreciated value of search cost accumulated up to time t).

Continue

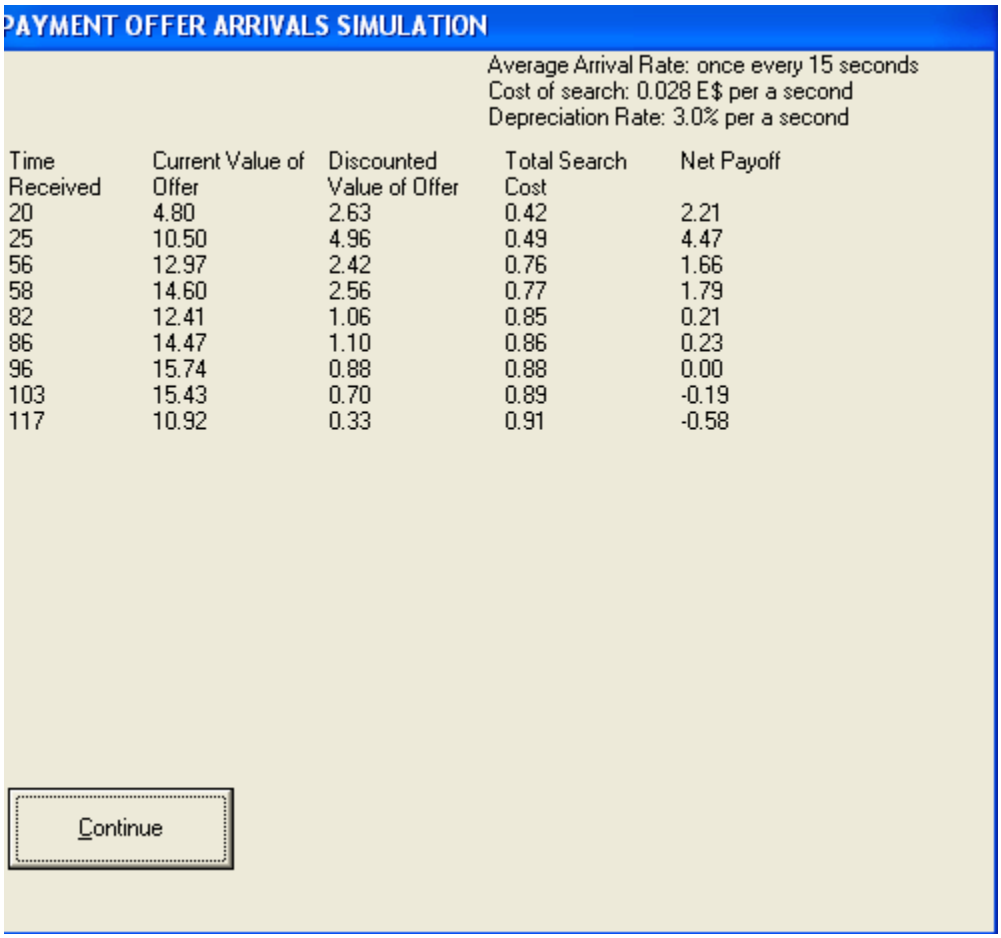
ARRIVAL RATES AND FINAL PAYOFFS

The only piece of information missing in our description of the experiment is the ARRIVAL RATE of payments. To illustrate what a random arrival process for payments feels like, and how these payment, when they arrive will affect your payoffs, click the CONTINUE BUTTON. After you do, you will sit and listen for the arrival of payments for two minutes. Every time a payment arrives you will hear a beep and a flag will appear on the screen telling you that a payment has arrived. In addition, when a payment arrives, we will present you with information about what that payment was, and what your payoff would be if you accepted that payment at that moment. In doing this we will break up this final payoff into a search cost component which will be subtracted from the PAYMENT associated with accepting this payment. Both of these will be presented in depreciated experimental dollars.

In this tutorial payments will arrive at the rate of one every 15 seconds although in the experiments you eventually do the arrival rate will vary from experiment to experiment. You will of course, be informed about the rate of arrival before any experiment begins.

Continue

Dynamic wage arrivals:
At this point in the program the subjects sit at their computers and watch the arrival of wages drawn from the distribution stated in the tutorial and with the arrival rate determined by the Poisson distribution described.
In the experiment, subjects search from three environments and before each one they experience the live arrival of wages for that environment. These screen shots do not capture the dynamic aspect of the instructions.
The screen below summarizes the arrival history of wages in the Tutorial.



PAYMENT OFFER ARRIVALS SIMULATION

Average Arrival Rate: once every 15 seconds
Cost of search: 0.028 E$ per a second
Depreciation Rate: 3.0% per a second

Time Received	Current Value of Offer	Discounted Value of Offer	Total Search Cost	Net Payoff
20	4.80	2.63	0.42	2.21
25	10.50	4.96	0.49	4.47
56	12.97	2.42	0.76	1.66
58	14.60	2.56	0.77	1.79
82	12.41	1.06	0.85	0.21
86	14.47	1.10	0.86	0.23
96	15.74	0.88	0.88	0.00
103	15.43	0.70	0.89	-0.19
117	10.92	0.33	0.91	-0.58

Certain aspects of this table are relevant for your search. Note that although offers arrive on the average rate of one every 15 seconds, their spacing is quite erratic. Some come two second apart while for others you have to wait 31 seconds. In your search you may well have to wait far more than 15 seconds in some instances. Second, note the impact of the depreciation factor. An offer of 10.50 received after 25 seconds is worth 4.96 after being discounted while an offer of 12.97 received after 56 seconds is worth only 2.42 after discounting. So waiting can be costly.

Continue

PAYMENT OFFER ARRIVALS SIMULATION

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82	12.41	1.06	0.85	0.21
86	14.47	1.10	0.86	0.23
96	15.74	0.88	0.88	0.00
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On the other hand, waiting can be beneficial since at 20 seconds acceptiong an offer of 4.80 after search costs are subtracted, yields a payoff of 2.21 while if this wage were rejected and the one received at 25 seconds (10.50) were accepted, the payoff after subtraction of search costs would be 4.47. Finally, note that as time goes on seach costs accumulate but the rate at which they do so decreases so that waiting 10 seconds from 86 to 96 increases search cost by .02 (from 0.86 to 0.88) while waiting five seconds (from 20 to 25) increases search costs by .07 (from .42 to .49).

Continue

SUMMARY

To summarize:

1) The time at which payment offers are made is random and determined by the ARRIVAL RATE.
2) When a payment offer is made, it is drawn randomly from a fixed and unchanging distribution of payments.
3) Once a payment offer is refused, it is lost for ever and can not be recalled and accepted later unless the same payment is offered to you at a later time.
4) Once a payment is accepted the experiment is over and you will be informed about your final payoff.
5) The longer you search the more search costs you accumulate.
6) The value of payments and the cost of search depreciate as time goes on.
7) Your final payoff in the experiment is equal to the depreciated value of your PAYMENT minus the depreciated value of your search costs.

Continue

THE EXPERIMENT

During the remaining time you are here you will engage in 2 different search experiments and perform each experiment 2 times. In each experiment three factors, the Arrival Rate of payments, the Time Cost of Search, and the Payment Distribution will all vary while the Depreciation Rate will be fixed at 0.030. These factors determine what we will call a SEARCH ENVIRONMENT.

At the start of each experiment such one such environment will be chosen randomly. Before you actually begin searching the three factors defining the search environment will be described to you in a brief tutorial. After the tutorial, when you begin your search, the clock will start and you will begin to accumulate search time costs. You will then sit in front of the computer and wait until a payment is offered to you. When an offer is received, THE CLOCK WILL STOP, so that you need not be rushed in making your decision. The arrival of an offer will be indicated, as before, by a beep and a banner displaying the words Payment Offer. The actual payment offer will not be shown to you, however. Rather, after an arrival of a job offer, you will be asked to specify the lowest payment you would accept (reservation payment) in order to stop searching and receive the final payoff associated with that payment offer. If the actual payment offer is below your reservation payment, you will automatically reject it and your search will continue. If the actual payment offer is above your reservation payment, it will be accepted and your search will be over.

Continue

THE EXPERIMENT

Note that it is never in your interest to specify a reservation payment other than your true one since specifying a payment lower than you true reservation payment might lead you to accept a payment which is too low, while stating one that is above your true reservation payment may lead you to reject a payment that you were actually willing to accept.

Your final payoff for that trial will then be shown to you on the screen and you will then be able to begin with the next search in this environment and continue in this manner until you have searched 2 times. At this point a new environment will be randomly generated and you will search 2 times from this environment. The experiment will then continue in this manner until you have searched from 2 environments 2 times each.

Continue

FINAL PAYOFFS

Your final payoff is the sum of the payoffs accumulated during the experiments engaged in. These experimental dollars will be converted into U.S. dollars at the rate of 1 E$ equals 0.050 U.S. dollars. In addition, we will pay you $5.00 for showing up today.

Finally, it is theoretically possible that you will earn a negative amount in some experiment although it is unlikely. This can happen if you were to search an exceptionally long time and eventually accept a low payment offer. Any such negative earnings will be taken from the $5.00 we pay you for showing up. Both the final experimental and US dollar payoffs will be displayed on the screen after the last search experiment ends.

Continue

Environment 1

The search experiments you will engage in will have randomly generated environments defined by a search cost, a payment distribution, and an arrival rate. Before you begin searching, let us briefly explain these factors for environment 1. To start environment 1 click the NEW ENVIRONMENT button.

New Environment

SEARCH COSTS AND ARRIVAL RATES

In this environment you will incur a search cost of 0.043 for every second elapsed before accepting a job offer and you will receive payment offers at an average rate of one every 19 seconds.

Continue

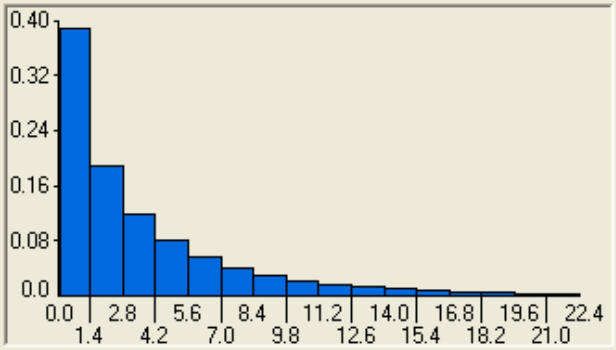
SEARCH COSTS AND ARRIVAL RATES

In this environment every time a payment offer is made is will come from a distribution of payments that is shown here.

Note that in this payment distribution there is a 75% chance of getting a payment greater than 0.7, a 50% chance of getting a payment greater than 2.1, a 25% chance of getting a payment greater than 5.1, and only a 10% chance of getting a payment greater than 9.5.

We have generated 40 payments drawn from this distribution for your inspection. Note the frequency with which you see relatively high and relatively low payments.

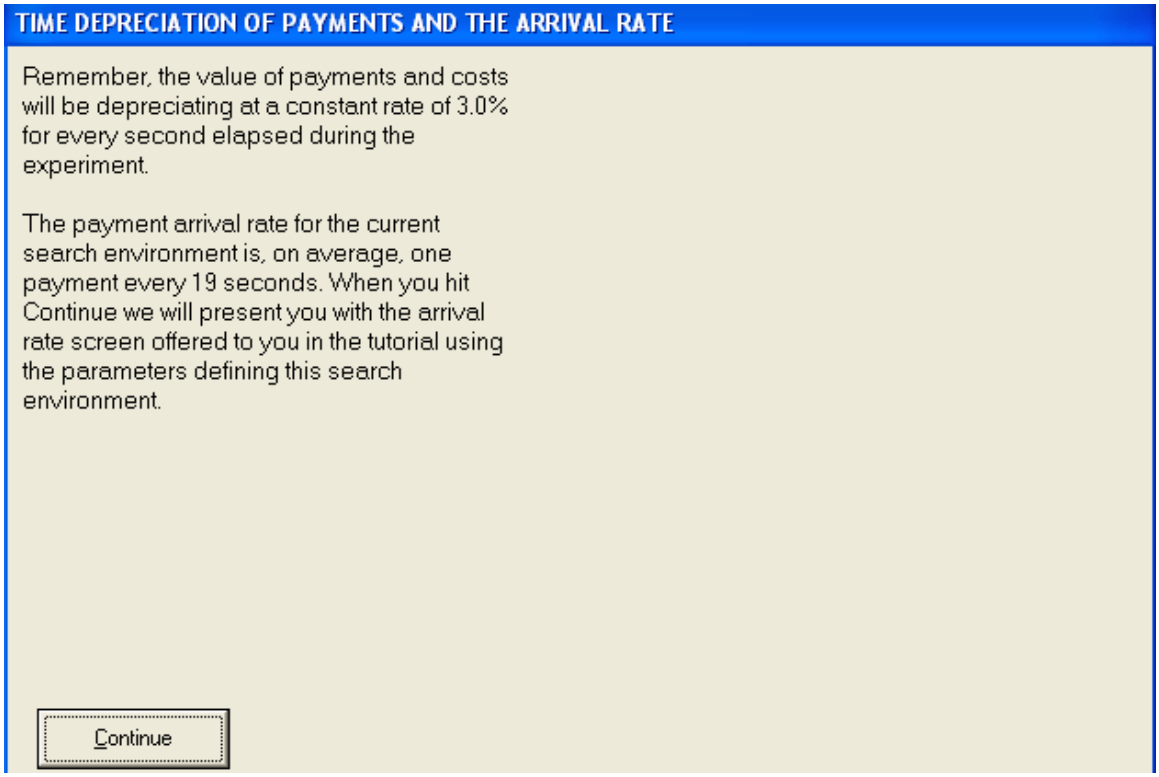
Payment Distribution



40 Random Payment draws:

8.05	3.82	2.60	2.84	5.28	2.20	0.58
6.56	0.34	6.46	3.84	0.14	0.81	2.28
0.15	0.11	1.65	1.63	11.99	1.90	0.00
0.21	2.26	4.05	0.67	1.79	0.01	0.94
6.98	0.22	2.05	1.02	0.52	2.21	2.40
0.38	2.27	6.04	4.06	1.34		

Continue



The program now has wages from the distribution of Environment 1 arrive at the arrival rate for that environment.

When this is done, the subjects start the experiment for environment 1. This is repeated for Environments 2 and 3.