The Relation Between Preference and Price of Different Amounts of Food with Hens.

(Preference and Price)

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SINEAD CANDICE BICKNELL

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Abstract

In the first condition six hens responded on concurrent schedule with two variable interval 60-s schedules leading to 2 s of access to wheat. This gave estimates of bias resulting from any uncontrolled differences between the two schedules (i.e., inherent bias). Then the same hens responded on concurrent chain schedules of reinforcement for two different durations of access to food: 2 s and 8 s. The initial links were both variable interval 60-s schedules and the terminal links were equal fixed ratio schedules. Over Conditions 2 to 8, the response requirement in the terminal links was varied over 1 to 128. Response and time ratios in the initial links showed responding and time allocation was greater on the key associated with the 8 s duration reinforcer, showing a preference for that terminal link, even when any inherent bias was removed. These preferences were generally greater the larger the response requirement. Preference followed the 8-s reinforcer when the key associated with that reinforcer was changed in Conditions 9 and 10, and was greater the larger the response requirement in these conditions. Thus increases in response requirement increased preference for the longer duration reinforcer. The terminal-link length increased equally for both food durations with increases in response requirement up to fixed ratio 32 for most hens. With fixed ratios of 64 and 128 there were some unequal length terminal links and these were associated with preference changes, with greater inequality between the terminal link lengths giving greater preference for the shorter terminal link. The study cannot separate out the effects of terminal link length and response requirement on preference, both most likely contributed to the preference changes. In the terminal links there were higher overall response rates and shorter post-entry pauses with the shorter

duration of reinforcer (2 s) at the smaller fixed ratio values. These data follow the pattern seen in studies of fixed ratio performance, where less preferred reinforcers have given higher overall response rates and shorter post-reinforcement pauses at smaller fixed ratio values. These data indicate that differences in overall response rate in do not reflect the preference seen in the initial links.

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Introduction

Within experimental and applied psychology, preference and demand are used to describe two different phenomena. Preference can be assessed from the choices that an organism makes in a given situation when there are two or more alternatives available simultaneously. Preference assessments may be used to measure the relative value of a reinforcer in comparison to the alternatives available in a particular circumstance. Conversely, demand is assessed by increasing the amount of work (effort) that is required of an organism to obtain a particular commodity. The way the consumption of that commodity changes with the amount of effort required for reinforcement is then examined (Tustin, 1994). Thus preference and demand are assessed differently.

Preference measures are based on the choices an organism makes between two or more alternatives. In preference assessments, the effort required to gain access to one of the selected commodities in minimal. For example, this can be as simple as pressing a key to gain access to the reinforcer selected. The degree to which one commodity is chosen over the alternatives is taken to measure the preference for that commodity over the other alternatives. When assessing an animal's preference for different commodities, the preference measure obtained is relative to the value of the other reinforcer available to the organism at that time (Grant, Foster, Temple, Jackson, Kinloch & Poling, 2014). Thus preference measures for one commodity may change when the other available options are changed. Preferences can be idiosyncratic to each organism, and so conducting a preference assessment allows the effectiveness of the stimuli available as a reinforcer to be assessed for the animal (Vicars, Miguel, & Sobie, 2014).

As Sumpter, Foster and Temple (2002) discuss, there are a range of methods in assessing preference in animals. The first and simplest method is free access, this method is where an animal is allowed 'free access' to two or more simultaneously available environments. Preference is then assessed by measuring the time spent in each environment. These types of preference assessments are relatively easy to implement, which makes them desirable to use but each have their own limitations. This is because the time spent in the alternative environment may not always indicate the relative value of that alternative. For example, the two environments were unequal in size. The animal may spend more time in one environment, simply because it is bigger affecting the preference obtained. Furthermore, Sumpter et al. (2002) stated there are behaviours that only take up a small amount of time but may be of high importance to that animal. For example, hens lay eggs, but this practice does not take up a lot of time. Having access to an environment in which to lay however may be of high importance for the animal. This means that even though laying eggs will only require the hen to be in that environment for a short amount of time, that environment may in fact be more important than the other environments they have access to over that time. This conclusion however, would not be seen if free access was assessed over, say, a 24-hr period.

Another method in assessing preference, described by Sumpter et al. (2002), is a T-maze procedure. This requires an animal to make a simple response (e.g., turning left or right) to gain access to one of two environments for a specified time. Within this procedure, the arm of the T-maze chosen or the time it takes the animal to move from the start of the T maze to one of the choice arms (latency-to-choice measure) is taken as a measure of preference. This procedure has been used with a group of animals or for individuals. In the group method all animals are put in the T maze procedure, and the measure of preference is the percentage of animals choosing each alternative. For example if 80% of the animals choose one alternative and 20% choose the other, the 80% chosen alternative is taken as the preferred one. The individual measure involves each animal being given many trials in the T-maze, and the proportion of times each alternative is selected is taken as a measure of preference for that individual animal. Thus the 80% means that the animal selected that alternative on 8 out of 10 trials. This does pose some difficulty in interpreting the data given that 20% chose the other alternative. Sumpter et al. (2002) highlight that with both of these choice procedures, there is the problem that the animal may choose the preferred alternative on every occasion, or nearly every occasion, resulting in an exclusive choice for that animal. This then, does not tell us anything about the relative value for the other alternative.

Preference can also be assessed using a paired-stimulus (PS) forced choice method. This was first proposed by Fisher, Piazza, Bowman, Hagoplan, Owens and Slevin (1992) and is a procedure that involves the presentation of two stimuli simultaneously where a subject has to pick just one. Many pairs are used and each stimulus is presented with every other stimulus, one on the left and the other on the right. The subjects are allowed to approach or select one of the stimuli. This procedure provides a ranked preference order of the stimuli. The proportion of times a stimulus is selected when offered, is the measure of preference. This type of assessment can be time consuming to administer given the number of trials required but has been successful at producing preference hierarchies for potentially reinforcing stimuli (Cronin, 2012).

Windsor, Piche, and Locke (1994) proposed a variation of the Fisher et al. (1992) preference assessment, referred to as multiple-stimulus (MS) forced choice method. In the MS preference assessment a large array of stimuli are presented simultaneously to an organism. Windsor et al. (1994) compared both the PS and MS preference assessments and found that both methods identified the same stimuli as the highly preferred stimuli but the MS method gave a more consistent ranking of preference. The main problem with MS however, is that exclusive choice can occur. Because of this, very little information can be obtained about the preference for the stimuli that were not chosen. However, the MS method has been recorded to be faster to administer than the PS which makes it more practical use in the applied setting (Windsor et al., 1994).

To address the problem of exclusive choice in the MS procedure, DeLeon and Iwata (1996) further explained this procedure. In their research, an array of items were presented to a subject for one to be selected, once an item was selected it was removed and was not presented again. This meant that every new presentation had less stimuli to choose from, which continued until all the stimuli had been chosen. DeLeon and Iwata (1996) called this procedure multiple-stimulus without replacement (MSWO). DeLeon and Iwata (1996) compared PS, MS and MSWO and found that PS and MSWO produced similar rankings of preferred stimuli. The MS procedure however did not produce similar rankings to the other methods. This was suggested to be because the MS method could result in exclusive choice as the stimuli were not replaced, therefore the organism could choose the same stimulus over repeated trials (DeLeon & Iwata, 1996). The MS and MSWO were quicker to administer than the PS and the MS method was the quickest to administer overall. All of the stimuli chosen in the PS and MSWO were found to function as successful reinforcers even if they had not been selected in the MS method. The MS procedure however, did not produce the same preferences found by the other methods. This method therefore is be less desirable to use.

A study conducted by Cronin (2012) used PS and MSWO preference assessments with possums and several foods and compared the preference hierarchies obtained. It was found that the two procedures produced similar hierarchies and the preferred foods found were consistent across the two methods. The results showed that 4 out of the 6 possums, had similar rankings of preferred stimuli across both methods. This indicates that both methods were successful at identifying the correct reinforcing stimuli. The hierarchy of foods identified by these two procedures were then evaluated on a Progressive Ratio (PR) schedule of reinforcement to see if these foods could function as effective reinforcers. It was found that all foods identified were successful at reinforcing the possum's behaviours. Cronin's (2012) research illustrated that both PS and MSWO measures are successful at identifying preferences for different commodities, and that the commodities identified can be successfully used as reinforcers for those animals.

Free access, T-mazes, PS, MS and MSWO preference assessments allow preference to be measured using straightforward methods. Sumpter et al. (2002) suggest concurrent schedules provide the ability to learn more about the relative preference for more than one commodity to a higher degree of accuracy. A concurrent schedule procedure is where two response manipulanda, such as a lever or a key are available simultaneously and an animal is required to respond on one of these manipulanda to obtain reinforcement (Sumpter et al., 2002). Each manipulanda is associated with a different reinforcer for example; different types of food, and responding on these manipulanda will result intermittently in access to the associated reinforcers. A schedule of reinforcement determines how often a response will result in a reinforcer. A measure of preference is taken as the response ratio or times spent responding on each manipulanda (Baum & Rachlin 1969).

Sumpter et al. (2002) summarised the data obtained from several different experiments using concurrent schedules to assess preferences for different foods (e.g. Mathews & Temple, 1979; Mathews 1983; Flevill 2002; Martin 2002) with a range of animals (e.g., cows, hens and possums). Sumpter et al. (2002) argued that concurrent schedules give stable measures of preferences. Flevill (2002) used concurrent schedules to measure food preference with domestic hen. In this study, Variable Interval (VI) schedules were used with wheat (W) paired with puffed wheat (PW) and with honey puffed wheat (HPW) as reinforcers. Initially W was presented in both food magazines to determine how the hens responded when the consequences were the same on both schedules. Subsequent conditions had PW or HPW compared to W, to assess the relative preferences for PW and HPW in comparison to W. The results indicated that the hens preferred W the most, followed by HPW and then PW (Sumpter et al., 2002). Sumpter et al. (2002) in reviewing the use of concurrent schedules concluded then, that when time permits it, and the consequences to be examined will maintain behaviour, concurrent schedule procedures should be the preferred method for measuring preference (Sumpter et al., 2002).

As in Flevill (2002) VI schedules are most often used when using concurrent schedules to assess preferences. A VI schedule is one in which the interval length changes unpredictability from one reinforcer to the next, so the amount of time between each reinforcer varies (Ferster & Skinner, 1957). Generally the lengths of the intervals vary around a mean value that was previously determined for that schedule, for example a VI 60-s schedule has a intervals averaging to 60 s. VI schedules generally produce a moderate amount of responding with no post-reinforcement pause. Behaviour maintained by VI schedules is also resistant to extinction, as a result of the unpredictability of the reinforcers (Martin & Pear, 2003). VI schedules encourage sampling of both schedule reinforcements, and thus maintain responding on both schedules (Ferster and Skinner, 1957; Sumpter et al., 2002). As previously reported, concurrent VI schedules have been used to assess preferences including reinforcer amounts (Grant et al., 2014; Matthews & Temple, 1979) food types, (Foster, Sumpter, Temple, Flevill, & Poling, 2009; Grant et al., 2014; Matthews and Temple, 1979) and reinforcer rates (Fantino & Davison, 1983). Commonly in concurrent VI schedules a changeover delay (COD) is included in the procedure to prevent the reinforcement of switching schedules or levers which may occur under such time-based schedules. A COD specifies the minimum amount of time that must pass between the first response on a schedule after a change over and the next successful response (Herrnstein, 1961). For example a 2-s COD would mean that 2 s must pass after the first peck on a schedule, before a subsequent pecks would be effective on the schedule of reinforcement in place.

Concurrent schedules can be arranged dependently or independently. Independent schedules are where the availability of a reinforcer on each schedule is not affected by the availability of a reinforcer on the opposing schedule (Sumpter et al., 2002). Independent schedules continue to time down to reinforcement, regardless of whether the opposing schedule is due to provide a reinforcer (Catania 1966). This procedure can sometimes lead to extreme biases and/or exclusive choice as an organism may continuously respond on the same manipulander and continue to gain reinforcers on that schedule (Sumpter et al., 2002). Dependent schedules, however, can reduce the possibility of exclusive choice, as in this procedure both schedules time down simultaneously. This means that when one schedule is due to provide a reinforcer, the opposing schedule also stops timing until that reinforcer is collected (Sumpter et al., 2002). This requires the subject to switch schedules to ensure maximum reinforcement is gained. It may mean reinforcer rates are decreased if change over delays are in place but they are decreasing on both schedules. Thus this procedure ensures that the relative rate of reinforcement is a programmed equally.

An advantage of concurrent schedules is that behaviour under these schedules has been shown to match relative reinforcer rate (Anderson & Woolverton, 2004). The Strict Matching law was proposed by Herrnstein (1961) as a way of qualitatively describing performance under concurrent schedules (Herrnstein, 1961). The equation for the strict matching law (SML) is as follows:

$$B1 / (B1 + B2) = R1 / (R1 + R2) \qquad (1)$$

Where B represents the behaviour on each schedule and R refers to the reinforcers obtained on each alternative. The numbers 1 and 2 refer to the two alternatives available. To conform to the Strict Matching law an organism would need to match their relative frequency of responding to the relative frequency of reinforcement that is available on the concurrent schedules of reinforcement. However, some research showed that behaviour did not always conform to the Strict Matching law. Such a finding lead to Baum (1974) deriving the Generalised Matching Law (GML) based on the Strict Matching Law to account for the deviation seen. The GML can describe choice between two alternatives when responding deviates from the alternatives. The Generalised Matching Law is represented in the following equation:

$$\log (B1 / B2) = a \log (R1 / R2) + \log c \qquad (2)$$

Where B and R are as previously defined. Parameter *a* describes the organism's sensitivity to changes in the rate of reinforcement. Log c represents the measure of bias the organism has towards one alternative or the other, over and above the effect of the differences in reinforcer rates. The measure of sensitivity, *a*, would be 1.00 if there was strict matching.

Baum (1974) described overmatching and undermatching as two deviations from the SML. Undermatching is where preference is less extreme than is predicted by the strict matching law. This is indicated by relatively more responding allocated to the leaner schedule of reinforcement, and is represented by an *a* value of less than 1.0. Overmatching is where an organism allocates more responding than is predicted by Strict Matching on the richer schedule of reinforcement and is represented by an *a* value greater than 1.0 (Baum, 1974).

Bias has also been identified by Baum (1974) as a potential deviation from strict matching. If log *c* is 1.00 then the animal distributes its behaviours equally across the two schedules when the schedules are equal. Any deviation from 1.00 under these conditions gives a measure of any Inherent bias (log *c* in Equation 2). If any log *c* differs from 1.00 this indicates that there is an independent variable that is affecting preference over and above the effect of reinforcer rate. Some of this bias may result from variables outside of experimental control, such as one key within the experimental chamber requires more effort to press than the other or there may be inherent preferences at play (e.g. colour preferences). Such biasing factors can contribute to the intrinsic bias but the causes of bias are rarely fully understood or known by the experimenter (Baum, 1974). Matthews and Temple (1979) argued that there are also factors within an experiments control that can contribute to the bias. They suggested that consistent differences in the reinforcers on the alternative schedules such as differences in quality or in amount of the reinforcer can bias behaviour. This bias could reflect an animal’s preference of one reinforcer over the other regardless of reinforcer rate.

Matthews and Temple (1979) investigated preference between two different feeds in cows through using concurrent schedules of reinforcement. They suggested a modification to Baum’s (1974) generalised matching equation to account for both the inherent bias and the bias due to different types of feed in their study:

$$\log (B1/B2) = a \log (R1/R2) + \log b + \log q \qquad (3)$$

Where *B, R* and *a* are as previously defined. Log *b* measures inherent bias and log *q* is the bias resulting from the feed differences and is the measure of preference. Thus they suggest that two sorts of bias, intrinsic bias and bias due to the food, add to give the overall bias seen. That is, log *b* and log *q* added together equal log c from Equation (2). Matthews and Temple (1979) showed Equation 3 described their data well, it allowed the removal of the inherent bias from the total bias to give a measure of preference of the two feeds.

Since then, concurrent schedules have been used to obtain measures of preference for aspects of a reinforcer (other than rate) in many studies (e.g. McAdie, 1998; Matthews & Temple, 1979; Foster et al., 2009) These studies have generally used equal VI schedules of reinforcement. Most have programmed them dependently to insure R1 = R2. They have normally obtained a measure of inherent bias (log *b*) by including a condition with equal VI schedule and equal consequences on the two schedules so that intrinsic bias is the only source of bias, in which case: log *c* = log *b* (as log *q* = 0). If R1 = R2 then (R1/R2) = 1.0 and so log (R1/R2) = 0. Equation 3 then reduces to:

$$\text{Log } B1/B2 = \log b + \log q \qquad (4)$$

Where the values are as in Equation 3. Once log *b* have been determined from the equal reinforcer condition, then the value of log *q* can be found from Equation 4, using a condition in which the consequences differ. Another way of assessing log *b* and log *q* (with differing reinforcers) is to conduct a condition with equal schedules of reinforcement (R1 = R2) but with the difference consequences. For example, there would be one reinforcer (e.g. large) on one schedule and a different one (e.g. small) on the other schedule and then to conduct another condition with the consequences the other way around (small vs. large). In the first condition, with R1=R2, and a large reinforcer on the left key and the small reinforcer on the right key, Equation 4 gives:

$$\log (BLL/BRS) = \log b + \log q \qquad (5)$$

Where BLL is responses on the left with the large reinforcer and BRS is responses on the right with the small reinforcer. Log *b* as previously defined and log *q* is the bias resulting from differences in the two reinforcers. In the second condition, now with the larger on the right and the smaller on the left) Equation 4 gives:

$$\log (BLS/BRL) = \log b - \log q \qquad (6)$$

Where BLS is responses on the left with the small reinforcer and BRL is responses on the right with the large reinforcer. Log *q* is now subtracted from log *b a*ssuming the bias resulting for the reinforcer is reversed, while inherent bias is not changed. Adding Equation 5 to Equation 6 to give Equation 7:

$$\log (\mathrm{BLL/BRS}) + \log \mathrm{BLS/BRL}) = 2 \log b \qquad (7)$$

This gives a measure of intrinsic bias,

$$\log b = ½ (\log (\mathrm{BLL/BRS}) + \log (\mathrm{BLS/BRL})) \qquad (8)$$

Subtracting Equations 6 from 5 gives:

$$\log (\mathrm{BLL/BRS}) - \log \mathrm{BLS/BRL}) = 2 \log q \qquad (9)$$

This gives a measure of bias resulting from the two different reinforcers.

$$\log q = \tfrac{1}{2} (\log (BLL/BRS) - \log (BLS/BRL)) \qquad (10)$$

Both methods require the minimum of two conditions and both methods allow assessment of bias due to reinforcer difference and inherent bias. The bias, log *q*, is taken as the measure of preference.

The use of bias in the GML is one way of assessing preferences of the relative value of a reinforcer. The ‘value’ of a reinforcer had been assessed using demand functions. The demand for a commodity is assessed through measuring the way consumption of a particular commodity changes as the amount of work required (price) to gain access to that commodity is increased (Hursh, 1980). A demand function plots the amount of a commodity purchased against the price (within most animal experiments the analogy of price this is often the number of responses required by the animal) of that commodity. These functions are most commonly expressed in logarithmic terms (Hursh, 1980; Lea, 1978).

A common schedule used as an analogue of price is a Fixed Ratio (FR) schedule of reinforcement. FR schedules require an organism to respond a predetermined number of times before a reinforcer becomes available (Ferster & Skinner, 1957). For example an FR 5 would give a reinforcer after every 5th response; this is also considered to be a price of 5 responses. FR schedules of reinforcement are used as price is easily manipulated through increasing the FR. This allows for demand to be assessed through observing reinforcers obtained as the FR is increased. It has been found using FR schedules, that as the price for a commodity increases, the consumption of that commodity will decrease (Hursh, 1980). Demand curves are generally graphed on logarithmic axes as it helps to analyse the relationship between changes in price and changes in consumption (Hursh, Madden, Spiga, DeLeon, & Francisco, 2013). The slope of the line in the logarithmic demand function changes as a result of the changes in consumption due to price, and this gives an indication of the elasticity of the demand for that commodity (Hursh et al., 2013). Three different types of elasticity have been described by Hursh (1980); inelasticity, elasticity and unit demand. Some functions also show mixed elasticity that is that as price increases the elasticity also changes.

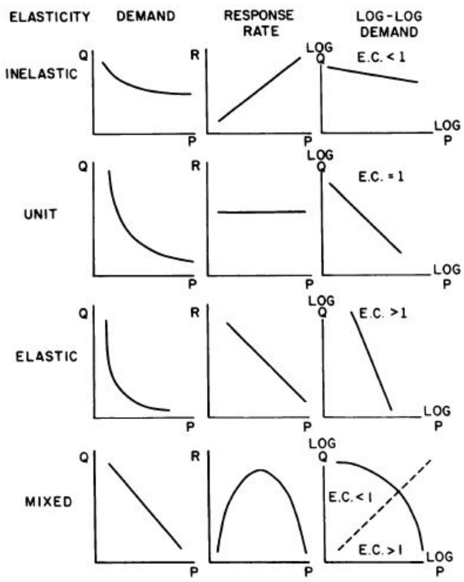

Figure 1: The four types of elastic demand, response rates and elastic co-effecients plotted in log-log co-ordinates. Reproduced from "Economic Concepts for the Analysis of Behaviour" by S. R. Hursh, 1980, *Journal of the Experimental Analysis of Behaviour*, 32, p.227.

Figure 1 was reproduced from Hursh (1980). The left column in Figure 1 shows how changes in price affect consumption. The middle column shows how changes in response rates sustain the consumption. The column on the right shows the demand plotted by lograthamic co-ordinates giving the elasticity co-efficient as the measure of elasticity (Hursh, 1980). In terms of log – log demand curves, when the slope is shallow or numerically greater than -1, the demand is described as inelastic (Hursh et al., 2013). This is indicated by the top left graph in Figure 1, where the demand curve shows a relatively shallow decrease. Inelastic demand describes behaviour in which responding that continues to increase despite an increase in price (Hursh et al., 2013). When demand is inelastic the commodities are said to be of ‘value’ to the animal and is suggested to be a need, not a luxury (Hursh et al., 2013). Elastic demand is where the demand curve has a slope that is steeper than -1. This is shown in the third row of Figure 1 where there is a steep decrease in consumption. This is an indication that consumption is highly sensitive to changes in price (Hursh et al., 2013). Elastic demand has been suggested to indicate that a commodity is not essential to the animal. Elastic demand represents a luxury item, because the animal does not maintain responding over price increases. This means that small changes in price have a big effect on the quantity consumed (Hursh, 1980).

Another type of elasticity described by (Hursh, 1980) is unit elasticity. This is where the slope of the demand curve is exactly equal to -1.0, and this gives the curve as represented by the second row of graphs in Figure 1. This shows that the effort required to obtain a commodity stays constant despite increases in the price of that commodity. This then means that due to the price increase and the equal level of responding, less reinforcement is obtained. A demand curve can also show mixed elasticity where the relationship between consumption and price is not linear. This is where the portions of the demand curve are portions of inelasticity, and portions are elastic. The bitonic response functions in the bottom row of graphs in Figure 1 illustrate this. Mixed elasticity is characterised by an increasing rate of responding as the price increases; the rate of responding then reaches a peak and then decreases as price continues to increase. This represents changes from inelasticity to elasticity in the demand function. This mixed elasticity is a result of a bitonic response rate function (Hursh, 1980). A demand curve with mixed elasticity has been described by Equation 11:

$$\ln Q = \ln L + b (\ln P) - a P \qquad (11)$$

Where Q refers to total consumption and *P* is the price. In L is the estimate of the initial level of consumption obtained at lowest price. The initial slope is described by the paramater *b*, and *a* reflects the change in the slope of the function as price increases. The values obtained from the equation can be used to identify the price at which demand changes from inelastic to elastic by being able to identify the point where the maximal response output occurs. This elasticity co-efficient is equal to -1.0 and the price is termed the P_{max} value (Hursh, 1980).

$$P_{max} = (1 + b) / a \qquad (12)$$

Where *b* is the initial slope, and *a* is the change in the slope of the function as price increases. P_{max} is useful in assessing demand for a range of commodities. This is because if the P_{max} value is higher for one reinforcer than another, this indicates that the reinforcer with the higher P_{max} has more value to that subject. Various aspects of demand functions can be compared when examining demand for different commodities (Hursh & Winger, 1995). There are several ways demand curves can differ including; the initial intensity of the demand curve, the initial elasticity, the rate at which elasticity changes and the P_{max} value. These factors all allow for a comparison of the commodities (Hursh, Raslear, Shurtleff, Bauman, & Simmons (1988). The demand curve then, can be used to compare different reinforcers to identify which is the more valued.

Preference assessments and demand assessments are two ways of assessing the importance of a commodity to an organism. One issue is how preference for and demand for a commodity relate. Tustin (1994) suggests that demand curves can predict preference, as a more highly preferred reinforcer will produce a flatter demand curve. This is because as schedule requirements are increased, the rate of responding for the more highly ‘valued’ reinforcer stays the same. However, it is not clear if preference taken from comparing demand curves is the same as that obtained from the more traditional methods of assessing preference, such as concurrent schedules of reinforcement. Both methods have been used to identify relative preferences for different reinforcers. This would suggest that preference and demand can measure the value of a reinforcer. How they relate is difficult to evaluate however, as there is a lack of experimental research that has examined both of these methods as a way of assessing the value of reinforcers.

A study that investigates both preference and demand was Flevill (2002). As previously mentioned, a concurrent schedule preference assessment was conducted with wheat (W), puffed wheat (PW) and honey puffed wheat (HPW). It was found, with hens, that W was the most highly preferred of these foods, followed by HPW and PW so when hens were are required to respond under equal concurrent schedules of reinforcement when the price is 1, W is the most preferred food. When the same foods were assessed using increasing FR schedules, Flevill (2002) found that the least preferred food (PW) had higher initial levels of demand and the most preferred food (W) the lowest. This resulted from the results that showed that the hens responded faster at low prices for the least preferred food when only one commodity was available. However, as price was increased, the responding for PW eventually decreased sooner than did the responding for W. That is, W maintained responding to higher prices. Flevill (2002) argues that one interpretation of her results would be that the preference changed as the FR schedule increased, at low prices PW was preferred, while W was preferred at high prices. However, such a conclusion is contrary to the preferences obtained under concurrent schedules.

Grant et al. (2014) argued that to examine further what might be happening here could be helped by replicating Flevill's (2002) research. Grant et al. (2014) used the same procedure and hens but used different magnitudes of reinforcer rather than different types of foods. The reason for this is that all else being equal, animals prefer larger amounts to smaller amounts so it would be expected that preference would be for the larger at all FR values and under concurrent schedules. Trosclair-Lasserre, Leman, Call, Addison and Kodak (2008) refer to magnitude as the quantity, intensity or duration of the reinforcer provided for responding. It is often found that larger magnitudes of a reinforcers maintaining behaviour more than small magnitudes of reinforcers (Hodos 1961; Fisher 1979; Davison and Baum 2003). Grant et al. (2014) found that their hens did prefer longer duration of food over the shorter under the concurrent schedules. Grant et al. (2014) also found the longer duration of reinforcement maintained behaviour to larger FR values than did the shorter under single FR schedules. As in Flevill (2002) there was higher initial demand (and response rates) at low FR schedules for the shorter duration reinforcement. Thus Grant et al. (2014) and Flevill (2002) both show that the longer duration or the more preferred food both maintain responding to higher FR values then the shorter duration or less preferred food. Thus they argue if relative preference for the larger food changes as the amount of effort (price) changes. They also both show higher response ratios for the less preferred food at low prices, but argue that this does not seem to reflect preference. To check if this is so requires measuring preference at different prices.

Concurrent schedules as used to measure preferences do not normally vary price, but it is possible to examine the effect of price on preference using concurrent chain schedules. A chained schedule is one in which an animal responds under one schedule associated with a stimulus, once the schedule requirement is meet a second stimulus as associated on another schedule is in effect, then a third and so on (Ferster and Skinner 1957: Kelleher 1966). A concurrent chain procedure consists of two phases, a choice phase (the Initial Links or ILs) and an outcome phase (the Terminal Link or TLs) (Kelleher 1966). In concurrent chained schedules the animal is exposed to two or more keys that are available under concurrent schedules of reinforcement in the ILs. In the ILs, the two keys are illuminated by a light or some other stimulus. Occasionally a response on one of the two produces a transition into a TL. This is usually signalled by the appearance of a stimuli associated with that TL (such as a change in key light) on the key last responded on in the IL. The other key will go black and become inoperative. During the TL the reinforcer is delivered contingent upon another schedule of reinforcement. At the conclusion of this TL (one reinforcement is obtained) the ILs are then reinstated and the cycle begins again (Moore 2009). Within the IL of the concurrent chain schedule, the allocation of behaviour on each manipulanda reflects relative preferences for the stimuli associated with the TL schedules. The TL stimuli are typically thought to function as conditioned reinforcers (Jimenez-Gomez and Shahan, 2012). A basic prediction for behaviour under concurrent-chain schedules, is that preference in the IL will change as the relative delay to the primary reinforcer delivery in the TLs changes. It is suggested that increases in the delay to the primary reinforcer in one TLs, decrease the relative value of the conditioned reinforcer in that TL (Jimenez et al, 2012).

Bruce (2007) used a concurrent chains procedure to investigate whether preferences do change when prices increased using W and PW and hens. Concurrent chains allowed preference to be assessed when the price for both foods was changed, through increasing the FR in both the TLs. Bruce (2007) also examined performance under increasing FR schedules presented alone (in a demand analysis) for comparison with performance under the FR terminal links with W and WP. The data was similar and both data sets replicated Flevill's (2002) single FR findings. That is, at low FR prices, there was slower overall response rates for W than PW but at higher FR's, there was faster overall responding for W than PW under the FR schedules. This gives higher initial intensity of demand when consumption is assessed using rate of reinforcers obtained. Despite this, under the concurrent chains schedule, the preference in the ILs was towards to W at FR1. This suggested that the faster response rates for PW than W on this FR schedule did not reflect the preference. As the FR in the TL increased, preference in the ILs for W became greater, and W maintained responding to larger FR schedules than PW under the single FR schedules. This indicated that although there were higher initial levels of demand for PW under both single FR's and in the terminal link of the concurrent chains, W was in fact the more preferred food and this preference became grater as the price for both was increased.

To further expand on the area of preference and demand, the current research replicated Bruce's (2007) research using the same methodology (concurrent chains) and hens but used different durations of access to wheat reinforcement. The use of the concurrent chain schedule allowed a comparison of preference in the ILs with behaviour under the FR schedules in the TLs. The IL in this experiment had equal VI schedules in order to assess the preference for the TL stimuli. The TLs were both FR schedules and allowed preference to be assessed at different prices. The aim was to assess how preference changed as the price of the two different magnitudes of the reinforcer were increased. It was expected that as the price increased, preference would change and that responding in the TL would replicate those data seen under single FRs by Grant et al. (2014)

Method

Subjects

Six mixed breed hens, numbered 11 to 16, were used as the subjects in this experiment. Each hen was individually housed in a wire cage that measured 310-mm high by 440-mm wide by 450-mm deep. Within the cages water was made freely available to each hen, via a nipple dispenser. The hens' free-feeding body-weight was calculated through daily weighing for three weeks prior to the experiment commencing. The hens were then maintained at approximately 85% (±5%) of this weight throughout the experiment. Vitamins and grit was provided weekly, and their feed was supplemented with commercial laying pallets if required. At the start of the experiment the hens were 3-4 years old and all had previous experience responding on concurrent VI schedules of reinforcement.

Apparatus

The experimental chamber used was 580-mm high by 625-mm wide by 610-mm deep and painted white. The floor of the chamber was covered in a removable clear plastic mat, with a black grip section in the middle to provide a non-slip surface for the hens to stand on. On one wall in the experimental chamber were three circular response keys, as shown in Figure 2, one of which (the middle key) was not operational throughout the experiment.

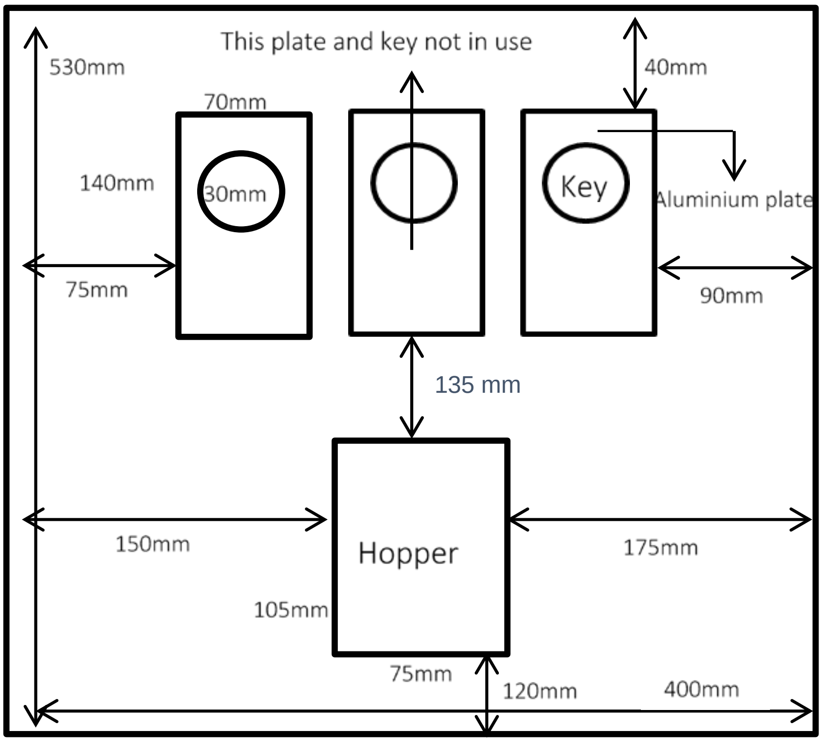

Figure 2: Drawing of the response key wall in the experimental chamber.

The experimental chamber used was 580-mm high by 625-mm wide by 610-mm deep and painted white. The floor of the chamber was covered in a removable clear plastic mat, with a black grip section in the middle to provide a non-slip surface for the hens to stand on. On one wall in the experimental chamber were three circular response keys, as shown in Figure 2, one of which (the middle key) was not operational throughout the experiment.

All keys were made of translucent Perspex and backlit with a white bulb in the initial link. These keys could also be backlit with other colours, including red and orange. The keys were 30 mm in diameter and surrounded by an aluminium plate 140 mm long, 70 mm wide and positioned 10 mm apart. The left key sat 75 mm from the left side of the chamber wall and the right key 90mm from the right side wall. Each effective response required 0.1

N of force and was followed by an audible beep produced by an electronic beeper situated behind the keys. Any responses made to an unlit key were ineffective and did not produce an audible beep or operate the magazine. On the same wall as the keys, 135 mm below the middle unused response key was an open square 105 mm high and 75 mm wide which was the entrance to the food hopper (as seen in Figure 2). This hopper was a part of an external magazine which contained the reinforcer, wheat. This magazine was manually filled with wheat in between experiment sessions. A 1-w white bulb, situated 30 mm above the hopper illuminated the reinforcer during the reinforcement period. The light from the keys and the food hopper were the only source of illumination in the experimental chamber.

Procedure

Baseline: Condition 1:

For the first condition of this experiment, a concurrent schedule (VI 60 s) was in place with 2 s access to wheat reinforcement on both keys. The hen was placed into the experimental chamber at the beginning of the session. When the session started, the left and right keys were lit white. The hen could peck at either of these two keys. The hen would peck at either key, and then after a variable amount of time, which was 60 s on average (VI 60 s) the next response would lead to a reinforcer. The key lights would switch off during reinforcement, the hopper would be illuminated and raised for 2 s to provide access to reinforcement. After reinforcement was obtained, there was a black out of all key and hopper lights for an inter-trial interval of 0.5 s. Following this a new trial began where again both keys would be illuminated white. This was repeated until 30 reinforcers were obtained or 2400 s had passed, whichever occurred first, which was the end of the session.

Each condition would end once statistical stability was reached. This was when the proportion of responses spent on the left key each calculated over five (not necessarily consecutive) sessions did not differ by more than 0.05. Graphical stability was also used, this was where it was agreed by at least two laboratory members that a graph of the proportions obtained in the last five sessions were visually stable (not trending in any direction) during each condition for each hen.

Preference and Demand Assessment: Conditions 2 – 6.

Once statistical stability was reached for the first condition, the experimental procedure was changed to a concurrent chain. This was where the IL was the same as the above condition, however, in the TLs FR schedules were in place. The reinforcement magnitudes were changed to 2 s on the left key and 8 s on the right key. The concurrent chain format meant that the ILS were the same as Condition 1 but effective responses in the IL led to a TL schedule which was associated with a change in the key colour and the offset of the other key. The left key changed from white to red and the right key changed from white to orange depending on which key was last pecked in the IL, the left or the right. The hen then had to complete the required number of responses on the FR in the TL. On the last response on the FR schedule the hopper was raised for 2 s on a left key choice or 8 s on a right key choice. After the reinforcement was complete there was a black out of the key and hopper illumination for either 2.5 s or 6.5 s to make the TLs durations from the start of the magazine operation to the restart of the ILS the same. After the black-out the IL would restart, this was repeated until 30 reinforcers were obtained or 2400 s passed, whichever occurred first. The session then ended. The FRs that were in place were FR 1, 8, 32, 64 and

128 from Conditions 2 to 6 respectively. Each FR was increased once statistical stability was reached for each hen. Statistical stability (as described previously) was the criteria for ending a condition and moving onto the next.

Replication conditions: Condition 7 and 8.

These two conditions were exactly the same as the previous conditions. Condition 7 had FR 8 in the TLs and Condition 9 repeated FR 1 in the TLs. Statistical stability (as described previously) was the criteria for ending each condition.

Reversal Conditions: Condition 9 and 10:

In these conditions the procedure remained the same as but the key light colours and reinforcement duration were switched between keys. The left key in the TL became orange and led to 8 s of reinforcement and the right key became red and produced 2 s of reinforcement. Everything else remained the same. The FRs used in the TL were FR 1 for Condition 9 and FR 32 for Condition 10. Statistical stability (as described previously) was the criteria for ending each condition.

Results

Initial Link Data Analysis

Raw data from the last five days of each condition are presented in Appendix A. These data were used in the following analyses.

Figure 3 shows the IL log response ratios and log time ratios for the last five sessions of each condition. The log response ratios were calculated by dividing the left pecks by the number of right pecks. Time ratios were calculated by dividing the time spend on the left key by the time spent on the right key. Data points at approximately zero on the y axis indicate indifferences between the TL stimuli. Data points above zero on the y axis indicate proportionally more responding and/or time spent on the left key (smaller reinforcer) and data points below zero indicate more responding and/or time spent on the right key (larger reinforcer). In Condition 1, when the duration of food reinforcement was the same (2 s) on both keys and there was no terminal link response requirement (i.e., concurrent schedules), all hen's time and response ratios were close to zero. In Condition 2 where the duration of the reinforcement became unequal (2 s on the left and 8 s on the right) and an FR 1 schedule was in effect in each terminal link, the response and time ratios were lower than in Condition 1 in all cases. Time ratios were more extreme than response ratios and both showed a bias towards the large reinforcer (right key).

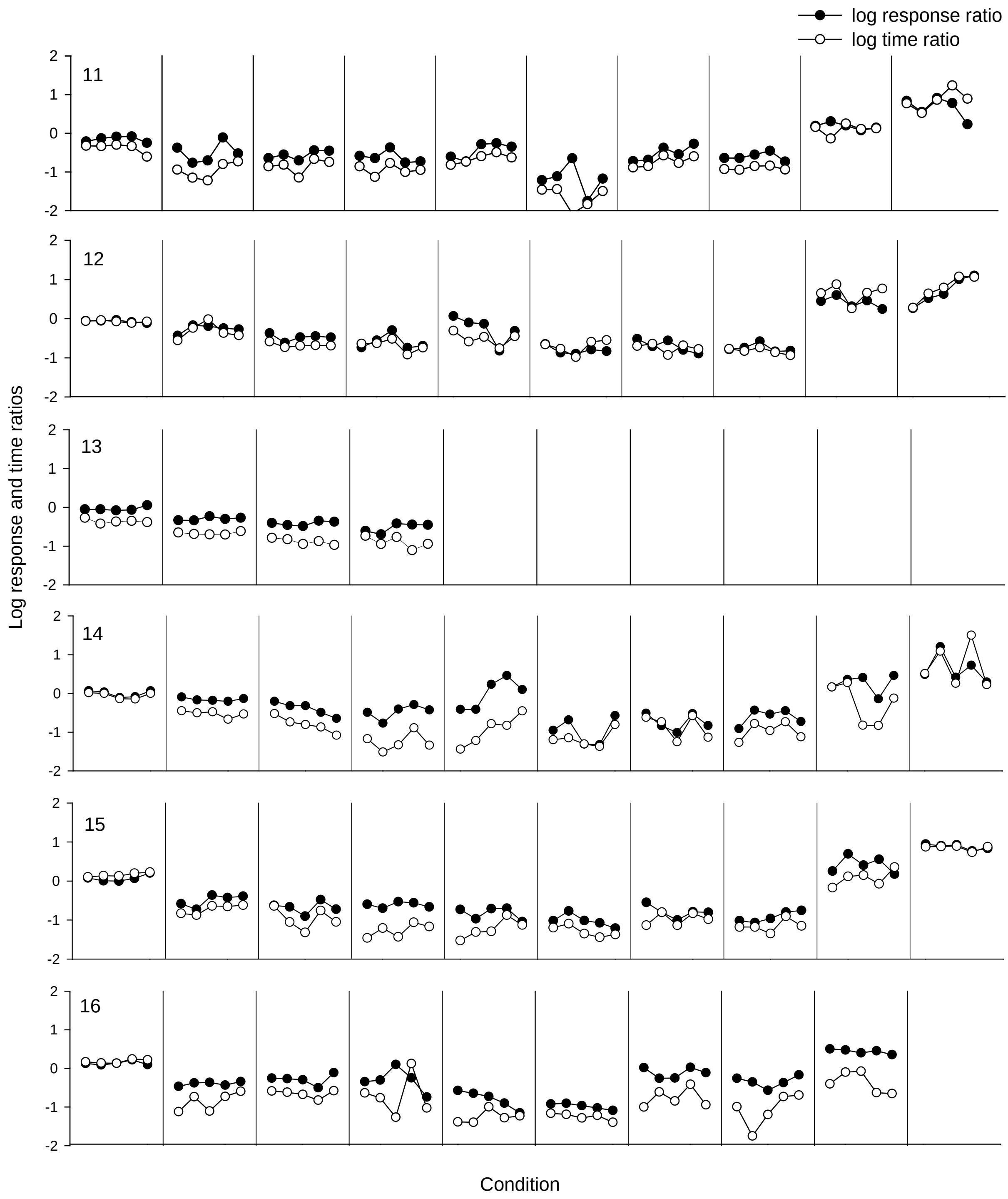

Figure 3: Log response and time ratios for each hen plotted against condition.

As the FR increased from 1 to 128 over Conditions 3, 4, 5 and 6 the ratios tended to decrease to some degree, showing greater biases towards the right key (the larger reinforcer) in most cases. For all hens the time biases were more extreme (towards the right key) than the response biases. For Hens 11, 12 and 13 the differences between the two were minimal and for the other hens the differences were larger and the biases tended to decrease more than the response duration for these hens. After the completion of Condition 4, Hen 13 died for reasons unrelated to this study and there was no more data for this hen.

Condition 7 was a replication of Condition 3 (FR8). Figure 3 (log response and time ratios) shows that both the log response and time ratio data in this replicated condition became less extreme moving back towards the data seen in Condition 3. The log time ratios were again more extreme (towards the right key) than the response ratios. Condition 8 was the replication of Condition 2 (FR1). Figure 3 shows that the Condition 8 data were less extreme than the Condition 7 data. The time ratios were slightly more extreme (towards the right key) than the response ratios in Condition 8.

In Condition 9 the reinforcement durations were reversed. Figure 3 shows that in Condition 9 (FR1 reversal) all biases moved further towards the left key (the now larger reinforcer). This was the last condition that Hen 16 completed before the end of data collection. Condition 10 had FR 32 in the TL. Figure 3 shows that all hens in Condition 10 developed greater biases towards the left key than in Condition 9, with both the response and time ratios being similar.

The averaged last 5 sessions data for the IL log response and time ratios are plotted against log FR in Figure 4. In Figure 4, the graphs on the left represent the log response ratio averages and the graphs on the right represent the averaged long time ratios. Within Figure 4 the solid lines represent the level of Condition 1 data that is the inherent bias. The circles are data from Conditions 2-6. The diamonds show data from Conditions 7 and 8 and the square data points represent the reversal Conditions 9 and 10.

In Condition 1 both the average log response and time ratios were close to zero with the time data being slightly less than zero (small bias towards the right key). From Condition 2 to 6 both the log response and time ratios show a downwards trend. The log time ratios are lower than the log response ratios. As the FR increased both the responses and time ratios showed increased biased towards the right key with the time ratios being more extreme. The replications (Conditions 7 and 8) gave similar data to the original conditions in most cases with Condition 7 data being more similar to Condition 3 data than Condition 2 data were to Condition 8 data. From Figure 4 it can be seen that in Condition 9 and 10 the log response and time ratios increased, that is, biases moved towards the left key (larger reinforcer). Increasing bias towards the key associated with the larger reinforcer in the terminal link is shown through the downward trend over Conditions 2 to 6 and the upwards trend over Conditions 9 and 10.

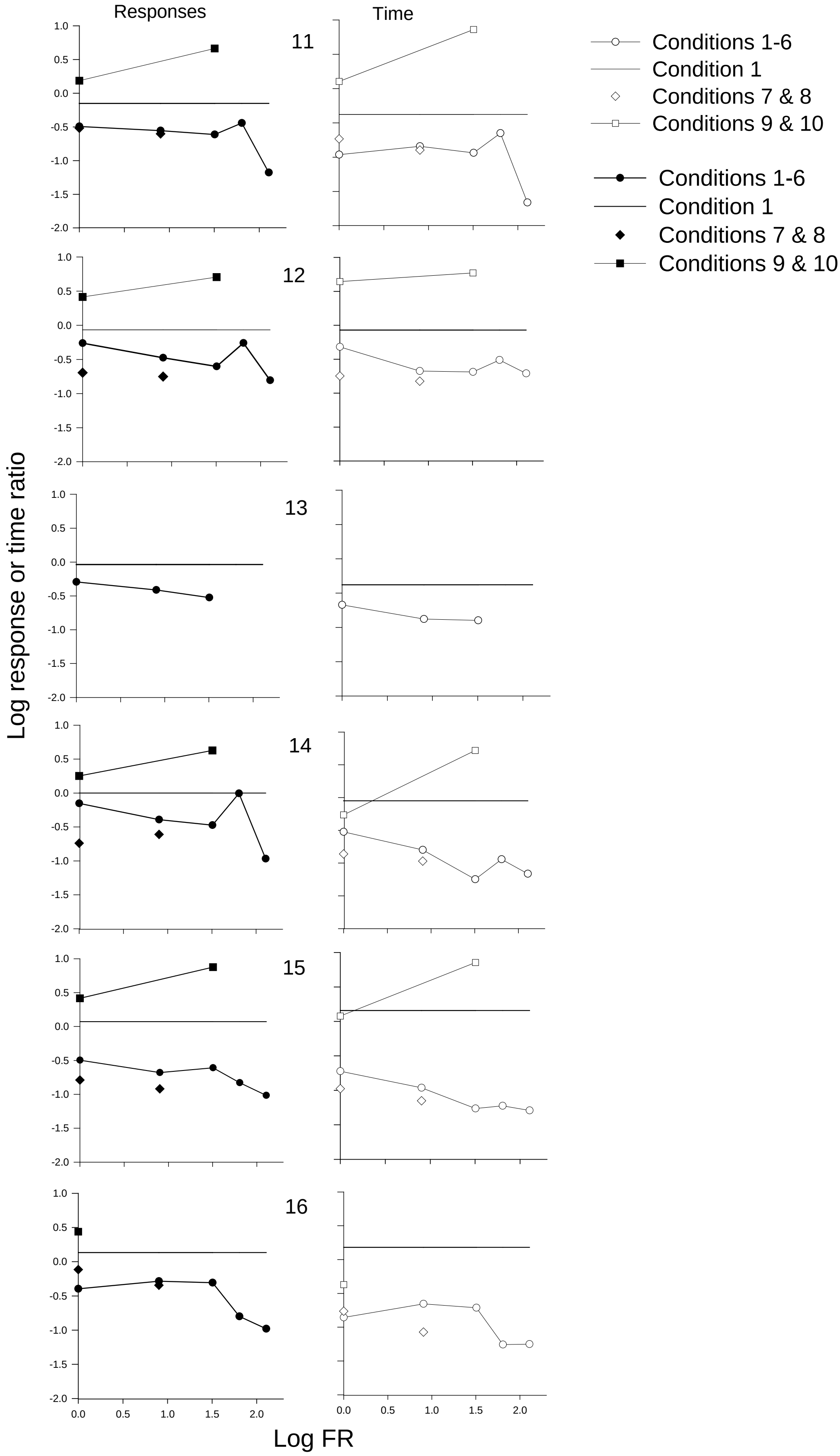

Figure 4: Averaged log Response and Time ratios for each hen plotted against log FR.

Table 1: *Presented are the Hen numbers, the FR, log b for responses, Condition 1 mean, log response ratio, SD and log q for responses. Rows labelled with * are the replication conditions. Rows labelled with + are the reversal conditions.*

Hen	FR	log b responses	Condition 1 SD	log response ratio B1/B2	SD	log q
11	1	-0.151	0.074	-0.492	0.265	0.342
	8			-0.556	0.116	0.405
	32			-0.614	0.156	0.463
	64			-0.442	0.209	0.291
	128			-1.177	0.392	1.026
	8*			-0.601	0.105	0.450
	1*			-0.518	0.194	0.367
	1+			0.187	0.084	-0.337
	32+			0.665	0.276	-0.816
12	1	-0.068	0.031	-0.261	0.104	0.193
	8			-0.476	0.089	0.407
	32			-0.603	0.189	0.535
	64			-0.259	0.340	0.191
	128			-0.805	0.098	0.737
	8*			-0.751	0.104	0.683
	1*			-0.694	0.158	0.626
	1+			0.415	0.139	-0.483
	32+			0.705	0.346	-0.773
13	1	-0.037	0.053	-0.293	0.045	0.256
	8			-0.411	0.057	0.374
	32			-0.523	0.122	0.486
14	1	-0.002	0.085	-0.154	0.044	0.152
	8			-0.392	0.174	0.391
	32			-0.474	0.180	0.473
	64			-0.005	0.393	0.003
	128			-0.968	0.347	0.966
	8*			-0.609	0.205	0.607
	1*			-0.740	0.245	0.738
	1+			0.253	0.245	-0.255
	32+			0.628	0.361	-0.630
15	1	0.072	0.082	-0.497	0.153	0.569
	8			-0.679	0.155	0.751
	32			-0.610	0.070	0.681
	64			-0.829	0.163	0.901
	128			-1.017	0.160	1.088
	8*			-0.919	0.137	0.991
	1*			-0.789	0.160	0.861
	1+			0.417	0.213	-0.345
	32+			0.875	0.080	-0.804

16	1	0.134	0.053	-0.396	0.052	0.530
	8			-0.286	0.140	0.420
	32			-0.307	0.300	0.441
	64			-0.799	0.232	0.933
	128			-0.980	0.077	1.114
	8*			-0.343	0.149	0.478
	1*			-0.114	0.138	0.249
	1+			0.438	0.059	-0.304

Table 2: *Presented are Hen numbers, the FR, log b for time, Condition 1 mean, log time ratio, SD and log q for time. Rows labelled with * are the replication conditions. Rows labelled with a + are the reversal conditions.*

Hen	FR	log b time	Condition 1 SD	log time ratio (B1/B2)	SD	log q
11	1	-0.376	0.127	-0.964	0.214	0.588
	8			-0.841	0.184	0.466
	32			-0.938	0.137	0.562
	64			-0.651	0.126	0.275
	128			-1.661	0.281	1.286
	8*			-0.896	0.052	0.521
	1*			-0.732	0.142	0.357
	1+			0.105	0.143	-0.481
	32+			0.862	0.256	-1.237
12	1	-0.070	0.026	-0.319	0.203	0.249
	8			-0.674	0.054	0.605
	32			-0.686	0.151	0.616
	64			-0.512	0.169	0.442
	128			-0.710	0.173	0.640
	8*			-0.824	0.077	0.754
	1*			-0.745	0.113	0.676
	1+			0.645	0.232	-0.714
	32+			0.772	0.331	-0.841
13	1	-0.357	0.055	-0.670	0.038	0.314
	8			-0.878	0.079	0.521
	32			-0.897	0.150	0.540

14	1	-0.051	0.080	-0.524	0.086	0.473
	8			-0.800	0.203	0.749
	32			-1.249	0.236	1.198
	64			-0.942	0.389	0.891
	128			-1.163	0.221	1.112
	8*			-0.970	0.226	0.919
	1*			-0.860	0.312	0.809
	1+			-0.265	0.532	0.213
	32+			0.719	0.558	-0.771
15	1	0.158	0.052	-0.723	0.119	0.880
	8			-0.963	0.268	1.121
	32			-1.264	0.173	1.422
	64			-1.225	0.242	1.383
	128			-1.291	0.143	1.448
	8*			-1.152	0.159	1.310
	1*			-0.975	0.159	1.133
	1+			0.077	0.204	0.081
	32+			0.854	0.075	-0.696
16	1	0.180	0.048	-0.856	0.241	1.036
	8			-0.656	0.100	0.836
	32			-0.712	0.528	0.892
	64			-1.258	0.163	1.438
	128			-1.250	0.093	1.430
	8*			-1.072	0.431	1.252
	1*			-0.763	0.245	0.943
	1+			-0.371	0.279	0.551

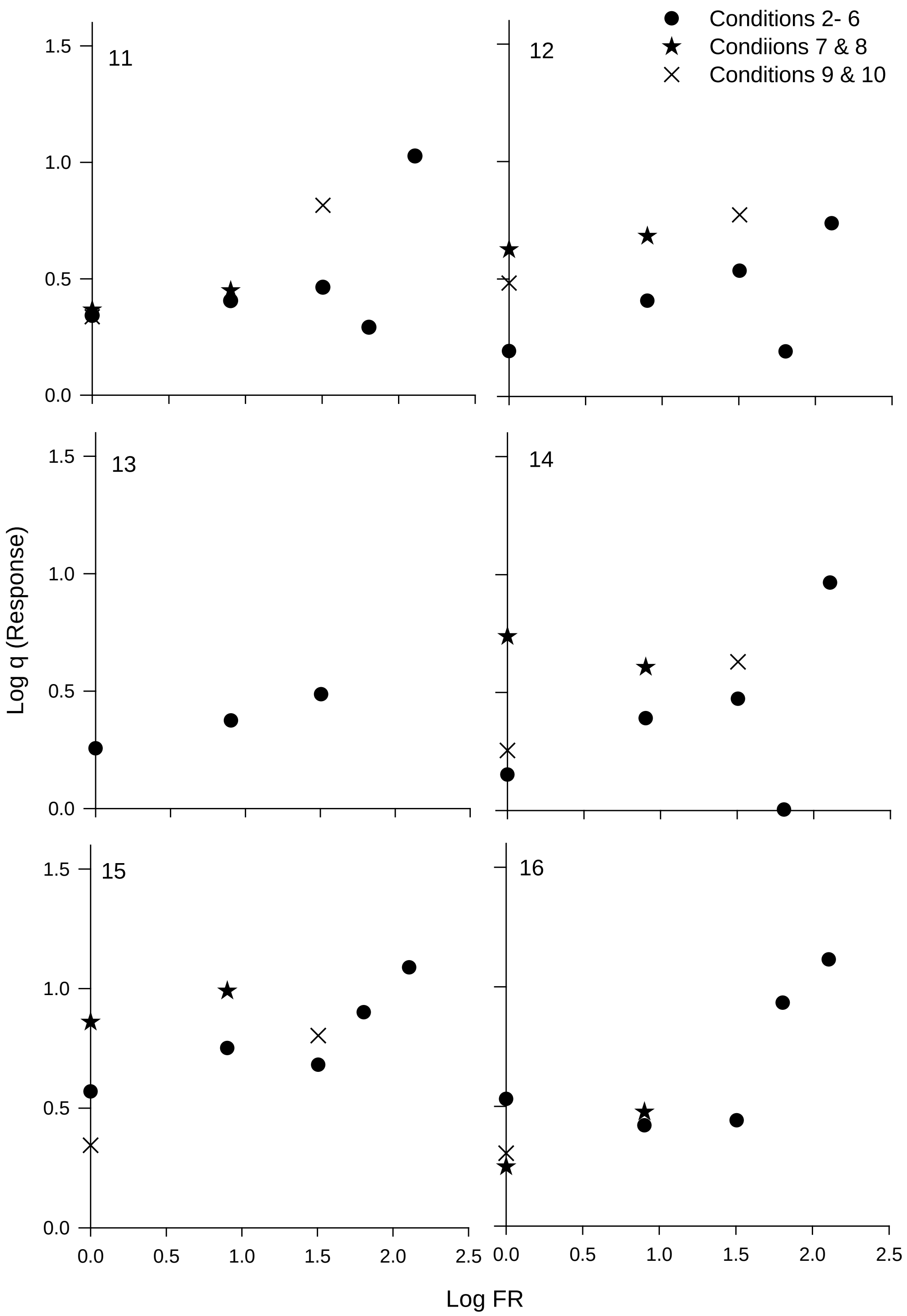

Figure 5: The log *q* bias for the response ratios for each hen plotted against log FR.

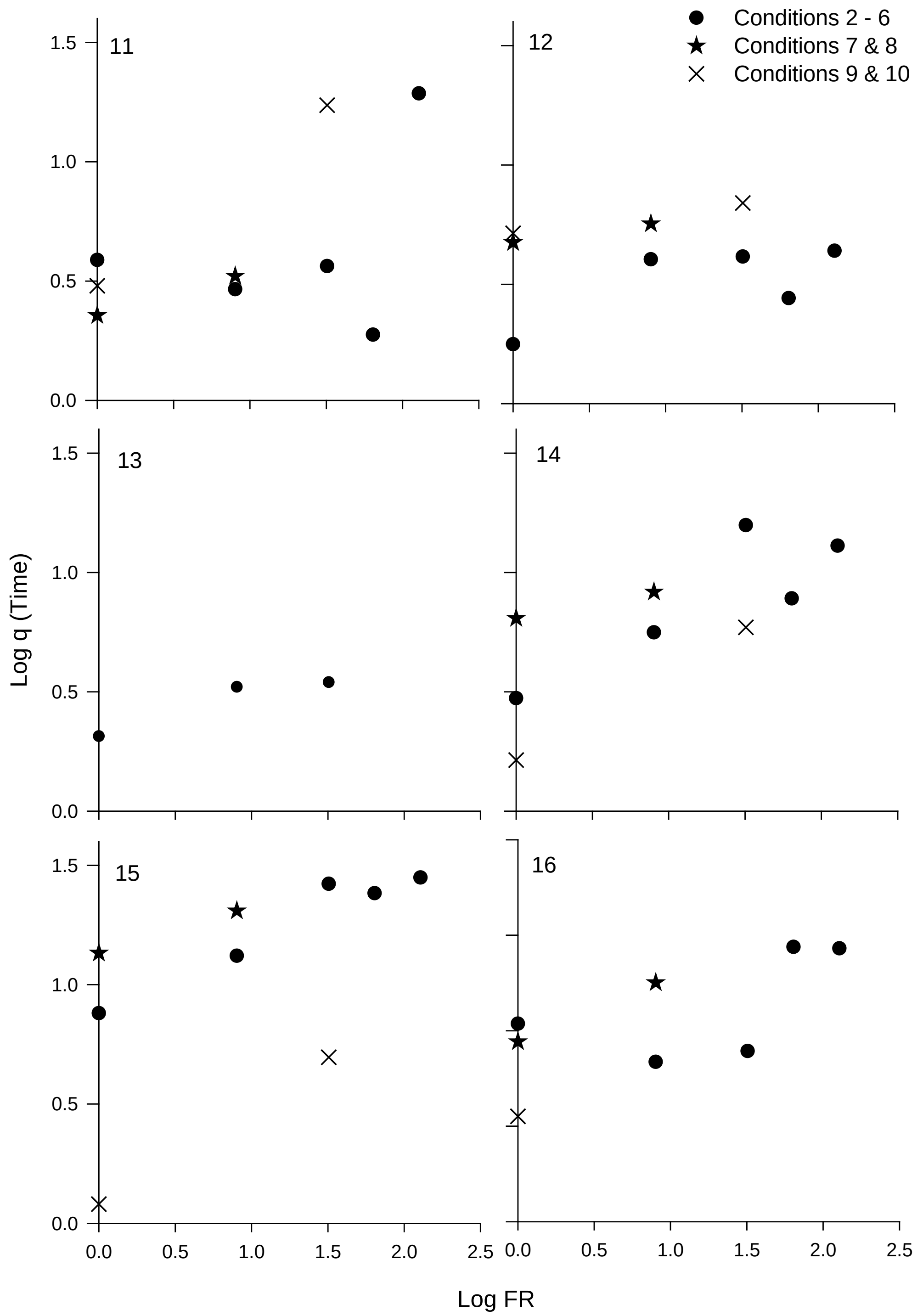

Figure 6: The log *q* bias for the time ratios for each hen plotted against log FR.

Table 1 and 2 give the values of the IL log response and time ratios (as shown in Figure 4) and also show the log ratios for Condition 1 data that give an estimate of the intrinsic bias (log *c,* Equation 4) that can be used in our estimate of log *b* (Equation 5). Bias due to food duration (log *q*, Equation 10) can be obtained by subtracting this inherent bias from the log response and time ratio values for each condition. In this table, these values have been made positive when the bias was toward the larger food duration. The log *q* from the response data are plotted in Figure 5 and those from the time data are plotted in Figure 6.

It can be seen from both Figure 5 and Table 1 that as the FR increased, the log *q* based on the response data generally increased. The replication data follow the same pattern as the original data. For three hen's (Hens 12, 14 and 16) the replication food duration biases are much larger than the earlier conditions data. The reversal data also generally follow in the same pattern with the bias from FR 32 being greater than that from FR 1. The log time biases follow much the same pattern as the response biases in Conditions 2 to 6 in that, as the FR increased the log *q* time biases became larger. (This is represented by Figure 6 and Table 2). They also follow the same pattern as the responses ratios for the replication and reversal conditions. Figures 5 and 6 show that the time data were generally larger than the response data.

Table 3: *The top panel shows the intrinsic biases (log b) with responses on the left and time on the right for Conditions 1, Conditions 2&9 and Conditions 4&10. The bottom two panles contain the Food Duration Bias (log q) with again responses in the left panels and time in right panels. The top panel of this section contains the FR 1 log q data for condition 2, condition 9 and conditions 2&9 combined. The bottom section contains FR 32 log q data for condition 4, condition 10 and conditions 4&10 combined.*

Intrinsic Bias (log *b*)

Responses				Time		
	Cond 1	Cond 2&9	Cond 4&10	Cond 1	Cond 2&9	Cond 4&10
Hen No.	FR 0	FR1	FR 32	FR 0	FR 1	FR 32
11	*-0.151*	**-0.153**	**0.026**	*0.376*	**-0.429**	**-0.038**
12	*0.068*	**0.077**	**0.051**	*0.070*	**0.163**	**0.043**
14	*0.002*	**0.049**	**0.077**	*0.051*	**-0.394**	**-0.265**
15	*0.072*	**-0.040**	**0.133**	*0.158*	**-0.323**	**-0.205**
16	*0.134*	**0.021**		*0.180*	**-0.613**	

Food Duration Bias (log *q*)

Responses				Time		
		FR 1			FR1	
	Cond 2	Cond 9	Cond 2&9	Cond 2	Cond 9	Cond 2&9
11	*0.342*	*0.337*	**0.340**	*0.588*	*0.481*	**0.534**
12	*0.193*	*0.483*	**0.338**	*0.249*	*0.714*	**0.482**
14	*0.152*	*0.255*	**0.203**	*0.473*	*0.213*	**0.130**
15	*0.569*	*0.345*	**0.457**	*0.880*	*0.081*	**0.400**
16	*0.530*	*0.304*	**0.417**	*1.036*	*0.551*	**0.242**

Responses				Time		
		FR 32			FR 32	
	Cond 4	Cond 10	Cond 4&10	Cond 4	Cond 10	Cond 4&10
11	*0.463*	*0.816*	**0.639**	*0.562*	*1.237*	**0.900**
12	*0.535*	*0.773*	**0.654**	*0.616*	*0.841*	**0.729**
14	*0.473*	*0.630*	**0.551**	*1.198*	*0.771*	**0.984**
15	*0.681*	*0.804*	**0.743**	*1.422*	*0.696*	**1.059**
16	*0.441*			*0.892*		

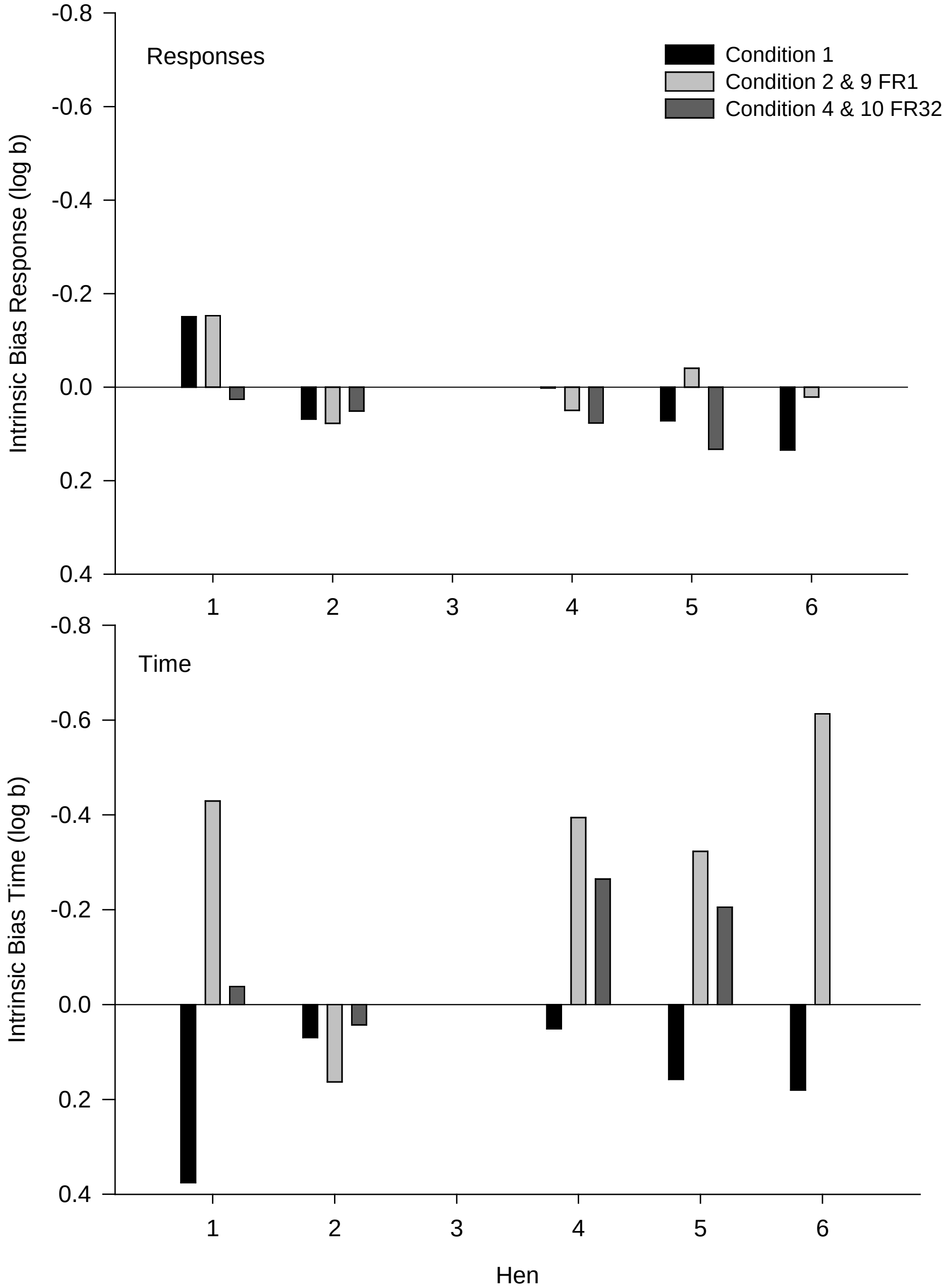

Figure 7: The top panel shows the log *b* response data and the bottom panel shows the log *b* time data for Condition 1, Conditions 2 & 9 and Conditions 4 & 10 plotted for each hen.

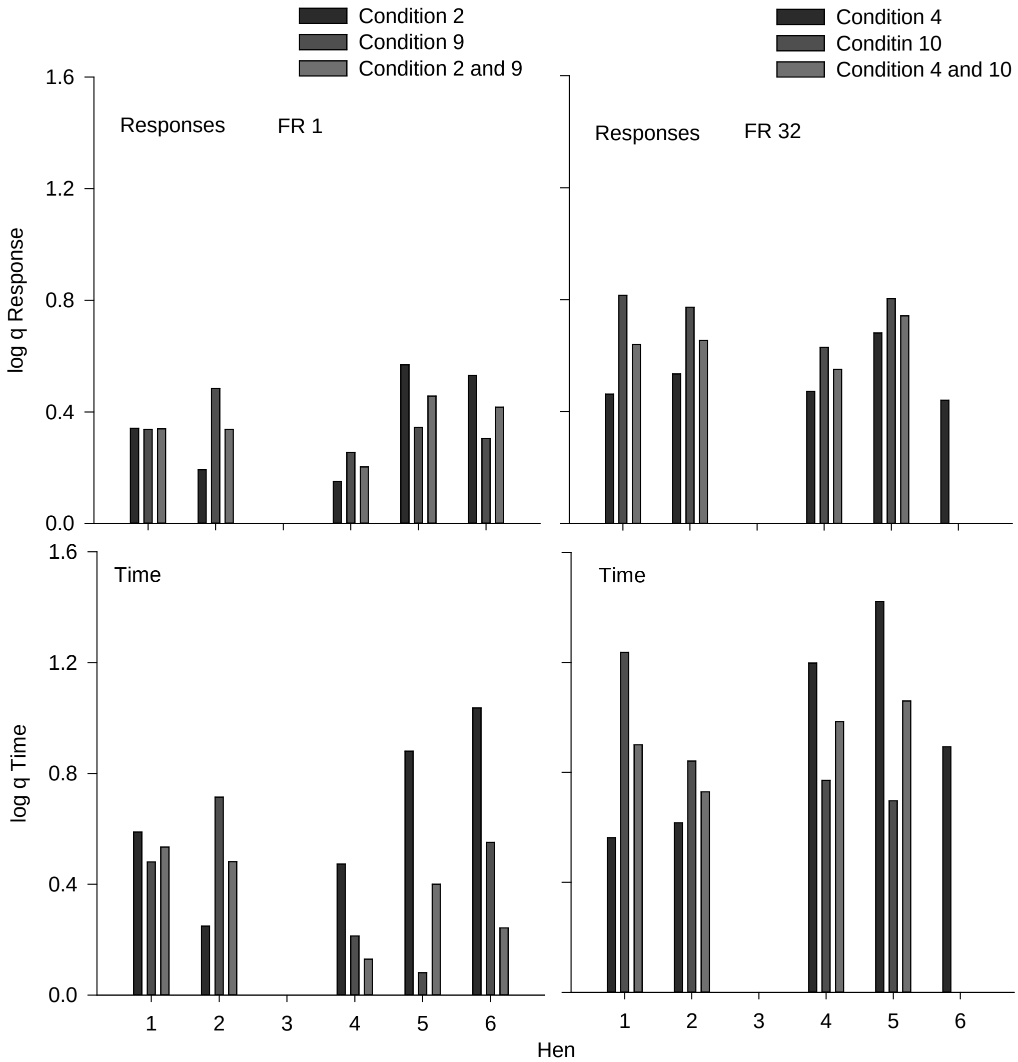

Figure 8: The two left graphs show the log *q* biases for FR 1 with response biases on the top and the time biases on the bottom. The two graphs on the right show the log *q* biases for FR 32, again response biases on top and the time biases on the bottom.

The reversal conditions can also give an estimate of estimate of intrinsic bias (log *b*) and bias due to food duration using Equations 5 and 10 these were calculated and are presented in Table 3 and Figure 7. Also given are the Condition 1 data for comparison. In Figure 7 it can be seen for response data that there were no consistent differences across any of the measures of intrinsic bias across hens. There were some differences in some cases where one estimate of bias was a lot larger than the other bias estimates but no consistent trends. There was no tendency for the intrinsic bias for the reversal of FR 32 to be larger or smaller than for the reversal of FR 1. In Figure 7 it can be seen that the time data tended to be larger than the response biases. For the time measures, the Condition 2 and Condition 9 data were generally larger than the time measures for the other conditions.

The food duration bias (log *q*) can also be calculated using the reversal conditions and Equation 10. These were calculated and are given in the bottom panel of Table 3 and Figure 8. These data are positive when the bias was towards the larger food duration. The left panel of Figure 8 gives the response and time log *q* estimates from Conditions 2 and 9, together with the log *q* biases from the reversal conditions plotted for each hen. The right panel of Figure 8 gives the response and time log *q* for each of Conditions 4 and 10 and from the reversals for each hen. There was no tendency for the log *q* value estimates from each separate condition to be consistently different from the log *q* estimated from the reversals. The data also show that the FR 32 log *q* values tended to be greater than the FR 1 log *q* values regardless of how each was calculated.

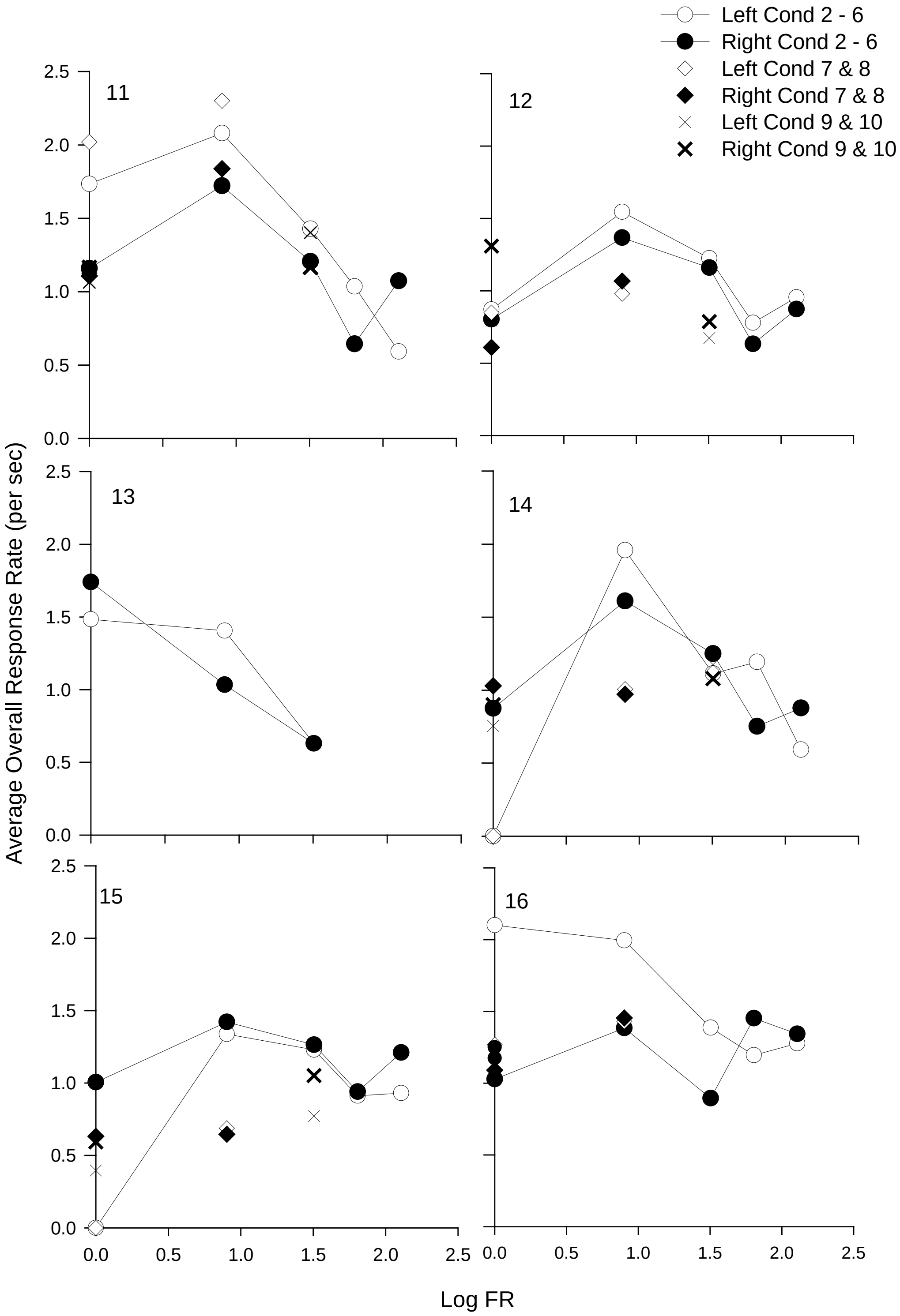

Figure 9: Average Overall Response Rates (per second) for the left key (white circles) and right key (black circles), for each hen plotted against log FR.

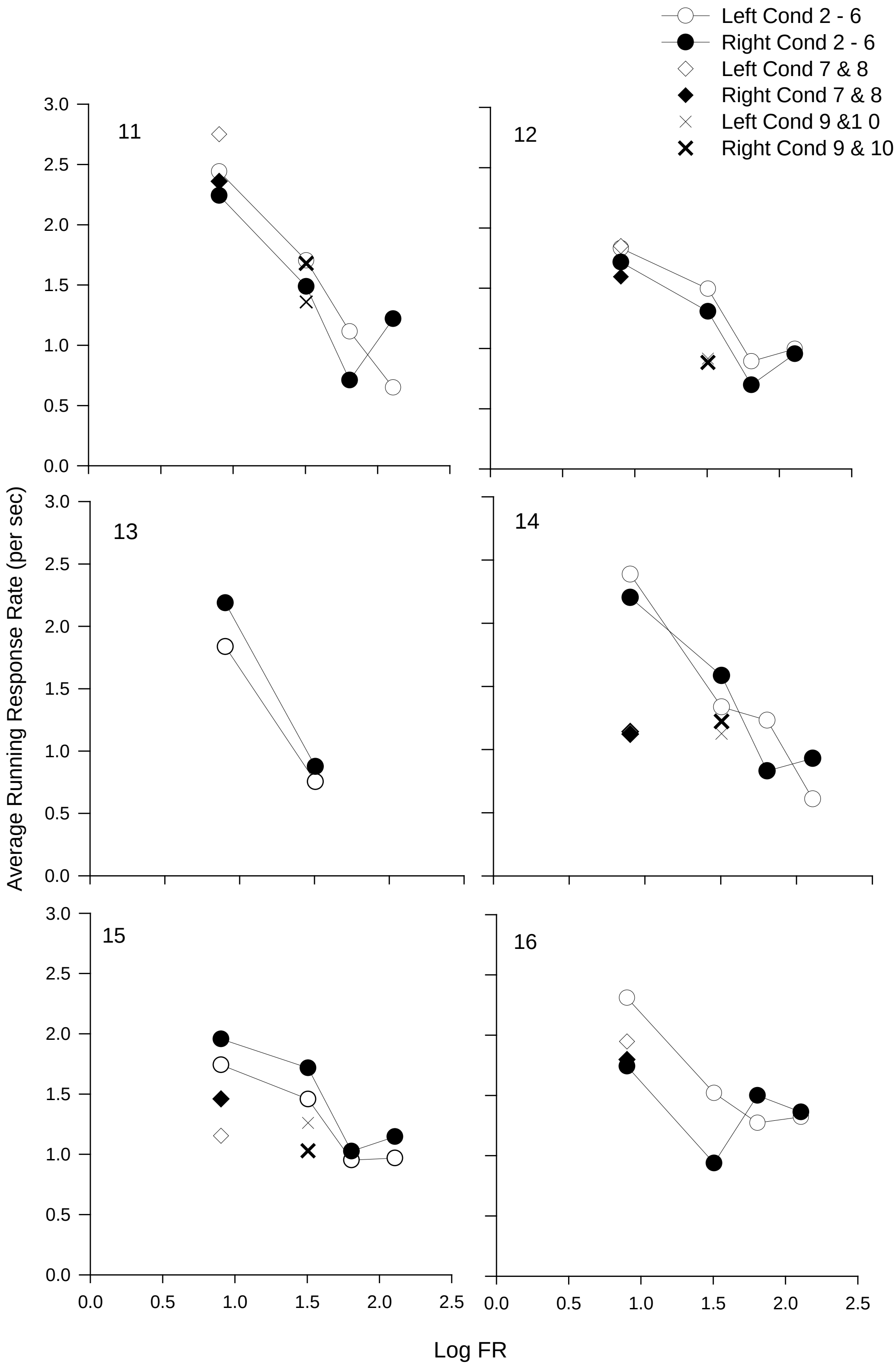

Figure 10: Average Running Response Rates (per second) for the left key (white circles) and the right key (black circles) for each hen plotted against log FR.

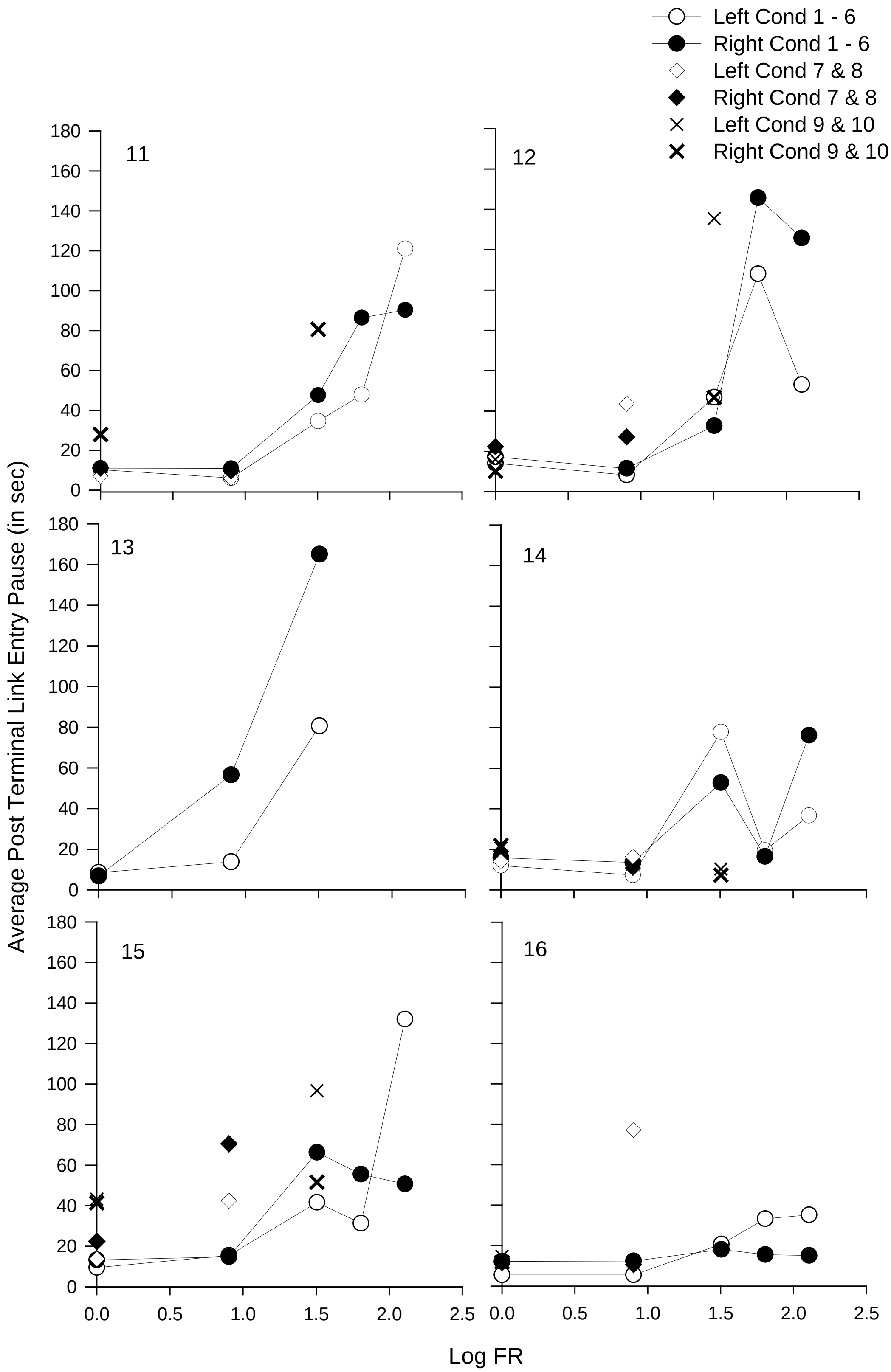

Figure 11: Average Post Terminal Link Entry Pauses (in seconds) for the left key (white circles) and the right key (black circle) for each hen plotted against log FR.

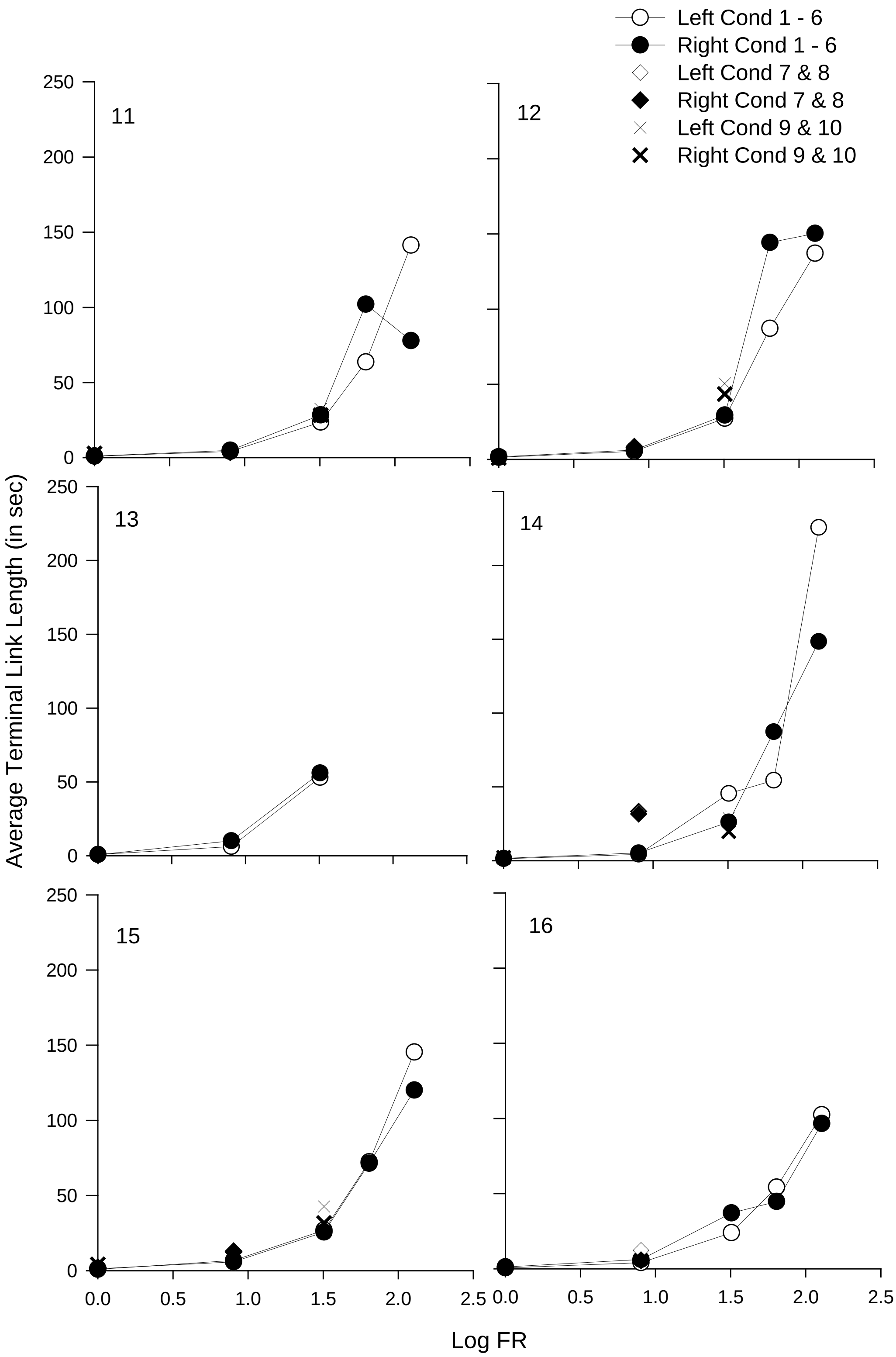

Figure 12: Average Terminal Link Length (in sec) for the left key (white circles) and the right key (black circles) for each hen plotted against log FR.

Terminal Link Data Analysis

Raw data from the last five days of each condition are presented in Appendix B. These data were used in the following analyses.

The average overall response rates in the terminal links data are shown in Figure 9. These were calculated as the total number of responses made over a session in a terminal link, divided by the key time in that TL. They are plotted against log FR for the left and right terminal links. The clear circles represent the left key data and the filled in circles representing the right key data. Circles connected with lines are data from Conditions 2 to 6. The diamonds represent the replication data, with the clear symbols showing the left key data and the filled in symbols show the right key data. Crosses show the data from the reversal conditions, thin crosses show the left key data and thick crosses show right key data. The data show some signs of bitonic functions with a tendency for response rate to increase over small FRs and to decrease at the large FRs. There is some tendency for Hens 11, 12 and 16's response rates in the TL associated with the 2-s duration to be faster than the 8-s duration TL up to the largest FR value. The replication and reversal data generally follow in a similar pattern. With the exception that the response rates in the TL Condition 9 tended to be lower than those in Condition 2 for 3 out of the 5 hens that completed both conditions.

The average running response rates (RRR) in the TLs are shown in Figure 10 using the same symbols as the previous graph. The RRR was calculated by dividing the total number of responses by the run time in a TL over a session. It is not possible to calculate the RRR for FR 1 as run time is the same as key time. From Figure 10 it can be seen that as the FR increased, the RRR decreased for all hens across both keys with no consistent differences across hens in the response rates on the two keys. Hens 11, 12, 14 and 16 had slightly higher running response rates for the left key than in the right key and Hens 13 and 15's right key data were slightly higher than the left key data. All hens had higher running response rates with the smaller FR schedules than with the larger FR schedules.

Figure 11 presents the average Post Entry Pauses (PEP) were calculated by dividing the total PEP time by the number of reinforcers obtained at each FR for each TL schedule. These are plotted against log FR. The symbols used on the graph are the same as used in the previous graphs. Figure 11 shows that there are no consistent differences between the pauses on the left and the right key across all hens. There was however a tendency for the pauses to become longer as the FR increased. Hens 11, 15 and 16 had slightly longer pauses on the left key TL (2-s reinforcer) with some tendency for the differences to increase as the FR increased. The remaining hens had slightly longer pauses in the right key (8-s reinforcer). Overall there was a slight trend for the larger FR to give larger PRPs. The replication and reversal data follow a similar pattern to the original data.

The average TL length is the time from stimulus light turning on in the terminal link to the completion of the FR requirement. These data are presented in Figure 12 with the symbols used the same as on the previous graphs. From Figure 12 it can be seen that there were no consistent differences in the TL length across hens or keys. As the FR increased, the time spent in the TL increased. For all hens, except Hen 12, the left key TL length (2-s TL) was longer in Condition 6 with the FR 128 (log 128 = 2.1 on the graph) than was the right key TL.

Discussion

The aim of this experiment was to investigate whether hens' preferences between two different durations of reinforcer changed as the FR required to obtain them was increased. A concurrent-chains procedure was used to investigate this. Both ILs of the concurrent-chains procedure were VI60-s schedules. The procedure allowed the hens to choose between two concurrently available alternatives (i.e. in the ILs) each of which gave intermittent access to one of two mutually exclusive outcomes, the TLs. Each TL involved an FR schedule followed by either 2 s or 8 s of magazine operation. The FR schedules the TLs were kept equal but varied over conditions. It was found that for all hens preference in the ILs was for the longer duration of reinforcer. In addition these preferences increased as the FR (price) in the TL was increased.

Bruce (2007) previously investigated this same question with hens, using two different types of food and concurrent chains. Bruce (2007) found a preference for W over PW with FR 1 in both TLs of the concurrent chain schedule. This preference was similar to that found by Flevill (2002) using hens and simple concurrent schedules. In addition, Bruce (2007) found that as the FR in the TL increased, responding in the initial link became more extreme, showing increased preference for W over PW. This result and the present data both show that preferences can be affected by the price and that increasing the price moves preference further towards the consequence that was preferred at a low price.

To obtain the log *q* values (i.e., bias due to food duration or preference for the different durations) here, the inherent bias was measured and then subtracted from the overall bias (Equation 10). Grant et al. (2014) also obtained the log *q* biases when examining simple concurrent schedule preference for two food durations with hens, as that study also assessed inherent bias. The inherent biases obtained through the equal food duration condition, here, ranged from -0.002 to 0.134. Grant et al.'s (2014) inherent biases ranged from -0.21 to 0.01. The range of these data points was similar for both experiments. In both the current research and Grant et al.'s (2014) experiment the degree of inherent bias was small. The food duration biases (log *q*) obtained here with FR 1 in the TLs ranged from 0.203 to 0.457. The log *q* biases obtained by Grant et al. (2014) with the same durations of access (2 s vs. 8 s) ranged from 0.09 to 0.27. Both sets of data show preference for the larger duration of reinforcer. The log *q* biases obtained in the current research were generally larger than those found by Grant et al. (2014).

One possible reason for this difference in size may be the use of a blackout after each reinforcer in the ITI in the current research. This blackout period after each reinforcer equalised the time associated with the reinforcer on each TL. That is, it equalised the time from the start of the magazine operation to the start of the next exposure to the ILs for both TL schedules. In Grant et al.'s (2014) research the reinforcers differed in duration but there was no balance of this time, so from the animals' perspective, responding on the 2-s schedule meant that the next reinforcer was available sooner than it would be on the 8-s schedule. Normally reinforcer time is excluded from the calculation of the reinforcer rate in concurrent schedules but if this were not so then, given the difference in magazine duration, the reinforcement rate could be slightly faster on the 2-s schedule than on the 8-s schedule. Thus the animals may have experienced higher rates of reinforcement on the shorter food-duration schedule when there was no balancing blackout, as in Grant et al.'s (2014) research. Thus it could be that the experienced rates of reinforcement for the schedule associated with 2-s food duration was faster than for the schedule associated with the 8-s duration This difference could have counteracted the effects of the different food duration somewhat and so could have reduced the degree of bias seen by Grant et al. (2104). Thus the response ratios found by Grant et al. (2014) may have been a product of both this possible difference in reinforcement rates and the different food durations. The present log response ratio may be larger than Grant et al.'s (2014) because the blackout maintained equality in the reinforcement rates on the two IL schedules and so the biases seen here are simply the result of the two different food durations. It remains to be seen if this is the case. This requires comparison of data from conditions using blackouts, as used in the current research, with data from conditions that do not. Future research is required to examine this more thoroughly.

Bruce (2007) did not measure intrinsic bias so the data from that study that can be best compared to the present data are the log response ratios. The current research log response ratios with FR 1 TL schedules averaged -0.34 (range: -0.497 to -0.154) (with negative values showing preference for 8 s reinforcer) whereas Bruce's (2007) log response ratios averaged 0.107 (range: -0.046 to 0.385). For Bruce's (2007) the larger the response ratio the greater the preference for W over PW. Thus the 2-s vs. 8-s data here generally gave a larger bias than did the W vs. PW data in the earlier study with FR1 TLs.

It is also possible to compare IL log response ratios from the conditions with FR values that were used in both studies. For Bruce (2007) with FR 8 TLs, the average log response ratio was 0.204 (range: -0.343 to 0.476). For FR 32 TLs the average was 0.971 (range: 0.68 to 1.394). These data are plotted in Figure 13 against log FR value**,** along with the averages from the present data for comparison (shown in the figure as positive values so that the larger the ratio the larger the preference for 8 s over 2 s). The average value from Grant et al. (2014), with the simple concurrent and 2 s vs. 8 s, is also shown in the figure for comparison, with the value shown on the y axis, plotted at zero on the x axis. A comparison of these data show Grant et al.'s (2014) study resulted in the smallest value, Bruce's (2007) FR 1 TL average log response ratio is higher than that from Grant et al. (2014) but lower than that from the current research with FR 1.The data from the current research and from Bruce (2007) increase similarly from FR 1 to FR 8. The data from the current research continue to increase at FR 32, following a similar pattern as from FR 1 to FR 8. The data point for Bruce (2007) at FR 32 is much higher than that from the present study. One possible variable that might contribute to this difference at FR 32 is the relative length of the two TL schedules.

If the two TLs differed in length then this could contribute to the degree of preference over and above the contributions of the different food durations. Under concurrent chain schedules the preference is normally for the shorter duration of two TL schedules (Davison, 1986; McDevitt & Williams, 2001; Kyonka, 2008; Mazur 2003 and Mazur 2004). In the current research, at FR 1, 8 and 32 the TL lengths were very similar on the two schedules. Given the TLs were similar in length up to FR 64, TL length differences were probably not a confound in assessing preference over FRs 1, 8 and 32. At FR 64, however, for 3 out of the 5 hens, the TL length on the key associated with the 8-s reinforcer was much longer than the TL for the 2-s key. Figure 4 shows these hens' (Hen 11, 12 and 14) log response ratios moved towards the 2-s key at FR 64, compared to FR 32, rather than continuing to increase towards the 8-s key. When the FR was FR 128, two hens (Hens 11 and 14) now had longer TLs on the 8-s key and in both cases Figure 4 shows the log response ratios were now more towards that key than might have been predicted from the trend over the smaller FR values. Hen 12's TL schedules were of similar length at FR 128 and this hen's response ratios now followed the trend seen over FR 1 to FR 32 for this hen. These data suggest that differences in TL length may contribute to the degree of bias seen. It is also possible to look at the relative TL length in Bruce's (2007) data. Examination of those data showed the TL lengths changed roughly equally from FR 1 to FR 8 as was found here, but at FR 32 the PW TL became much longer than the W TL. This large difference in TL length could have contributed to the sudden increase in preference for W seen in Figure 13. The effect of different length TLs on preference when FR schedules are involved in those TLs requires further study. It would be useful to compare behaviour seen in the present study to that of the same hens when responding under concurrent chains with delays to the reinforcer in the TLs. Using delays similar in length to the obtained TL lengths here, might help clarify to what degree the present biases are the result of the FR response requirement or the result of differences in TL length.

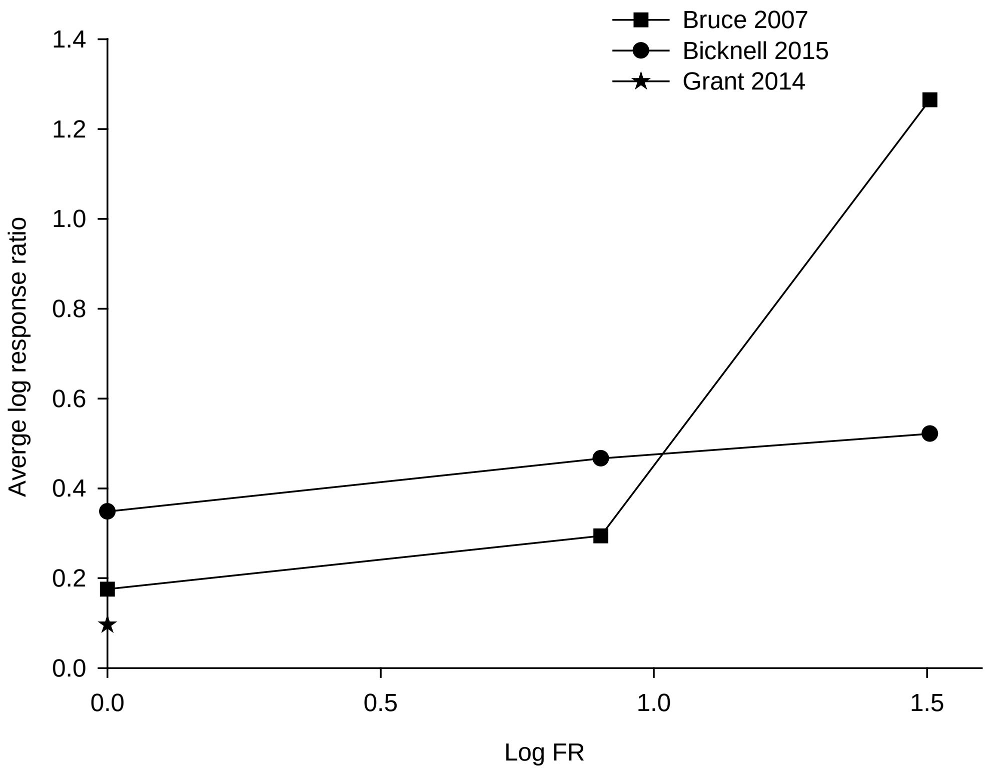

Figure 13: Average log response ratios from Bruce (2007), Grant et al. (2014) and Bicknell (2015) (the current research) for FR 1 8 and 32 plotted against log FR.

The concurrent-chain schedules in the current research used dependent schedules so the relative rate of entry into the TLs on both keys was the same on both schedules. The addition of the blackout (ITI) after the magazine operation was to equalise the time from the start of the reinforcer to the start of the next ILs. Thus, the biases obtained should not have been a result of either unequal TL entries or of differences in rate of entry to the TL (as already discussed) but might have, in some cases, been affected by differences in TL length (as discussed above).

The present research as well as Bruce (2007) both illustrate that as the FR increased there was an increase in preference towards the originally more preferred reinforcer as shown in Figure 13. It should be noted, however, that as the FR increased, the required responses took more time to complete and so, there was an overall increase in TL length. One question is whether an overall increase in TL length might affect preference even when the two TLs remain equal in length.

It has been shown by Omino (1993) that bias in the IL of a concurrent chain schedule gets greater the longer the overall length of the TLs. Omino's (1993) data show that the IL bias increased towards the shorter duration TL as the TLs were both increased but maintained their relative size. In the present study, the TLs increased in length as response requirement increased. Had there been no preference between the TLs it might have been expected that an overall increase in TL length would not affect IL behaviour (i.e., had there been no preference e.g. 50/50 responding in the TL, overall increases in TL length would not have been expected to change this). However, the different durations of food gave a bias in the ILs and this became greater as both TL length and FR increased. It is not possible to determine whether it was the increase in time or the increase in responses that caused this effect as they co-varied. This is a problem as whenever an FR is increased, increases in FR normally result in increases inter-reinforcement time and reduced rates of reinforcement. So even in single FR schedules increases in response requirement correlate with increases in inter-reinforcement time. There have been several studied that have tried to unpack this question (Foltin, 1994**)**, but it is still not fully understood which parameter is causing this effect.

One recent study that aimed to examine this question was by Harris (2011). This study tried to separate the effect of the time taken to complete the response requirements and the response requirement itself, using singly presented second-order schedules and hens. Harris (2011) held the time available for responding constant and varied the response requirement. Harris (2011) also held the responses required constant and varied the time available for responding. Harris (2011) used the reciprocal of post reinforcement pauses (or schedule initiation immediacy) as a measure of consumption rate. This was because she held time and responses constant and therefore the pause time was the only aspect that was free to vary. It was found that holding the responses constant while increasing the time resulted in the PRPs becoming longer and thus in the measure of consumption decreasing. When the time was held constant and the responses were increased the same effect was seen; the PRP became longer (consumption decreased) as the number of responses required increased. There were slightly greater deceases in the schedule initiation immediacies over a unit of response (1 response) than over a unit of time (1 s). Despite this, both the time and responses had an influence on pause length. Harris (2011) concluded that the behaviour seen in FR schedules is influenced by a combination of both the duration (inter-reinforcement interval) and the effort it takes to complete an FR schedule and that the changes in duration may be responsible for the effects of increasing the FR requirement. Thus the present biases are probably influenced by both response requirement and the resulting TL length.

The overall response rates in the TL were calculated for this experiment. It was found that 5 out of the 6 hens had higher overall response rates on the key associated with the 2-s reinforcer and 1 hen had higher overall response rates for the 8-s key for FR values up to FR 64. This is, counter intuitive if higher response rates were to be taken as meaning higher preference for the consequence in that TL, as the IL data showed a consistent preference for the 8-s duration TL over these FR values. However, at FR 128 a switch in the response rates was seen. There were now higher overall response rates on the 8-s duration key for this FR. Similar overall response rate differences have been found in FR schedules in previous studies. In Grant et al.'s (2014) single FR schedules with different durations of reinforcer, there also tended to be higher overall response rates with the shorter duration of reinforcer at the smaller FR values. Grant et al.'s (2014) preference assessments had indicated a clear preference for the larger duration of reinforcement. The tendency for the hens to have higher overall response rates on the key associated with the 2-s reinforcer over the key associated with the 8-s reinforcer in the current research is also similar to Bruce's (2007) findings. Bruce (2007) found that the hens had higher overall response rates both in the TLs for the key leading to PW compared to those on the key leading to W. This was also true in the single FR schedules with PW compared to those with W at the smaller FR values. PW however, was found to be the less preferred commodity from the IL data. These findings are also similar to Flevill (2002), where, in the single FR schedules at the smaller FR values, the overall response rates for PW was higher than for W whereas preference in the concurrent schedules was for W. Both Bruce (2007) and the present study found that as the FR value increased over the smaller FR values, the more preferred commodity had the slower overall response rates. As the FR increased in the TLs then when response rates changed so that they were more similar or so that the response rate was higher for the more preferred outcome at the larger FR values, preference in the ILs was still for the originally preferred outcome. Thus the overall response rates under the FR schedules were not a reflection of the preferences seen in the IL at all.

With only five FR values in the current research, fitting a demand function is not sensible; a larger data set is required to determine the slope of the function. However the data can be compared to those seen in other studies. One effect of the higher overall response rates at small FRs would be to make the initial intensity (height or level) of the demand function as assessed by a demand curve for the 2-s reinforcer greater than the intensity that would be seen with 8 s. The present data would follow this pattern and so would be similar to the findings in the demand curves shown by Flevill (2002), Bruce (2007) and Grant et al. (2014) (as mentioned in the introduction), where a less preferred outcome gave higher intensity of demand at small FR values when consumption was assessed as reinforcer rate or number of reinforces obtained in a fixed time. Also, the pattern of changes seen in the overall response rates in the TLs as the FR increased would give a demand function for 2 s that would "drop" earlier than that for 8 s (that is, the 2-s function would change from being inelastic to elastic at a lower price than the 8-s function). This in turn suggests that 8 s would maintain responding to higher FR values than would 2 s. This again would be similar to the findings from Flevill (2002), Bruce (2007) and Grant et al. (2014), where the more preferred food gave higher P_{max} values. That is, longer duration reinforcers and W both maintained responding to higher FR values than did shorter duration reinforcers or PW. Thus the current data support the findings form these other studies. Together these findings question the use of initial intensity of demand when comparing demand for two commodities. It is not the case that the higher initial intensity reflects greater preference. On the other had P_{max} does seem to reflect preference, with more preferred outcomes maintaining behaviour to higher FR values, supporting the use of this measure to compare demand for different commodities.

Two different ways of assessing bias due to food duration were compared in the current research. Neither method gave consistently different results across hens. There was variation in bias over all methods but no tendency for one to give larger or smaller bias than the other. There was an overall tendency for the time biases to be larger than the response biases for all hens, with both measures. It is not clear however, why this was so. There was also some tendency for the response vs. time difference to decrease over the experiment. Again it is not clear why this is so but it might be worth investigating if an early reversal of the food durations might have reduced the differences seen as the biases are closer from the reversal in Condition 9. If this were found to be so then the use of reversals might be the best way to assess log *b* and log *q.*

Problems encountered during the study include the death of one hen near the beginning of the research and one just before the completion of the last condition. These deaths were not related to the experiment but did reduce the subject numbers. In addition, due to time constraints for the thesis, only a limited number of conditions could be completed. This limited the number of FR values that could be investigated, and replication and reversals that could have been done. It would also have been useful to have been able to examine performance under single FR schedules with these consequences for comparison. Having more FR values would have extended the current research findings and would make a demand analysis of performance in the TLs possible. There were also some equipment issues from time to time in the running of the experiment that contributed to the length of time each condition took to run to stability. The magazine chain broke a few times and so those conditions in which these happened were run for much longer than normal to allow recovery form the problem. This in turn limited the number of conditions that could be completed.

Future research in this area could replicate the current research while including more reversals and over a larger range of FR values. It could also be possible to unpack the effect of increased response requirements and increased TL length by using TLs with delays to the reinforcer of similar length. The effects of TL lengths that are Fixed Time (FT) could also be compared to TLs that include FR schedules. It would be important to measure inherent bias and log *q* measures at a larger range of FR values, either using equal TLs or by reversals, to obtain a better understanding of these values.

In conclusion, the current research aimed to investigate whether preference between two different durations of reinforcer delivery changed as the FR required to obtain them, was increased. Through the use of concurrent chain schedules it was found that preference seen in the IL increased towards the longer duration of reinforcer (8 s over 2 s) as the FR in the TL increased. As the FR increased in the TL, this also increased the TL length and it is argued that both influence the degree of preference seen. The TL data generally showed faster overall response rates for the shorter duration of reinforcers at the small FR values even though preference was for the larger reinforcer. This supported findings from other studies that the response rates under FR schedules are not representative of preference.

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Appendix A:

Raw data, from the last five days for each hen and each condition in the Initial link of the experiment. The Hen no, Year, Day, month, condition, 1st peck (1^{st} P), first peck time (1^{st} PT) last peck (Last P) Last peck time (Last PT) and Left Variable Interval (LVI) are presented in the first section. The second section contains The Right Variable Interval (RVI), Pecks on the left key (L Peck) Pecks on the right key (R Peck), Proportion of time spent on left and right (Prop.), the Median of the proportion (Median), the time spent on the left (L Time) the time spent on the right (R Time), the changeover delays left to right (CO L>R), change over delays right over left (CO R>L), change over delay pecks left to right (COP L>R), change over delays pecks right to left (COP R>L), the left Fixed Ratio (LFR) the right Fixed ratio (RFR), the pecks on the left (Pecks L) the pecks on the right (Pecks R), left reinforcer (L RFT) right reinforcer (R RFT), Terminal Link Left Time (TL LT), Terminal Link Right Time) (TL RT) and the total time (Tot Time). All values are in seconds.

Hen .no	Year	Day	Month	Cond	1st P	1st PT	last P	last PT	LVI
Condition 1		FR0							
11	14	26	6	1	2	1.8	11	1249.1	60
11	14	27	6	1	2	5	11	1215.2	60
11	14	28	6	1	1	1720.8	21	2400	60
11	14	29	6	1	2	3.5	11	1337	60
11	14	30	6	1	2	171	21	2322.9	60
12	14	26	6	1	1	3.7	21	1200	60
12	14	27	6	1	2	0.4	21	1232.4	60
12	14	28	6	1	2	1.8	21	1194.1	60
12	14	29	6	1	2	1	11	1222.5	60
12	14	30	6	1	1	21.2	21	1228.1	60

13	14	26	6	1	1	0.8	11	1314.5	60
13	14	27	6	1	2	0.7	11	1484.6	60
13	14	28	6	1	2	1.5	11	1243.1	60
13	14	29	6	1	2	8.7	21	1340.5	60
13	14	30	6	1	2	12.2	11	1471.2	60
14	14	26	6	1	2	4.8	21	1269.1	60
14	14	27	6	1	2	6	21	1246.5	60
14	14	28	6	1	2	1.5	11	1209.2	60
14	14	29	6	1	2	5.2	11	1225.8	60
14	14	30	6	1	2	5.4	21	1297.9	60
15	14	26	6	1	2	10.5	11	1259.3	60
15	14	27	6	1	1	3.2	11	1311.7	60
15	14	28	6	1	2	2.1	21	1244.1	60
15	14	29	6	1	1	4.2	11	1359.1	60
15	14	30	6	1	2	31.6	11	1419.1	60
16	14	26	6	1	2	2.4	21	951.1	45
16	14	27	6	1	2	1.3	11	927	45
16	14	28	6	1	2	1.8	11	948.9	45
16	14	29	6	1	2	0.4	21	994.3	45
16	14	30	6	1	1	1.7	21	907.9	45
Condition 2		FR1							
11	14	4	8	2	2	3.5	21	2321.6	60

11	14	5	8	2	2	1.1	21	2377.1	60
11	14	6	8	2	2	13.6	21	2374.2	60
11	14	7	8	2	2	2.6	21	2359.8	60
11	14	8	8	2	2	1.2	13	1638	60
12	14	4	8	2	1	5.9	24	2064.6	60
12	14	5	8	2	1	3.5	24	1437.8	60
12	14	6	8	2	2	5.6	13	2144	60
12	14	7	8	2	2	11.4	13	1533.4	60
12	14	8	8	2	2	4.6	13	1468.7	60
13	14	4	8	2	2	1.7	13	1537.2	60
13	14	5	8	2	2	0.6	13	1668.1	60
13	14	6	8	2	2	0.6	13	1634.1	60
13	14	7	8	2	2	1.2	13	1548	60
13	14	8	8	2	2	0.5	13	1602.8	60
14	14	4	8	2	1	3.5	13	1475.5	60
14	14	5	8	2	1	1.6	24	1481	60
14	14	6	8	2	2	2.9	13	1447.4	60
14	14	7	8	2	2	1.2	24	2122.2	60
14	14	8	8	2	2	3.2	13	1499.5	60
15	14	4	8	2	2	9.7	13	2017.8	60
15	14	5	8	2	1	3.2	13	1877.4	60
15	14	6	8	2	1	5.7	24	1762.3	60

15	14	7	8	2	2	8.3	13	1710.2	60
15	14	8	8	2	2	30.6	13	1554.4	60
16	14	30	7	2	2	1.4	21	1529.1	60
16	14	1	8	2	2	1.1	13	1537.8	60
16	14	3	8	2	2	1.8	21	1384.3	60
16	14	5	8	2	2	1.2	13	1468.5	60
16	14	7	8	2	2	0.9	24	1427	60
Condition 3		FR8							
11	14	4	9	3	2	1.9	13	1874.1	60
11	14	5	9	3	2	1.7	24	1798.4	60
11	14	6	9	3	2	1.4	21	2372.6	60
11	14	7	9	3	2	14.5	13	1795.8	60
11	14	8	9	3	2	5.8	24	1735.2	60
12	14	4	9	3	2	4.6	24	1873.7	60
12	14	5	9	3	1	11.5	13	2138.7	60
12	14	6	9	3	2	7.3	13	2015.4	60
12	14	7	9	3	1	8.4	13	1988.4	60
12	14	8	9	3	2	5.2	13	1946.5	60
13	14	4	9	3	2	1.7	13	1892.7	60
13	14	5	9	3	2	3.1	13	2000.1	60
13	14	6	9	3	2	3.3	21	2395	60
13	14	7	9	3	2	1.7	13	2144.7	60

13	14	8	9	3	2	3.8	21	2398.6	60
14	14	4	9	3	2	2.4	13	1665.3	60
14	14	5	9	3	2	1.7	24	2392.1	60
14	14	6	9	3	1	1	13	1876.9	60
14	14	7	9	3	2	0	24	1663.4	60
14	14	8	9	3	1.5	-0.7	24	1769.2	60
15	14	4	9	3	2	2.1	24	2027.4	60
15	14	5	9	3	2	17.3	21	2344.7	60
15	14	6	9	3	2	1.7	21	1928.2	60
15	14	7	9	3	1	24.6	13	1968.7	60
15	14	8	9	3	2	3.5	22	2399.4	60
16	14	28	8	3	2	1.2	24	1670.7	60
16	14	30	8	3	2	1.1	13	1739.4	60
16	14	1	9	3	2	2.3	13	1661.7	60
16	14	4	9	3	2	1.5	13	1780.1	60
16	14	6	9	3	2	3.4	13	1623.3	60
Condition 4		FR32							
11	14	29	9	4	2	5.2	21	2275.1	60
11	14	30	9	4	2	3	24	2397.9	60
11	14	1	10	4	2	4.1	21	2057.2	60
11	14	2	10	4	2	2	21	2320.1	60
11	14	3	10	4	2	2	21	2398.2	60

12	14	29	9	4	2	17.9	24	2396.6	60
12	14	30	9	4	2	25	11	2390.8	60
12	14	1	10	4	2	4.5	21	2368.6	60
12	14	2	10	4	2	2.9	21	2387.6	60
12	14	3	10	4	2	5.9	21	2392	60
13	14	25	9	4	2	10.3	21	2399.9	60
13	14	26	9	4	2	2.3	24	2399.2	60
13	14	27	9	4	2	3	24	2400	60
13	14	28	9	4	2	2.5	13	2384.2	60
13	14	29	9	4	2	4	21	2256.1	60
14	14	29	9	4	2	1.1	21	2106	60
14	14	30	9	4	2	0.3	21	2370.5	60
14	14	1	10	4	2	1.4	21	2287.5	60
14	14	2	10	4	2	0.3	21	2395.2	60
14	14	3	10	4	2	11.4	21	2206.5	60
15	14	29	9	4	2	6.4	21	1754.6	60
15	14	30	9	4	2	1.4	21	2198.2	60
15	14	1	10	4	2	66.4	21	2235.3	60
15	14	2	10	4	2	1.4	24	2385.8	60
15	14	3	10	4	2	2.8	21	2375.4	60
16	14	18	10	4	2	1.5	13	2255.8	60
16	14	20	10	4	2	1	24	2387.6	60

16	14	22	10	4	2	171.3	22	2399.4	60
16	14	24	10	4	2	4	11	2171	60
16	14	26	10	4	2	0.1	21	2389.5	60
Condition 5		FR64							
11	14	27	10	5	2	4.2	21	2397.1	60
11	14	28	10	5	2	7.8	22	2349.6	60
11	14	29	10	5	1	5.2	13	2399.4	60
11	14	30	10	5	1	66	24	2400	60
11	14	31	10	5	2	8.3	21	2398.7	60
12	14	25	10	5	1	6.6	24	2399.2	60
12	14	26	10	5	1	7.8	12	2381	60
12	14	27	10	5	2	6	24	2397.3	60
12	14	3	11	5	2	10.9	13	2384.1	60
12	14	4	11	5	1	3.5	21	2327.6	60
14	14	27	10	5	2	1	21	1953.1	60
14	14	28	10	5	2	3	11	1365.7	60
14	14	29	10	5	2	1.4	21	1435.3	60
14	14	30	10	5	2	2.4	11	1765.7	60
14	14	31	10	5	2	3	24	2382	60
15	14	14	11	5	2	1.4	21	1041.7	60
15	14	15	11	5	2	2.2	21	2304.7	60
15	14	16	11	5	2	2.8	21	2354.1	60

15	14	17	11	5	2	0.8	21	2318.1	60
15	14	18	11	5	2	7.9	21	2319.8	60
16	14	14	11	5	2	8	21	2113	60
16	14	15	11	5	1	5	21	2398.3	60
16	14	16	11	5	2	14.8	21	2313.2	60
16	14	17	11	5	2	3.2	24	2399.5	60
16	14	18	11	5	2	2.1	13	2399.7	60
Condition 6		FR128							
11	14	14	11	6	2	3.5	21	2394.2	60
11	14	15	11	6	2	0.7	24	2399	60
11	14	16	11	6	2	21.8	13	2399.7	60
11	14	17	11	6	2	1.5	13	2363.5	60
11	14	18	11	6	2	1.4	21	2399.7	60
12	14	16	11	6	2	19.5	21	2399.6	60
12	14	17	11	6	2	17.4	21	2389	60
12	14	18	11	6	2	3.9	13	2397.5	60
12	14	19	11	6	2	18.6	22	2395.7	60
12	14	20	11	6	2	29.7	11	2131.1	60
14	14	21	11	6	1	6.3	11	1520.7	60
14	14	22	11	6	2	0.8	13	555.3	60
14	14	23	11	6	2	2.1	11	2384.7	60
14	14	24	11	6	2	1.4	11	1294.9	60

14	14	25	11	6	1	2.1	13	2101.9	60
15	14	27	11	6	2	42	13	2362	60
15	14	28	11	6	2	31.9	21	2371.4	60
15	14	29	11	6	2	25.9	21	2399.7	60
15	14	30	11	6	2	61.7	21	2244.7	60
15	14	1	12	6	2	44	11	1160.4	60
16	14	27	11	6	2	0.8	24	2399.7	60
16	14	28	11	6	2	1.3	21	2396.5	60
16	14	29	11	6	2	0.7	22	2400	60
16	14	30	11	6	2	3.5	13	2398.5	60
16	14	1	12	6	2	4.4	21	2392	60
Condition 7		FR1							
11	15	5	1	7	2	22.8	13	1742.7	60
11	15	6	1	7	2	6.4	13	1626.8	60
11	15	7	1	7	2	11.2	24	1512	60
11	15	8	1	7	2	2.8	24	1516.8	60
11	15	9	1	7	2	1.3	13	1587.5	60
12	15	5	1	7	2	10.3	21	2076.4	60
12	15	6	1	7	2	20.1	13	1884.2	60
12	15	7	1	7	2	11.8	21	2352.5	60
12	15	8	1	7	2	11.7	13	1578	60
12	15	9	1	7	2	5.9	13	1795.1	60

14	15	12	1	7	1	1.4	13	1560.4	60
14	15	13	1	7	2	4.4	13	2046	60
14	15	14	1	7	2	2.1	21	2204	60
14	15	15	1	7	2	0.9	13	1710.4	60
14	15	16	1	7	2	38.4	21	1815.2	60
15	15	12	1	7	2	25.8	21	2348.6	60
15	15	13	1	7	2	6	13	1869.4	60
15	15	14	1	7	2	29.5	21	2399.8	60
15	15	15	1	7	2	3.2	13	1815.1	60
15	15	16	1	7	2	24	13	2395.2	60
16	15	19	2	7	2	114.6	21	1820.7	60
16	15	20	2	7	2	0.9	13	1536.7	60
16	15	21	2	7	2	37.8	21	2365.4	60
16	15	22	2	7	2	68.1	24	1565.1	60
16	15	23	2	7	2	74.6	21	1510.1	60
Condition 8		FR8							
11	14	14	12	8	2	2.8	24	1940.7	60
11	14	15	12	8	2	6.6	13	1870.3	60
11	14	16	12	8	2	1.8	13	1828.1	60
11	14	17	12	8	2	6.2	13	1802.7	60
11	14	18	12	8	2	26	13	1825	60
12	14	14	12	8	2	12	13	2192.6	60

12	14	15	12	8	1	5.5	13	2336.5	60
12	14	16	12	8	2	1.4	13	1956.9	60
12	14	17	12	8	1	8.9	13	2093.8	60
12	14	18	12	8	2	3.4	21	2393.1	60
14	14	14	12	8	2	5.1	21	2207.8	60
14	14	15	12	8	2	1.2	13	1910	60
14	14	16	12	8	2	0.7	21	2359	60
14	14	17	12	8	2	0.4	13	1724.5	60
14	14	18	12	8	2	1.4	21	2391.6	60
15	14	14	12	8	2	4.9	21	2397.5	60
15	14	15	12	8	2	3.3	21	2326.7	60
15	14	16	12	8	2	5	21	2373.4	60
15	14	17	12	8	2	2.7	13	2129.4	60
15	14	18	12	8	2	22.3	21	2250.1	60
16	15	23	1	8	2	1.6	24	2394.1	60
16	15	24	1	8	2	10.4	21	1323.7	60
16	15	25	1	8	2	4.2	13	1169.3	60
16	15	26	1	8	2	9.3	24	1803	60
16	15	27	1	8	2	1.8	11	1358.7	60
Condition 9		FR1 reversal							
11	15	7	2	9	1	0.5	13	1454.4	60
11	15	8	2	9	2	33.7	21	1432.5	60

11	15	9	2	9	1	11.9	13	1534.6	60
11	15	10	2	9	2	4	24	1502.8	60
11	15	11	2	9	1	13.1	13	1440.9	60
12	15	16	2	9	1	6	24	1891.4	60
12	15	17	2	9	1	8.3	11	2354.2	60
12	15	18	2	9	1	10.6	21	1887.8	60
12	15	19	2	9	1	2.3	13	1759.7	60
12	15	20	2	9	1	1798.4	11	2399.1	60
14	15	7	2	9	2	2.7	13	1483.8	60
14	15	8	2	9	2	13	24	1608.7	60
14	15	9	2	9	2	40.5	21	1676.8	60
14	15	10	2	9	2	71.3	24	1200.7	60
14	15	11	2	9	2	48.8	22	2399.9	60
15	15	8	2	9	1	49.4	21	2361.8	60
15	15	9	2	9	1	23.8	13	2332.6	60
15	15	10	2	9	1	36.2	22	2217.3	60
15	15	11	2	9	2	15.1	21	2327	60
15	15	12	2	9	2	30.3	12	1824.1	60
16	15	13	3	9	2	28.4	21	1676.5	60
16	15	14	3	9	2	8.8	21	1515.7	60
16	15	15	3	9	2	64.5	21	1503.4	60
16	15	16	3	9	2	24.2	21	1105.6	60

16	15	17	3	9	2	37.9	22	990.2	60

Condition 10 FR32 reversal

11	15	15	3	10	1	20.8	21	1277.4	60
11	15	16	3	10	2	17.6	21	1159	60
11	15	17	3	10	2	29.9	11	1032.9	60
11	15	18	3	10	1	3.9	11	1021.9	60
11	15	19	3	10	2	5.2	11	1170.9	60
12	15	19	3	10	1	9.5	24	1491.3	60
12	15	24	3	10	2	38.6	22	2398.9	60
12	15	25	3	10	1	6.5	12	2216.6	60
12	15	26	3	10	1	12.6	11	2398.1	60
12	15	27	3	10	2	25.7	13	2399.9	60
14	15	8	3	10	1	13.1	22	2076.5	60
14	15	9	3	10	2	2.3	11	927.1	60
14	15	10	3	10	1	2.7	24	1672.1	60
14	15	12	3	10	2	2.1	11	669.6	60
14	15	13	3	10	1	0.9	21	722.9	60
15	15	8	3	10	2	1.9	21	2398.6	60
15	15	9	3	10	1	2.9	24	1719.5	60
15	15	10	3	10	2	2.5	11	2396.8	60
15	15	12	3	10	2	1	21	1901.4	60
15	15	13	3	10	2	8.3	24	1667	60

RVI	L Peck	R peck	Prop.	Median	L Time	R Time	CO L>R	CO R>L	COP L>R
Condition 1									
Hen 11									
60	344	560	0.381	0.381	373.1	779.8	59	59	59
60	359	482	0.427	0.427	356.4	759.6	50	50	50
60	209	256	0.449	0.449	209.4	414.7	31	30	31
60	405	488	0.454	0.454	393.9	842.7	77	77	77
60	33	58	0.363	0.363	441.6	1764.8	11	11	11
Hen 12									
60	454	514	0.469	0.469	512.5	588.6	61	60	61
60	435	494	0.468	0.468	544.6	591.2	70	69	70
60	456	493	0.481	0.481	502.4	594.3	66	65	66
60	464	565	0.451	0.451	493.1	633.4	66	66	66
60	466	604	0.436	0.436	510.8	600.2	68	67	68
Hen 13									
60	257	287	0.472	0.472	426.7	793.1	50	50	50
60	250	281	0.471	0.471	384	1006.2	53	53	53
60	193	231	0.455	0.455	344.9	804.5	39	39	39
60	224	260	0.463	0.463	383.6	855.6	39	38	39
60	262	231	0.531	0.531	401.7	965.2	39	39	39
Hen 14									
60	410	346	0.542	0.542	596.9	572.6	58	57	58
60	432	398	0.520	0.520	573	572.5	62	61	62
60	344	438	0.440	0.440	470.8	643.3	49	49	49
60	344	415	0.453	0.453	472.2	654.7	51	52	51

60	508	435	0.539	0.539	601.1	596.4	64	63	64
Hen 15									
60	407	340	0.545	0.545	644.6	509.9	58	58	58
60	395	389	0.504	0.504	700.1	512.8	65	65	65
60	332	332	0.500	0.500	657.6	489.3	68	67	68
60	361	308	0.540	0.540	770.5	489.1	64	64	64
60	391	244	0.616	0.616	811.5	482.1	51	52	51
Hen 16									
45	489	362	0.575	0.575	508.8	346.2	45	44	45
45	548	445	0.552	0.552	482.5	349.6	50	50	50
45	479	353	0.576	0.576	492.4	361.4	43	43	43
45	620	372	0.625	0.625	572.3	328.7	42	41	42
45	429	344	0.555	0.555	507.3	306	38	37	38
Condition 2									
Hen 11									
60	234	550	0.298	0.231	215.9	1869	38	37	38
60	156	899	0.148	0.199	143.7	2012.5	28	27	28
60	143	720	0.166	0.231	123.6	2031.3	27	26	27
60	197	252	0.439	0.231	297.9	1843.5	29	28	29
60	240	797	0.231	0.220	212	1133	37	37	37
Hen 12									
60	396	1071	0.270	0.353	383.6	1366.1	57	56	57
60	390	576	0.404	0.337	408.3	704.7	52	51	52
60	372	576	0.392	0.392	894.5	928.4	54	54	54
60	339	592	0.364	0.378	362.5	837.6	59	59	59

60	365	681	0.349	0.364	316.1	839.6	55	55	55
Hen 13									
60	194	416	0.318	0.425	228	1016.7	40	40	40
60	201	435	0.316	0.317	234.1	1141.7	39	39	39
60	213	360	0.372	0.318	223.7	1119.8	36	36	36
60	204	408	0.333	0.326	208.7	1049.5	36	36	36
60	228	424	0.350	0.333	257.6	1058.7	43	43	43
Hen 14									
60	493	605	0.449	0.494	306.1	856.3	56	56	56
60	339	498	0.405	0.427	283.5	896.6	43	42	43
60	358	538	0.400	0.405	287.6	858.4	45	45	45
60	292	465	0.386	0.402	319.1	1479.7	39	38	39
60	326	443	0.424	0.405	267.9	913	43	43	43
Hen 15									
60	146	558	0.207	0.412	220.4	1483.7	42	42	42
60	106	563	0.158	0.183	185.3	1389.9	28	28	28
60	152	351	0.302	0.207	272.2	1184.3	36	35	36
60	158	421	0.273	0.240	255	1145.5	40	40	40
60	138	339	0.289	0.273	237.5	987.9	41	41	41
Hen 16									
60	191	557	0.255	0.405	154.8	2035.7	30	29	30
60	314	749	0.295	0.275	193.4	1048.8	48	48	48
60	185	426	0.303	0.295	155.8	1987.4	30	29	30
60	255	694	0.269	0.282	185.2	990.6	45	45	45
60	317	696	0.313	0.295	230.5	899.4	47	46	47

Condition 3

Hen 11

60	301	1314	0.186	0.231	181.3	1292.1	36	36	36
60	329	1164	0.220	0.220	188.9	1219	38	37	38
60	219	1105	0.165	0.186	138.6	1927.9	26	25	26
60	338	927	0.267	0.203	244.4	1120.1	40	40	40
60	358	1011	0.262	0.220	204.3	1121.8	37	36	37

Hen 12

60	201	469	0.300	0.349	300.4	1151.3	35	34	35
60	204	838	0.196	0.300	262.4	1397.2	32	32	32
60	237	705	0.252	0.252	263.4	1295.1	33	33	33
60	205	573	0.263	0.258	262.1	1256.2	28	28	28
60	263	789	0.250	0.252	258.1	1263.4	31	31	31

Hen 13

60	207	522	0.284	0.333	203.8	1241.5	42	42	42
60	183	522	0.260	0.284	203.7	1348	37	37	37
60	163	495	0.248	0.260	193.7	1705.4	34	33	34
60	206	457	0.311	0.272	193.3	1433.9	31	31	31
60	150	353	0.298	0.284	171.4	1594.1	26	25	26

Hen 14

60	460	731	0.386	0.386	290.6	959.1	44	44	44
60	432	893	0.326	0.386	307.9	1675.8	53	52	53
60	306	631	0.327	0.327	202	1281	34	34	34
60	220	678	0.245	0.326	150.7	1109.5	29	28	29
60	143	628	0.185	0.326	106.4	1270.45	24	23	24

Hen 15									
60	175	738	0.192	0.273	289.7	1263.3	35	34	35
60	112	516	0.178	0.192	166.4	1877.8	22	22	22
60	54	432	0.111	0.178	99.6	2070.9	14	13	14
60	169	509	0.249	0.185	224.4	1285.4	32	32	32
60	97	515	0.158	0.178	172.1	1921.7	23	22	23
Hen 16									
60	421	757	0.357	0.313	257.3	988.6	47	46	47
60	487	898	0.352	0.352	256.3	1066.7	54	54	54
60	401	793	0.336	0.352	217.2	1023.7	44	44	44
60	330	1047	0.240	0.344	179	1186.4	43	43	43
60	453	585	0.436	0.352	246.9	938.4	40	40	40
Condition 4									
Hen 11									
60	154	587	0.208	0.262	184.9	1315.7	34	33	34
60	133	582	0.186	0.208	105.2	1407.4	21	20	21
60	224	518	0.302	0.208	232.9	1365.9	34	33	34
60	123	699	0.150	0.197	152.4	1513.5	27	26	27
60	160	853	0.158	0.186	153	1351.3	34	33	34
Hen 12									
60	98	532	0.156	0.250	281.9	1219	30	29	30
60	115	411	0.219	0.219	289.9	1223.1	21	22	21
60	92	181	0.337	0.219	445.5	1454.7	12	12	12
60	102	561	0.154	0.187	187.3	1544.6	25	24	25
60	93	459	0.168	0.194	245.1	1340.7	30	29	30

Hen 13									
60	64	259	0.198	0.231	227.2	1231.9	22	22	22
60	57	283	0.168	0.262	120.4	1055.6	20	19	20
60	76	198	0.277	0.264	181.6	1058.5	24	23	24
60	51	142	0.264	0.262	109.1	1378.4	21	21	21
60	67	190	0.261	0.261	134.2	1171.1	16	15	16
Hen 14									
60	120	370	0.245	0.245	118.5	1750.9	17	16	17
60	69	405	0.146	0.185	55.7	1823.2	10	9	10
60	78	197	0.284	0.245	87.7	1880.1	12	11	12
60	166	321	0.341	0.264	224.4	1735.3	19	18	19
60	84	224	0.273	0.278	83.7	1832	10	9	10
Hen 15									
60	19	75	0.202	0.202	74	2132.9	6	5	6
60	60	299	0.167	0.167	108.5	1741	12	11	12
60	50	170	0.227	0.202	69.1	1859.2	10	9	10
60	104	376	0.217	0.209	142.8	1637	17	16	17
60	101	467	0.178	0.197	111.5	1642	18	17	18
Hen 16									
60	344	763	0.311	0.311	232.6	1006.6	66	66	66
60	286	576	0.332	0.332	195.1	1129	46	45	46
60	154	122	0.558	0.332	98.4	1807.5	15	14	15
60	192	337	0.363	0.347	1022.1	763.2	28	28	28
60	144	793	0.154	0.332	129.3	1368.6	36	35	36
Condition 5									

Hen 11									
60	68	272	0.200	0.158	168.8	1102.3	20	19	20
60	49	260	0.159	0.159	155.3	839	21	20	21
60	104	199	0.343	0.200	203.6	794.3	41	41	41
60	107	193	0.357	0.272	192.1	593	17	16	17
60	113	250	0.311	0.311	175	737.6	28	27	28
Hen 12									
60	83	71	0.539	0.253	284.4	573.3	16	15	16
60	46	58	0.442	0.305	197	758.4	14	14	14
60	14	19	0.424	0.433	96.6	281.9	3	3	3
60	90	591	0.132	0.433	178.9	1020.3	20	20	20
60	100	206	0.327	0.424	393.4	1103.1	24	23	24
Hen 14									
60	50	129	0.279	0.281	68.4	1884.4	13	12	13
60	38	98	0.279	0.279	37.4	615.2	7	7	7
60	149	87	0.631	0.279	252.9	1522.5	16	15	16
60	119	41	0.744	0.455	143.6	956.5	10	10	10
60	112	89	0.557	0.557	129.6	365.7	15	14	15
Hen 15									
60	32	172	0.157	0.178	52	1748.7	8	7	8
60	22	204	0.097	0.157	90	1829.9	8	7	8
60	61	312	0.164	0.157	82.7	1609	13	12	13
60	91	453	0.167	0.160	132.9	996.1	20	19	20
60	54	595	0.083	0.157	94.7	1266	16	15	16
Hen 16									

60	88	328	0.212	0.212	65.8	1596.7	14	13	14
60	39	172	0.185	0.185	76.2	1903.7	10	9	10
60	126	671	0.158	0.185	137.8	1363.6	37	36	37
60	82	654	0.111	0.171	65	1242.2	21	20	21
60	80	1135	0.066	0.158	74.3	1259.8	19	19	19
Condition 6									
Hen 11									
60	36	584	0.058	0.311	38.3	1101.2	9	8	9
60	26	336	0.072	0.072	31	863.2	7	6	7
60	5	22	0.185	0.072	4.4	523.7	1	1	1
60	16	895	0.018	0.065	21.2	1442.8	4	4	4
60	35	521	0.063	0.063	31.7	989.8	6	5	6
Hen 12									
60	56	248	0.184	0.256	130.5	593.9	11	10	11
60	46	338	0.120	0.158	105.9	623.4	12	11	12
60	45	354	0.113	0.152	82.3	786.5	11	11	11
60	53	325	0.140	0.130	186.6	729.7	14	13	14
60	25	169	0.129	0.129	220.5	778.6	8	8	8
Hen 14									
60	13	116	0.101	0.594	41.8	652.5	4	4	4
60	12	58	0.171	0.364	16	222.9	3	3	3
60	15	306	0.047	0.136	53.9	1091.9	6	6	6
60	27	568	0.045	0.074	38.4	897.9	4	4	4
60	71	264	0.212	0.101	87.7	555.9	10	10	10
Hen 15									

60	44	457	0.088	0.088	68.2	1067.5	11	11	11
60	57	335	0.145	0.088	67.2	833.6	9	9	9
60	38	391	0.089	0.089	54.9	1229.1	9	8	9
60	28	332	0.078	0.088	35.7	988.3	5	5	5
60	21	341	0.058	0.088	25.3	596.9	3	4	3
Hen 16									
60	67	558	0.107	0.107	61.3	894.8	17	16	17
60	66	528	0.111	0.107	56.9	880.1	15	14	15
60	48	442	0.098	0.107	43.6	837.6	11	10	11
60	58	612	0.087	0.103	65.7	1081.1	14	14	14
60	40	491	0.075	0.098	35.5	885	8	7	8
Condition 7									
Hen 11									
60	211	1105	0.160	0.160	165.6	1259.5	28	28	28
60	175	844	0.172	0.160	165.9	1165.4	29	29	29
60	322	758	0.298	0.172	254.4	950.4	37	36	37
60	262	917	0.222	0.197	178.6	1040.9	30	29	30
60	348	649	0.349	0.222	261.9	1032.6	38	38	38
Hen 12									
60	177	581	0.234	0.132	352.6	1757	25	24	25
60	148	756	0.164	0.164	286.1	1255.1	23	24	23
60	142	513	0.217	0.217	225.1	1908.9	18	17	18
60	110	688	0.138	0.190	213.7	1027.8	20	20	20
60	108	843	0.114	0.164	209.8	1254.7	20	20	20
Hen 14									

60	254	821	0.236	0.231	243.5	1007.6	39	39	39
60	187	1272	0.128	0.197	270.9	1460.7	41	41	41
60	55	561	0.089	0.143	116.6	2066.8	19	18	19
60	257	855	0.231	0.180	294.4	1099.5	44	44	44
60	93	624	0.130	0.130	146.6	1976.8	22	21	22
Hen 15									
60	113	400	0.220	0.150	142.9	1936.3	20	19	20
60	134	852	0.136	0.150	214.8	1354.9	26	26	26
60	89	888	0.091	0.136	139	1889.3	20	19	20
60	126	776	0.140	0.138	195.2	1318.3	26	26	26
60	120	763	0.136	0.136	198.3	1894.8	25	25	25
Hen 16									
60	187	179	0.511	0.404	183.2	1830.8	26	26	26
60	371	672	0.356	0.404	243.1	995.3	37	37	37
60	351	622	0.361	0.361	261.4	1822.1	43	42	43
60	414	389	0.516	0.436	329.8	854.7	46	45	46
60	206	266	0.436	0.436	212.9	1875.8	32	32	32
Condition 8									
Hen 11									
60	269	1171	0.187	0.063	165.4	1390.6	28	27	28
60	252	1093	0.187	0.187	150	1313	24	24	24
60	261	927	0.220	0.187	179.8	1264.3	27	27	27
60	290	816	0.262	0.204	178.9	1220.9	28	28	28
60	216	1155	0.158	0.187	148.1	1272.8	22	22	22
Hen 12									

60	146	887	0.141	0.140	238.2	1396.5	25	25	25
60	133	733	0.154	0.141	236.2	1577.7	21	21	21
60	168	634	0.209	0.154	222.2	1209.4	24	24	24
60	113	775	0.127	0.147	189	1361	21	21	21
60	118	776	0.132	0.141	204.5	1750.9	22	21	22
Hen 14									
60	75	608	0.110	0.078	67.3	1241.6	15	14	15
60	261	704	0.270	0.161	196.5	1173.5	32	32	32
60	196	670	0.226	0.219	195	1774.5	30	29	30
60	253	706	0.264	0.245	191.2	1030.7	31	31	31
60	174	926	0.158	0.226	139.1	1827.1	27	26	27
Hen 15									
60	81	846	0.087	0.078	108.9	1648.4	20	19	20
60	85	988	0.079	0.079	113.1	1702.7	20	19	20
60	69	632	0.098	0.087	86.4	1920.4	13	12	13
60	121	756	0.138	0.093	167.9	1348.5	26	26	26
60	78	443	0.150	0.098	127.2	1793.5	17	16	17
Hen 16									
60	248	448	0.356	0.087	194.7	1911.2	31	30	31
60	35	79	0.307	0.307	39.5	2226.6	9	8	9
60	42	155	0.213	0.307	35.9	561.8	8	8	8
60	270	634	0.299	0.303	215.8	1157.5	32	31	32
60	220	324	0.404	0.307	169.4	834.3	26	26	26
Condition 9									
Hen 11									

60	650	418	0.609	0.349	689.3	472.9	42	42	42
60	49	24	0.671	0.609	553.9	749.5	17	16	17
60	716	448	0.615	0.615	781.9	437.5	48	48	48
60	614	511	0.546	0.612	676.9	524.8	56	55	56
60	633	450	0.584	0.609	649.7	481.3	60	60	60
Hen 12									
60	790	281	0.738	0.138	1295.2	289.6	40	39	40
60	776	194	0.800	0.738	1844.8	244.5	42	42	42
60	360	174	0.674	0.738	1419	772.2	27	26	27
60	727	250	0.744	0.741	1194.6	259.8	40	40	40
60	51	29	0.638	0.738	448.9	76.5	5	5	5
Hen 14									
60	685	465	0.596	0.231	695.8	471.2	60	60	60
60	958	417	0.697	0.596	841.5	442.3	75	74	75
60	280	109	0.720	0.697	293.7	1939.7	26	25	26
60	8	11	0.421	0.646	296.4	1996.2	3	2	3
60	739	255	0.743	0.697	869.6	1155.5	51	50	51
Hen 15									
60	283	158	0.642	0.140	846.2	1246.6	31	30	31
60	472	95	0.832	0.642	1217.4	929	29	29	29
60	38	15	0.717	0.717	1314.8	933.7	5	4	5
60	179	50	0.782	0.749	1034.5	1215.9	14	13	14
60	24	16	0.600	0.717	1609.9	708.7	6	6	6
Hen 16									
60	553	173	0.762	0.516	594.1	1498.7	48	48	48

60	519	174	0.749	0.749	561.4	700.9	62	61	62
60	377	150	0.715	0.749	538.5	638	43	42	43
60	260	91	0.741	0.745	413.8	1762.1	26	25	26
60	182	80	0.695	0.741	400.1	1801.2	25	24	25
Condition 10									
Hen 11									
60	381	55	0.874	0.729	700.1	117.1	9	8	9
60	311	87	0.781	0.828	467.4	138.2	14	14	14
60	156	19	0.891	0.874	1942.9	263.8	6	6	6
60	285	47	0.858	0.866	1918.2	110.4	11	11	11
60	287	167	0.632	0.820	1859.2	236.9	26	26	26
Hen 12									
60	98	53	0.649	0.649	482.3	253.3	14	13	14
60	456	137	0.769	0.649	1048.4	238.7	20	19	20
60	316	74	0.810	0.769	1145.2	184.4	21	21	21
60	720	71	0.910	0.790	1349.7	113.4	15	15	15
60	567	45	0.926	0.810	1183	101.5	12	12	12
Hen 14									
60	176	57	0.755	0.749	1665.7	510.3	23	22	23
60	113	7	0.942	0.849	2131.1	173	4	4	4
60	535	204	0.724	0.755	661.9	361.7	32	31	32
60	278	52	0.842	0.842	2109.1	66.2	7	7	7
60	205	104	0.663	0.724	274.8	162.8	10	9	10
Hen 15									
60	748	85	0.898	0.782	1287	170.9	21	20	21

60	486	61	0.888	0.888	948.5	124.1	21	20	21
60	644	76	0.894	0.894	1115.9	141.9	21	21	21
60	569	97	0.854	0.891	950	174.5	20	19	20
60	294	43	0.872	0.880	564	74.7	11	10	11

COP R>L	LFR	RFR	Pecks L	Pecks R	L RFT	R RFT	TL LT	TL RT	Tot time
Condition 1									
Hen11									
327	0	0	0	0	15	15	0	0	1252.1
282	0	0	0	0	15	15	0	0	1218.2
153	0	0	0	0	7	10	0	0	2400.1
355	0	0	0	0	15	15	0	0	1340.1
30	0	0	0	0	3	4	0	0	2400.1
Hen 12									
500	0	0	0	0	15	15	0	0	1203.1
498	0	0	0	0	15	15	0	0	1235.4
481	0	0	0	0	15	15	0	0	1197.1
529	0	0	0	0	15	15	0	0	1225.5
546	0	0	0	0	15	15	0	0	1231.1
Hen 13									
179	0	0	0	0	15	15	0	0	1317.6
182	0	0	0	0	15	15	0	0	1487.7
127	0	0	0	0	15	15	0	0	1246.1
139	0	0	0	0	15	15	0	0	1343.5
167	0	0	0	0	15	15	0	0	1474.3

Hen 14									
373	0	0	0	0	15	15	0	0	1272.1
407	0	0	0	0	15	15	0	0	1249.5
310	0	0	0	0	15	15	0	0	1212.2
317	0	0	0	0	15	15	0	0	1228.9
442	0	0	0	0	15	15	0	0	1300.9
Hen 15									
283	0	0	0	0	15	15	0	0	1262.4
298	0	0	0	0	15	15	0	0	1314.7
295	0	0	0	0	15	15	0	0	1247.2
267	0	0	0	0	15	15	0	0	1362.1
212	0	0	0	0	15	15	0	0	1422.2
Hen 16									
315	0	0	0	0	15	15	0	0	954.1
437	0	0	0	0	15	15	0	0	930.1
305	0	0	0	0	15	15	0	0	951.9
332	0	0	0	0	15	15	0	0	997.3
296	0	0	0	0	15	15	0	0	910.9
Condition 2									
Hen 11									
226	1	1	14	15	14	15	31	12.8	2400.1
177	1	1	11	13	11	13	7.5	13.8	2400.1
148	1	1	11	12	11	12	7.1	12.4	2400.1
172	1	1	12	13	12	13	9.8	16.1	2400.1
257	1	1	15	15	15	15	7.6	16.3	1647

Hen 12									
484	1	1	15	15	15	15	19.8	20.1	2073.6
443	1	1	15	15	15	15	16.6	35.1	1446.8
427	1	1	15	15	15	15	20.3	25.4	2153
476	1	1	15	15	15	15	24.7	26.4	1542.4
514	1	1	15	15	15	15	20.1	19.1	1477.7
Hen 13									
162	1	1	15	15	15	15	12.3	10.9	1546.3
166	1	1	15	15	15	15	12.2	11.6	1677.1
150	1	1	15	15	15	15	12.8	9.8	1643.1
168	1	1	15	15	15	15	12.7	8.6	1557.1
187	1	1	15	15	15	15	10.4	7.3	1611.8
Hen 14									
514	1	1	15	15	15	15	20.3	19.3	1484.5
357	1	1	15	15	15	15	14.9	15.9	1490
386	1	1	15	15	15	15	13.4	16.5	1456.4
320	1	1	15	15	15	15	20.1	34	2131.2
349	1	1	15	15	15	15	18.4	28.8	1508.5
Hen 15									
169	1	1	15	15	15	15	12.7	23.2	2026.8
102	1	1	15	15	15	15	18.2	14.4	1886.4
123	1	1	15	15	15	15	13.2	19.4	1771.3
138	1	1	15	15	15	15	12.2	21.1	1719.2
139	1	1	15	15	15	15	11.3	18.7	1563.4
Hen 16									

178	1	1	10	11	10	11	4.8	9.5	2400.1
311	1	1	15	15	15	15	6.2	19.4	1546.8
150	1	1	12	13	12	13	7.4	17.2	2400.1
229	1	1	15	15	15	15	6.5	16.3	1477.5
284	1	1	15	15	15	15	8.9	19.5	1436
Condition 3									
Hen 11									
391	8	8	120	120	15	15	62.8	68.2	1883.1
400	8	8	120	120	15	15	52.8	68.5	1807.4
286	8	8	88	104	11	13	55.8	55.6	2400.1
404	8	8	120	120	15	15	64.2	84.6	1804.8
417	8	8	120	120	15	15	57.4	78.4	1744.2
Hen 12									
268	8	8	120	120	15	15	68.1	81.9	1882.7
261	8	8	120	120	15	15	94.7	105.5	2147.7
268	8	8	120	120	15	15	79.6	103.3	2024.4
224	8	8	120	120	15	15	92	102.7	1997.4
310	8	8	120	120	15	15	73.7	79	1955.6
Hen 13									
241	8	8	120	120	15	15	75.5	102	1901.7
199	8	8	120	120	15	15	75.2	102.5	2009.1
162	8	8	112	120	14	15	86.2	143.7	2400.1
201	8	8	120	120	15	15	97.3	151.3	2153.7
142	8	8	112	120	14	15	113.6	250.6	2400.1
Hen 14									

572	8	8	120	120	15	15	63.1	82.2	1674.3
538	8	8	112	120	14	15	63	83.3	2400.1
332	8	8	120	120	15	15	59.2	66.4	1885.9
280	8	8	120	120	15	15	62.3	74.1	1672.4
160	8	8	120	120	15	15	60.35	66.2	1778.2
Hen 15									
186	8	8	120	120	15	15	117.4	87.5	2036.4
123	8	8	80	96	10	12	60.4	75.5	2400.1
50	8	8	56	56	7	7	56.2	42.9	2400.1
165	8	8	120	120	15	15	83.5	83.5	1977.7
114	8	8	80	80	10	10	62.8	55.7	2400.1
Hen 16									
422	8	8	120	120	15	15	63.7	91.5	1679.7
573	8	8	120	120	15	15	59.1	86	1748.4
445	8	8	120	120	15	15	59.1	90.8	1670.7
441	8	8	120	120	15	15	58	86.5	1789.1
421	8	8	120	120	15	15	63.3	103.3	1632.3
Condition 4									
Hen 11									
209	32	32	320	352	10	11	289.9	409.8	2400.1
172	32	32	352	385	11	12	294.8	377.9	2400.1
233	32	32	384	416	12	13	265.5	300.6	2400.1
150	32	32	384	416	12	13	228.2	273.9	2400.1
193	32	32	416	416	13	13	273.4	380.4	2400.1
Hen 12									

158	32	32	352	249	11	7	392.9	321.2	2400.1
135	32	32	384	352	12	11	326.3	325	2400.1
76	32	32	160	288	5	9	128.4	238.2	2400.1
153	32	32	256	352	8	11	192.8	296.8	2400.1
139	32	32	352	416	11	13	262.6	324.5	2400.1
Hen 13									
68	32	32	192	256	6	8	366.3	434.7	2400.1
66	32	32	256	280	8	8	446.9	627.1	2400.1
72	32	32	288	332	9	10	398.3	582.9	2400.1
52	32	32	196	288	6	9	317.9	453.4	2400.1
66	32	32	256	320	8	10	426.9	498.6	2400.1
Hen 14									
150	32	32	192	288	6	9	155.5	235.9	2400.1
99	32	32	160	288	5	9	157.3	235	2400.1
102	32	32	160	224	5	7	136.5	184	2400.1
198	32	32	192	128	6	4	243	104	2400.1
109	32	32	96	128	3	4	305.6	102.5	2400.1
Hen 15									
19	32	32	64	96	2	3	61.9	79	2400.1
53	32	32	224	288	7	9	186.2	216.1	2400.1
45	32	32	192	160	6	5	169.3	135.1	2400.1
103	32	32	256	320	8	10	208.4	244.7	2400.1
110	32	32	256	352	8	11	180.5	288.9	2400.1
Hen 16									
416	32	32	480	480	15	15	306.1	438.1	2264.8

289	32	32	448	448	14	14	294.4	521.3	2400.1
123	32	32	160	96	5	3	124.9	123.7	2400.1
215	32	32	256	224	8	7	193.3	277.8	2400.1
214	32	32	320	352	10	11	289.2	418.8	2400.1
Condition 5									
Hen 11									
70	64	64	512	384	8	6	424.9	570.5	2400.1
55	64	64	448	448	7	7	457.3	811.3	2400.1
109	64	64	413	512	6	8	487.2	778.4	2400.1
76	64	64	448	637	7	9	413.2	988.4	2400.1
122	64	64	576	448	9	7	582.4	748.1	2400.1
Hen 12									
45	64	64	384	435	6	6	451	974.3	2400.1
45	64	64	256	320	4	5	446.8	906.9	2400.1
6	64	64	192	371	3	5	303.7	1638.9	2400.1
128	64	64	512	512	8	8	562.2	480.2	2400.1
142	64	64	320	384	5	6	386.5	410.6	2400.1
Hen 14									
56	64	64	192	192	3	3	165.1	225.3	2400.1
42	64	64	192	320	3	5	1219.2	451.9	2400.1
85	64	64	320	256	5	4	231.8	308.1	2400.1
46	64	64	128	320	2	5	749	483.7	2400.1
88	64	64	320	398	5	6	257.3	1542.7	2400.1
Hen 15									
40	64	64	192	320	3	5	206	318.2	2400.1

27	64	64	192	256	3	4	177.2	236.3	2400.1
74	64	64	320	192	5	3	388.4	242.9	2400.1
131	64	64	512	512	8	8	569.7	553.1	2400.1
82	64	64	320	384	5	6	424.8	505.3	2400.1
Hen 16									
84	64	64	320	512	5	8	268.3	341.7	2400.1
43	64	64	256	192	4	3	214.3	136.1	2400.1
187	64	64	512	448	8	7	444.2	299.7	2400.1
112	64	64	576	582	9	9	480.9	442.5	2400.1
132	64	64	526	640	8	10	456.4	441.6	2400.1
Condition 6									
Hen 11									
50	128	128	384	896	3	7	484.9	680.2	2400.1
36	128	128	512	873	4	6	718.1	695.5	2400.1
4	128	128	108	0	0	0	1850	0	2400.1
19	128	128	260	512	2	4	486.9	392.4	2400.1
40	128	128	640	640	5	5	814.7	471.1	2400.1
Hen 12									
55	128	128	896	512	7	4	968.4	586.6	2400.1
74	128	128	896	512	7	4	913.8	638.6	2400.1
71	128	128	645	768	5	6	610.4	815.7	2400.1
80	128	128	768	384	6	3	883.6	498	2400.1
35	128	128	384	512	3	4	722	584.8	2400.1
Hen 14									
10	128	128	384	128	3	1	1513.5	149.3	2400.1

16	128	128	1	256	0	2	1844.9	297	2400.1
27	128	128	128	768	1	6	279.8	908.1	2400.1
23	128	128	128	128	1	1	1313.4	130.2	2400.1
68	128	128	513	640	4	5	970.4	701	2400.1
Hen 15									
57	128	128	513	512	4	4	594.9	553.4	2400.1
59	128	128	640	640	5	5	775.2	600.3	2400.1
44	128	128	512	512	4	4	589	427.6	2400.1
30	128	128	512	640	4	5	590.3	641.7	2400.1
24	128	128	128	384	1	3	1377.3	319.9	2400.1
Hen 16									
105	128	128	896	941	7	7	671.6	642.1	2400.1
94	128	128	768	1024	6	8	595.7	736.9	2400.1
64	128	128	768	896	6	7	653.6	745.5	2400.1
82	128	128	812	640	6	5	666.2	482.1	2400.1
51	128	128	768	896	6	7	646.5	709.6	2400.1
Condition 7									
Hen 11									
245	1	1	15	15	15	15	13.9	14	1751.7
209	1	1	15	15	15	15	7.5	14.9	1635.8
367	1	1	15	15	15	15	11.1	16.5	1521
290	1	1	15	15	15	15	8.2	18.8	1525.8
332	1	1	15	15	15	15	8	15.9	1596.5
Hen 12									
182	1	1	13	13	13	13	16.1	24.9	2400.1

186	1	1	15	15	15	15	25.1	32.4	1893.2
124	1	1	11	12	11	12	22	21.3	2400.1
160	1	1	15	15	15	15	27.2	31.8	1587
165	1	1	15	15	15	15	24.9	34.1	1804.1
Hen 14									
349	1	1	15	15	15	15	23.5	16.4	1569.4
339	1	1	15	15	15	15	22.2	19.3	2055
101	1	1	9	10	9	10	20.3	19.5	2400.1
380	1	1	15	15	15	15	26	21.2	1719.5
152	1	1	11	12	11	12	13.3	13.4	2400.1
Hen 15									
100	1	1	12	12	12	12	27.9	46.9	2400.1
142	1	1	15	15	15	15	8.3	18.8	1878.4
107	1	1	14	15	14	15	30.4	45.9	2400.1
137	1	1	15	15	15	15	11.5	20.4	1824.1
135	1	1	14	14	14	14	11.1	18.6	2400.1
Hen 16									
137	1	1	13	14	13	14	9	14.5	2400.1
367	1	1	15	15	15	15	19.4	10.9	1545.7
383	1	1	13	14	13	14	14.4	14.4	2400.1
404	1	1	15	15	15	15	24.9	19.2	1574.1
200	1	1	10	12	10	12	13.8	19	2400.1
Condition 8									
Hen 11									
305	8	8	120	120	15	15	53.9	61.1	1949.7

279	8	8	120	120	15	15	65.9	68.7	1879.3
297	8	8	120	120	15	15	52.1	63.7	1837.1
310	8	8	120	120	15	15	54.6	75.9	1811.7
249	8	8	120	120	15	15	45.3	66.7	1834
Hen 12									
201	8	8	120	120	15	15	153.8	125.8	2201.6
150	8	8	120	120	15	15	118.4	132.7	2345.5
189	8	8	120	120	15	15	135.9	121.4	1965.9
132	8	8	120	120	15	15	132.1	136.6	2102.8
136	8	8	96	112	12	14	111.5	91.3	2400.1
Hen 14									
138	128	128	384	640	3	5	398.9	612.9	2400.1
331	8	8	120	120	15	15	135	136.5	1919
218	8	8	88	104	11	13	87.6	121	2400.1
304	8	8	120	120	15	15	107.2	128	1733.5
242	8	8	88	104	11	13	102.8	108.8	2400.1
Hen 15									
100	8	8	112	104	14	13	174.4	215.8	2400.1
110	8	8	104	112	13	14	163.5	169.8	2400.1
68	8	8	72	72	9	9	119	103.9	2400.1
139	8	8	120	120	15	15	175.4	168.7	2138.5
81	8	8	88	80	11	10	132.8	131.7	2400.1
Hen 16									
249	8	8	80	80	10	10	62.8	47.5	2400.1
41	8	8	24	40	3	5	21.4	28.2	2400.1

46	8	8	27	40	3	5	1691.7	32.9	2400.1
258	8	8	120	120	15	15	74.1	79.2	1812
194	8	8	96	96	12	12	1102.5	71	2400.1
Condition 9									
Hen 11									
310	1	1	15	15	15	15	12.9	10.3	1463.5
31	1	1	3	1	3	1	46.5	978.1	2400.1
401	1	1	15	15	15	15	24.1	10.6	1543.7
437	1	1	15	15	15	15	17	10.3	1511.8
496	1	1	15	15	15	15	13	13.8	1449.9
Hen 12									
333	1	1	15	15	15	15	21.8	10.7	1900.4
263	1	1	15	14	15	14	25.1	9.3	2400.1
134	1	1	9	10	9	10	13.4	9.1	2400.1
325	1	1	15	15	15	15	19.5	16	1768.7
19	1	1	5	2	5	2	9.1	2.8	2400.1
Hen 14									
571	1	1	15	15	15	15	28.2	15.7	1492.8
636	1	1	15	15	15	15	24.3	15.9	1617.7
200	1	1	4	6	4	6	6.4	25.9	2400.1
6	1	1	2	1	2	1	6.6	2.1	2400.1
433	1	1	15	14	15	14	25.4	31.3	2400.1
Hen 15									
142	1	1	11	12	11	12	27.4	17.8	2400.1
138	1	1	10	10	10	10	31.3	13.1	2400.1

13	1	1	3	3	3	3	20.5	39.6	2400.1
42	1	1	4	7	4	7	13.2	19.9	2400.1
14	1	1	2	2	2	2	11.1	3.4	2400.1
Hen 16									
333	1	1	12	14	12	14	25	12.4	2400.1
331	1	1	12	12	12	12	11	893.1	2400.1
201	1	1	13	13	13	13	11	907.5	2400.1
117	1	1	9	9	9	9	17.6	15.5	2400.1
94	1	1	8	7	8	7	11	10.6	2400.1
Condition 10									
Hen 11									
34	32	32	192	128	6	4	215.8	1254.5	2400.1
96	32	32	192	224	6	7	226.9	1430.3	2400.1
24	32	32	64	32	2	1	88.3	47.2	2400.1
66	32	32	224	192	7	6	146.3	102.1	2400.1
175	32	32	192	128	6	4	135.4	69.4	2400.1
Hen 12									
49	32	32	256	226	8	7	323.5	1193.6	2400.1
79	32	32	320	352	10	11	418	463.7	2400.1
84	32	32	288	288	9	9	472.6	425.5	2400.1
100	32	32	256	256	8	8	452.3	324.9	2400.1
54	32	32	293	256	9	8	555.8	378.2	2400.1
Hen 14									
86	32	32	64	96	2	3	74.3	88.3	2400.1
15	32	32	96	0	3	0	66	0	2400.1

242	32	32	256	326	8	10	220.6	985.7	2400.1
41	32	32	96	96	3	3	96.6	70.5	2400.1
75	32	32	96	192	3	6	73.3	1805.5	2400.1
Hen 15									
79	32	32	384	320	12	10	454.5	283.5	2400.1
85	32	32	192	232	6	7	295	909.2	2400.1
99	32	32	384	352	12	11	530.4	397.8	2400.1
109	32	32	288	288	9	9	339.1	769.5	2400.1
43	32	32	224	164	7	5	309.9	1332.7	2400.1

Appendix B

Raw data from the last five days for each hen for each condition in the Terminal Link of the current experiment. Presented in the first section are the hen no. day, month, year, Fixed Ratio (FR), Average Left latency (Av LL) average right latency (av RL), the average left total time (av LTT) the average right total time (av RTT). Presented in the second section is the average left run time (av LRT) the average right run time (av RRT), average leflt pecks (av LPs), average right pecks (av RPs), the average left overall response rate (av LORR) the average right overall response rates (av RORR), the average left run rate (av LRR), average right run rate (av RRR), left reinforcer (LRFT) and the right reinforcer (RRFT). All values are in seconds.

Hen. no	Day	Month	Year	FR	av LL	av RL	av LTT	av RTT
Condition 2								
11	4	8	2014	1	22.57	8.87	2.26	0.89
11	5	8	2014	1	7.45	11	0.75	1.1
11	6	8	2014	1	6.91	10.83	0.69	1.08
11	7	8	2014	1	8.67	12.77	0.87	1.28
11	8	8	2014	1	5.4	11.33	0.54	1.13
12	4	8	2014	1	13.8	13.67	1.38	1.37
12	5	8	2014	1	11.67	23.93	1.17	2.39
12	6	8	2014	1	14.13	17.67	1.41	1.77
12	7	8	2014	1	16.93	18.2	1.69	1.82
12	8	8	2014	1	13.8	13	1.38	1.3
13	4	8	2014	1	8.6	7.8	0.86	0.78
13	5	8	2014	1	8.67	8.2	0.87	0.82
13	6	8	2014	1	9.07	6.8	0.91	0.68

13	7	8	2014	1	8.67	6	0.87	0.6
13	8	8	2014	1	7.4	5.27	0.74	0.53
14	4	8	2014	1	13.73	13.4	1.37	1.34
14	5	8	2014	1	10.27	11.2	1.03	1.12
14	6	8	2014	1	9.33	11.67	0.93	1.17
14	7	8	2014	1	13.73	23.13	1.37	2.31
14	8	8	2014	1	12.87	19.67	1.29	1.97
15	4	8	2014	1	8.87	15.6	0.89	1.56
15	5	8	2014	1	12.53	9.93	1.25	0.99
15	6	8	2014	1	9.13	13.4	0.91	1.34
15	7	8	2014	1	8.73	14.4	0.87	1.44
15	8	8	2014	1	8.07	13	0.81	1.3
16	30	7	2014	1	5.2	9.09	0.52	0.91
16	1	8	2014	1	4.53	13.53	0.45	1.35
16	3	8	2014	1	6.67	13.62	0.67	1.36
16	5	8	2014	1	4.73	11.33	0.47	1.13
16	7	8	2014	1	6.47	13.27	0.65	1.33
Condition 3								
11	4	9	2014	8	7.8	10.67	4.23	4.59
11	5	9	2014	8	5.33	10.07	3.55	4.6
11	6	9	2014	8	5.55	9.85	5.09	4.32
11	7	9	2014	8	5.73	13.13	4.32	5.67

11	8	9	2014	8	5.8	10.6	3.87	5.25
12	4	9	2014	8	7.53	10.4	4.59	5.51
12	5	9	2014	8	9.67	12.07	6.36	7.08
12	6	9	2014	8	9.47	13.13	5.33	6.93
12	7	9	2014	8	8.47	10.47	6.17	6.89
12	8	9	2014	8	6.47	11.73	4.96	5.31
13	4	9	2014	8	7.4	26.33	5.07	6.82
13	5	9	2014	8	6.2	26.4	5.05	6.87
13	6	9	2014	8	12.71	46.2	6.21	9.63
13	7	9	2014	8	11.87	65.13	6.53	10.11
13	8	9	2014	8	30.71	118.47	8.16	16.76
14	4	9	2014	8	5.73	13.93	4.23	5.51
14	5	9	2014	8	6.21	12.13	4.56	5.59
14	6	9	2014	8	5.53	11	3.99	4.46
14	7	9	2014	8	7.73	15.87	4.21	4.99
14	8	9	2014	8	11.08	14.54	4.3	5.59
15	4	9	2014	8	19.87	14.13	7.87	5.88
15	5	9	2014	8	14.3	16.83	6.09	6.34
15	6	9	2014	8	14.86	16	8.11	6.16
15	7	9	2014	8	14	12.6	5.61	5.61
15	8	9	2014	8	14.4	14.4	6.33	5.64

16	28	8	2014	8	6	10.6	4.27	6.14
16	30	8	2014	8	5.33	12.8	3.97	5.78
16	1	9	2014	8	5.47	12.87	3.99	6.11
16	4	9	2014	8	5.2	10.73	3.91	5.8
16	6	9	2014	8	5.4	14.87	4.25	6.93
Condition 4								
11	29	9	2014	32	25.6	71.82	29.02	37.31
11	30	9	2014	32	44.27	56.42	26.85	31.25
11	1	10	2014	32	43.58	40.08	22.2	23.15
11	2	10	2014	32	20.42	23.23	19.05	21.11
11	3	10	2014	32	38.46	46.23	21.08	29.29
12	29	9	2014	32	67.36	24	35.76	39.26
12	30	9	2014	32	61.25	41	27.23	29.58
12	1	10	2014	32	35.4	37.67	25.7	26.51
12	2	10	2014	32	43.75	27.64	24.1	27.04
12	3	10	2014	32	26.36	33.38	23.91	24.99
13	25	9	2014	32	92.5	131.63	61.1	54.39
13	26	9	2014	32	83.63	271.75	55.9	68.74
13	27	9	2014	32	56.11	111.6	44.29	56.24
13	28	9	2014	32	85.17	146	50.03	50.46
13	29	9	2014	32	85.5	164.5	53.41	49.86
14	29	9	2014	32	40.67	47.56	25.95	26.27
14	30	9	2014	32	46.2	45.78	31.52	26.14

14	1	10	2014	32	40.6	54.57	27.36	26.33
14	2	10	2014	32	75.83	62	40.55	26.05
14	3	10	2014	32	185.67	54.25	101.9	25.68
15	30	9	2014	32	14.71	54.56	26.66	24.06
15	29	9	2014	32	66	81.33	31	26.37
15	1	10	2014	32	60.5	41.4	28.27	27.04
15	2	10	2014	32	34.88	72.6	26.11	24.52
15	3	10	2014	32	31.88	81.73	22.63	26.31
16	18	10	2014	32	8.07	15.27	20.43	29.24
16	20	10	2014	32	15.93	19.14	21.09	37.25
16	22	10	2014	32	15	13.33	25.02	41.3
16	24	10	2014	32	43.25	30.14	24.22	39.74
16	26	10	2014	32	21.2	12.36	28.94	38.15
Condition 5								
11	27	10	2014	64	26.88	104	53.16	95.13
11	28	10	2014	64	37.43	86.71	65.36	115.93
11	29	10	2014	64	97.5	60.13	76.13	97.34
11	30	10	2014	64	15.14	84.78	59.06	94.97
11	31	10	2014	64	61.89	96.29	64.77	106.89
12	25	10	2014	64	131.67	174.5	75.2	139.78
12	26	10	2014	64	136.5	134.8	111.7	181.4
12	27	10	2014	64	96.67	290	101.27	271.8
12	3	11	2014	64	86.88	60.75	70.32	60.09

12	4	11	2014	64	88.4	68.83	77.34	68.5
14	27	10	2014	64	8.67	103.67	55.07	75.13
14	28	10	2014	64	18.67	109.2	61.63	90.44
14	29	10	2014	64	8.8	53.25	46.38	77.08
14	30	10	2014	64	27.5	51.8	57.45	96.78
14	31	10	2014	64	22	66.67	51.52	96.62
15	14	11	2014	64	53.67	44.8	68.77	63.68
15	15	11	2014	64	22	33	59.1	59.13
15	16	11	2014	64	36.4	68.33	77.72	80.97
15	17	11	2014	64	32.25	69.5	71.24	69.19
15	18	11	2014	64	12.4	62.17	85	84.23
16	14	11	2014	64	38.4	17.25	53.7	42.75
16	15	11	2014	64	35	21.33	53.63	45.4
16	16	11	2014	64	25.38	14.57	55.59	42.86
16	17	11	2014	64	34.67	13.67	53.48	48.31
16	18	11	2014	64	32.63	10.7	54.63	44.2
Condition 6								
11	13	11	2014	128	47	101.43	173.73	90.81
11	14	11	2014	128	125	102	161.67	97.19
11	15	11	2014	128	50	98.17	179.63	99.42
11	17	11	2014	128	210	119	202.65	98.15
11	18	11	2014	128	219.8	132.2	162.96	94.3

12	16	11	2014	128	56.86	75.25	138.37	146.72
12	17	11	2014	128	47.86	100.5	130.57	156.9
12	18	11	2014	128	43.6	121	118.5	135.98
12	19	11	2014	128	88.17	192.67	147.32	166.03
12	20	11	2014	128	29	139.5	151.07	146.25
14	20	11	2014	128	22.5	53.5	276.8	170.8
14	21	11	2014	128	39.33	66	211.4	149.3
14	23	11	2014	128	38	43.5	264.6	151.4
14	24	11	2014	128	6	120	208.4	130.2
14	25	11	2014	128	77.25	98.2	167.38	140.24
15	27	11	2014	128	12.5	69	139.13	138.4
15	28	11	2014	128	14.8	80	155.1	120.08
15	29	11	2014	128	330.25	57	147.3	106.93
15	30	11	2014	128	12.75	55.8	147.63	128.34
15	1	12	2014	128	132	50.67	137.7	106.63
16	27	11	2014	128	35.57	11.43	96.01	86.36
16	28	11	2014	128	32.33	23.63	99.33	92.14
16	29	11	2014	128	25.83	17.14	108.98	106.57
16	30	11	2014	128	37	12.8	99.77	96.48
16	1	12	2014	128	45	10.29	107.8	101.4
Condition 7								
11	14	12	2014	8	6.87	6.8	3.65	4.11
11	15	12	2014	8	5.2	9.27	4.43	4.61

11	16	12	2014	8	4.93	9.33	3.5	4.29
11	17	12	2014	8	6.93	13.27	3.69	5.11
11	18	12	2014	8	5.07	9.4	3.08	4.49
12	14	12	2014	8	52.2	29.67	10.29	8.41
12	15	12	2014	8	34.67	35.93	7.94	8.91
12	16	12	2014	8	42.13	23.53	9.1	8.15
12	17	12	2014	8	47.4	29.47	8.84	9.15
12	18	12	2014	8	41.83	17.57	9.31	6.61
14	14	12	2014	8	4	28.6	133.03	122.62
14	15	12	2014	8	11.4	11.73	9.06	9.15
14	17	12	2014	8	7.33	11.67	7.19	8.59
14	16	12	2014	8	7.36	18.31	8.02	9.35
14	18	12	2014	8	23.82	11.62	9.39	8.4
15	14	12	2014	8	38.79	88.54	12.5	16.45
15	15	12	2014	8	48.77	67.64	12.63	12.15
15	16	12	2014	8	40.44	65.33	13.26	11.6
15	17	12	2014	8	46.67	61.47	11.74	11.29
15	18	12	2014	8	37.64	69.5	12.11	13.22
16	23	1	2015	8	25.7	7.6	6.32	4.8
16	24	1	2015	8	34.33	10.6	7.23	5.72
16	25	1	2015	8	313.67	15.6	37.7	6.62
16	26	1	2015	8	6.47	8.93	4.98	5.32

16	27	1	2015	8	5.92	10.33	5.15	5.98
Condition 8								
11	5	1	2015	1	9.8	9.67	0.98	0.97
11	6	1	2015	1	5.47	10.27	0.55	1.03
11	7	1	2015	1	7.93	11.47	0.79	1.15
11	8	1	2015	1	5.8	12.93	0.58	1.29
11	9	1	2015	1	5.73	11.13	0.57	1.11
12	4	1	2015	1	17.4	30.07	1.74	3.01
12	5	1	2015	1	13	19.62	1.3	1.96
12	6	1	2015	1	17.27	21.93	1.73	2.19
12	7	1	2015	1	20.55	18.42	2.05	1.84
12	8	1	2015	1	18.6	21.6	1.86	2.16
14	12	1	2015	1	16	11.27	1.6	1.13
14	13	1	2015	1	15.27	13.2	1.53	1.32
14	14	1	2015	1	23	19.7	2.3	1.97
14	15	1	2015	1	17.8	14.67	1.78	1.47
14	16	1	2015	1	12.55	11.42	1.25	1.14
15	12	1	2015	1	23.83	39.67	2.38	3.97
15	13	1	2015	1	6.13	13.07	0.61	1.31
15	14	1	2015	1	22	31.2	2.2	3.12
15	15	1	2015	1	8.07	14.13	0.81	1.41
15	16	1	2015	1	8.43	13.79	0.84	1.38

16	19	2	2015	1	7	10.86	0.7	1.09
16	20	2	2015	1	13.33	7.4	1.33	0.74
16	21	2	2015	1	11.46	10.71	1.15	1.07
16	22	2	2015	1	17.13	13.2	1.71	1.32
16	23	2	2015	1	14.5	16.25	1.45	1.63
Condition 9								
11	7	2	2015	1	9.13	7.67	0.91	0.77
11	8	2	2015	1	155.67	107	15.57	10.7
11	9	2	2015	1	16.4	7.67	1.64	0.77
11	10	2	2015	1	11.87	7.27	1.19	0.73
11	11	2	2015	1	9.33	9.6	0.93	0.96
12	16	2	2015	1	15.07	7.73	1.51	0.77
12	17	2	2015	1	17.13	7	1.71	0.7
12	18	2	2015	1	15.44	9.8	1.54	0.98
12	19	2	2015	1	13.67	11.27	1.37	1.13
12	20	2	2015	1	19	15	1.9	1.5
14	7	2	2015	1	19.27	10.87	1.93	1.09
14	8	2	2015	1	16.6	11.13	1.66	1.11
14	9	2	2015	1	16.5	43.67	1.65	4.37
14	10	2	2015	1	33	21	3.3	2.1
14	11	2	2015	1	17.27	22.71	1.73	2.27
15	8	2	2015	1	25.55	15.33	2.55	1.53
15	9	2	2015	1	31.9	13.3	3.19	1.33

15	10	2	2015	1	69.33	132.33	6.93	13.23
15	11	2	2015	1	33.25	29	3.32	2.9
15	12	2	2015	1	56	17	5.6	1.7
16	13	3	2015	1	21.17	9.43	2.12	0.94
16	14	3	2015	1	9.42	7.75	0.94	0.78
16	15	3	2015	1	8.85	8.69	0.88	0.87
16	16	3	2015	1	20	17.78	2	1.78
16	17	3	2015	1	14.13	15.57	1.41	1.56
Condition 10								
11	15	3	2015	32	62.83	75.75	36.02	33.05
11	16	3	2015	32	64.33	38	37.87	27.09
11	17	3	2015	32	63	244	44.2	47.2
11	18	3	2015	32	32.71	15.33	20.96	17.02
11	19	3	2015	32	49.17	29.75	22.6	17.35
12	19	3	2015	32	89.5	40.29	40.48	40.46
12	24	3	2015	32	112	62.18	41.85	42.2
12	25	3	2015	32	140.78	28.22	52.58	47.29
12	26	3	2015	32	159	38.25	56.58	40.65
12	27	3	2015	32	176	65	61.26	47.33
14	8	3	2015	32	16.5	5.67	37.15	29.43
14	9	3	2015	32	9.67	0	22.03	0
14	10	3	2015	32	9.25	11.2	27.64	23.77
14	12	3	2015	32	7.67	12.67	32.27	23.53

14	13	3	2015	32	8.33	6.67	24.43	21.45
15	8	3	2015	32	80.92	48.2	37.92	28.26
15	9	3	2015	32	88.17	37.43	49.2	30.79
15	10	3	2015	32	123.17	78.09	44.23	36.22
15	12	3	2015	32	103.67	53.22	37.72	30.14
15	13	3	2015	32	87.71	41	44.36	33.26

av LRT	av RRT	av LPs	av RPs	av LOR	av ROR	av LRR	av RRR	LRFT	RRFT
Condition 2									
Hen 11									
0	0	1	1	1.68	1.37	Inf	Inf	14	15
0	0	1	1	1.57	1.2	Inf	Inf	11	13
0	0	1	1	1.54	1.11	Inf	Inf	11	12
0	0	1	1	1.77	1.01	Inf	Inf	12	13
0	0	1	1	2.11	1.1	Inf	Inf	15	15
Hen 12									
0	0	1	1	0.85	0.96	Inf	Inf	15	15
0	0	1	1	0.95	0.6	Inf	Inf	15	15
0	0	1	1	0.86	0.71	Inf	Inf	15	15
0	0	1	1	0.78	0.73	Inf	Inf	15	15
0	0	1	1	0.92	1.02	Inf	Inf	15	15
Hen 13									
0	0	1	1	1.52	1.55	Inf	Inf	15	15
0	0	1	1	1.37	1.56	Inf	Inf	15	15

0	0	1	1	1.35	1.72	Inf	Inf	15	15
0	0	1	1	1.51	1.81	Inf	Inf	15	15
0	0	1	1	1.67	2.06	Inf	Inf	15	15
Hen 14									
0	0	1	1	1.15	0.89	Inf	Inf	15	15
0	0	1	1	1.24	1.13	Inf	Inf	15	15
0	0	1	1	Inf	0.96	Inf	Inf	15	15
0	0	1	1	Inf	0.74	Inf	Inf	15	15
0	0	1	1	0.97	0.66	Inf	Inf	15	15
Hen 15									
0	0	1	1	1.23	0.97	Inf	Inf	15	15
0	0	1	1	1.06	1.1	Inf	Inf	15	15
0	0	1	1	Inf	0.99	Inf	Inf	15	15
0	0	1	1	Inf	0.94	Inf	Inf	15	15
0	0	1	1	Inf	1.03	Inf	Inf	15	15
Hen 16									
0	0	1	1	1.97	1.27	Inf	Inf	10	11
0	0	1	1	2.3	0.96	Inf	Inf	15	15
0	0	1	1	1.76	0.84	Inf	Inf	12	13
0	0	1	1	2.51	1.13	Inf	Inf	15	15
0	0	1	1	1.96	0.94	Inf	Inf	15	15
Condition 3									
Hen 11									
3.45	3.52	8	8	2.04	1.84	2.47	2.37	15	15
3.01	3.59	8	8	2.38	1.79	2.76	2.33	15	15

4.54	3.34	8	8	1.89	1.89	2.19	2.47	11	13
3.75	4.36	8	8	1.94	1.47	2.24	1.93	15	15
3.29	4.19	8	8	2.15	1.62	2.55	2.11	15	15
Hen 12									
3.83	4.47	8	8	1.8	1.53	2.15	1.93	15	15
5.39	5.87	8	8	1.3	1.24	1.53	1.53	15	15
4.39	5.62	8	8	1.58	1.26	1.92	1.56	15	15
5.32	5.84	8	8	1.37	1.25	1.61	1.52	15	15
4.31	4.14	8	8	1.68	1.56	1.95	2.04	15	15
Hen 13									
4.33	4.19	8	8	1.68	1.28	2.01	2.08	15	15
4.43	4.23	8	8	1.68	1.22	1.91	2.1	15	15
4.94	5.01	8	8	1.31	1.02	1.71	2.12	14	15
5.35	3.6	8	8	1.36	0.89	1.71	2.44	15	15
5.09	4.91	8	8	1	0.76	1.85	2.2	14	15
Hen 14									
3.66	4.12	8	8	1.97	1.54	2.29	2.04	15	15
3.94	4.37	8	8	1.88	1.5	2.19	1.99	14	15
3.44	3.36	8	8	2.05	1.83	2.42	2.45	15	15
3.43	3.4	8	8	1.97	1.71	2.43	2.52	15	15
3.19	4.14	8	8	1.92	1.47	2.61	2.02	12	13
Hen 15									
5.88	4.47	8	8	1.23	1.43	1.6	2	15	15
4.66	4.66	8	8	1.51	1.34	1.86	1.88	10	12
6.63	4.56	8	8	1.05	1.37	1.34	1.93	7	7

4.21	4.35	8	8	1.54	1.51	2.03	1.96	15	15
4.89	4.2	8	8	1.36	1.46	1.88	2.01	10	10
Hen 16									
3.67	5.08	8	8	1.93	1.34	2.24	1.63	15	15
3.43	4.5	8	8	2.06	1.47	2.39	1.88	15	15
3.44	4.83	8	8	2.02	1.39	2.35	1.8	15	15
3.39	4.73	8	8	2.06	1.46	2.39	1.8	15	15
3.71	5.44	8	8	1.9	1.26	2.18	1.6	15	15
Condition 4									
Hen 11									
26.46	30.13	33	32	1.17	0.88	1.34	1.15	10	11
22.42	25.61	32	32	1.24	1.04	1.51	1.32	11	12
17.84	19.15	32	32	1.48	1.4	1.85	1.75	12	13
17.01	18.78	32	32	1.7	1.55	1.93	1.77	12	13
17.23	24.67	32	32	1.55	1.16	1.89	1.45	13	13
Hen 12									
29.03	36.86	32	32	0.9	0.84	1.13	0.91	11	7
21.11	25.48	32	32	1.23	1.11	1.54	1.28	12	11
22.16	22.74	32	32	1.29	1.27	1.59	1.46	5	9
19.72	24.27	32	32	1.34	1.2	1.67	1.34	8	11
21.27	21.65	32	32	1.37	1.38	1.55	1.55	11	13
Hen 13									
51.85	41.22	32	32	0.55	0.61	0.67	0.84	6	8
47.54	41.56	32	32	0.58	0.53	0.71	0.82	8	8
38.68	45.08	32	32	0.75	0.67	0.85	0.83	9	10

41.52	35.86	32	32	0.65	0.66	0.79	0.91	6	9
44.86	33.41	32	32	0.62	0.68	0.75	0.98	8	10
Hen 14									
21.88	21.51	32	32	1.28	1.24	1.49	1.51	6	9
26.9	21.57	32	32	1.06	1.26	1.24	1.52	5	9
23.3	20.87	32	32	1.27	1.23	1.51	1.56	5	7
32.97	19.85	33	32	1.13	1.26	1.38	1.66	6	4
83.33	20.25	33	32	0.83	1.26	1.07	1.68	3	4
Hen 15									
25.19	18.6	32	32	1.22	1.35	1.29	1.76	7	9
24.4	18.23	32	32	1.04	1.23	1.31	1.76	2	3
22.22	22.9	32	32	1.2	1.2	1.53	1.42	6	5
22.63	17.26	32	32	1.26	1.31	1.5	1.86	8	10
19.44	18.14	32	32	1.43	1.23	1.66	1.78	8	11
Hen 16									
19.63	27.71	32	32	1.6	1.11	1.67	1.17	15	15
19.49	35.34	32	32	1.53	0.89	1.66	0.93	14	14
23.52	39.97	32	32	1.32	0.79	1.41	0.82	5	3
19.9	36.73	32	32	1.34	0.82	1.62	0.89	8	7
26.82	36.91	32	32	1.14	0.86	1.24	0.88	10	11
Condition 5									
Hen 11									
50.48	84.73	64	64	1.23	0.68	1.29	0.76	8	6
61.61	107.26	64	64	0.99	0.58	1.05	0.63	7	7
66.38	91.33	64	64	0.84	0.67	0.97	0.72	6	8

57.54	86.49	64	64	1.1	0.68	1.13	0.76	7	9
58.58	97.26	64	64	1.02	0.61	1.13	0.68	9	7
Hen 12									
62.03	122.33	64	64	0.87	0.47	1.05	0.53	6	6
98.05	167.92	64	64	0.59	0.36	0.67	0.4	4	5
91.6	242.8	64	64	0.64	0.25	0.71	0.27	3	5
61.64	54.01	64	64	0.95	1.11	1.08	1.21	8	8
68.5	61.62	64	64	0.85	0.98	0.96	1.08	5	6
Hen 14									
54.2	64.77	64	64	1.16	0.85	1.18	0.99	3	3
59.77	79.52	64	64	1.04	0.72	1.07	0.82	3	5
45.5	71.75	64	64	1.4	0.84	1.43	0.9	5	4
54.7	91.6	64	64	1.11	0.68	1.17	0.72	2	5
49.32	89.95	64	64	1.26	0.67	1.31	0.72	5	6
Hen 15									
63.4	59.2	64	64	0.93	1.01	1.01	1.09	3	5
56.9	55.83	64	64	1.11	1.1	1.14	1.17	3	4
74.08	74.13	64	64	0.83	0.82	0.87	0.91	5	3
68.01	62.24	64	64	0.91	0.94	0.95	1.05	8	8
83.76	78.02	64	64	0.78	0.83	0.79	0.91	5	6
Hen 16									
49.86	41.02	64	64	1.2	1.51	1.29	1.57	5	8
50.13	43.27	64	64	1.21	1.43	1.29	1.49	4	3
53.05	41.4	64	64	1.16	1.51	1.22	1.56	8	7
50.01	46.94	64	64	1.2	1.34	1.29	1.37	9	9

51.36	43.13	64	64	1.2	1.47	1.27	1.51	8	10

Condition 6

Hen 11

169.03	80.67	129	128	0.76	1.42	0.78	1.59	3	7
149.17	86.99	128	128	0.8	1.37	0.87	1.52	3	7
174.63	89.6	128	128	0.72	1.3	0.75	1.44	4	6
181.65	86.25	128	128	0.63	1.34	0.71	1.54	2	4
140.98	81.08	128	128	0.81	1.36	0.92	1.6	5	5

Hen 12

132.69	139.2	128	128	0.94	0.88	0.98	0.93	7	4
125.79	146.85	128	128	0.99	0.82	1.02	0.88	7	4
114.14	123.88	128	128	1.09	0.97	1.14	1.06	5	6
138.5	146.77	128	128	0.91	0.81	0.97	0.93	6	3
148.17	132.3	128	128	0.85	0.89	0.87	0.98	3	4

Hen 14

274.55	165.45	128	128	0.49	0.75	0.5	0.78	2	2
207.47	142.7	128	128	0.61	0.86	0.62	0.9	3	1
260.8	147.05	128	128	0.48	0.86	0.49	0.88	1	6
207.8	118.2	128	128	0.61	0.98	0.62	1.08	1	1
159.65	130.42	128	128	0.77	0.94	0.81	1.01	4	5

Hen 15

137.88	131.5	128	128	0.92	0.93	0.93	0.98	4	4
153.62	112.08	128	128	0.87	1.09	0.88	1.16	5	5
114.28	101.22	128	128	0.95	1.2	1.12	1.27	4	4

146.35	122.76	128	128	0.87	1	0.88	1.05	4	5
124.5	101.57	128	128	0.93	1.21	1.03	1.27	1	3
Hen 16									
92.46	85.21	128	128	1.35	1.49	1.4	1.51	7	7
96.1	89.78	128	128	1.29	1.4	1.34	1.43	6	8
106.4	104.86	128	128	1.19	1.21	1.22	1.23	6	7
96.07	95.2	128	128	1.34	1.34	1.39	1.35	6	5
103.3	100.37	128	128	1.21	1.27	1.26	1.29	6	7
Condition 7									
Hen 11									
2.96	3.43	8	8	2.27	1.98	2.75	2.39	15	15
3.91	3.69	8	8	1.9	1.82	2.18	2.33	15	15
3.01	3.35	8	8	2.44	1.91	2.86	2.47	15	15
3	3.79	8	8	2.25	1.62	2.79	2.22	15	15
2.57	3.55	8	8	2.65	1.86	3.18	2.39	15	15
Hen 12									
5.07	5.45	8	8	0.83	1.02	1.69	1.58	15	15
4.47	5.31	8	8	1.15	0.93	1.94	1.55	15	15
4.89	5.79	8	8	0.97	1.06	1.89	1.51	15	15
4.1	6.21	8	8	1	0.98	2	1.53	15	15
5.13	4.85	8	8	0.95	1.35	1.73	1.81	12	14
Hen 14									
132.63	119.76	128	128	0.97	1.06	0.97	1.09	3	5
7.92	7.98	8	8	0.93	0.94	1.06	1.1	15	15
6.45	7.43	8	8	1.15	0.97	1.29	1.14	15	15

7.28	7.52	8	8	1.05	0.9	1.19	1.13	11	13
7.01	7.24	8	8	0.93	0.99	1.2	1.15	11	13
Hen 15									
8.62	7.59	8	8	0.67	0.51	1	1.18	14	13
7.75	5.39	8	8	0.66	0.67	1.19	1.53	13	14
9.21	5.07	8	8	0.65	0.7	1	1.59	9	9
7.07	5.15	8	8	0.74	0.73	1.4	1.63	15	15
8.35	6.27	8	8	0.72	0.62	1.18	1.37	11	10
Hen 16									
3.75	4.04	8	8	1.95	1.7	2.42	2.02	10	10
3.8	4.66	8	8	1.11	1.46	2.15	1.85	3	5
6.33	5.06	8	8	0.85	1.22	1.45	1.64	3	5
4.33	4.43	8	8	1.65	1.52	1.92	1.83	15	15
4.56	4.94	8	8	1.59	1.37	1.8	1.65	12	12
Condition 8									
Hen 11									
0	0	1	1	1.6	1.27	Inf	Inf	15	15
0	0	1	1	2.47	1.05	Inf	Inf	15	15
0	0	1	1	1.73	1.09	Inf	Inf	15	15
0	0	1	1	2.06	1.04	Inf	Inf	15	15
0	0	1	1	2.24	1.09	Inf	Inf	15	15
Hen 12									
0	0	1	1	0.8	0.63	Inf	Inf	15	15
0	0	1	1	0.98	0.66	Inf	Inf	13	13
0	0	1	1	0.74	0.58	Inf	Inf	15	15

0	0	1	1	0.99	0.64	Inf	Inf	11	12
0	0	1	1	0.74	0.54	Inf	Inf	15	15
Hen 14									
0	0	1	1	1.23	0.95	Inf	Inf	15	15
0	0	1	1	0.91	1.46	Inf	Inf	15	15
0	0	1	1	0.93	0.99	Inf	Inf	9	10
0	0	1	1	Inf	0.83	Inf	Inf	15	15
0	0	1	1	2.06	0.92	Inf	Inf	11	12
Hen 15									
0	0	1	1	0.57	0.27	Inf	Inf	12	12
0	0	1	1	0	0.91	Inf	Inf	15	15
0	0	1	1	0.73	0.39	Inf	Inf	14	15
0	0	1	1	1.41	0.82	Inf	Inf	15	15
0	0	1	1	0	0.77	Inf	Inf	14	14
Hen 16									
0	0	1	1	1.59	1.04	Inf	Inf	13	14
0	0	1	1	1.39	1.47	Inf	Inf	15	15
0	0	1	1	1.3	1.14	Inf	Inf	13	14
0	0	1	1	0.89	0.96	Inf	Inf	15	15
0	0	1	1	1.17	0.84	Inf	Inf	10	12
Condition 9									
Hen 11									
0	0	1	1	1.39	1.45	Inf	Inf	15	15
0	0	1	1	0.42	0.09	Inf	Inf	3	1
0	0	1	1	1.01	1.48	Inf	Inf	15	15

0	0	1	1	1.2	1.53	Inf	Inf	15	15
0	0	1	1	1.3	1.28	Inf	Inf	15	15
Hen 12									
0	0	1	1	0.8	1.55	Inf	Inf	15	15
0	0	1	1	0.75	1.66	Inf	Inf	15	14
0	0	1	1	0.78	1.23	Inf	Inf	9	10
0	0	1	1	0.88	1.26	Inf	Inf	15	15
0	0	1	1	0.76	0.85	Inf	Inf	5	2
Hen 14									
0	0	1	1	0.75	1.01	Inf	Inf	15	15
0	0	1	1	1	1.24	Inf	Inf	15	15
0	0	1	1	0.76	1.02	Inf	Inf	4	6
0	0	1	1	0.55	0.48	Inf	Inf	2	1
0	0	1	1	0.72	0.75	Inf	Inf	15	14
Hen 15									
0	0	1	1	0.48	0.73	Inf	Inf	11	12
0	0	1	1	0.39	0.97	Inf	Inf	10	10
0	0	1	1	0.22	0.24	Inf	Inf	3	3
0	0	1	1	0.34	0.44	Inf	Inf	4	7
0	0	1	1	0.55	0.59	Inf	Inf	2	2
Hen 16									
0	0	1	1	1.04	1.37	Inf	Inf	12	14
0	0	1	1	1.26	1.44	Inf	Inf	12	12
0	0	1	1	1.34	1.33	Inf	Inf	13	13
0	0	1	1	1.12	0.97	Inf	Inf	9	9

0	0	1	1	1.11	1.14	Inf	Inf	8	7
Condition 10									
Hen 11									
29.73	25.47	32	32	0.91	1.01	1.11	1.29	6	4
31.43	23.29	32	32	0.87	1.23	1.04	1.4	6	7
37.9	22.8	32	32	0.76	0.68	0.91	1.4	2	1
17.69	15.48	32	32	1.57	1.9	1.87	2.08	7	6
17.68	14.38	32	32	1.43	1.85	1.87	2.23	6	4
Hen 12									
31.53	36.43	32	32	0.82	0.8	1.06	0.9	8	7
30.65	35.98	32	32	0.77	0.78	1.06	0.9	10	11
38.5	44.47	32	32	0.63	0.87	0.86	0.93	9	9
40.67	36.83	32	32	0.59	0.8	0.82	0.9	8	8
43.66	40.83	32	32	0.56	0.69	0.78	0.79	9	8
Hen 14									
35.5	28.87	32	32	0.87	1.11	0.92	1.14	2	3
21.07	0	32	0	1.47	0	1.53	0	3	0
26.71	22.65	32	32	1.18	1.38	1.23	1.44	8	10
31.5	22.27	32	32	1.03	1.38	1.06	1.46	3	3
23.6	20.78	32	32	1.33	1.53	1.38	1.59	3	6
Hen 15									
29.83	23.44	32	32	0.87	1.15	1.11	1.4	12	10
40.38	27.04	32	32	0.66	1.1	0.82	1.26	6	7
31.92	28.41	32	32	0.74	0.92	1.05	1.18	12	11
27.36	24.82	32	32	0.86	1.09	1.23	1.33	9	9

35.59	29.16	32	32	0.73	1	0.94	1.13	7	5