AUDITORY AND VISUAL SYNCHRONIZATION PERFORMANCE OVER LONG AND SHORT INTERVALS

By

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ABSTRACT

The thesis is that the same timing mechanism is available and is used by experienced subjects in a synchronization task whether the intervals involved are relatively long (eg 2000 msec) or short (eg 200 msec) and whether the stimuli are auditory or visual.

Synchronization involves two main stimuli. One marks the start of a target interval. The second marks its end. The subject is to respond in synchrony with the second stimulus.

Previous synchronization research using short auditorily bounded intervals has strongly supported the hypothesis that the underlying mechanism is continuously adjustable, deterministic, and, despite continuous adjustability, that the main source of variability in the task is quantal. A periodic process in the nervous system controls the timing of information transfer from one processing stage to the next. Waiting state durations (before transfers) are uniformly distributed from 0 to q msec, where q is the quantum size. As an example of a timing model along these lines, suppose there is a quantal delay between sensory registration of a stimulus marking the start of an interval and transfer of the message that the interval has started to a "perfect" central clock. In synchronization, the subject waits a specified time after the stimulus, then makes a response. The message from the clock that the required interval has elapsed is subject to another quantal delay before arriving at the motor system, which carries out the response. Variability at the sensory and motor levels may add to the total timing variance in the system, but the main source

of variation in extremely experienced subjects is quantal.

Data from various paradigms suggest that different mechanisms govern timing of long and short intervals and that different types of, or at least differentially variable, mechanisms are involved in timing visually and auditorily marked intervals. Both hypotheses have received some support from past synchronization research though they have received much less support from duration discrimination studies that also suggest quantal mechanisms.

There were five experiments, two involving long auditory intervals, one with short auditory intervals, and two with short visual intervals.

All aspects of the thesis were supported: similar practice effects and distributional shapes are found for short auditory and visual intervals. Performance at longer intervals differs from these in variance only, which is concordant with discrimination results, though a specific quantal counting model for discrimination (Kristofferson, 1980) that has had difficulty with previous synchronization data (Hopkins, 1982) has the same difficulty with the present results.

The data support the hypothesis of a common central timing mechanism across modalities and intervals to 2000 msec, and also the idea that boundary conditions on quantal theory found applicable in any given paradigm and modality will also apply to the others.

There are suggestions in the data that minimum reaction time has been overestimated previously. The data also indicate that a specific model for synchronization (Hopkins, 1982; Kristofferson, 1976) is probably incorrect.

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1. Introduction: Theories of Subjective Duration

If any area of research could be taken as suggesting that psychologists have a talent for bringing chaos out of order, time perception must be it. As Woodrow (1930, p.473) put it, "the bewildering confusion concerning the fundamental facts of the psychology of time has existed for so many years that one might believe that psychologists accept the situation as inevitable". Woodrow denied the inevitability of this confusion and embarked on an extensive research program which he expected to "lead to a resolution of the gross inconsistencies and ambiguities which characterize the findings in this field" (1930, p. 473). Unfortunately, he did not succeed. Bemoaning the state of the literature, at least two more modern works (Frankenhaeuser, 1959, p. 12; Ornstein, 1969, p. 16) introduced the field with Nichols' (1891) classic summary:

> Casting an eye backward we can but be struck by the wide variety of explanations offered for the time mystery. Time has been called an act of mind, of reason, of perception, of intuition, of sense, of memory, of will, of all possible compounds and compositions to be made up of them. It has been deemed a General Sense accompanying all mental content in a manner similar to that conceived of pain and pleasure. It has been assigned a separate, special, disparate sense, to nigh a dozen kinds of 'feeling', some

familiar, some strangely invented for the difficulty. It has been explained by 'relations', by 'earmarks', by 'signs', by 'remnants', by 'struggles', and by 'strifes', by 'luminous trains', by 'blocks of specious-present', by 'apperception'. It has been declared a priori, innate, intuitive, empirical, mechanical. It has been deduced from within and without, from heaven, and from earth, and from several things difficult to imagine as of either".

Especially over the past 20 years (since Creelman, 1962), the literature has become mathematically more formal, and the data base has grown considerably. Unfortunately, this has not led to much further agreement about the nature of perceived duration. A number of apparently mutually exclusive hypotheses have been more clearly put, and more strongly supported. My aim in the present research is to extend the realm of application of a specific theory of duration, but I do not mean to imply (and do not believe) that this is a Grand Theory. The timing mechanism explored may be one of many bases for subjective duration, and it may or may not be the main one. To place the work in context, I will begin with a sketch of the dominating perspectives in the field, highlighting what I see as the major differences in assumptions and research interest between them.

1.1 Nontemporal Cue Theories of Subjective Duration

Following a long and popular tradition, Frankenhaeuser (1959) and Ornstein (1969) argued that our impression of the length of an interval derives from nontemporal information in the interval. There is no dedicated internal process for timing (Frankenhaeuser), or, if there is one, it doesn't play a major role, and studying it won't lead to many interesting or useful results (Ornstein). Instead, some other aspect(s) of the stimulus is used as the basis for an (unconscious) inference about the stimulus duration, such as "the amount of mental content" (Frankenhaeuser) or the amount of information encoded (Ornstein) during the stimulus interval.

The empirical case for the nontemporal cue position rests on demonstrations that differences in nontemporal characteristics of equally long stimuli (such as a different number of events occurring within the stimulus intervals) reliably produce differences in their perceived duration. Recent demonstrations along these lines come from Avant and Lyman (1975a, 1975b), Buffardi (1971), Burnside (1971), Cantor and Thomas (1976, 1977), Curton and Lordahl (1974), Long and Beaton (1980a, 1980b, 1981), Schiffman and Bobko (1974), Thomas and Brown (1974), Thomas and Cantor (1975, 1976a, 1978), Thomas and Weaver (1975), Underwood (1975) and Underwood and Swain (1973), among others (For more, see the reviews of Allan, 1979, Fraisse, 1963, and Poppel, 1971). Not all of these demonstrations implicate information or mental content as the mediating cue to duration, but for present purposes that is a side issue. These studies and their many predecessors demonstrate large effects on perceived duration of nontemporal differences between temporally identical stimuli. Reports of differences in duration judgments on the order of 35% and upwards are common.

The lesson that I take from such data is that any complete theory of duration perception must include an explanation of the systematic variation of perceived duration due to changes in nontemporal characteristics of the stimulus. But other types of variability in temporal judgments must also be explained. Systematic shifts in perceived duration due to changes in stimulus duration should be quantitatively predictable. The basis of apparently random variation of perceived duration of repeatedly presented identical stimuli should also be made clear.

These latter problems have not been so well dealt with in the context of the nontemporal cue research to date. If amount of information encoded determines the perceived duration of an interval, what is the function relating information to perceived duration? What rates of encoding should we expect under different conditions, and will these vary with stimulus duration? Without answers to these questions (and the answers are not known), the relationship between stimulus and subjective duration cannot be predicted. Random variability is a more curious problem. Nontemporal approaches are typically concerned with mean perceived duration and differences in mean perceived duration across conditions. Random variation is treated as "noise", to be minimized, perhaps estimated for purposes of testing hypotheses about mean differences, but to be ignored thereafter. This is such a common approach to research design and analysis that it would not be worth mentioning if this noise for the nontemporal cue theorist was not a main object of study for most internal clock theorists. To the degree that a clear and accurate description of perceptual variability can be derived from a description of an internal clock, I find it hard to accept dismissals of clocks as unlikely or uninteresting, at least until nontemporal cue theories can provide descriptions of this type as well.

1.2 Internal Clock Theories of Subjective Duration

It is generally accepted that cognitive variables play a significant role in determining spatial judgments. It is not generally accepted that this implies that the visual system is a nonexistent, minor, or uninteresting supplier of information about relative spatial position and extent. It is generally accepted that cognitive variables play a significant role in determining temporal judgments. Does this imply that there are no dedicated physiological systems for supplying us with information about relative temporal position and extent?

Internal clock theorists assume the existence of at least one dedicated physiological system for temporal information, i.e. at least one internal clock. There may be more than one, just as relative spatial position is encoded rather differently by the visual and auditory systems, but there must be at least one. The key problem with this assumption is that we don't know what this internal system is. Various physiological systems have been suggested as candidate clocks, but there is little evidence, and no general agreement, that any one of these is directly involved in duration perception (see, eg., Kristofferson, Note 3; Ornstein, 1969).

Internal clock theories share the assumption of a dedicated process for timing but differ regarding the details of the process.[1] In the absence of an obvious and demonstrable physiological basis, description of the clock is most conveniently done in terms of a mathematical characterization of a hypothetical timing system. Such characterizations often include or lead directly to specification of the probability distribution of subjective duration associated with a given stimulus duration, and of the parametric changes in the distribution across durations or across changes in other aspects of the stimulus conditions. If a theory of performance, relating internal distributions to response distributions, can also be specified then fine-grained analyses of the "noise" in the data should provide powerful tests of the hypothesized mechanism. Examples of proposed mechanisms and of the types of distributions implied by them follow.

1.2.1 Creelman's Poisson Counter Model

Perhaps the most common theories of timing, and certainly the first to be quantitatively modelled (Stroud, 1955; Creelman, 1962) are counter models. It is assumed that some internal source produces "ticks" or "pulses" at fairly regular intervals. The count of the number of pulses emitted during the period that the observer perceives a stimulus determines her perception of the duration of that stimulus. The accuracy of the clock is determined by the average interpulse interval (IPI) and by the variability of the IPI. If there is no variability in the IPI, we have a quantal clock (such as Stroud's), to be discussed below. It seems plausible to suppose instead that the time between pulses is subject to variation (as is, for example, the time between neural spikes), and an exponential distribution is often taken as a fairly accurate description of the distribution of waiting times between simple neural events (see, eg., Luce and Green, 1972). Creelman (1962) made this assumption, along with the assumption that the delays between pulses are strictly independent. These are the main conditions that must be satisfied for a Poisson process to apply (for the others, see Parzen's excellent presentation in 1962).

Predictions from a Poisson process model differ depending on the type of task. In some tasks, the subject is required to make a judgment about the length of a presented stimulus interval. Typically, discrimination experiments are thought of in this way (eg. Allan, Kristofferson and Wiens, 1971; Creelman, 1962), and I will refer to these as discrimination-type tasks. In other cases, the subject is required to generate an interval of a certain duration, or to indicate when a certain amount of time has passed. These include production, reproduction and synchronization tasks, and I will call these production-type tasks. Kristofferson (1977) has shown that in some discrimination settings, the subject actually treats the task as a production task. Rather than deciding, for example, how long a stimulus is, and on this basis, deciding whether the stimulus is "long" or "short", the subject generates an internal duration of a standard length and decides whether the stimulus is long or short by noting which ended first, the produced standard or the external stimulus. This alternate strategy in some discrimination tasks will be of interest in the discussion of quantal timing below, but I will set consideration of it aside until then. For simplicity of presentation, I will also postpone, for as long as possible, consideration of the role of afferent and efferent latencies in timing. Stimuli are not perceived immediately. The delay between stimulus onset and stimulus registration is the afferent latency. The delay, in a production-type task, between the decision to respond and the completion of the movement marking the end (and/or start) of the interval is the efferent latency. If these are variable, and efferent latency certainly is, modelling of response distributions becomes more complicated.

Under the Poisson process model, the internal measure of the duration of a stimulus corresponds to the pulse count, which is Poisson distributed. Comparison of the durations of stimuli involves comparison of the magnitudes of Poisson distributed variates, and is readily dealt with using the constructs of Signal Detection Theory (Egan, 1975; Green and Swets, 1966). The distribution of produced intervals is not Poisson. In this case, the subject's goal is to produce an interval that contains the right number of pulses. The waiting time between pulses is exponential, and the sum of waiting times to the last pulse required is gamma distributed. This, then, is the production timing distribution. (See Luce and Green, 1972, for many relevant derivations.)

The Poisson and gamma distributions share the property that their variance increases linearly (proportionally) with the mean, so this linear relationship should be obtained whatever the timing task.

Creelman's theory has the potential to predict behavior in a wide range of experimental situations, on the basis of very few parameters, in the simplest case only one, the mean interpulse interval. The theory is mathematically tractable, and the assumptions seem plausible. A number of discrimination studies (eg. Abel, 1972; Creelman, 1962; Divenyi and Danner, 1977; Kinchla, 1972) have yielded results compatible either with the original version of the theory or with slightly modified versions. On the production side, Wing (1973; Wing and Kristofferson, 1973a) found that the variance of repetitive productions of an interval increased linearly with the target interval, as required by the theory. Similar results were obtained by Rosenbaum and Patashnik (1980).

There are also conflicting data, however. When the performance of well-practiced subjects has been studied, discriminability (and thus internal variability) has been found to be constant or non-monotonically (for example, stepwise) increasing with base duration, rather than linearly increasing (Allan, Kristofferson and Wiens, 1971; Allan and Kristofferson, 1974a; Carbotte, 1972; Carbotte and Kristofferson, 1973; Kristofferson, 1973, 1980, 1983; Rousseau, 1975; Rousseau and Kristofferson, 1973). In other cases variability has increased in accord with Weber's Law, which predicts a linear relation between standard deviation and base duration, rather than between variance and duration (see below). On the production side, Kristofferson (1976) showed in a synchronization task that intervals from 160 through 550 msec could all be produced with the same variance and that the shapes of the response distributions across this range were identical. Beyond 550 msec, variability did increase, but according to Weber's Law, i.e. linear in the standard deviation, not the variance. Both findings are incompatible with a hypothesized gamma distribution. Regarding distributional shape, constancy across durations could only arise in the gamma case if enough pulses were being counted that the total waiting time to the last was normally distributed. Hopkins (1982) found that the convolution of a triangular and a logistic distribution (compatible with a quantal theory, below) described synchronization response distributions better than did the normal.

In sum, Creelman's theory is attractive, and has some support, but if it is not dead wrong, it is often not right.

1.2.2 Weber's Law

Weber's Law describes the variability of performance in discrimination experiments. It does not specify the nature of the timing mechanism involved. The original form of the law specified that the size of a just noticeable difference between a comparison and standard stimulus is proportional to the standard. This is not found in most or all modalities when extremely small or large magnitude stimuli are studied. The more recent form of the law instead specifies a linear relationship between discriminability and base stimulus magnitude (in our case, duration.) That is, if S is the standard deviation of the probability distribution associated with discrimination judgments about a stimulus or stimulus pair, and M is the magnitude of the standard stimulus, the original form of the law specified that S = KM, for some constant K, whereas the more recent version holds that there is some minimum degree of variability, even when no stimulus is presented, and so S = KM + c, for constants K and c. The constant c reflects the minimum level of variability associated with the particular modality and task. This correction to the law has only recently been given serious consideration in the literature on temporal psychophysics (Triesman, 1963, and, especially, Getty, 1975). However, it is not all that "modern" an idea. Fechner, who brought the law into general notice in the first place, was also the first to propose the additive constant (eg. 1860, p. 156). Within the psychophysical literature more generally, Miller's (1947) presentation of the modification is perhaps the most often cited. It is now routinely presented in nontrivial introductions to psychophysical theory (eg. Engen, 1971; Galanter, 1963). The idea of a nonzero minimum for perceptual variability has independently gained almost unanimous acceptance in psychophysics since the advent of Signal Detection Theory (Green and Swets, 1966; Swets, 1961).

Weber's Law can be translated into a statement about the variability of performance: the function which describes the probability that the comparison will be called longer than the standard, across all values of the comparison stimulus, is called the psychometric function. According to the original form of Weber's Law, the standard deviation of the psychometric function should be strictly proportional to the standard duration. According to the modern form, the standard deviation should be linearly related to the duration (Getty, 1975).

Getty (1975) stressed that Weber's Law does not imply that the standard deviation of internal timing distributions increases with the mean, and gave examples of very different underlying mechanisms that could give rise to the law. The variance of subjective durations might even be constant if other conditions are satisfied. However, if the law is correct, the range of acceptable models for the clock is limited, and does not include quantal clocks or Creelman's Poisson process (though Divenyi and Danner modified Creelman's theory, added a further parameter, and were able to accommodate the law in this case.)

Weber's Law is an empirical generalization about discrimination performance. It does not tell us anything directly about production. However, if the standard deviation of the clock were found, in a production setting, to be linear in the mean duration produced, we would expect that this timer, when used in a discrimination experiment, would yield results quite compatible with Weber's law.

Fraisse (1963) cites a long history of rejection of Weber's Law for duration, beginning with Nichols in 1890. Woodrow (1951) considered the case against Weber's Law conclusive. Allan and Kristofferson (1974b) and Allan (1979) also reviewed evidence against the law. Findings such as those of Rousseau and Kristofferson (1973), who reported constant discriminability across a range of base durations from 100 to 2000 msec, are incompatible with any version of Weber's Law. There is so much evidence against Weber's Law, and there has been for so long, that one might be amazed that temporal psychologists are still willing to talk about it seriously.

There is still some room for argument, however. Fraisse (1963) noted that the original form of Weber's Law (proportionality) seemed to fit fairly well in the range from 200 to 2000 msec. The problem of fit for short durations is comparable to that found for weak stimuli in modalities such as vision and hearing, which led to the linear generalization of Weber's Law (a point raised more explicitly by Triesman, 1963 and Getty, 1975). As to longer stimuli, Fraisse argued at length that intervals longer than about 2 seconds are estimated (perceived duration is determined by cognitive factors) rather than perceived directly. The law breaks down beyond 2 seconds because a different type of timing has come into play, with different sources of variability. Working with stimuli within this range Alpern and Darwin (1982), Divenyi and Danner (1977), Getty (1975, 1976), Kristofferson (1976, 1980), Thompson, Shiffman and Bobko (1976) and Treisman (1963, who included stimuli out to 9 seconds) have all reported data which appeared compatible with Weber's Law. For present purposes, the work of Getty (1975) and of Kristofferson (1976, 1980) are most interesting.

Getty (1975) studied the performance of fairly well practiced subjects in a discrimination experiment covering base durations from 50 to 3200 msec. Weber's Law failed for durations longer than 2000 msec but accounted for shorter duration performance quite convincingly. Subjects made 330 judgments at each base duration. The base duration was constant within sessions, but was changed randomly across sessions. Kristofferson's (1973, 1980) study can be viewed as a conceptual replication of Getty's work. There were numerous procedural differences -- Kristofferson used a many-to-few procedure and provided subjects with feedback, whereas Getty used a two alternative forced choice procedure without feedback -- but the results were remarkably comparable in spite of this. Getty reported Weber ratios (standard deviation / base duration) on the order of .05 to .06. Kristofferson's ratio, for the first 5 sessions at each duration, averaged .053. The key difference between Kristofferson's and Getty's procedure is one of practice. Kristofferson's subject stayed at each base duration for 20 consecutive sessions (6000 judgments per base duration) rather than for 1 session. While Kristofferson's results from the first 5 sessions per base duration are very similar to the results from Getty's first (and only) session per duration, Kristofferson's results for the last 3 sessions per duration are very different. After extended practice, variability no longer increased smoothly with base duration. Instead, it increased in a stepwise manner, the standard deviation doubling at base durations of 200, 400, and 800 msec. Within these subranges, the variances were not perfectly constant, but as Kristofferson suggested then, with even more practice it has been found that they become constant (Kristofferson, 1983). Allan and Kristofferson (1974a) also stressed the need for extended practice at each base duration if results of constant or stepwise increasing variability are to be obtained.

The other result reported by Kristofferson (1976) that is compatible with Weber's Law was obtained in a synchronization, or production-type setting, rather than in a discrimination experiment. Synchronization will be described in detail below. For now it is sufficient to note that the subject is required to produce a given interval, i.e. to wait for a specified period of time before responding, rather than to discriminate between stimuli. As in Kristofferson's (1980) discrimination experiment, the subjects practiced <u>ad tedium</u>, producing only one interval per session (400 times per session), for many sessions. Variability was constant in the region of 150 to 550 msec. Beyond 550 msec, the variance of synchronization response latencies increased continuously, the standard deviation being proportional to the mean latency less 550 msec. A timer whose standard deviation increases linearly with duration should yield a psychometric function whose standard deviation increases linearly with base duration in discrimination experiments, so if the timer underlying synchronization performance were also used in a discrimination setting, Weber's Law would be supported in that experiment.

In contrast with the discrimination results of Kristofferson (1980), lack of practice at specific intervals was not the cause of increasing variability with duration beyond 550 msec. The subject who showed this effect (only one synchronized at long durations) was most practiced at 940 msec, having started the experiment with 60 sessions (24,000 responses) at this interval. Kristofferson concluded that there must be a shift in timing mechanisms used in the task at about 550 msec. For shorter intervals, a deterministic timer was used. For longer ones, a model assuming deterministic timing for the first 550 msec and variable timing for the rest of the interval provided an excellent description of the data.

Kristofferson's 550 msec transition point is of interest because a similar one was found by Michon (1967) in an entirely different type of experiment, magnitude estimation, at about the same duration. Michon found that the exponent relating judged to physical duration changed abruptly between 500 and 600 msec. Tying this to introspective reports that the subjective experience of duration changes qualitatively in the 500 to 1000 msec region, to a peak in discriminability often found in the 600 to 750 msec region, and to the common finding that intervals shorter than about 700 msec are overestimated, whereas intervals longer than this tend to be underestimated (all reviewed in detail by Fraisse, 1963), Michon argued that the timing processes used for very short (below 600 or so msec) stimuli are different from those involved in timing slightly longer ones. Kristofferson's (1976) result appears to support this suggestion strongly.

It is exceedingly curious that the same subject, studied in the same lab by the same experimenter, who used basically the same equipment, should yield synchronization data that suggest a different timer for short and slightly longer stimuli while also yielding discrimination data (Kristofferson, 1980, 1983) that suggest precisely the reverse conclusion. Comparison of long and short duration synchronization performance is one of the foci of the present research. For now, however, I'll set that aside and return to the issue at hand. Curious it may be, but synchronization performance from an extremely well practiced subject indicates that Weber's Law describes the variability of the timer in this task from 550 to 2190 msec. Treisman (1963) and Getty (1976) also found evidence for Weber's Law in production-type tasks. In Getty's case, a number of statistics of the data were also examined for compatibility with the Poisson process. The hypothesis of a linear relationship between internal variability and duration was strongly favored over that of proportionally increasing variance with duration.

1.2.3 Quantal Theories

The final class of theories to be considered here is the quantal class. These form the theoretical context within which the present research was conducted and so will be presented in greater detail.

Quantal theories assume, as does Creelman's counter theory, that timing is determined by a periodic internal process. The key difference in assumptions is that the interval between pulses is assumed fixed in the quantal case. The interpulse interval's constant value is an indivisible unit of time (a time quantum), and is often represented by q. Quantal hypotheses have been around for a long time. For references to the older literature, see Harter (1967), Poppel (1971) and Stroud (1955). I will focus exclusively on the work of Stroud and of Kristofferson and his colleagues.

1.2.3.1 Stroud's Perceptual Moment Hypothesis

Stroud (1955) postulated a counter theory quite similar in conception to Creelman's later (1962) counter theory. As noted by Creelman, the only formal difference between them was that Stroud assumed no variability in the interpulse interval whereas Creelman assumed an exponentially distributed interval. In Stroud's theorizing, pulses occur every q msec, and they are used to assign internal "dates" to stimuli. Although Stroud didn't make this point explicitly, under this view the subjective duration of an interval should be directly determined by the number of pulses contained within it.

The fact that the interpulse interval is fixed does not imply that timing is free of variability. Consider a production task first. The subject is presented with a stimulus, and is to press a button at some specified time after the onset of the stimulus. The subject achieves this by counting an appropriate number of pulses before responding. The physical response takes time to execute and this time is definitely variable (Wing, 1973, 1980) but as above, for now I will ignore efferent and afferent latencies, focussing exclusively on timing. If the subject starts counting pulses from the first one after registration of the stimulus, he misses the delay between stimulus registration and that first pulse. The delay may be zero, i.e. the pulse might occur right after stimulus registration, or the delay might be q msec, if the stimulus is registered right after a pulse. Pulses occur every q msec independently of external stimulus conditions, so stimulus onset (and registration) may take place at any time within this range relative to the time of the next pulse. The delay is uniformly distributed, between 0 and q, as, therefore, must be the interval between stimulus onset and the time of the last counted pulse. Timing variability in a production task should thus be uniformly distributed, with a variance of $q^2/12$. (Note that this assumes, as has all discussion of counter theories above, that the counting mechanism works perfectly. If the counter misses the odd pulse, the situation becomes more complicated, a point raised by Kristofferson (1980).)

Turning to the internal measure of the duration of a stimulus, suppose as an example that the time between registration of stimulus onset and stimulus offset is 2.6q msec. If the first internal pulse occurs less than .6q msec after registration of the onset of the stimulus, three pulses (bounding 2q msec) will occur during the stimulus. If instead the delay between registration and the first pulse is longer than .6q msec, the stimulus interval will only contain two pulses (1q msec). In general, if an internal interval lasts T = nq + m msec, where n is the largest integer less than T, and so m = T modulo q (by definition, the remainder of integer division of T by q), then either n or n+1 pulses will be counted. The count distribution is thus point binomial and the probability of a count of n is m/q. The variance of the count is $m(q-m)/q^2$. This is not a direct function of the duration of the interval, but it is a function of m, the interval mod q. Examined over widely spaced values of T, the variance should appear roughly constant with duration. In fact, though, it is periodically related to T, with a period of q.

Various early applications of this model to studies of reaction time, successiveness discrimination, and other tasks appeared successful (Augenstine, 1955; Kristofferson, 1966b, 1967; Schmidt and Kristofferson, 1963; Stroud, 1955), but with complications. First, there were conflicting estimates of the quantum size. Kristofferson (1966a, 1966b, 1967a, 1967b) typically obtained values around 50 msec. Kristofferson (1969) obtained values closer to 25, as did Heath (1972). Stroud (1955) estimated q at about 100 msec. These differences were not due to statistical instabilities. Kristofferson obtained remarkably similar results across tasks, as did Stroud. Augenstine (1955) conducted a spectral analysis on response time data from two tasks and found two levels of periodicity, at 50 and at 100 msec. (A third period, of 265, was also obtained in the first task). Kristofferson (1967a) presented evidence that successiveness discrimination involved a mixture of quantum levels. Sometimes the subjects operated with a q of 50 msec, sometimes with a q of 100. This was particularly a problem with relatively unpracticed subjects. Kristofferson (1981) reports that early reaction time work of his also yielded estimates of 25 and 50. This type of result was eventually used to advantage, as strong support for a different quantal theory (Kristofferson, 1980, discussed below), but at the time these results were essentially anomalous.

More important than the lack of agreement on a single value for q was the consistent finding that this quantal counting theory did not predict duration discrimination performance at all (reviewed by Allan and Kristofferson, 1974b). Internal duration distributions did not appear to be uniform. Instead, Allan and Kristofferson (1974a; Allan, Kristofferson and Wiens, 1971; Kristofferson, 1973) found that discrimination performance was well described if the internal distributions were assumed to be triangular, not uniform. Triangularity makes no sense in terms of the original quantal counting model. Nor does the finding that subjects can set a response criterion, or vary a response latency, across a continuous range (eg. Kristofferson, 1976, 1977). If a subject's indivisible unit of time is 25 msec, how does he shift a mean response time by 5 msec? And that without otherwise affecting the shape of the response distribution in any way?

The finding that intervals generated by subjects are continuously adjustable is a nasty one for any quantal counting theory. Some continuous process has to be accommodated within the framework of a fundamentally discrete system, and in a plausible way, if the quantal view is to be maintained. If the main function of the periodic process proposed to underlie the quantum is timing, and the main mechanism supposed for timing is the assignment of "dates" to events in terms of these time points, continuous adjustability seems to me to be critically negative evidence. Accordingly, I will set aside this particular quantal view, Stroud's "perceptual moment" hypothesis. (See also Allan, 1975, Allport, 1968, and Baron, 1971.)

1.2.3.2 Cortical Excitability Cycles

Kristofferson's (1966a, 1966b, 1967a, 1967b, etc.; Schmidt and Kristofferson, 1963) point of view was somewhat different from Stroud's. It was hypothesized that the time quantum reflected a processing limitation of the nervous system, not a dedicated process for conscious timing. According to this "cortical excitability cycle" hypothesis (reviewed in Harter, 1967), certain types of jobs can be done in the nervous system only at specific times, minimizing the total processing load at any instant. Thus, for example, attention switching might only be possible once every q msec. Sampling of input in an attended channel might also occur once every q msec, perhaps a few msec after the time at which attention switching to a channel can be completed. (This particular case was raised by Kristofferson, not by Harter. See Santa-Barbara's 1967 review of the physiological thinking behind Kristofferson's quantal theory.) The time quantum reflected in human timing is the period of whatever process it is that regulates switching and/or sampling times. The process may send out one signal per cycle that can be counted, and if it does, and these signals are counted, we have a quantal counting clock. However, that is not the only type of clock possible under this view, and the quantum may be reflected in timing whether or not counting takes place. Suppose there is a "perfect" clock in the nervous system. Messages to the clock to start or stop timing, and messages from the clock that an interval is complete, or that an interval lasted so long, still have to be sent and received in the system. If messages to and from the clock can only take place once every q msec, then the resolution of timing is not infinite, as is this hypothetically perfect clock's, but instead it is determined by the quantum size.

The central idea in Kristofferson's quantal theorizing is that messages (eg. stimulus events) are processed in stages, and a periodic process determines when a message may proceed to the next stage. A number of different timing hypotheses have grown out of this, at least one of which is probably wrong, and more than one of which might be right, depending on the situation and the strategy of the subject. Before presenting those, I should note explicitly that EEG alpha, with a frequency of 20 cycles per second, is very frequently discussed in presentations of periodic processes and timing. EEG figured prominently in Kristofferson's early work and thought (Kristofferson, Note 3), and in many other discussions. The research linking timing and EEG has produced a rather underwhelming case for this idea, however (for example, Holubar, 1969; Legg, 1968). The present discussion is without reference to any particular periodic process in the nervous system.

1.2.3.3 The Onset-Offset Model

The first quantal model for duration discrimination (after simple quantal counting failed), was the onset-offset model of Allan, Kristofferson and Wiens (1971). Suppose that there is time jitter of up to q msec before a stimulus is processed centrally. There are two sources of variability in stimulus presentation: the onset of the stimulus interval has to be registered, and the offset of the interval has to be registered. If the onset and offset delays are uniformly distributed, and are independent, their sum is triangularly distributed, with a variance of $q^2/6$ (see also Kristofferson, 1966b). If there is no other variability in the timing process, then subjective durations associated with stimuli should be distributed in the same way. This model also predicts that timing variance should be constant across the range of intervals over which onset and offset delays are the only sources of timing variance.

Allan et. al. found that the assumption of equal variance triangular distributions predicted the operating characteristic curves of their subjects' duration discriminations quite well, at least as well as an assumption of equal variance normal distributions, and much better than Creelman's model, which implies proportionally increasing variance in the internal durations. Quantal estimates from the data were either very close to 50 (4 between 46.1 and 52.1) or very close to 25 (5 between 23.0 and 26.5) with one exceptional value of 37.6. The numerical values thus appeared quite comparable to estimates from successiveness discrimination and reaction time work. In this experiment, the range of durations studied was rather narrow (50 - 150 msec), but results in some ways comparable to them were obtained by Allan and Kristofferson (1974) using a range of stimuli from 70 to 1020 msec. No subject worked with the entire range of stimuli, and for identical stimuli more cross-subject variability was evident than in Allan et. al. (1971). Further, variability was not constant across the ranges studied for most subjects, and variability definitely appeared to increase with duration. However, variability did not increase continuously with duration. Instead, it seemed as though variability might be constant over subranges, with sharp increases to new levels, which would remain constant over a further range of durations. Estimates of q were again close to previous values, 25, 50, or 100, excepting data from one subject (of 5 in 1974) that yielded a q estimate close to 150. Both of these studies used light flashes as the stimuli. Rousseau and Kristofferson (1973) used the offset of a light and the onset of a tone to mark the boundary of an interval, and obtained equal stimulus discriminability across a range from 100 to 2000 msec. Discriminability in this study was poorer than previously, but the evidence of constant variability in the timing process seemed quite strong. Allan and Kristofferson (1974b) and Allan (1979) review more of the same types of results.

The onset-offset model was explicitly dissociated from the hypothesis of quantal counting. Subjective duration was seen as a continuous variable, not a quantized one. Variance is due to periodic (quantal) delays in getting information to the clock, which, implicitly, is assumed to keep perfect time once it gets the message. This approach preserves the core of Kristofferson's quantal theorizing, that a periodic process is a major source of timing variability, while avoiding the complications inherent in quantal counting models.

Despite its success in accounting for some aspects of the data, there are a number of problems with the onset-offset model. First, there is a conceptual problem with the notion of independent uniform delays of the onset and offset stimuli, a problem raised in detail by Hopkins (1982). The rationale behind the quantal delay is that a periodic process determines when a stimulus representation can be dealt with centrally. Since the stimulus can be presented at any time relative to the start of a cycle of this process, we can assume that the distribution of waiting times before the stimulus is dealt with (eg. before a message to start timing or to stop timing and report the length of the interval) is uniform. But by the definition of the process, the times between successive "ready" periods are fixed. Similarly, the time between stimulus onset and stimulus offset is fixed, for identical stimuli. Once we know what the waiting time to process the first stimulus was, and what the value of q is, then for any stimulus duration we should be able to predict perfectly what the waiting time to process the offset stimulus will be. Both delays are uniformly distributed, but they can't be independent.

In the context of a model for synchronization performance, Hopkins (1982) made a more satisfactory suggestion. In the synchronization task, the subject is presented with a short stimulus pulse (P1) and is to make a response in synchrony with a later pulse (P2). In order to synchronize with P2, since the response movement takes time (Michaels, 1977, estimated that the triggering of the response starts about 100 msec before it is completed), the subject must estimate how long it has been since P1 and respond on the basis of that estimate, not on the basis of perception of P2 itself.

Synchronization is a timing task, not (usually) a task involving reaction time to P2. The stimulus-response chain can be divided into three stages, afferent, central (including timing), and efferent, with two quantal delays, one between initiation of timing after the stimulus is registered, and one between initiation of the response after the timer indicates that responding should begin. So far, this is identical to the thinking behind the onset-offset model, except that in that case there is no central-to-efferent delay as there is no timed response. The two delays in discrimination are afferent-to-central delays. Hopkins' contribution was the suggestion that the periodic process controlling output from the clock might have a trivially different frequency from the process controlling input. If so, the two processes will pass through all possible phase relations, and knowing the waiting time for input to the clock will yield no information about the waiting time for transfer to the motor centers, so the sum of the waiting times will still be triangular.

Timing in the nervous system is not determined by a single crystal clock, as it is in a computer. Instead it is determined, presumably, by the actions of a number of cells. The idea that transfer from the clock to the motor system would involve different groups of cells ~~from~~ transfer from the sensory system to the clock seems plausible enough. The idea that different groups of cells would be involved in periodic regulation of transfer times also seems plausible to me, and if so, the notion that the frequencies of the processes might differ seems quite reasonable. Stretching the argument back toward discrimination, if a second periodic process determines the waiting time from the clock outward, whether to the motor system or to anywhere else, we have a second, effectively independent, quantal stage that does not require the difficult hypothesis that waiting times of time-locked stimuli into the clock are independent. I'm not fully satisfied with this argument, but this is the best suggestion available for triangularity in the discrimination task. It should be noted that not only does triangularity fit the various statistics from duration discrimination data quite well (Allan et. al. 1971; Allan and Kristofferson, 1974a; Brewster, 1983; Kristofferson, 1973, 1980, 1983), but it describes the data at least as well as or better than a normal distribution (Allan et. al. 1971; Brewster, 1983). In the synchronization situation, Hopkins (1982) compared the fit of a triangle convoluted with a logistic distribution (efferent latency variability) with that obtained from a variety of other distributions, and the triangular hypothesis was consistently supported. In sum, whether the specific mechanism proposed in the onset-offset model is reasonable, triangularity is empirically well established, and some quantal stage approach should predict it (which no other theory does).

Far more difficult for the onset-offset model is the variation observed in q. If the only source of variability is in input to and/or output from the clock, and the clock times in continuous units, then why does the variance increase with duration, stepwise or otherwise? There is no good reason for this and Allan (1979) and Kristofferson (1977, 1981) have abandoned the model.

Research since the proposal of the onset-offset model in 1971 has pointed to two key revisions to this way of thinking about discrimination behavior. First, the onset-offset model assumes that subjects actually estimate the duration of the stimulus, and that they base their discrimination judgments on this estimate. This is called the interval measure hypothesis and it parallels standard assumptions about the basis of discrimination in any modality (eg. Thurstone, 1959; Green and Swets, 1966). At least for the tasks under study, this hypothesis is demonstrably incorrect. The alternative that does describe the data is the real-time criterion hypothesis (Kristofferson, 1977), which I describe in the next subsection. The second revision has been the acceptance of quantal counting, strongly suggested by the finding of very orderly stepwise increases in the variability of internal times. The problem for quantal counting was and is the finding that subjects can produce intervals along a continuous scale. Since the problem is critical for the hypothesis, I'll review the evidence for it, and a suggestion for its basis, before describing the evidence leading to quantal counting.

1.2.3.4 The Real-Time Criterion

In a single-stimulus discrimination paradigm, the subject is presented with, and asked to categorize, stimuli one at a time. In a given session, you might present many different stimuli, having the subject state, after each is presented, whether it is "short" or "long". The midpoint of the stimulus set is usually used by the experimenter as a dividing point, and the subject's judgment, refined with trial-by-trial feedback, is to be based on whether the stimulus is longer or shorter than that middle duration. According to the interval measure hypothesis, in this type of task, the subject compares the perceived duration of the stimulus with some criterion value, and says "long" if the duration is too large. Now, suppose that you present a subject with a long stimulus, and you discover that she consistently responds "long" before the stimulus interval is complete. How she does this is not clear at this point, but how she does <u>not</u> do it is by measuring the duration of the stimulus interval, basing her judgment on the difference between this interval measure and a criterion. (The interval has not yet ended so how could she have measured it?) The interval measure hypothesis cannot deal with this kind of behavior, but this is what happened in numerous discrimination experiments.

Kristofferson and Allan (1973) outlined the real-time criterion hypothesis as an alternative and Kristofferson brought data to bear on the issue in 1977. The idea is that the subject turns the task into a time production task, generating a criterion interval, and bases her judgment on which ended first, the stimulus or the criterion. As soon as one of them ends, she can immediately respond, either long if the criterion interval ended first, or short if the stimulus ended first. It is called the "real-time" criterion because it is assumed that the subject is working in "real" time. With training, she learns to generate an interval of the required length. How long that interval seems subjectively doesn't matter. All that matters is that it is the right length, and, given that, whether it or the stimulus ends first.

To test the idea, Kristofferson examined subjects' performance in a speeded discrimination paradigm. In this case, the duration stimulus was an empty interval, bounded by two short (10 msec) auditory pulses, P1 and P2. The subject was instructed to respond "long" or "short" as quickly as possible. (To avoid response competition problems, in any given session, subjects either made "long" responses, doing nothing when the stimulus was judged short, or they made "short" responses. Many sessions of each type were conducted.) Three predictions can be made about performance in this task. First, "long" responses should be time-locked to P1, the stimulus marking the start of the interval, and the "short" responses should be time-locked to P2. By "time-locked" I mean that the distribution of response times should depend only on the time since the stimulus to which they are "locked". "Long" responses are triggered by the criterion, and should occur at the same time no matter when P2 is, so long as P2 comes after the criterion interval ends. "Short" responses are made when the stimulus ends (P2 happens) before the criterion interval ends. They should be simple reactions to P2, and should not depend on P1. The second prediction is related to the idea of time-locking: the distribution of "short" responses should look like a distribution of reaction times, whereas the distribution of "long" responses should look like a distribution of time production responses. The final prediction is that q should be estimable from both the response probabilities and from the response latencies, and the same estimates should be obtained in both cases.

Kristofferson and Allan (1973) can be consulted for the details of estimating q from discrimination probabilities. As to the response latencies, Kristofferson (1977) made the following argument. If a "long" response is time-locked to P1, its latency includes the afferent latency (the delay between stimulus onset and stimulus registration), the duration of the criterion interval, and the efferent latency (the delay between the end of the criterion interval and the completion of the response). The latency of the short response, as measured from P2, consists of the afferent latency associated with P2 plus the efferent latency, the delay between registration of P2 and the making of the fast reaction response. Assuming that the variances of the afferent latencies in both cases, and those of the efferent latencies in both cases, are the same, the variance of the internal criterion interval is simply the variance of the "long" response latencies minus the variance of the "short" response latencies. If internal timing distributions are triangular, their variance should be $q^2/6$, so the difference in variance between latencies of long and short responses should yield an estimate of q directly.

It is important to note that there is no way of filtering out afferent response latencies in the discrimination case. Estimates of variability (and thence of q) in duration discrimination are based on response probabilities, which reflect the total variability in the task. If there is afferent latency variance, the estimate of q from discrimination should be higher than the one we obtain from the response latencies.

One question that is preliminary to research of this type, by the way, is whether or not subjects can produce an internal criterion interval with any degree of stability. Kristofferson (1976) addressed this using a synchronization paradigm. In this case, the subject is not required to make a discrimination response. She is merely required to respond a specified time after P1. P2 is presented as a marker of that time, i.e. her goal is to respond in synchrony with P2, and the earliness or lateness of P2 relative to the response serves as immediate feedback on each trial. Subjects perform this task well and their response distributions look triangular.

The results from Kristofferson (1977) were as expected. My description will ignore results from stimuli that fell within one q of the base duration used (1160 msec) as examination of these would introduce complications that are not relevant here. (They are not discordant with the theory). The response distributions to the "short" stimuli were supposed to be reaction time responses to P2, and were not supposed to depend on the P1-P2 interval. They were, and they didn't. On average, responses followed P2 by 168 msec. Kristofferson (1976) estimated reaction time to similar stimuli at about 160 msec. Response distributions to P2, at three different P1-P2 intervals, looked the same in shape as well as in mean (see Kristofferson's Figure 4, in which they are superimposed). The distributions were highly peaked, fairly symmetrical, and comparable in variance to those obtained from the same subject in synchronization (Kristofferson 1976) when the synchronization response was to follow P1 almost immediately (i.e. when P2 was in the reaction time range after P1). The distribution of "long" responses was time-locked to P1. The mean response latency from P1 was 1340 when P2 followed P1 by 1330 msec, 1343 for a P1-P2 interval of 1375 and 1347 when P2 followed P1 by 1550 msec. The distributions were again symmetrical and superimposable. The estimated q from the latencies was 95.5. From the response probabilities, the (entirely independent) estimate was 95.3 msec. To instantiate the meaning of "well-practiced subjects", since I've raised the issue of practice before, these data were collected over 114 sessions of 300 trials each, using the same base duration in each session. Data reported in the same paper from subjects who had only participated in 60 and 64 sessions, respectively, were more variable, and the subjects had clearly not attained asymptotic levels of performance, as is required by the theory for any stringent tests.

Kristofferson (1983) extended these results, on the same subject, across more base durations, obtaining highly comparable q estimates from the latencies and the response probabilities across conditions, and also obtaining q estimates highly comparable to those found, from the same subject, in non-speeded discrimination (Kristofferson, 1980). As such, they also provided further support for the quantal counting hypothesis, which cannot be taken seriously until the problem of continuous adjustability is cleared up.

1.2.3.5 Deterministic Internal Delays

The criterion duration can be estimated from response probabilities in standard duration discrimination data, and Kristofferson (1973) noted that these seemed rather more precisely placed than would be expected if the subjects were working in quantal (eg. 25, 50 or 100 msec) units. Without downgrading the value of such data, I'll note that inferences about the shape and mean of internal distributions that are derived from discrimination are necessarily rather indirect. All that you have to go on is a large number of binary decisions (long, short) associated with a few, sometimes very few, stimuli. Many assumptions are involved in estimation of criterion durations from such data. More direct evidence for continuous adjustability comes from production tasks. If the subject can accurately produce any duration specified, without changing any statistics of his response distribution other than the mean, from interval to interval, the conclusion that he is working with a continuous scale is inescapable. Kristofferson (1976) obtained results of this type using a synchronization task.

To illustrate the problem this poses for a quantal counting theory, I'll present a hypothetical example. As above, to keep the discussion to the point, I will ignore afferent and efferent latencies and their variances. Suppose that q is 25 and the timing distribution is triangular. The variance of the response distribution is $q^2/6$, or 104 $msec^2$. If we present the subject with a stimulus, P1, and ask him to respond precisely 300 msec later, he should have no trouble with this, because it is exactly 12 quanta from P1. Similarly, synchronizing with a P2 tht occurs 325 msec (13 quanta) after P1 should also be easy, the variance should be the same, as should be the response distribution's shape. Now, suppose we make the P1-P2 interval 312.5 msec. This is 12.5 quanta, but, quanta being indivisible, the subject will have difficulty counting half of one. He can produce a mean of 312.5 by counting 12 quanta half the time and 13 quanta the other half of the trials, but now his response distribution will have a flat top rather than a sharp peak and his variance will be much larger. If his timing is based strictly on quantal counting, he cannot produce an average 312.5 msec interval in any way but by producing a mixture distribution of responses, some based on overcounts and some on undercounts. Similar problems arise, of course, for 305, 310, 315 and 320 msec intervals. (In these cases, the distributions have unique modes but they are asymmetrical.)

Kristofferson (1976) found that synchronization response distributions had the same shape and variance from 170 through 550 msec. Variances throughout this region were about 125 $msec^2$. Many intervals studied differed by only 5 msec. The mean latencies were very close (within a few msec) to the P1-P2 intervals at every interval studied. I should qualify this by noting that the variance steadily increased, for one subject, as the reaction time limit was approached, and was only convincingly constant from 300 to 550 msec. The shorter the P1-P2 interval below 300, the more difficult the task for that subject, and the more variable his responses. However, small differences in the interval produced small differences in variability, and the means still tracked the intervals closely. All distributions were unimodal, bounded, symmetrical, and very highly peaked. They were not produced from mixtures of counts of different numbers of quanta.

The response distributions were not exactly triangular, nor should they be. Efferent latency variance may be constant from interval to interval, but it is not zero. Wing (1973) developed a means, in a repetitive keytapping task, of estimating efferent latency variability, which he manipulated by changing the required response movement from condition to condition. In well-practiced subjects, motor variance is about 10 to 50 $msec^2$. (Similar estimates come from Meijers and Eijkman, 1974, and Vorberg and Hambuch, 1978.) There is no strong evidence regarding the distribution of efferent latencies, but there are some grounds for supposing that the distribution is bell shaped. Meijers and Eijkman (1974) make a convincing case that the variability of motor delays reflects the contribution of delays from a large number of cells, in which case the delays might be normally distributed. Hopkins (1982) reviewed this literature in somewhat more detail, and used a logistic distribution as an approximation to the normal in examining synchronization response distributions, and testing the fit of the quantal model. Subsequently (during his thesis defence) he has stated that with further reading and discussion he thinks the logistic model might be more accurate than the normal. It doesn't matter all that much in the context of the present research which finite-variance bell shaped distribution we use for the efferent latencies. I will assume, with Hopkins, that it is logistic. The distribution of synchronizations under this view should be the distribution of a triangular variate added to an independently distributed (Botwinick and Thompson, 1966, for example) logistic. Plus, of course, a random variable representing afferent latency, unless that isn't variable, and it seems not to be, at least for auditory and tactile stimuli.

Synchronization variance is constant from 160 to 550 msec and there is no difference in the shapes of the distributions across this range. Delaying a reaction time range response (160 msec) by up to 400 msec has no effect on the response distribution, except in the mean. Given the lack of effect on variance and shape, it is most plausible to assume that these internal delays are not themselves variable, i.e. that they are deterministic.[2] But these delays are not only deterministic; they also seem to be continuously adjustable, at least for auditorily bounded durations. Quantal delays are deterministic, but they are not continuously adjustable. Where are <u>these</u> coming from?

Kristofferson (1976) speculated that it might be in the afferent latency. The introspective basis for this hypothesis was the report of perceptual "shortening" of stimulus intervals by experienced subjects when working with relatively long intervals. At the very start of a session, the subjective duration associated with a P1-P2 interval was reported to be much longer than that associated with the same interval a few trials into the session. Once the subject was "warmed up", the interval seemed fairly short, and, subjectively, it stayed that way. This suggests that tbe stimulus is being delayed before it reaches the clock. As a subject who became very experienced at a P1-P2 interval of 460 msec in Joan Brewster's synchronization experiments, I should report that this does not describe my impressions at all. Nor, from reports from the two subjects in the present research who synchronized in the 1400-2100 msec P1-P2 range, does it describe their subjective experiences. However, it was striking for Kristofferson's subjects and was the basis for a plausible suggestion independently of the introspective reports.

If we parse the synchronization stimulus-response chain into afferent, central and efferent components, then a deterministic delay isn't likely to be part of the efferent latency, which is not deterministic at any level studied (see, eg. Meijers and Eijkman, 1974). If by central we mean a discontinuous quantal clock, it can't be here. If there is no variability in the afferent latency, then at this level, perhaps the stimulus could be recycled through some part of the afferent mechanisms before it is brought to the clock. If afferent latency variance is zero, this is the most likely candidate for the delay, even if the clock is not quantal (especially if the clock is variable, with increasing variance with duration).

One source of evidence for non-variable afferent latencies is the finding that in speeded discrimination the latency based estimates are the same as the discrimination based estimates. If afferent latency variance was present, q estimates from the response probabilities should reflect this, and be higher. Certainly, there is room for such variability to be missed when q is about 100, since timing variance at this level should be more than 1600 msec^2 ($q^2/6$). But when q is only 23.9, as in Kristofferson (1983), variance is only 95.2, which is more constraining. When synchronization latency variances are as low as 35 msec^2, as obtained by Hopkins (1982; Hopkins and Kristofferson, 1980) after exorbitant amounts of practice, there is barely enough for us to include efferent latency variance. If q is as low as 12.5, timing variance should be 26 msec^2. There is simply none left over for afferent latency variability to account for. Further, Hopkins (1982) tested the fit between these data and his model for response latencies that specified that they should be distributed as the sum of a logistic efferent latency variable plus a triangular timing variable, with no provision for afferent variability. The fit of the model to the data was excellent. Divenyi and Danner (1977) developed an extension of Creelman's (1962) theory that allowed them to estimate auditory afferent latency variability in their task. Their estimate was 1 msec^2. In a separate review, Divenyi (1976) has argued that it is around .2 msec^2. Finally, Hopkins and Kristofferson (1980; Hopkins, 1982) were able to obtain synchronization variances to tactile stimuli that were just as impressively low as the responses when P1 was auditory. Either tactile and auditory latency variances are non-zero and equal or the latencies are not variable and the authors considered non-variability more parsimonious.

For no reason that I could logically defend, I find it difficult to believe that afferent latencies are constant. Nor, assuming that they are, am I convinced that deterministic timing is accomplished at this level. However, the existence of deterministic timing seems well enough established, and Kristofferson's and Hopkins' plausibility arguments for this basis seem valid, as plausibility arguments, and I don't have any better suggestion to offer, so as a working hypothesis, I assume that they are correct.

Given that there is recycling at the afferent level, it can take one of two forms. In Kristofferson's (1976) study, the behavior of one subject was examined across a range from 155 to 2190 msec. His variability was constant in the 300 to 550 msec range, increasing slightly with shorter stimuli, and increasing substantially with longer ones. If it was supposed that a strictly deterministic timer was responsible for timing out to 550 msec, and that a new clock came into play from 550 msec onward, the data indicate that that new clock is a Weber's Law clock. If central timing in this task is non-deterministic, the afferent latency can be lengthened as much as 400 or so msec (the other 150 of the 550 msec latency being taken up by the time it takes to perceive and respond.) This would explain the perceptual shortening reported in the task, and the transition to the new clock at 550 msec. Presumably, the stimulus can't be held up internally forever.

Alternatively, the stimulus might be recycled only for a few msec, and then be passed to a quantal counting clock. Recalling the example at the start of this section, if the representation of a 312.5 msec stimulus was always held up by precisely 12.5 msec, the subject would be faced with the simple task of timing a 12 quantum interval. If we then increased the interval to 317 msec, the afferent delay could be increased to 17 msec, and the task would again be the same for the clock. If the afferent delay, once set, is constant until it is re-set for a new interval, this adds no variability. Part of the function of training might be the development of, or development of reliance on, a constant length delaying neural pathway. This fails to explain why there is a transition at 550 msec, but, as noted earlier, Michon (1967) has made the case that there should be a transition to a new timing mechanism at this interval. On the other hand, from discrimination data to be described next, a strong case can be made that there is no shift to a new type of clock, but there is a quantal counter. If fine-tuning of the quantal counter can be accomplished by short, continuously adjustable, deterministic delays at the afferent level, the devastating argument against quantal counting, i.e. the problem of continuous adjustability, loses its force, and we are free to take evidence for such a mechanism seriously.

1.2.3.6 Quantal Counting

Throughout the discussion above, I've referred to q values that hovered around 12.5, 25, 50, or 100. The visual discrimination data of Allan et, al. (1971) yielded estimates very close to 50 in one condition, and very close to 25 in a later condition, after the experimental procedures were refined. Durations studied in this case ranged from 50 to 150 msec. Synchronization data (Kristofferson (1976) yielded estimates close to 25 in the 160 to 550 msec region of P1-P2 intervals. Converging estimates from speeded discrimination data (Kristofferson, 1977) were virtually identical, and very close to 100 (95.3). Durations in this case were centered about 1160 msec. Hopkins (1982) used a minimum chi-square estimation technique to estimate the triangular and logistic parameters separately from synchronization response distributions. From very highly practiced subjects, he reported q estimates of 16.6, 14.8, 11.4, and 9.1, averaging 12.98. Synchronization intervals in this case were also within the 170 - 550 msec region. Other examples are distributed throughout the discussion above. What do these different values imply?

Three empirical generalizations come to mind from examining such data. First, as is evident from the numbers, q estimates form a geometric series. Each value of q is double the next smallest. Second, there is some trend for q to increase with base duration, though it is found to be constant across ranges of base durations. Third, if there is a minimum value that can be achieved at a given base or synchronization interval, there is no guarantee that it will be achieved there. Comparing Hopkins' (1982; Hopkins and Kristofferson, 1980) results in the same range as Kristofferson's (1976) (which shared one subject, by the way, so cross-subject variability doesn't account for this), the q estimates in Hopkins' case are half of Kristofferson's. Hopkins introduced a number of procedural refinements into his version of the task, and practiced his subjects even more extensively, and there was evidence of continuing improvement with practice even after 100,000 trials at the same interval.(!) Thus, while there may be a minimum achievable value of q associated with any interval (there may not), the value that will be obtained in any particular task depends on practice levels and on the specifics of the task.

Some further evidence for stepwise increase in q comes from the visual discrimination data of Allan and Kristofferson (1974a). Over the range from 70 to 230 msec, q appeared to be 22. Around 400 msec, only one subject was studied. The q estimate was 59. From 500 upwards, q appeared close to 100, though for one subject it was higher. Still, there was a lot of cross-subject variability, few different base durations (midpoints of single stimulus sets) were involved, and no subject was studied across the range. The stepwise increase is suggested in these data, but it is not clearly evident unless one is looking for it.

Much more extensive data were collected with auditory stimuli by Kristofferson (1973, 1980, 1983) and the case they make is far more convincing. The 1973 and 1980 data are the same (with, I believe, more data in 1980). The 1983 study used speeded responding whereas the 1980 study did not, and it included much more extensive practice at fewer base durations, selected on the basis of the 1980 results. In the 1980 paper performance at 13 base durations was reported. (Again, these are midpoints of single stimulus sets. The advantage of this procedure is that on a given trial, there is only one stimulus, and so only one triangularly distributed variate.) The base durations ranged from 100 to 1480 msec. The data from the first five sessions at each base duration conformed nicely to Weber's Law. Standard deviations, and thus q estimates, increased linearly with the means. With increasing practice, variability at some intervals declined substantially, while variability at others remained virtually constant. By the end of 20 sessions per base duration, a very different picture was evident in the data. Durations could be grouped into four ranges. At 100 and 160 msec, q was close to 14. From 200 to 350 msec, q was close to 25. Q was nearer 50 in the 450 to 800 msec region, and above that it was closer to 100, with some values around 150 as the interval increased. Within these ranges, q was still increasing somewhat, but at a much slower rate than found at first. Further, the differences across ranges were clearly larger than the differences within ranges. Finally, the q estimates for stimuli toward the low end of any given range had not changed much, whereas those from the longer stimuli in each range had come down considerably. With increased practice, Kristofferson (1980) argued, q values obtained from stimuli at the long end of each range should decline further. That was checked in 1983, with up to 70 sessions practice at durations chosen from both ends of some of these ranges, and was clearly confirmed.

The empirical generalization that emerges from such data is that the values of q can be described in terms of "doubles sets". From 100 to 200 msec, q is about 12.5. From 200 to 400 msec, i.e. double the previous range, q is 25. From 400 to 800, it is 50. Double everything again to obtain q = 100 in the 800 to 1600 region. Kristofferson (1983) also studied stimuli centering around 1800, which should be in a 1600 to 3200 range with a q of 200. The estimated q, from response latencies and from response probabilites, was very close to 204. These would be sensible values if the subject's duration estimate was based on a quantal count, with a maximum possible count of 16. If the smallest possible q is 12.5, the subject can use that to time out intervals lasting up to 200 msec. Beyond that, either the subject can give up on counting, or he will have to count in larger units. Quanta being indivisible, the next unit is 2 quanta, 25, which takes him to 400 msec, and so forth. I should be explicit here in noting that this counting is not done consciously.

Fine tuning of the system, according to the argument presented in the previous section, is done by the setting of deterministic afferent delays. Stimuli are perceptually shortened so that the clock can work with an integral number of quanta, even though the stimulus itself does not last an integral number of quanta. Kristofferson (1980) puzzled over the increase in variability within ranges, and suggested that perhaps there was some variance in the count, that increased with the count. In this case, as stimulus duration increases beyond the minimum value for a range, so does the timing variability. Perhaps this is correct. Alternatively, I suspect that if the afferent delay hypothesis is correct, it would be much harder to delay a stimulus for a long time at this level than it would be to delay it for a short time. Perhaps the variance increase, within ranges, simply reflects the amount of practice required before a stable afferent delay can be obtained at the right value.

The hypothesis of quantal counting, with a 4 bit (16 maximum) counter, cannot be tested in all experimental settings, nor could the subject use such a counter effectively in all settings. Suppose that we randomly varied stimulus duration from 50 msec through 2000 msec within a single session, for example. (Such variation would be quite reasonable in the context of a two alternative forced choice task, in which the subject is merely to state which of two intervals is longer. This is how such tasks are usually run, in most modalities.) The subject has no way of knowing, in this case, what range of stimuli is reasonable for a given trial. If he tried to count quanta, he might be faced with the hopeless task of spreading at most sixteen 12.5 msec q's across a 2000 msec interval. Having learned a lesson on that trial, he might be faced on the next with timing a 50 msec stimulus using a 200 msec quantum. With practice, the subject would undoubtedly become expert in the use of some other timing mechanism. That other timer might be a Poisson clock, a Weber's Law clock, a "perfect" clock, or something else altogether. There is no restriction on the type of clocks possible in Kristofferson's quantal theorizing. The quantum reflects the period of an information gating process, which restricts the temporal precision possible in any situation by introducing variable delays at the level of input to and output from the clock. The expectation that these delays will be relatively large enough, in variability, to be measurable behaviorally is based on the assumption that with practice the subject will learn to use the most sensitive timing strategy that he can. This will only sometimes be a quantal counting strategy.

In naturalistic settings, the use of deterministic timing strategies might be quite restricted. Quantal counting with an appropriate multiple of the minimum quantum size was possible in the discrimination experiments because the same narrow range of durations was used for session after session until well after the range of stimulus intervals possible was extremely well known to the subject. The types of situations in which people might use quantal timing regularly might include timing out a short interval before striking the next key on a piano, by a professional musician, or timing the required delay between the pitch of a baseball and the swing of the bat by an experienced ball player (hopefully resulting in good synchronization between the arrival time of P2, the ball at the plate, and the response).[3]

1.2.3.7 Visual/Auditory Modality Differences

If timing is centrally done, and if the quantum reflects a periodic process determining when input will progress to central processing, and when processing will progress to the next stage after, the last thing that should affect timing variability is the modality of the stimulus markers, especially if afferent latency variance is zero. Why should it matter whether the stimulus used to mark the onset and offset of an interval is visual, tactile, or auditory? Yet it seems to. Returning to the discrimination data, comparison of the visual results of Allan et. al. (1971) and Allan and Kristofferson (1974a) to the auditory results from Kristofferson (1980) (comparable values were obtained from Brewster, 1983, at 240 msec), and averaging results across subjects, conditions, and measures, I obtain the following (all units in msec):

Interval	Auditory q	Visual q
100	14	22 (1974) 34 (1971)
150	16	24
200	25	29
350	31	
400		59
450	48	
570	60	105
740	60	127
910	113	112

There are some problems with this comparison because the subjects in the visual experiments participated in fewer sessions, in total, than the subject of Kristofferson (1980) and those of Brewster (1983, who obtained q estimates as low as 17 in the 240 msec region, but using a task too complicated to describe in detail here.) This is especially problematic in the 1971 visual study, in which conditions were varied in random order, from session to session, which may have reduced the benefits of practice. Further, some procedural refinements affected q, yielding a bimodal distribution of q estimates clustering around 50 and, in the second experiment, 25. In the 1974 study, however, subjects stayed at the same base duration for 10 to 21 (usually 20) sessions (288 trials per session), which isn't very different from the 20 sessions (300 trials each) at each base duration used by Kristofferson (1980). This small difference in practice shouldn't account for the virtual doubling of q values in the visual relative to the auditory data.

There is also evidence of a difference in the estimated duration of visually and auditorily marked intervals. Visually marked intervals are typically perceived as shorter. Goldstone and Lhamon (1972, 1974) and Lhamon and Goldstone (1974) review dozens of experiments of theirs (many with Goldfarb) that employed a wide range of psychophysical procedures, including production, reproduction, discrimination, and category rating. Their findings are quite consistent, and they cite many independent replications. Interestingly, Lhamon, Edelberg and Goldstone (1962) found a much smaller difference between auditory and tactile stimuli than between auditory and visual ones. Goldstone's studies have typically employed lots of subjects, making judgments about lots of stimuli, but not making many judgments about any particular stimulus. The only cross-modal study that I am aware of that involved many judgments per stimulus was conducted by Tanner, Patton and Atkinson (1965), who studied only three pairs of durations, 500 vs 600 msec, 1000 vs 1100 msec, and 1500 vs 1600 msec. Only one pair of intervals was presented (512 times) per session. Either of the pair of stimuli could be auditory or visual. Visual stimuli were judged as longer (not shorter) than auditory stimuli when the base duration was 500 msec, but not otherwise. The authors suggested that they failed to obtain the effects reported by Goldstone and his colleagues because of the difference in practice of their subjects. Goldstone's response has included many more experiments, including discrimination studies (which had not been run previously), that used many subjects, many stimuli, and not many responses per stimulus. He still gets the effect, which, despite the occasional failure to replicate (eg. Brown and Hitchcock, 1965), seems pretty reliable for unpracticed subjects (see also Walker and Scott, 1981, who report even more of the same). Eisler (1977) reviewed and reanalyzed studies which indicated that if the psychophysical function for duration can be represented by a power function, the exponent for auditory durations is smaller than that for visual durations. Again, these involve few judgments per stimulus. The one effect arising from this literature for practiced subjects, which is all that I'm interested in for present purposes, is the finding by Tanner et. al. (1965) that pairs of auditory stimuli in their experiment were discriminated more accurately than pairs of visual stimuli, which is what the comparison of the visual and auditory data above also shows. In this case, however, the subjects all have the same level of experience with the stimuli.

There have been no extremely long term studies of visually presented duration of the class available for auditory durations from Kristofferson (1973, 1980, 1983). Comparisons of fully asymptotic discrimination behavior across modalities is not possible. There has been one attempt to compare long-term synchronization performance across modalities (Hopkins, 1982).

Hopkins (1982) started with a comparison of synchronization performance when P1 and P2 were tactile to performance when the stimuli were visual. I'll spend some time discussing the specifics of his approach, partially because an understanding of these is prerequisite to an understanding of his interpretation of visual to auditory comparisons, and also because many of my analyses, and an important aspect of my procedure, were directly based on his work.

In the synchronization work of Kristofferson (1976) and Brewster (1983), trials were paced by the computer that controlled the experiment. That is, at the end of a trial, the computer waited a fixed period of time before starting the next trial with a warning stimulus, a loud auditory "honk". Following the honk was a silent interval, the foreperiod, that lasted a fixed interval of time, and it was followed by P1 and thence P2. Hopkins (1982; Hopkins and Kristofferson, 1980) and Michaels (1977) used self-paced trials instead. Subject to a very short minimum intertrial interval, the subject was free to start the next trial at any time she wanted. To start a trial, she placed her finger on a brass button, closing a very weak electrical circuit between the button and a brass plate on which she rested the heel of her hand throughout the session. The subject kept her finger on the button until she was ready to respond, in synchrony with P2. Each trial, then, included two responses, a trial initiation response (finger down) and a synchronization response (finger up, breaking the circuit). Hopkins' synchronization stimulus was presented almost immediately after the trial initiation response. The foreperiod in this case, the interval between trial initiation response and onset of P1, was usually fixed at a constant value of 91 msec.

The act of pressing the response button is a source of tactile stimulation in this situation. If the auditory P1 stimulus is perfectly timelocked to the initiation response, as when the foreperiod is a constant 91 msec, the subject doesn't have to listen to P1 in order to perform the task. She could just as well start timing from the moment she feels the button, which is a very salient stimulus under the circumstances. Hopkins' goal was to determine which stimulus was controlling her behavior, auditory P1 or tactile feedback from the response. He started by inserting a uniformly distributed delay of up to 20 msec into the foreperiod. The variance of the interval between initiation response and P1 is now 33 msec^2, which would be trivial except that the variances of the synchronizations were well under 100 msec^2. P2 was still fully time-locked to P1, i.e. the time between P1 and P2 (the "synchronization interval") was kept constant. If the subject responded on the basis of the time of P1, this manipulation should have had no effect on her behavior. If she responded on the basis of the time of her response, P1 and thus P2 were randomly delayed relative to that response, so the extra variance should have shown up in synchronization latencies, which are measured from the time of P1. Hopkins found no difference in performance due to insertion of the variable foreperiod, indicating that P1 was controlling behavior.

Hopkins then removed P1 from the stimulus sequence, forcing the subject to rely on feedback from her response. After practice, when the foreperiod was constant the subjects' variances looked exactly the same as they did when P1 was present (the average difference in variances was 0.15 $msec^2$). This indicates that subjects can use their initiation response as a temporal marker and that they can use it as precisely as an auditory stimulus. Hopkins also inserted a uniformly distributed delay into the foreperiod when P1 was not presented to the subject. In this case latency variance, relative to P2, increased by 33 $msec^2$. This was simply a check, to confirm that if the subjects were using the initiation response in the presence of auditory P1, the addition of a random delay between that response and P1 would have had a detectable effect on their performance.

Hopkins' results tell us three things. First they tell us that subjects can indeed do what they're instructed to do in the auditory case, i.e. start timing the P1-P2 interval from P1. Second, they tell us that the subjects don't have to do this. They can perform just as well if they base their time estimates on the tactile stimulation obtained from their trial initiation response. Finally, if afferent latencies associated with auditory and tactile stimuli are variable, the variances in both modalities must be the same. Otherwise the synchronization latency variances in these conditions would have differed.

Hopkins proceeded to compare visual and auditory performance in the task, using some new and some auditorily experienced subjects with visually presented P1 and P2 stimuli. Performance was somewhat more variable with the visual stimuli, compared to performance with auditory stimuli at the same stage of practice, through much of acquisition, but eventually the variances settled down to a level somewhat comparable to the auditory levels. In this case, however, insertion of a random delay between initiation response and the visual P1 introduced variance into the subjects' response latencies, as measured from P1. Further, performance with visual P1 present was the same as performance with visual P1 absent, whether or not the foreperiod was random. This indicates that the subjects were relying on tactile feedback from their initiation responses in both cases, i.e. that they had learned to ignore visual P1.

Ignoring visual P1 is a suboptimal strategy when the foreperiod is variable, unless the variance associated with processing the visual stimulus (such as afferent latency variance) is greater than that associated with tactile stimuli. If visual afferent latencies are more variable than tactile latencies by more than 33 msec^2, the internal time of visual P1 is less reliable as a predictor of the time of P2 than is the internal time associated with the initiation response, even if the delay between that response and P2 is experimentally subjected to jitter of up to 20 msec. Hopkins argued that visual afferent latencies are variable, and are more variable than tactile and auditory latencies by at least 33 $msec^2$.

Hopkins also studied the effect of removing P2 on performance. For short P1-P2 intervals, the only difference between synchronization and many reaction time paradigms is the presence of the marker, P2, signalling when, exactly, the subject is to respond. There is another feedback stimulus, presented after the response, indicating whether the response was early or late relative to P2, and by how much. The temporal asynchrony between P2 and the response serves as immediate feedback about the accuracy of the synchronization response. The later feedback serves as delayed feedback. Comparable delayed feedback has been used in simple reaction time experiments (experiments without a P2), in which the subject is instructed to respond within a certain small range of times after the stimulus (eg. Saslow, 1974; Snodgrass, 1969; Snodgrass, Luce and Galanter, 1967). Response latency variances in those tasks were much higher than those obtained from synchronization, a point discussed at length by Kristofferson (1976; Hopkins and Kristofferson, 1980; and Hopkins, 1982). The goal of this modification to the simple RT paradigm was variance minimization. The obvious difference between synchronization and these modified RT tasks is the presence of immediate feedback (P2), so it appears that the presence of P2 is important for acquisition and maintenance of low variance synchronization performance. Hopkins found that removal of P2 had an effect (averaging 35 $msec^2$) on the subjects' variability when P1 and P2 were auditory. Removal of P2 when it was visual had no effect on the results from well practiced subjects, suggesting again that they had learned to ignore the visual stimulus markers. The effects of removing both P1 and P2 in the visual case depended on the amount of the practice of the subject, suggesting that the subject had used visual markers early in training but, again, that they were not used later on.

I should note that Hopkins reported that his subjects (himself included) fully believed that they were relying on the visual stimulus markers when they were present, even though all of the data indicate that they were not. This was not a mere strategy problem that could have been changed with better or repeated instructions.

By the end of the experiments, visual variances were comparable to auditory variances, but were still higher. Asymptotic performance of the one subject studied in both visual and auditory stimuli, when the foreperiod was constant, was 53 msec^2 in the visual case and 34 msec^2 in the auditory case. The performance difference may have been due to the ineffectiveness of visual P2 in the visual condition.

Hopkins' conclusion, that subjects learned to ignore visual P1 and P2, seems inescapable. His suggestion that they did so, unconsciously, because of increased afferent latency variance in the visual system, is less certain. There is evidence, as Hopkins pointed out, that visual latencies are variable. Hopkins cited a study by Zacks (1973), who studied the discriminability of temporal order of light flashes. Two spatially separated flashes were presented to the subject, who had to judge which started first. Using analyses derived from Signal Detection Theory, Zacks estimated the variances in the task as ranging from 56 to 151 msec^2 (or 182 msec^2 with less bright stimuli). As Zacks (1973) pointed out, these represent upper limits on afferent latency variability. Levick (1973) estimated response latency variances of retinal ganglion cells at various intensities, using a number of procedures (see also Levick and Zacks, 1970). In this case, latency variance estimates were substantially lower, ranging from 1 to 36 msec^2. It is difficult to interpret cell variabilities, however, because the final result may be more or less variable than that of component inputs. This point was made at length by Meijers and Eijkman (1974), who found variances on the order of 400 msec^2 in the responses of pyramidal tract neurons whose output eventually lead to motor responses. Variances of the responses themselves, measured behaviorally (eg by Wing) or by examination of the EMG (Meijers and Eijkman) are closer to 20 msec^2 despite the much larger variability associated with the component inputs. So perhaps Zacks' (1973) psychophysically based estimates are the ones we should rely on.

There are real problems associated with an afferent latency variance in the visual system of 56 to 151 msec^2, though. Harking back to the temporal discrimination results of Allan et. al. (1971) and Allan and Kristofferson (1974a), we find q estimates for visual duration stimuli that are reliably as low as 22. These are based on response probabilities, based on judgments of the durations of visual stimuli. Thus, the variance of the judged durations is about 81 msec². If variation in the afferent latencies perturbs perceived onset with a variance of 56 to 151 msec², the variance left to be accounted for by timing is remarkably low, ranging from 25 msec² ($q = 12.2$) to -70 msec², which is an unlikely value for a variance. Note that this ignores the afferent latency variance associated with the offset of the stimulus, which would cut our estimates of q even further. From these data, then, afferent latency variance couldn't be more than 50 and is probably much less.

There is another way of interpreting Zacks' (1973) results. Zacks made the argument that the stimuli were widely enough separated that they could be considered, in effect, to be processed along separate input channels. That is, presentation of one has no impact on processing of the other. In this case, temporal order judgments fit within the standard framework of a quantal gating theory. Successiveness judgments have often been found to be describable in terms of a uniform distribution (Kristofferson, 1967a; Schmidt and Kristofferson, 1963, for example), representing a one-stage quantal delay in processing. Suppose we interpret these variances along those lines and estimate q (variance $= q^2/12$). The three variances reported by Zacks were 56 ($q = 25.9$), 151 ($q=43.3$) and 182 ($q=46.8$), close to 25 and 50 as is typical of quantal estimates. Zacks' variances need not reflect afferent variability at all.

If there is a 25 to 50 msec² afferent latency variance associated with visual stimuli, this could explain the discrepancy between auditory and visual discrimination performance when q is found to be close to 12.5 in the auditory case and close to 25 in the visual case, as the calculations of the second last paragraph show. However, they do not explain discrepancies at longer intervals, when we are dealing with larger values of q. At 570 msec, for example, q was estimated at 60 msec when stimuli were auditory and at 105 msec when stimuli were visual. The variances associated with these values are 600 and 1838 $msec^2$ respectively. The difference of 1238 $msec^2$ cannot be accounted for by a 50 $msec^2$ afferent latency variance.

In sum, there is evidence for a difference in temporal discriminability as a function of stimulus modality, but this may instead be due to a difference in practice levels of the subjects. It is not due to a small difference in afferent latency variance. There is evidence for some difference in estimation of intervals as a function of marker modality, though it may disappear with practice. There is some evidence of afferent latency variance in the visual system. Afferent variability appears less likely in the auditory and tactile systems. There is clear evidence that experienced subjects don't use visual synchronization stimuli under Hopkins' conditions, and there is an argument that this is because of higher variance in the visual system than in the auditory system. There are no long term comparisons of auditory and visual discrimination or synchronization performance. I don't count Hopkins' data as a long term comparison because, as he so carefully demonstrated, the subjects didn't use the visual stimuli, so his data don't tell us what would have happened if they had used the stimuli. There are grounds for concluding that timing of visual and auditory stimuli differ, but this conclusion is not inescapable.

I find Hopkins' arguments difficult to fully credit more because of my extended experiences with synchronization as a subject in Brewsters' research and in pilot studies leading to the present research than because of my theoretical predilections. There are differences between auditory and visual stimulus conditions which are not captured by dry descriptions of experimental procedures. Here are some of my introspections. Many of these have also been volunteered by subjects in the present experiments. They are not strictly idiosyncratic.

The auditory stimulus is a 68 dB 10 msec tone, delivered over headphones. It is quite salient. Since it is delivered over headphones, the intensity does not change with the posture of the subject. Subjects were free to vary their posture in these experiments. (Uncomfortable subjects probably wouldn't produce such low variances). The result of this is that a subject can change the position of his head by over a meter relative to the position of the stimulus light used for delayed feedback or as P1 and P2. Sometimes the subject is hunched over the desk on which the response pad (holding the button and the brass plate) rests. Sometimes the subject leans back with his feet up, pad on his lap or on a different desk. The distance of the visual stimulus varies over at least a twofold range, i.e. the intensity varies by a factor of four or more, and it can vary from trial to trial. Latency is definitely a function of intensity, as is routinely found in reaction time and other studies (see Grice, 1968; Kohfeld, 1971; Kohfeld, Santee and Wallace, 1981; Levick, 1973; Teichner, 1954, and their many references). Free movement of the subject in the visual case introduces afferent latency variability that has nothing to do with latency variance for identical stimuli. (It is tempting to argue that subjects in the visual case should be forced to use bite bars, but I not only doubt that many subjects would be willing to participate in the experiments over long periods of time in this case but I also think the discomfort involved, especially toward the end of a session, would induce more variance than would be saved by the control. My experience with bite bars dates from employment as a research assistant in Hiroshi Ono's laboratory at York University, who used them routinely for visual research.)

The visual stimulus used by Hopkins was a 5.08 mm light emitting diode which produced a 3.2 mcd stimulus when driven at 20 mA. Rise time for led's is very short, so this intensity was attained even for the very short 10 msec duration of P1 and P2. Hopkins (and Brewster, (1983), who used a similar light) called this stimulus "salient". It was salient in the sense that if you were looking at it and it came on, it was clearly on. But if you weren't looking directly at it, you could miss it. In pilot work with the light, I found blinking a problem. It wasn't a big problem because I didn't blink at just the wrong time very often. But relative to a variance of 33 $msec^2$, almost any problem can be a big problem. As an auditory subject, to aid concentration, I often stared off into space, totally ignoring the delayed feedback light that Brewster (and Hopkins and I) used to indicate whether the response was early or late. Other times, I would close my eyes, or stare at my finger as I responded. Again, this reduced the value of delayed feedback, but that didn't seem to matter, a point made by some of the present studies' subjects (who did the same things). Hopkins (1982) demonstrated that delayed feedback indeed did not matter once subjects were experienced. In the auditory case, we could afford to ignore the visual stimulus. Closing your eyes may be conducive to concentration on auditory stimuli but it is not the best of tactics when P1 and P2 are visual. Thus, many of the things that I could do, and often did do as an auditory subject, I could not do as a visual subject. I missed them in pilot work.

Even when I was looking at the light, I would not say that it was as salient a stimulus as the tactile feedback from pressing the response button on Hopkins' (and my) pad to start a trial. Pressing that button was a voluntary behavior and I expected to feel it. The auditory stimulus was, to me, more salient than the visual one. I would rate the tactile feedback as more salient still, but only slightly, and others might disagree in either direction in the auditory vs. tactile case.

Hopkins reported that the subjects in his experiment (including himself, in visual and auditory conditions) felt that P1 came immediately after the trial initiation response, with no delay, and, when the delay was variable, they did not notice it. He knew the delay was variable, and he reports that he still didn't notice it. In such a case, I doubt that that variability was behaviorally effective. My suspicion is that in Hopkins' visual task, the clearly more salient stimulus, i.e. the tactile feedback, is the one that controlled the subject's behavior. The stimulus was so closely connected with P1 that, according to Hopkins, the subjects felt they were using visual P1 even though they weren't. The distinction between the stimuli appears to have been insufficient for the subjects to notice that they were not using P1, but were instead using the more salient stimulus, and to correct this.

Separation of the trial initiation response by a longer and more variable foreperiod would probably go a long way toward aiding the subject in separating them subjectively, making it easier for him to use the visual stimulus. A brighter and/or larger stimulus would probably solve some of the salience problems. Unfortunately, it still wouldn't solve all of them unless the stimulus was unreasonably bright or large. (By unreasonably I mean that some of the stimuli I tried in pilot studies gave me prolonged headaches. Other stimuli, which I did not try, would have been excessively expensive.) The subject still has to be looking at the stimulus, which rules out staring blankly, staring at one's finger, closing one's eyes, and blinking. Even with the stimulus that I eventually settled on, I would expect acquisition of low variance levels to take longer than it takes in the auditory case, because the auditory stimulus, to me, seems more salient. This expectation is stronger for Hopkins' stimulus light.

Summing up this section, the issue of timing dependence on modality seems unclear, at least for practiced subjects. Asymptotic performance levels might or might not be equivalent. For unpracticed subjects they are not. Nor are they for fairly well practiced subjects. The difference in exponents, in time estimation studies, and, to a lesser degree the difference in perceived duration of lights and tones in various studies, nearly all obtained from relatively unpracticed subjects, suggests that there might be a difference in processing mechanisms that goes beyond a difference in variability. Afferent latency variance in the visual system accounts, to my mind, for neither effect, and I am not convinced that the evidence for afferent latency variance in this system is conclusive. Finally, the evidence for afferent latency variance from synchronization is, I would argue, wholly inconclusive. Asymptotic performance levels might not differ at all and even if they did this might reflect other differences in task difficulty and latency variance due to variance of the intensity of the visual stimulus, caused by postural changes by the subjects.

1.3 Boundary Conditions

The four approaches to internal clocks discussed above make clearly different predictions about the variability associated with timing. Yet if we ask whether the variance or the standard deviation increases linearly with duration or if, instead, the increase is stepwise or nonexistent, the answer we get back is "yes". Competently run experiments have provided evidence for all of these relationships.

It appears that people can use a variety of different mechanisms for timing, in which case we should be studying the circumstances under which each is used, not trying to decide which one is the mechanism. There is a theoretical risk associated with an eclectic viewpoint: a new mechanism can be invoked to account for the results of each new experiment. One way around that is to focus on a single mechanism that seems well established and to determine how much behavior can be explained in terms of it. Ideally, systematic examination of a number of different models would lead to acceptance of domains of applicability of each, probably with some indistinct boundaries separating different domains. Systematic work along these lines has been done for the quantal theory, and the intent of the present research is to explore what appear to be fuzzy edges along the deterministic quantal timer's boundaries. In this section I will briefly recap the description of the quantal applicability domain, leading to a statement of the present thesis in terms of it.

Variability in timing is subject to an irreducible minimum, the time quantum, which is the period of an internal gating process. Processing of information passes through stages. The periodic process(es) determines when the information may be passed to the next stage of processing. Delays at each stage are uniformly distributed, ranging from 0 to q msec, and are effectively independent. Waiting time until processing is complete can thus be represented as the sum of a series of identically distributed uniform variates. In some tasks, such as successiveness discrimination, only one quantal delay may be involved. In many tasks involving timing, two stages are involved, and in these timing variability is triangularly distributed.

Quantal delays are assumed to be involved in all tasks but the relative contribution that they make to the variability of judgments or behavior may sometimes be negligible. Quantal delays are relatively short, so their variance is relatively small. Variance from other sources can mask the contribution of these delays. For example, if the standard deviation of an internal timer increases proportionally with timed duration, the quantal contribution might only show up as a positive intercept in the function relating discriminability (whose variance sources include the timer plus delays into and out of the timer) to duration. Evidence for quantal delays, then, and data suitable for estimation of their magnitude, should only be expected to be obtainable under highly restricted situations, in which all other sources of variability are brought under control. In the optimal case, the only central source of variability will be the periodic gating process. This can be achieved in a timing task only if the subject uses a fully deterministic timer. It is remarkable that people are capable of using such a timer at all, and we should not expect that such a mechanism will be usable under all circumstances. It appears, from the data at hand, that at least five variables limit the range of circumstances under which a deterministic timer can be employed consistently by the subject, to the exclusion of other mechanisms, these being the range over which the current stimulus can vary, the degree of experience that the subject has had with the specific stimuli involved in the task, the type of task, the duration of the stimuli, and, perhaps, the stimulus modality.

From Kristofferson's (1980, 1983) discrimination results it appears that deterministic timing includes a quantal counter, i.e. one which increments once per gating period. In auditory tasks, this appears to be a four bit counter, i.e. it runs to 16 at most. If intervals longer than 16 quanta are to be counted, the quantal intervals must be concatenated, so that the count advances once per n quanta, where n is a nonnegative integral power of 2. These larger values themselves serve as quantal units. A counting strategy will fail in any task in which the same quantal unit cannot be used for all of the stimuli that might be presented on a given trial. Subjects might use the q value necessary to time the longest interval to time all intervals, but at some stage, such as working with a q of 200 msec when stimuli lasting 20 msec are possible, this is not an optimal timing strategy and it will probably be discarded. Quantal counting should not be expected in typical scaling tasks, such as magnitude estimation, magnitude production, and so forth (described in Stevens, 1976), nor should it arise in discrimination experiments involving roving standards, i.e. cases in which pairs of similar stimuli are to be evaluated during each trial but pairs may differ widely across trials. In such cases the first stimulus of a pair could not be timed accurately, so there would be no basis for comparison with the second.

The 4 bit quantal counter describes auditory discrimination probabilities and latencies extraordinarily well, but visual discrimination data and auditory synchronization latency data both suggest limits to its generality. In the visual case, q also appears to increase in steps, but values of q are larger at many durations than they are when stimuli are auditory. If stepped increases are due to a maximum possible count, the visual maximum must be lower. On the other side, Hopkins' results indicate that a q as small as 12.5 can be used when auditory synchronization intervals are 460 msec long. Even if we subtract 150 msec from the 400 to take afferent and efferent delays into account, central timing would involve 310 msec, or a count of 24.

Practice may not make timing perfect but it helps, and it continues to help all the way out to 100,000 synchronizations at the same interval and, apparently, beyond (Hopkins, 1982). Different amounts of practice seem necessary for different stimuli, at least in discrimination. Kristofferson (1980, 1983) found that little practice was needed for asymptotic performance to be reached at the low end of a quantal step but that much longer practice was needed for durations at the high end of the step, i.e. for durations which required a large count of the smallest usable (count < 16) quantum level. Early in practice, performance conformed to Weber's Law (see also Getty, 1975). Only after thousands of trials with stimuli at the high end of their respective steps did performance fully conform to a quantal counting model. Also evident in those data, but not in the synchronization data of Kristofferson (1976) and Hopkins (1982; Hopkins and Kristofferson, 1980), is the need for extended training at the specific interval under study. There is relatively little transfer of training in discrimination across durations.

In at least one task in which subjects have been trained for long periods at the same interval, timing never appears to be quantal. This is the repetitive tapping task, in which the subject is to tap-tap-tap-etc. with a fixed inter-tap interval. Wing (1973) demonstrated that the variability of well practiced subjects in this task increases with duration and provided one well cited model (Wing and Kristofferson, 1973a) to account for this. Vorberg and Hambuch (1976) showed that different models describe performance as the interval is increased over a fairly modest range. There are complexities in this behavior which are most surprising given its subjective simplicity. Kristofferson (1981) has interpreted the task as involving "pure motor timing". Many tasks are executed under the control of motor programs which, once started, continue without the need of peripheral to central feedback (Schmidt, 1982). Perhaps this is one of them, in which case no opportunity for deterministic central timing would arise.

Regarding stimulus duration, internal clock theories have typically been restricted to short intervals. Poppel (1971), a quantal advocate, indicates that he expects the quantal mechanism to break down for intervals longer than 10 seconds. Kristofferson has proposed no specific upper limit but in discussions we have had, he has made it clear that he expects some upper limit. Relevant research in his lab has generally been restricted to about 2000 msec and less. Fraisse (1963) has argued that judgments of intervals longer than 2 seconds must involve higher order cognitive processes. It is interesting that Getty (1975) found Weber's Law inapplicable for durations longer than 2 seconds, and this in fact replicates much older work (reviewed by Fraisse). Most research involving cognitive processes and time has involved relatively long stimuli, with the notable exception of Thomas' studies. Thomas (eg. Thomas and Brown, 1974) used stimuli on the order of 100 msec and has repeatedly found evidence of cognitive mechanisms in conjunction with an internal timer. Thomas' case, which I used to find convincing, has been weakened by the argument of Long and Beaton (1980a, 1980b, 1981) that such effects may be due to visual persistence. Bigger, brighter, more complex stimuli last longer on the retina than smaller, duller, simpler ones. There may well be higher-order determinants of this low-level physiological process, but if there are, this is an altogether different role for "cognitive" variables in duration perception.

There is some indication of a second transition point in timing, in the 500 to 700 msec region. Michon (1967) reviewed and presented evidence along a number of lines but it is not clear that those data have any relevance to well-practiced behavior in tasks in which we would expect to find deterministic timing. (Though some workers in the field, such as Carbotte (1973) believe that they should be relevant.) There is no hint in discrimination results of a change in mechanism, just a change in q, with increasing duration. However, there is clear evidence of a shift in timers at 550 msec in synchronization. Kristofferson (1976) found that Weber's Law described performance from 550 to 2190 msec in the task despite extensive practice at 940 msec.

Finally, we come to modality. Some modality restrictions should be obvious: subjective duration of tastes or odors would probably be too variable to be of interest. Alternatively, there appears to be no difference between practiced timing of auditory and tactile stimuli (Hopkins and Kristofferson, 1980), and very little difference in relatively unpracticed estimation across the modalities (Lhamon et. al., 1962). There is a mass of confusing data for auditory vs. visual timing. (For more, see Allan's 1979 review.) If Hopkins' (1982) conjecture that visual afferent latencies are variable is correct, and if Kristofferson's (1976) conjecture that continuously adjustable deterministic delays are established via recycling through the afferent systems is also correct, then we might expect visual synchronization performance to show increasing variability with duration, as the length of time over which the stimulus is recycled increases. Alternatively, if minimum length delays are used, i.e. if stimuli are only held in the system until the learned remainder of their duration is an even multiple of q, we should expect to find a periodic increase of variance with duration, reaching a maximum when the stimulus is infinitesmally shorter than an integral multiple of q.

1.4 Statement of the Thesis

My goal in the present research is to demonstrate that the same timing mechanism is available and is used by experienced subjects in a synchronization task whether the stimuli are long (to 2100 msec) or short (to 150 msec) and whether the stimuli are auditory or visual.

I expected to find that synchronization with long auditory stimuli yields performance comparable to that obtained with short stimuli either in all respects or in all respects except absolute level of variance once extended practice across a range of long stimuli has been completed. I made no predictions about initial performance with long auditory stimuli, except that later performance would be much better. I expected asymptotic performance to yield constant variance or stepped increase in variance with increasing stimulus duration across a range of long duration stimuli.

I expected to find that visual and auditory performance are comparable in distributional shape, in showing similar practice effects, in showing continuous adjustability, and in the constancy of variance across stimulus ranges or subranges, without any obvious periodic relationship between duration and variance in either modality. I hoped, but did not expect, to find that visual and auditory variance levels would be the same. I very much hoped, but did not expect, that visual stimuli would yield asymptotic performance levels as quickly (relatively speaking) as auditory stimuli.

1.5 Overview of the Research

Five closely interrelated experiments were conducted, using very long term subjects.

The first experiment studied auditory synchronization in the

1400 - 2100 msec range.

The second experiment examined auditory synchronization performance in the 150 - 350 msec range, to allow comparisons with longer interval auditory data and with visual synchronization performance.

Experiment 3 was intimately connected with Experiment 2 in execution but had a stronger conceptual link with Experiment 1. In this experiment (3), I reduced the P1-P2 interval of subjects who had been working with 150 to 200 msec intervals to below 100 msec. It should be impossible for subjects to use P1 effectively as a response trigger because absolute minimum reaction time is estimated at 100 to 105 msec in the literature (see, eg., Kohfeld's, 1971 review, and some further discussion below, in Chapter 4.) Accordingly, they should be timing from the warning stimulus or the trial initiation response. Given a long foreperiod (close to a second here), this is a covert long auditory synchronization condition, and it allows within-subject comparison of long and short auditory synchronization performance, which was otherwise highly impractical.

Experiments 4 and 5 involved visual synchronization in the 275 - 500 msec region. Experiment 4 used new subjects. Experiment 5 used the one subject from Experiments 2 and 3 who was willing and able to participate further in the research, hopefully allowing within-subject comparison of auditory and visual performance.

The procedure is discussed in detail in the next chapter. It was quite close to Hopkins', but with a few key revisions. The visual stimulus was larger and brighter than Hopkins'. The foreperiod was longer and more variable, hopefully making it easier for the subject (and for the experimenter) to distinguish timing from the Warning Stimulus (WS) from timing from P1. The larger variance and a geometric distribution of foreperiods rather than a uniform distribution were used to minimize the effectiveness of reliance on WS (or, equivalently, on the trial initiation response) instead of P1. Finally, Hopkins studied performance at very few intervals, relying on very extensive practice at a given interval to produce asymptotic performance at that interval. Kristofferson (1976) showed that apparently asymptotic performance at a given interval could be substantially improved upon if the subject was trained at other intervals and then returned to the original one. Suspecting that this would be a more efficient means of achieving minimal variance levels, and because I was interested in performance across a range of durations in each Experiment, I used Kristofferson's "scanning" technique (practice across a range with extensive training only at a few points) rather than studying performance at only one interval per condition.

2. Methodological Details

2.1 The Session in Brief

The sequence of events in a trial was: trial initiation response, warning stimulus, foreperiod, P1, silent period, P2, silent period, feedback, intertrial interval. The subject was to respond in synchrony with P2, which was time-locked to P1. There were 100 trials in a block, with four blocks per session. Subjects were advised that the first block of each session was a "warm-up" block and that only the data from the last three blocks would be analyzed. Discussions of all analyses below refer only to the last 300 trials of each session.

By "P1-P2" interval I mean the interval from P1 onset to P2 onset, which was constant for all trials in a session. The "synchronization interval" was usually the P1-P2 interval, and I often use them interchangeably. In some cases I explicitly distinguish between them below: the synchronization interval is the interval between the stimulus from which the subject times (usually P1) and P2.

2.2 Computer Control

Stimulus presentation, response collection and all timing was controlled by a computer, originally a PDP-8/e minicomputer and, for the majority of the sessions, an Apple II microcomputer. The PDP-8 was retired after a series of equipment failures, including an intermittent timing problem. There was a six week delay between shutdown of the PDP-8 and completion of testing of the Apple program and a variety of new peripheral devices introduced with it. Some aspects of the procedure were modified at this time, with, so far as I can tell, no effect on the subjects' performance. These changes are noted below.

The PDP-8 was programmed in a version of Focal, enhanced mainly by Reese, Michaels and Hopkins to allow real-time control. Durations were specified in msec in this language and the interval from the trial initiation response to the end of the interval preceding feedback had to be restricted to 4096 msec to avoid timing variability. Timing of critical events within a trial was accurate to within a millisecond, typically to within narrower limits. The main Apple program was written in 6502 Assembler. Input of session parameters at the start of the session and data analysis and output at the end were done in Basic, which was co-resident with the Assembler program. Durations were specified in units of 200 microseconds, with typical timing accuracy to within 200 microseconds and a maximum possible error from trial initiation to the end of the interval before feedback of 600 microseconds. I spent about 8 months designing and testing this system and, since it was brought on line, no "bugs" have shown up and no modifications to the assembler program have been made. Session parameters, such as device addresses and output voltage levels, were specified in a separate data file on disk, read at the start of each session. I made a few blunders in describing the stimuli to the computer, delivering a 1000 Hz auditory stimulus to the subject at about 60 dB rather than a 2000 Hz at 68 dB for a few sessions. These were caught and fixed early on. Maximum trial duration in this program, when timing is done in 200 microsecond units, is just over 13 seconds, rather than 4 seconds as on the PDP-8. This eliminated the need for some otherwise arbitrary restrictions on some intervals.

2.3 The Response Pad

Responses were made on a response pad, basically an armrest with a metal button near the front end and a metal plate toward the middle. The subject rested the heel of her hand on the metal plate throughout the session. To start a trial, she rested her finger on the button, completing a very weak electrical circuit from the plate to the button. Circuitry in the pad amplified this signal and sent it to the computer. The subject kept her finger on the button until she was ready to make her synchronization response, which she did by moving her finger away from the button, usually upwards, breaking the circuit. Schematics for the original pad were given by Hopkins (1982). The original pad wore out and was replaced with a similar one on which the metal was copper rather than brass. Some minor details of the circuitry were changed with the changeover to the Apple and, later, to improve the pad's signal to noise ratio.

There is no travel time on the response button and only a minimal degree of pressure on the button was required to maintain the electrical connection.

2.4 Warning Stimulus and Foreperiod

Hopkins' (1982) finding that subjects started timing at the start of the trial, rather than from P1, when P1 was visual, is reminiscent of the common problem in reaction time (RT) experiments that subjects time from the warning stimulus rather than reacting to the reaction stimulus (equivalent to P1). In fact, while some timing work has been done with synchronization-like paradigms (eg. Bartlett and Bartlett, 1959), most of the development of this procedure was done in an effort to bring this problem for RT measurement under control by indicating to the subject when she should respond in reaction time tasks (Naatanen, Muranen and Merisalo, 1974; Saslow, 1974; Snodgrass, 1969; Snodgrass, Luce and Galanter, 1967; and see the reviews in Kristofferson, 1976; Hopkins and Kristofferson, 1980). When the P1-P2 interval is very short, the subject must respond immediately to achieve coincidence with P2, so synchronization _is_ a reaction time task. Kristofferson (1976) showed that delayed reactions, i.e. synchronizations up to 400 msec past reaction time to P1 (about 150 msec), looked the same in variance and distributional shape as synchronization responses when the P1-P2 interval was at the reaction time limit.

Kristofferson (1976) and Brewster (1983) initiated a trial with a warning stimulus, a low frequency, noisy, 68 dB (A-weighted) "honk", delivered to the subject over an external speaker (rather than headphones), which lasted for 100 msec. P1 was presented 1000 msec later. Michaels (1977) also used a 1000 msec foreperiod but the subject's trial initiation response replaced the honk as the signal that the trial had begun. I prefer self-pacing (not done by Kristofferson or Brewster), but with a long foreperiod it helps to have a stimulus that signals that the computer has indeed picked up the initiation response and that the trial has now started. This may be one of the reasons that Michaels' results were so much more variable than the others, though his procedure differed from the others in many other respects too. Hopkins used an extremely short foreperiod (91 msec when it was constant) and was the first to use a variable foreperiod to determine from which stimulus the subject started timing. In his case, subjects didn't even notice the foreperiod, and they used their trial initiation response, rather than P1, when P1 was visual. Wanting the subjects to time from P1, I used a long foreperiod to separate P1 and trial initiation. I also increased its variability, to 90 msec^2, partially to make it easier for me to tell which stimulus controlled behavior and partially to make pre-foreperiod events less reliable for the subjects as predictors of the time of P1 and P2. As did Kristofferson and Brewster, I preceded the foreperiod with the "honk" warning stimulus.

Hopkins' foreperiods were uniformly distributed, over a 20 msec range. In the reaction time literature, uniformly distributed foreperiods are quite common, and the typical finding is that reaction time is negatively correlated with foreperiod duration (Klemmer, 1956, 1957; Ollman and Billington, 1972; Naatanen, 1970; Niemi and Naatanen, 1981). The intention behind adoption of random foreperiods in these settings is to make the time of the reaction stimulus sufficiently unpredictable that the subject will give up on a strategy of timing from the warning stimulus. Uni~~formly~~ variable foreperiods don't achieve this goal, partially because their hazard functions are not constant. The hazard function is a conditional probability function:

given that the stimulus has not yet been presented, how likely is it that it will come in the next few msecs? For uniformly distributed foreperiods, which by definition can only last so long, this conditional probability increases as the foreperiod drags on, and this seems to provide usable information to the subject. Geometrically distributed foreperiods have constant hazard functions. Knowing that the stimulus has not yet happened gives you no further information about when it will happen. Very few reaction time studies have used geometric, or approximately geometric, foreperiods, but those that have have found smaller correlations between response latency and foreperiod duration (reviewed by Niemi and Naatanen, 1981). With long and variable foreperiods I was worried about this, and adopted a geometric rather than a uniform foreperiod distribution.

On the PDP-8, foreperiods ranged from 890 to 990 msec, with a mean of 900 msec, rather than 1000 msec, the foreperiod length of Brewster, Michaels and Kristofferson. I kept the interval shorter, and restricted its range, because of the 4096 msec trial duration limit on the PDP-8. Those extra milliseconds were needed in the long synchronization interval work to allow the subject plenty of time to make a late response. This mean was inconvenient for Experiment 3, however, and on the Apple it was changed.

In Experiment 3, I covertly forced subjects to time from the warning stimulus (or from their initiation response, to which it was time-locked) by making the P1-P2 interval impossibly short. Subjects' variances at those levels suggest that they were operating with a q of about 50, which is operative in discrimination experiments over a 400 to 800 msec range. With a foreperiod of 900 msec (on average) and a P1-P2 interval of 100 msec (or less), if subjects time from the warning stimulus the actual synchronization interval is at least 1000 msec. It is probably 1100 msec, the time between the onset of the honk and the onset of P2. Subtracting 150 msec as an upper estimate of the time taken by afferent and efferent delays, we find that the subject is timing an interval between 850 and 950 msec in duration, barely into the q=100 range, which, in discrimination, is operative across base durations from 800 to 1600 msec. The claim that subjects can use a q of 50 for intervals longer than 800 msec could be more convincingly made with a longer foreperiod. On the Apple, the mean foreperiod was 1000 msec rather than 900 as on the PDP-8, yielding net timed intervals of about 950 to 1050 msec rather than 850 to 950 msec. These are still at the short end of the 800 - 1600 msec range but a larger change may have produced unwanted side effects. As far as I can tell, this 100 msec shift had no effect on any of the data.

Both computers were involved in Experiment 3. Mean foreperiod duration is graphed and tabled on a session by session basis below, and this indicates which computer each session. There was no specified maximum foreperiod duration on the Apple, as there should not be for geometric variates. The variance was kept constant across computers at 90 $msec^2$.

Finally, different algorithms were used to generate the geometric foreperiods on the PDP-8 and on the Apple. The LabFocal random number generator does not pass standard tests of randomness. I used the generator to select (without replacement) members of a previously generated list of candidate foreperiods, which appeared in the list in proportion to their geometric probabilities. This yielded a distribution which approximated the geometric well in terms of frequency (as tested by the Kolmogorov-Smirnov and Chi-Square tests) but which suffered from a small serial dependence of one foreperiod duration on those preceding it. The dependence was smaller than would have been obtained from a more direct use of the LabFocal generator, and I don't think it was noticeable, but it was statistically detectable.

The random number generator used on the Apple, for foreperiod generation and for the simulations noted below was developed by John Vokey and myself. This was a traditional mixed linear congruential generator (Knuth, 1981), i.e. one which generates successive numbers, R[N], R[N+1], according to the algorithm,

R[N+1] = (A R[N] + B) modulo M,

where A, B and M are constants and M, if A and B are properly chosen, is the period of the generator. In our case, M, and the period, were 2^{40} (just over a trillion). The values of A (we developed three generators of this class) were selected from about 38,000 candidates tested by the full-period Spectral Test (Knuth, 1981), essentially a search for nonrandom patterning of doublets, triplets, etc., in the output of the generator using a Fourier analysis across the entire period. This is the most powerful test known for random number generators. Large values are good, with 0.10 being a "pass" and 1.0 being a "pass with flying colors" according to Knuth. Our lowest value (examining doublets through sextuplets) was 2.37. Values of B, which have no effect on the Spectral Test results but which do affect serial correlations, were chosen to minimize full-period serial correlations, lags 1 through 20, and our worst correlation was less than 0.00000002. The values of A for the two generators that I relied upon most heavily were 27182819621 and 8413453205. The respective values of B were 3 and 99991. In simulations, these were often used in combination (for example, using the McLaren-Marsaglia Algorithm, commonly called Algorithm M, again see Knuth) to break up some theoretically remaining (if statistically indetectable) sequential dependencies. The third generator was rarely used because it performed less well than the two above on other tests for randomness that they passed. An extended discussion of the testing of pseudorandom number generators is beyond the present scope. For an extended tutorial-level discussion of our approach and results see Kaner and Vokey (Note 1), and for a thorough general treatment, see Knuth (1981).

2.5 P1 and P2

These stimuli were identical in a session. They were either visual or auditory and they lasted for 10 msec.

If P1 was auditory, it was a 2000 Hz stimulus presented binaurally to the subject over headphones. When on continuously, the intensity of the signal coming from each headphone was 68 dB (re .0002 dynes/cm²). To avoid "clicks" at onset and offset of the stimulus, the stimulus was gated at zero crossings and was presented with a 2.5 msec rise and decay time. The stimulus was at peak intensity only for the middle 5 msec of P1 and P2. Shaping of the wave envelope was not done during the first few weeks after the Apple was brought on line.

Light flashes were presented over a pair of light emitting diodes (l.e.d.'s: Hewlett-Packard #2785) glued together to make a single larger stimulus and mounted in a rectangular grey metal box. These l.e.d.'s are rectangular, but a circular stimulus, subtending about 1 degree visual angle, was desired. Only part of the l.e.d. pair was made visible, through a circular aperture cut in the box, measuring 2 cm in diameter. With variation in the subject's head position, the actual visual angle subtended by the stimulus ranged from about .7 to about 1.5 degrees. The stimuli emitted a yellowish green light (585 nm dominant wavelenth), at 7 mcd, when driven at 6 mA. Background lighting was dim but in the photopic range.

Subjectively, the stimulus was easily detected and was seen as reasonably bright. The stimulus was much more salient than the small l.e.d. used by Hopkins and it seemed better than various other stimuli that I tried out in pilot work. I would rate it as less salient than the auditory stimulus.

Visually bounded intervals were subjectively different from auditorily bounded intervals due to visual persistence of the visual markers. P1 and P2 were physically 10 msec but they lasted much longer subjectively. (See Efron, 1970, Haber and Standing, 1970, and Long and Beaton, 1980a, 1980b, 1981, for more on visual persistence.) An auditory P1-P2 interval of 150 msec was subjectively clearly divided into three parts, P1, silence, P2. Analogously, the visual interval should look like P1, darkness, P2. Instead, with a P1-P2 interval of 150 msec, the visual stimulus typically looked to me like a single flash that varied in intensity over time. While I always saw three events (P1, dark, P2) when P1-P2 was 250 msec or more, subject DK reported that early in the experiment (but not later) she sometimes saw only one flash even when the interval was as long as 300 msec. Under these conditions, however, the 300 msec interval still looks shorter to me than an auditory 300 msec interval sounds. The relationship across different synchronization intervals between the subjective durations of the visual and auditory P1-P2 stimulus sequences appears nonlinear to me. The goal of Experiment 4, the main experiment in which visual stimuli were used, was demonstration that the response distributions associated with visual stimuli were the same across a 275 - 500 msec synchronization interval range. This result was in fact obtained, with variance levels comparable to those obtained with auditory stimuli in the 150 to 350 msec range. We know from Kristofferson (1976) that auditory synchronization distributions are the same from 150 to 550 msec, or at least from 300 to 550 msec (depending on which subject's performance is examined). Given this constancy across ranges for both modalities, in the context of the present work it seems not to matter that there are real problems of commensurability with the subjective durations of the auditory and visual stimuli.

The degree of visual persistence is a function of various characteristics of the stimulus. Hopkins' stimulus yields less persistence and so is usable across a wider range of durations, though it is less salient.

2.6 Events Past P2

Following P2 there is a silent interval during which the subject may respond if she has not already responded. The exact length of this interval varied on the PDP-8, depending on the P1-P2 interval, but it was never shorter than 400 msec, which is much longer than reaction time to P2. On the Apple, the interval was fixed at 1000 msec. On both machines there was a short delay between the end of the period in which responses could be made and the start of feedback (shorter and less variable on the Apple, and less than 100 msec, at the most, on either system). During this period, the computer determined which type of feedback was to be presented, on the basis of the response latency.

Feedback came in three varieties. If the subject's response came after P2, a 2000 Hz, 68 db stimulus was presented. It lasted for as many milliseconds as the response was late, where a perfect response would be one synchronous with the onset of P2. If the response was early, the same stimulus was presented, the duration indicating how early instead of how late, and it was accompanied by a light flash of the same duration. The feedback light was a 5.08 mm diameter l.e.d., easily detectable if the subject was looking in its general direction, but less salient than the P1 light. Responses which coincided with the onset of P2 were originally given no feedback, which was perceptually quite distinct. The subjects repeatedly complained that lack of feedback on these trials broke their rhythm and disrupted performance on the next few trials. I changed the computer program so that it would treat perfect responses, for feedback purposes (only) as though they were 5 msec early.

The final type of feedback was "blown trial" feedback. If the subject responded before the onset of P1, or if she failed to respond, the trial was considered "blown" and was re-run. Data from these trials was kept and early responses were analyzed when the P1-P2 interval was less than 200 msec, for in such cases early responses were sometimes "real", generated by subjects who were timing from the warning stimulus rather than from P1. On the PDP-8, blown trials were marked by three 300 msec presentations of the "honk", separated by 100 msec from each other. On the Apple, the feedback was instead a simultaneous 500 msec presentation of the honk, the P1 light and the feedback light. Both were obviously different from normal feedback. They were also quite effective for waking dozing subjects, which was sometimes necessary in this rather boring task.

2.7 Instructions and Other Information Available to the Subjects

Subjects were told to minimize their variance while responding as closely to P2 as possible. They were advised that I considered mean synchronization latencies which differed from the synchronization interval by more than 10 msec to be unacceptable.

At the end of each session, the computer printed out the latency means (measured from P1 onset) and variances for each block (including the first) and for all blocks combined (excluding the first). It also printed a histogram of the response distribution for the session (excluding block 1). Subjects were aware that I expected the distributions to be highly peaked and symmetrical. They were never explicitly told that the distributions should look like triangles, but some of them read Kristofferson's previous papers, so they probably figured this out for themselves.

Subjects were advised that the foreperiod was variable and were told that the variability was there to make timing from the warning stimulus a poor strategy. They were instructed to time their responses from the onset of P1. Occasionally I mentioned to some subjects that they were relying on the warning stimulus, not on P1, and requested that they pay more attention to P1. The subjects thus knew that I examined the relationship between foreperiod duration and response latency, but they were not told how, nor what I intended to make of this. To their knowledge, my examination of foreperiod effects was done simply to monitor their performance. Especially in Experiment 3, in which responding from P1 was made impossible, some subjects expressed the feeling that they might be timing from the warning stimulus. In such cases, I agreed that the task was difficult, but asked them to try harder to respond on the basis of P1.

Subjects were allowed to examine each others' computer printouts and were not asked to avoid talking with each other about the experiment. A spirit of friendly competition was encouraged throughout the experiment.

During the very first session, I instructed the subject verbally about the stimulus order and then went into the experimental chamber with the subject to demonstrate how to perform the task. The subject made about 30 responses on the first day, with me in the booth to answer questions as necessary. These data were discarded. Session 1 in the tables refers to the first complete session, which was always actually the subject's second.

Subjects were paid at a pre-tax rate of $5 per session. Occasional rewards (such as a pitcher of beer at the graduate pub) were given to some subjects from time to time in recognition of excellent performance.

Sessions lasted about 45 minutes on the PDP-8, with about 8 minutes of that required for generation of the random foreperiods distribution at the start and for analysis, printing and punching out of the data onto paper tape at the end. Sessions lasted about 35 minutes on the Apple, due to faster generation of the random foreperiods at the start of the session, a faster printer, and to the use of floppy disk, rather than paper tape, data storage.

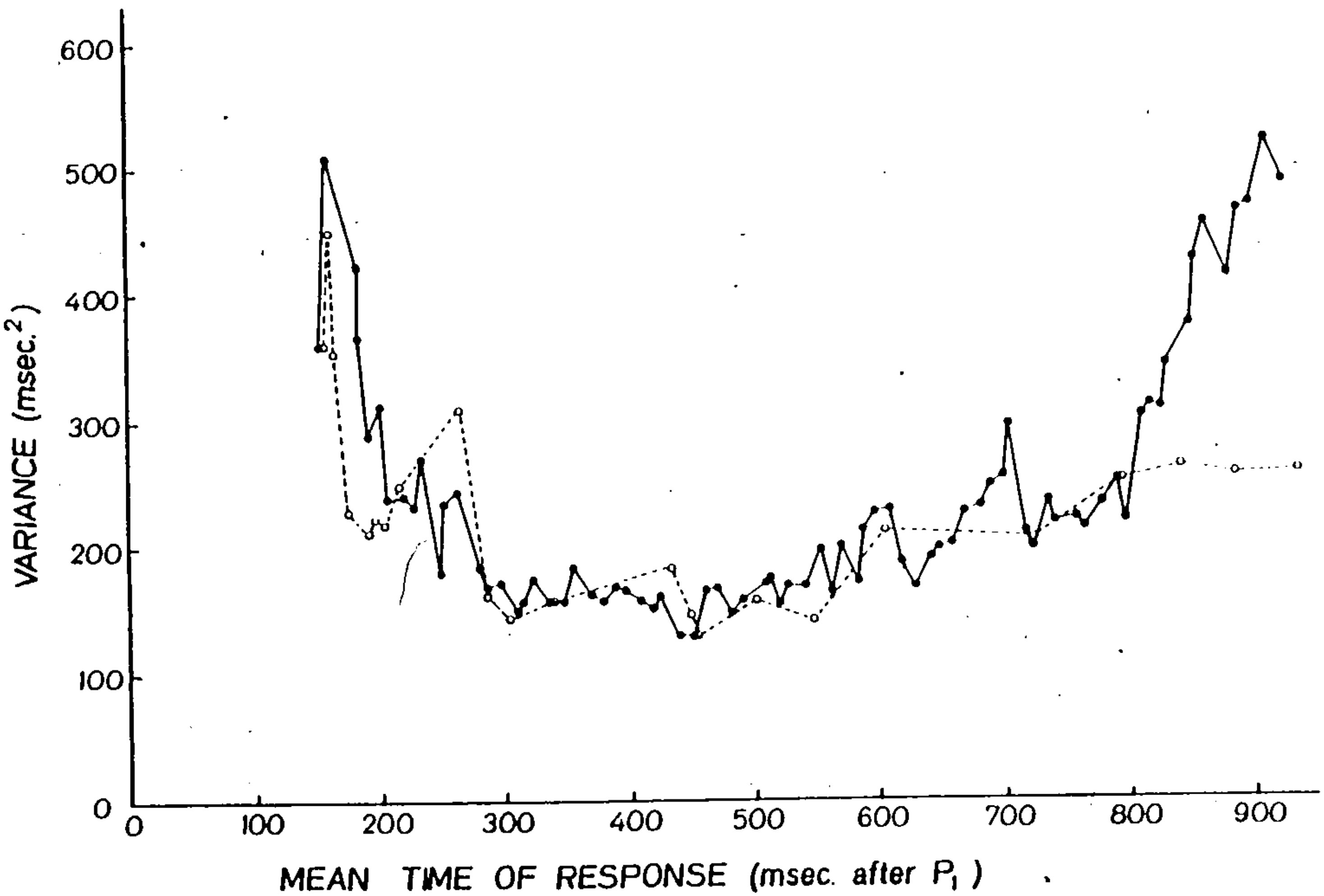
2.8 Scanning Procedure

All of the experiments below are concerned with performance across a range of durations. It is impossible to fully practice subjects at every interval within the ranges. Extended practice can only be carried out at a few intervals.

Figure 1 is a reproduction of Figure 5 from Kristofferson (1976). In it the variance of synchronization latencies from one subject are plotted as a function of duration and as a function of practice with other stimuli within the range. The subject started with 60 sessions at 940 msec, reaching a stable asymptotic variance of 497 $msec^2$. Synchronization intervals were then reduced by 10 msec per session until the lowest interval, 160 msec, was reached. Intervals were then increased, by varying amounts, and were kept constant for 3

FIGURE 1

Synchronization variances from Kristofferson, 1976 (reproduction of his Figure 5). The figure shows mean within-block variance as a function of mean latency. Filled circles are from the initial descending series, with 300 latencies per point. Open circles are from the ascending series, after the first session at each interval, and are based on a minimum of 900 latencies per point.


VARIANCE (msec.^{2})
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
800
900
MEAN TIME OF RESPONSE (msec. after P_1)

to 10 sessions. Study of performance over the range as the interval is decreased gradually can be called "scanning down" the range. The graph shows the results from an initial scan down (filled circles) followed by a scan up (empty circles).

Variances of this subject appear constant in the 300 - 550 msec region and appear to increase as the interval is changed in either direction outside this range. Variance levels from another subject were constant from about 170 msec to 550 msec, at about the same level as obtained by this subject from 300 to 550 msec. The effect of scanning was to reduce variability across the range, but especially to reduce it in the regions in which it was a non-constant function of duration. One might speculate that with even more extensive practice, the relationship between variance and duration might flatten out completely, across the 160 to 940 msec range shown. The reduction in variance at 940 msec was from an apparently stable asymptotic level of 497 $msec^2$ to a final level of less than 300 $msec^2$, due to practice at durations other than 940 msec.

Kristofferson (1983) studied discrimination performance as the separation between pairs of stimuli on opposite sides of the midpoint (base duration) was varied. The estimates of q were based on performance with these stimuli and with others left alone from condition to condition (given a constant midpoint) in this single stimulus paradigm. Initially, the estimated value of q varied with stimulus separation even though base duration was unchanged. Scanning up and down the range of separations had to be done twice before these estimates of internal variability appeared constant, which was eventually obtained.

Scanning across a range of values appears to be a highly effective training strategy for reducing variances and it may be more efficient than further training at the same interval, once asymptotic performance at this interval appears to have been reached.

I made extensive use of a scanning strategy in all of the experiments. After initial stabilization training at a specific interval for at least 50 sessions, synchronization intervals were gradually increased or decreased toward the other end of the range for that experiment. Typically extended practice was also given at one or a few intermediate intervals within the range. Scanning was typically carried out to extreme durations just beyond the longest or shortest intervals at which extensive practice would be required, to minimize any end effects. In general, I was interested in performance levels at the well-practiced intervals. Except in Experiment 4 (vision), I was only concerned with performance at these intervals, spending sessions at the others only as a means of improving performance at the key ones.

The details of the scanning procedures used varied from experiment to experiment and, especially, from subject to subject. Such variation between subjects was absolutely necessary. Some subjects were willing to participate in over 600 sessions. Most were unwilling to commit themselves beyond 200 sessions. Interested in asymptotic performance levels, I adopted what seemed to be the most thorough training schedule possible given the number of sessions that could be expected from the subject and the subject's rate of improvement in the task.

2.9 Data Truncation and Lost Data

The raw data from some sessions were lost due to equipment problems. The PDP-8 paper tape punch generated a number of unreadable tapes, leaving the printout of means and variances at the end of the session as the only record of the data. The Apple disks were substantially more reliable but the computer "crashed" a few times on encountering bad sectors on disks. Further, one of the drives needed more frequent speed calibration than it originally received, and it wrote some unreadable files. Eventually I solved this and other difficulties with the Apple by training at Apple Canada to be a Level 1 Service Technician, after which I calibrated the drives and did other preventative maintenance myself on a regular basis. In the session by session graphs of the data, lost sessions are indicated by gaps. When mean latencies and their variances were obtainable from printouts, these were included in the appropriate graphs.

A number of other problems arose which introduced outliers (extreme latencies) into the data. On the equipment side, electrical transients produced when P1 was presented sometimes caused the PDP-8 to record responses at the time of P1, even though the subject responded much later, near P2. A mixer through which the auditory P1 and P2 stimuli were passed before being presented to the subjects in the PDP-8 setup was a source of intermittent noise for an undetermined number of sessions. The problem was corrected once it became regular enough that the subjects and I realized there was a problem. The effect was that sometimes a short noise burst produced by the mixer was interpreted by the subject as P1 or P2. Noise bursts occured at random times. The PDP-8 suffered a variety of timing problems, all intermittent, at different times. The typical result was a random reduction in recorded response latency. The original response pad occasionally generated its own responses, or responded to movements of the hand in the vicinity of, but not on, the button. The replacement was originally less sensitive than the first one, and contact with the button could be maintained without maintenance of closure of the electrical circuit. Even with the fixed pad, some subjects required Redux Cream, an electrolytic cream, to increase the conductivity of their hand. Use of too much cream made the button sticky, which interfered with performance. The Apple also failed from time to time, requiring over the course of the experiment a new power supply, two new motherboards, and various memory and other chip replacements. Intermittent and total failures to present stimuli were uncommon but they arose. DK's session 395 has been excluded from analysis because P1 and P2 were not presented during the last hundred trials, due to a faulty connection. In a few other sessions (3 or 4), the same thing happened but the subjects terminated the session early, leaving no data to exclude from analysis. In perhaps 5 further sessions, P1 and P2 were not presented for very few trials. These data were kept: I relied on the truncation algorithm described below to automatically remove the abberant responses obtained in these trials.

On the subjects' side, sneezes were the main cause of outliers. Subjects also occasionally leaned back on the chair at a strange angle, ending up on the floor, making an unintentional response by removing the hand from the response pad in the process. Some subjects deliberately "blew" the odd trial, withholding a response in order to hear or see the interval. This was usually no problem since no-response trials were discarded. Occasionally, however, the subject would accidentally lift her finger during the post-P2 interval, generating an accidental and spuriously long response.

There were other problems, but this is a sufficient list of examples. The vast majority of the data were uncontaminated but over the course of a million trials such problems should be expected.

The problem of transients in the PDP-8 system arose in Hopkins' and Brewster's work as well, and had been so for some years before the present research began. In their data, it appeared as a measured latency of 10 msec, i.e. as a response coincident with the end of P1, and they routinely eliminated 10 msec latencies from their data. This was the earliest latency that their programs could report. Three or four such latencies were often obtained in a single session. In my situation, for other technical reasons, response-latency timing was from the start of the foreperiod, so reports of latencies shorter than 10 msec, including negative ones (responses preceding P1) were possible. Remember the task here. The subject is to time an interval that begins with P1 and ends with P2, responding in synchrony with P2. If the response occurs at or before P1, according to the computer, this may reflect a transient or a sneeze, but whatever the difficulty, this is not a synchronization response. I decided to deal with this directly, on an a priori basis, as part of the design of the experiment. A response which the computer claimed occurred at or before P1 offset was flagged immediately with "blown trial" feedback, the abberant latency was stored in a separate data array in the program, and the trial was re-run. My goal in this was to obtain 300 good trials per session and to remove the "bad" trials (the "blown" ones) from view completely. Confident that extremely short and negative latencies could not be "real", I had no intention of including them in any analyses.

For P1-P2 intervals longer than 200 msec, I am still confident that this reasoning was correct, and these "blown" trials have not been analysed.

For P1-P2 intervals of 200 msec or less, I am not confident that all "blown" trials should be removed automatically. The difficulty is clearest when P1-P2 is a mere 85 msec, which was used in Experiment 3 (designed long after Experiments 1 and 2 were started). In this case, the subject is almost certainly timing from WS (the warning stimulus), rather than from P1. For example, with a mean foreperiod duration of 900 msec, the subject might try to wait 985 msec from offset of WS before responding, independently of the time of occurrence of P1. I will consider this strategy in Chapter 4. The point here is that if this is the subject's strategy, and if there is an extraordinarily long foreperiod in a given trial, the subject's response time relative to the long delayed P1 could indeed be 10 msec or less. When P1-P2 is very short, the subjects' response distributions have long negative tails. There is little justification for truncating these tails when they extend past 10 msec.

Even with the addition of foreperiod variance in the response distribution, when timing is from WS rather than from P1, there is a limit on how far back "plausible" latencies can extend. A latency of 10 msec might be believable when P1-P2 is 85 msec. It is less believable when P1-P2 is 150 msec, especially when the low variances and symmetry of the response distributions at this interval are considered, except for subject KC. Even at 200 msec, KC's performance was highly variable and her latencies were strongly correlated with foreperiod duration, suggesting that she was timing from WS rather than from P1. It seemed improbable, but not sufficiently extremely improbable, that responses at or before P1 offset could have been part of her response distribution. KC's behavior in the task was sufficiently abberant that I eventually asked her to leave the experiment, a point to which I'll return in Chapter 4. Her data were analysed, and summary tables appear in Appendix 1. To avoid missing latencies that might have been "real", I included in the analyses any response that preceded P2 by 200 msec or less (her longest P1-P2 interval was 200 msec). To avoid inconsistency of treatment of the data from different subjects, I adopted the same rule for all of them.

To summarize, on an <u>a priori</u> basis, I decided to exclude from analysis all responses which occurred at or before P1 offset. This decision was made before Experiment 3 was designed and the criterion was inappropriate for that experiment. I modified it as follows: all responses which occurred at or before P1 offset <u>and</u> which preceded P2 by more than 200 msec were excluded from analysis. They are not reflected in any tables or graphs below, nor will I refer to them again in the thesis. This restriction on truncation left many transient-based outliers in the data of Experiments 2 and 3.

I spent considerable time thinking about how to remove these remaining transient-based short latencies and other outliers which arose from the problems discussed at the start of this section. I object in principle to data elimination on the basis of the "eyeball test". Further, the notes about problems that subjects often made on their sessions' data printouts were not an adequate basis for a consistent elimination criterion, though I made much use of them in checking the effects of different outlier removal criteria that I considered.

After a number of false starts, I settled on a kurtosis criterion for removal of outliers. If M is the sample mean of a distribution of responses, R_i, and V is the sample variance, the sample kurtosis is defined as b_2 where

$$b_2 = \Sigma (R_i - M)^4 / V^2.$$

This statistic is quite sensitive to extreme values, becoming very large when one or more outliers are present in the data. The kurtosis criterion for removal of outliers is used as follows: Calculate the sample kurtosis. If it exceeds a critical value, exclude the datum most distant from the sample mean. Recalculate the kurtosis, continuing to remove the most extreme of the remaining values until the kurtosis drops below the critical value. This is a common and powerful test for outliers (see Barnett and Lewis, 1978, for more details.)

The difficulty with this procedure, for present purposes, lies in choice of a critical value for the kurtosis. Simulation-based estimates of the kurtosis distribution are available when the response distribution is normal (eg. D'Agostino and Pearson, 1973), but they are not available for most other distributions. Accordingly, I ran a small scale simulation to obtain critical values for this procedure. If the subject is timing from P1, the response distribution is known to be symmetrical and highly peaked. Pseudorandom variates were generated in batches of 300, to make up a simulated session, and 200 such sessions of data were examined for each distribution studied.

To approximate the response distribution when the subject is timing from P1, I used normal (population kurtosis of 3.0), triangular (kurtosis of 2.4), and logistic (4.2) distributions, and three convolutions of triangular and logistic distributions (kurtosis ranging from 2.4 to 4.2, depending on the relative variances of the two distributions). Across the 1200 "sessions" of data so examined, sample kurtosis never exceeded 8.3. On the basis of this, I conclude that if the subject is timing from P1, it is exceedingly unlikely that the sample kurtosis of his data would exceed 10 by chance. For this case, then, I use a kurtosis criterion of 10.

If the subject is timing from WS, his response distribution includes the variability of the foreperiod. If we measure response latency from WS, the distribution should be symmetrical and peaked, as it is from P1 when the subject times from P1. However, if we measure latency from P1 and the subject is timing from WS, we are subtracting the foreperiod duration from the interval the subject is actually timing. This is a geometric variate, with a variance of 90 $msec^2$. I used the same base distributions (triangle, logistic, convolution of the two, normal), and subtracted geometric variates to simulate the response latency distribution to be expected in this case. The kurtosis of such distributions depends on the relative variance of the timing and foreperiod distributions, so I varied these as well. In a total of 17 distributions (3400 kurtosis values calculated), 10 was exceeded five times. That is, a kurtosis of 10 should be rare if the subject times from WS and we measure the latency from P1, but it is not extremely rare. The same results would be expected if the subject timed from P1 and we measured latency from WS, adding the geometric foreperiod to the latencies, rather than subtracting it from them.

It is not always possible to decide beforehand whether a given subject at a given P1-P2 interval will time from P1 or from WS. To avoid arbitrary decisions here, I used a compound criterion. If the kurtosis of the latency distribution exceeded 10 when latencies were measured from P1 onset, and if it also exceeded 10 when latencies were measured from foreperiod onset, then I eliminated the most extreme latency. In principle, one of these two latency distributions should be symmetrical and highly peaked while the other should be skewed and less peaked due to the addition or subtraction of a geometric variate, whether the subject is timing from P1 or from WS. Values as large as 10 from the symmetric distributions were never obtained in the simulations, and fewer than 0.15% of the kurtosis values from the skewed distributions were this large.

I consider this compound criterion quite conservative. Further, from examination of the histograms of the response distributions printed for each session, and from the subjects' notes, I am satisfied that the latencies which were eliminated should have been eliminated. A few outliers remain in the data, which can be directly traced to known equipment problems, but relaxing the kurtosis criteria to allow elimination of these responses would have resulted in elimination of others that should not be removed from the data.

As a final note on the simulations, I derived the population kurtosis for each of the distributions studied, and compared this to the estimate obtained by simulation (along with estimates of other statistics of the distributions). The theoretical and obtained values agreed well, as they must for the simulation to be considered valid.

Appendix 1 includes tables of a number of statistics of the response distributions for each subject and session. Included in this is the number of trials per session that were included in the analysis. If any trials were eliminated from that session's data, the number of these is given in brackets beside the number included. A total of 186 responses were eliminated, from 3,116 sessions' data (or about 1 response per 5,000). Reflecting the string of problems with the machine, 146 of the 186 eliminated responses were from data collected on the PDP-8, which controlled only 756 of the 3,116 sessions.

3. Experiment 1: Long Auditory Intervals

In this experiment, synchronization intervals were varied across a range from 1400 to 2100 msec. On the basis of the review in the introduction, three plausible results can be envisioned:

From Kristofferson's (1976) synchronization experiment, we should expect variability to increase continuously as the P1–P2 interval is increased. Kristofferson found that beyond 550 msec, the standard deviation of synchronization latency distributions increased linearly with duration. (More precisely, the standard deviation of the added delay, in excess of 550 msec, was directly proportional to the mean of the added delay.) Only one subject was studied in that experiment. His variances in the 1400 to 2100 msec region ranged from 888 msec^2 at 1390 msec to 3283 msec^2 at an interval of 2090 msec.

On the basis of Kristofferson's (1980, 1983) discrimination research (which involved the same subject), we should expect Weber's Law compatibility early in the experiment but after extended practice the variance should increase in a stepwise manner with duration, rather than continuously. Kristofferson (1980, 1983) estimated q, the parameter of the internal triangular distribution, as 100 msec across the range from 800 to 1600 msec, and as 200 from 1600 upwards.

Translation of the discrimination results into predictions about synchronization latency variances involves a few steps. First, the breakpoint should probably not be at 1600 msec because some time is taken for the subject to perceive P1 and to respond to it. If we parse the stimulus-response chain into three stages, afferent (input), central, and efferent (output), and assume that the internally timed interval starts after the stimulus is registered and ends with the initiation of the response, we should subtract afferent and efferent latencies to estimate the duration of the internal interval timed. Following Kristofferson (1976), we can estimate the non-central latencies as 150 msec, close to the mean latency of simple reaction time responses when using 2000 Hz 68 dB auditory stimuli. (The parameters are important because RT varies with intensity and frequency.) In this case, we should expect a break from q=100 to q=200 at a synchronization interval of about 1750 msec. The triangular variances (given by $V = q^2/6$) are 1667 msec^2 and 6667 msec^2 respectively. To these, a further 10 to 50 msec^2 should be added to reflect efferent latency variance of well practiced subjects (Wing and Kristofferson, 1973). Wing's (1973) results depended on the type of response demanded of the subject. Hopkins (1982) estimated efferent latency variances using the same equipment and response as were used in the present experiment. His estimates averaged approximately 25 msec^2. Accordingly, we should expect the variances to be about 1690 msec^2 from 1400 to 1750 msec (1600 + 150) and about 6790 msec^2 for intervals ranging from 1750 to 2100 msec.

These values are substantially larger than many long interval synchronization variances reported by Kristofferson (1976), so a prediction of complete compatibility with the discrimination results of

Kristofferson (1980, 1983) is not plausible. We might still anticipate a stepwise increase in variance, however, with a break at 1750 msec.

Kristofferson's (1980) explanation of the stepwise variance increase was in terms of a quantal counting model, with a maximum count of 16. Hopkins (1982) reported synchronization variances as low as 33 $msec^2$ for intervals as long as 460 msec. With a q of 12.5 msec (close to Hopkins' estimates) and subtracting 150 msec from the 460 to reflect input and output delays, we still obtain a count of over 24 q. If we maintain a quantal counting model, we must drop the maximum of 16 for the count. This restates the difficulty noted in the last paragraph: the variances are too small to be fully compatible with Kristofferson's (1980) discrimination findings.

Brewster (1983) showed, in a task involving both synchronization and discrimination responses, that variability of each type of response could be manipulated independently of the variability associated with the other. She interpreted this as indicating that different timing mechanisms or strategies were involved in the two tasks. These results give us some leeway to ignore the discrimination findings. The third outcome that I will raise as "plausible" is that the variances may stay constant across the entire interval.

My expectation in this experiment was that the results would be similar to those obtained in most other very long term experiments on subjective duration and/or timing. With respect to variability, I expected that after sufficient practice the relation between synchronization interval and variance would be constant or stepwise increasing, not monotonically increasing. This is not a foregone conclusion. Kristofferson (1976) included very extensive practice at 940 msec, but despite that practice the variance at this interval was higher than that obtained at 890 msec, and lower than that obtained when the synchronization interval was 990 msec (the two surrounding intervals in this experiment). It appeared from that experiment that Weber's Law would describe asymptotic performance. I considered this result anomalous and, as discussed in the introduction, I did not expect to obtain it.

There is more to "similarity of results" than similarity in terms of constant or stepwise increasing variance. My thesis is that the same timing mechanism is available for long interval synchronization as is used for short intervals. If this is true, we should find that estimates of q in this experiment hover about 12.5, 25, 50, or 100 msec, after much practice, and that the distribution of responses is symmetrical and peaked. From Hopkins (1982), I would expect that convolution of a triangular (timing) with a logistic (efferent latency) variate should yield a theoretical distribution that describes the response latencies. Population statistics of this and other distributions are given in Appendix 2. I evaluate the quality of this description by examining the coefficients of symmetry, $\sqrt{b_1}$, which should be 0, and of kurtosis, b_2, which should be between 2.4 and 4.2.

I will not specify the mechanism beyond the statement that it is quantal and that it yields response distributions as described above. All that we have to work with from this task are the response distributions, and different quantal mechanisms could generate the same results. Hopkins' model, involving effectively independent uniform delays in getting information into and out of the clock, perfect timing by the clock, plus an independent logistic variate describing motor variance, is the one I adopt as a working model. There is no hint of quantal counting in this model. I am confident that a counting model could be constructed to predict exactly the same results in this task.

3.1 Method

3.1.1 Subjects

Two male subjects, DG and GH, participated in this experiment. DG was a senior undergraduate, GH a graduate student. As is true for all of the subjects in this thesis, neither had participated in synchronization experiments previously. Both had some familiarity with the timing literature and had participated in various other psychological experiments.

3.1.2 Procedure

The general procedure was described in Chapter 2. DG started at 2000 msec and practiced extensively at this interval before moving toward 1500 msec, in steps of 25 msec. There was only one session per interval for most of the intermediate intervals. I scheduled 5 sessions per interval at 1900, 1800, 1700 and 1600 msec to slow the rate of change somewhat. My intent in designing the schedule was to change the interval to 1500 msec quickly but not so quickly that the benefits of practice at the longer intervals would be lost at the shorter intervals. After 5 sessions at 1500 msec, the interval was reduced in steps of 25 msec to 1400 msec, to avoid any end effects at 1500. The interval was then lengthened, always in 25 msec steps, to 1500, where DG stayed for 30 sessions. The interval was then brought up to 1750 msec, and after extended practice it was lengthened to 2000 msec where it was kept for the final 52 sessions of the experiment.

The schedule for GH was similar, except that he started at 1500 msec, worked with intervals as long as 2100 msec, and finished at 1500.

In both cases, attention was paid to performance at 1750 msec, as compared to that obtained at 1500 and 2000 msec. My intention was to study the region around 1750 msec in detail if it appeared that there was a variance step between 1500 and 1750 or between 1750 and 2000 msec.

The exact schedule for each subject is displayed visually in numerous figures below. Appendix 1 provides tables of descriptive statistics for each session of each subject, and these list each session's synchronization interval.

3.2 Results

3.2.1 Latencies

Figures 2.1 and 2.2 show the relationship between synchronization interval (lower panel) and mean synchronization latency (upper panel) for each subject. All sessions are plotted. Clearly, response latencies are linearly related to the synchronization intervals. It is not evident in the graphs, but can be seen in the first two tables of Appendix 1, that DG's mean latencies were typically within 10 msec of perfect synchrony. This is typical of synchronization performance, in the data of this dissertation and in the other works cited previously. GH's responses typically occurred more than 10 msec before P2. The means were often 20 to 30 msec early. Still, increases and decreases in GH's latencies followed increases and decreases in the duration of the P1-P2 interval quite closely.

3.2.2 Variances

The upper panel of Figures 3.1 and 3.2 show DG's and GH's variances for each session. The middle panels again show synchronization intervals. The lower panels show the mean foreperiod durations, near 900 msec on the PDP-8 and near 1000 on the Apple. There is no indication of a change in performance due to the change of equipment.

Figures 4.1 and 4.2 show variance levels at "practiced" intervals. I refer to statistics of "practiced intervals" frequently below. By this, I mean all intervals with which the subject worked for two or more consecutive sessions. The figures show averages of the within-session variances of the last five sessions, or of all sessions if there were fewer than five at this interval.[4] These averaged variances are presented in tabular format in Tables 1.1 and 1.2, along with the intervals, averaged estimates of q, the mean symmetry and kurtosis coefficients, and the mean correlation between response latency and foreperiod duration. There are clear practice effects in the data, so these tables list the results in the order in which they were obtained. The final few rows in each table are the ones of major interest.

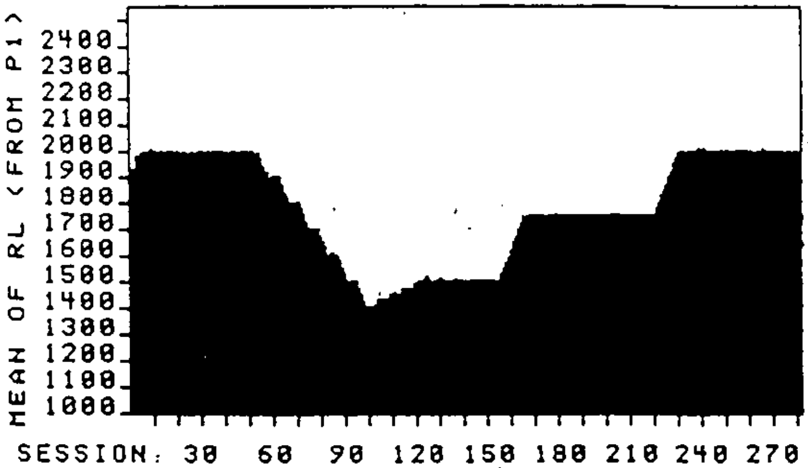
DG's and GH's data contain some striking dissimilarities, so I

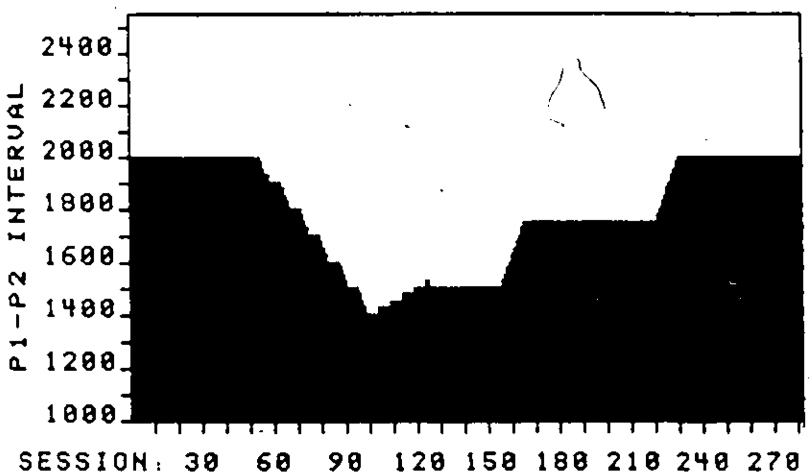
FIGURE 2

Upper panel: Mean synchronization latencies, in milliseconds, of each session.

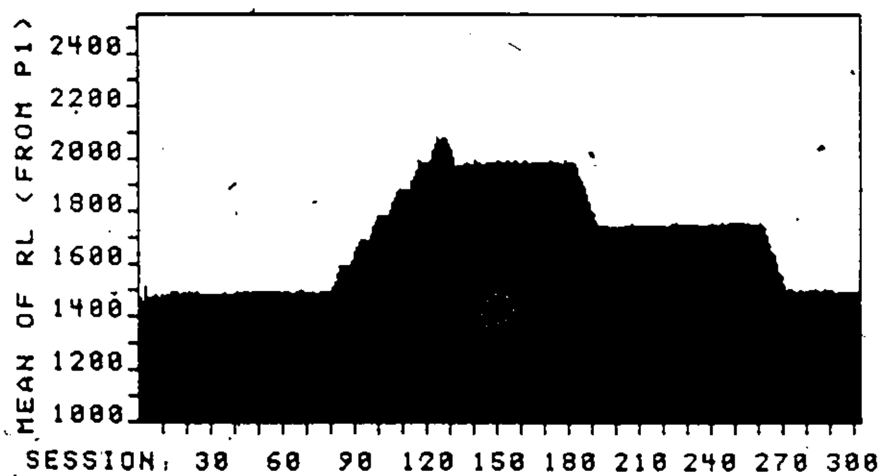
Lower panel: Synchronization interval, in milliseconds, of each session.

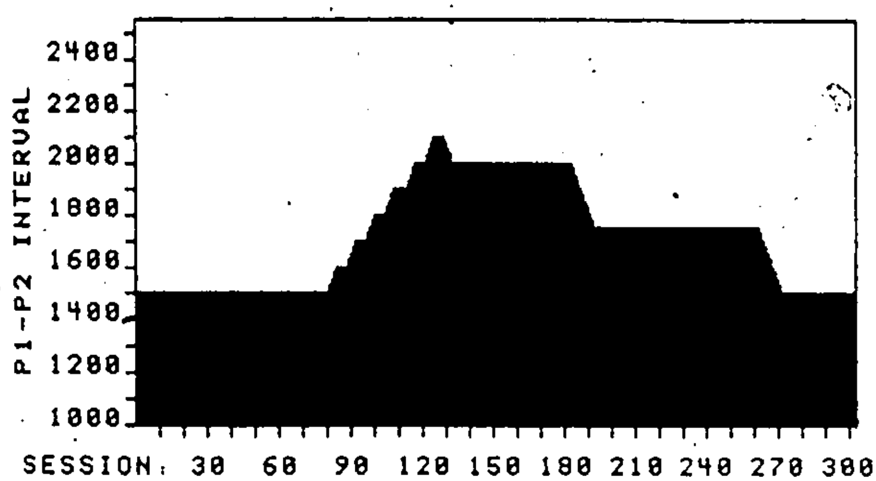
Figure 2.1, subject DG. Figure 2.2, Subject GH.


MEAN OF RL (FROM P1)
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
SESSION: 30 60 90 120 150 180 210 240 270


P1-P2 INTERVAL
2400
2200
2000
1800
1600
1400
1200
1000
SESSION: 30 60 90 120 150 180 210 240 270

DG AUDITORY


MEAN OF RL (FROM P1)
2400
2200
2000
1800
1600
1400
1200
1000
SESSION: 30 60 90 120 150 180 210 240 270 300


P1-P2 INTERVAL
2400
2200
2000
1800
1600
1400
1200
1000
SESSION: 30 60 90 120 150 180 210 240 270 300

GH AUDITORY

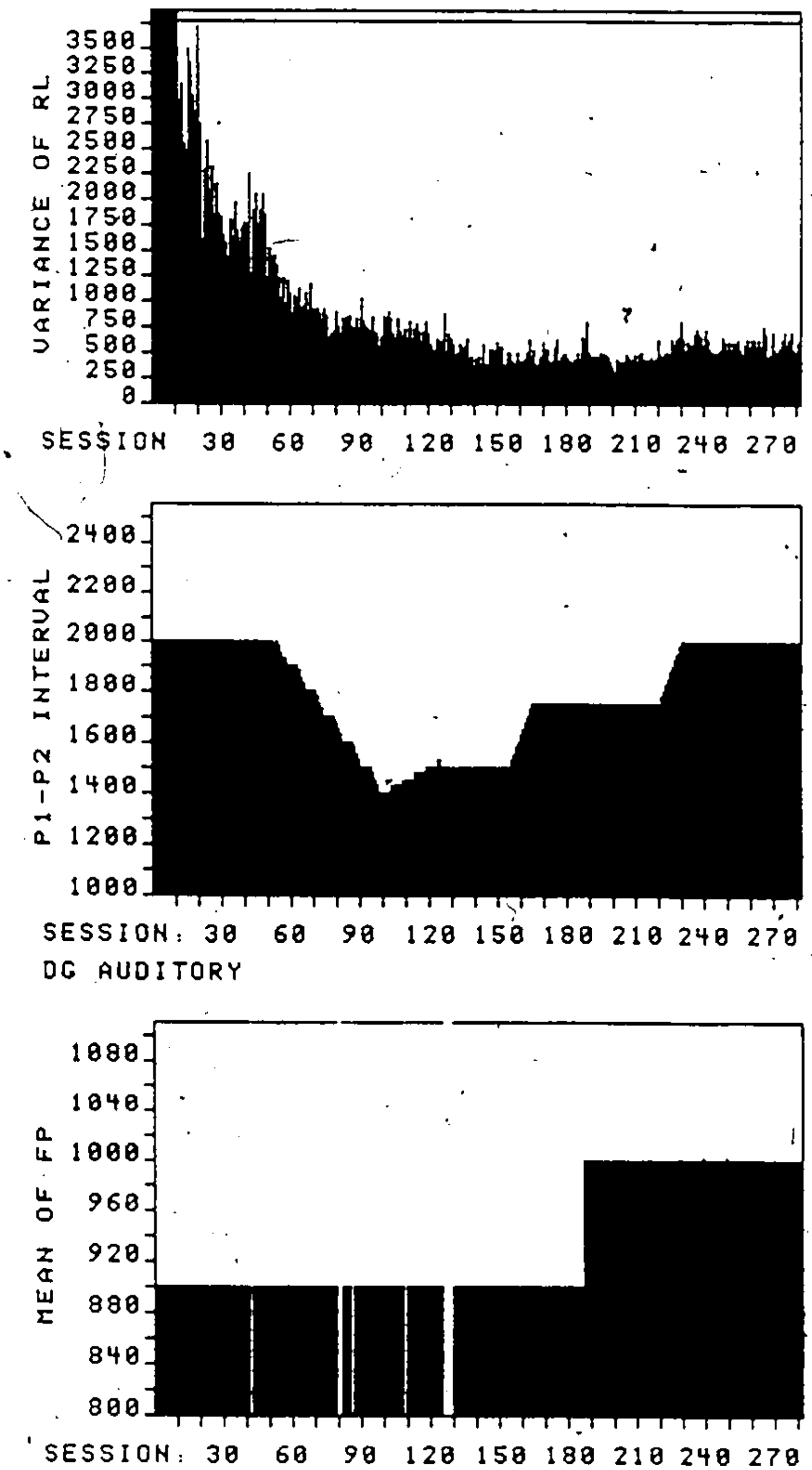
FIGURE 3

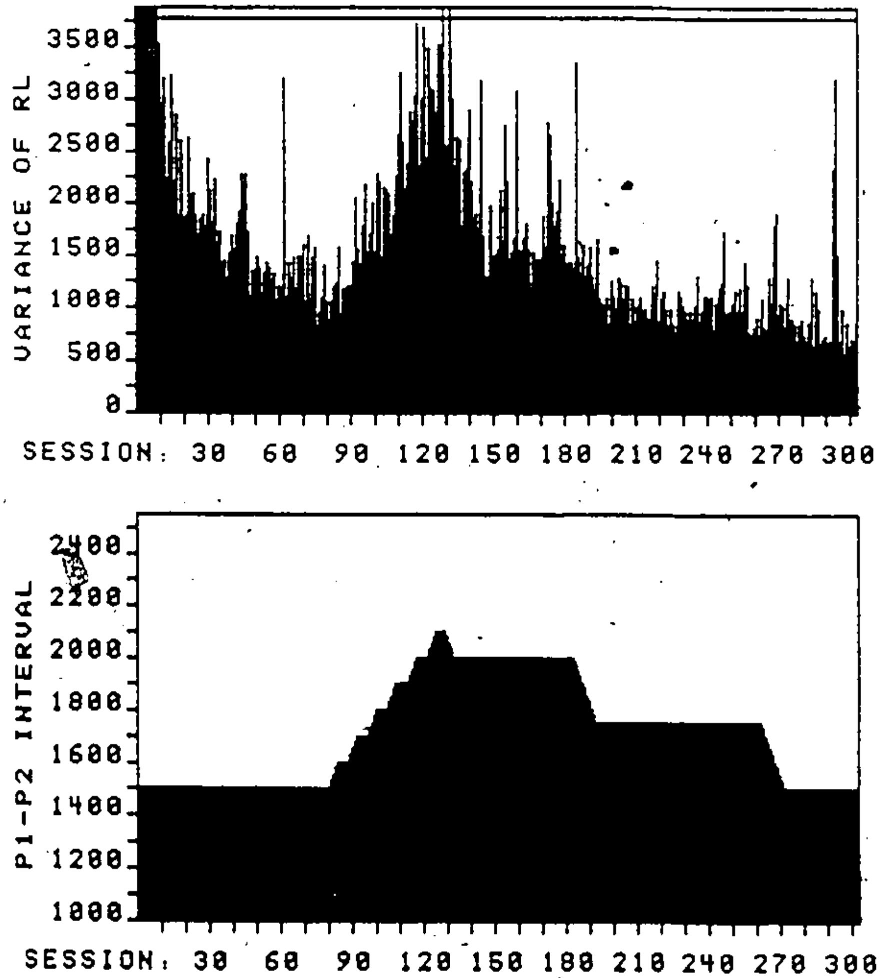
Upper panel: Response latency variances, in $msec^2$, of each session. Note that there are two lines marking the top of the panel. Variances shown as extending to the topmost line were too large to show accurately on this scale. For exact values, see Appendix 1.

Middle panel: Synchronization interval, in milliseconds, of each session.

Lower panel: Mean foreperiod duration, in milliseconds, of each session. The means were approximately 900 msec when the PDP-8 controlled sessions and 1000 msec when the Apple controlled sessions. Gaps in the figure (ostensibly 800 msec means) are due to loss of the raw data, making calculation of that session's mean foreperiod duration impossible.

Figure 3.1: Subject DG. Figure 3.2: Subject GH.


VARIANCE OF RL
3500 3250 3000 2750 2500 2250 2000 1750 1500 1250 1000 750 500 250 0
SESSION 30 60 90 120 150 180 210 240 270
P1-P2 INTERVAL
2400 2200 2000 1800 1600 1400 1200 1000
SESSION: 30 60 90 120 150 180 210 240 270
DG AUDITORY
MEAN OF FP
1080 1040 1000 960 920 880 840 800
SESSION: 30 60 90 120 150 180 210 240 270


VARIANCE OF RL
3500
3000
2500
2000
1500
1000
500
0
SESSION: 30 60 90 120 150 180 210 240 270 300
P1-P2 INTERVAL
2400
2200
2000
1800
1600
1400
1200
1000
SESSION: 30 60 90 120 150 180 210 240 270 300

GH AUDITORY

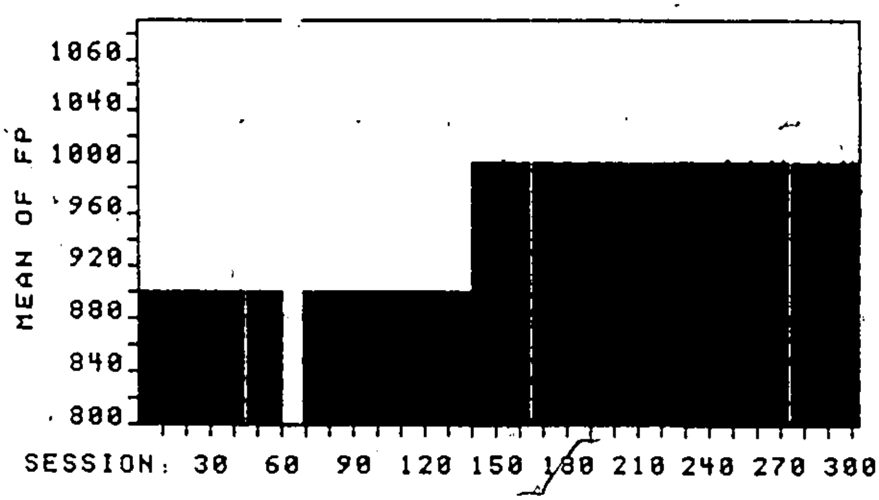
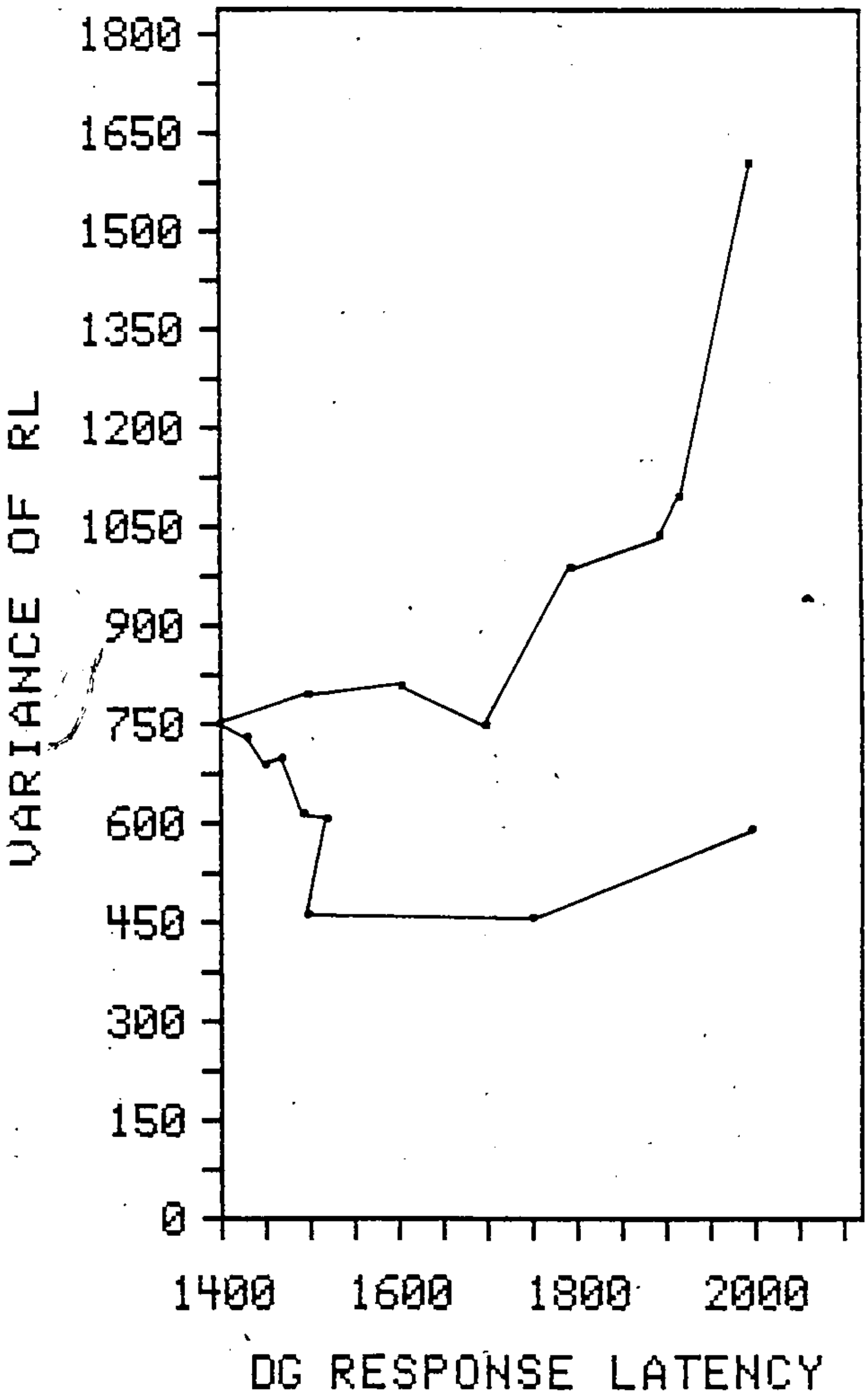
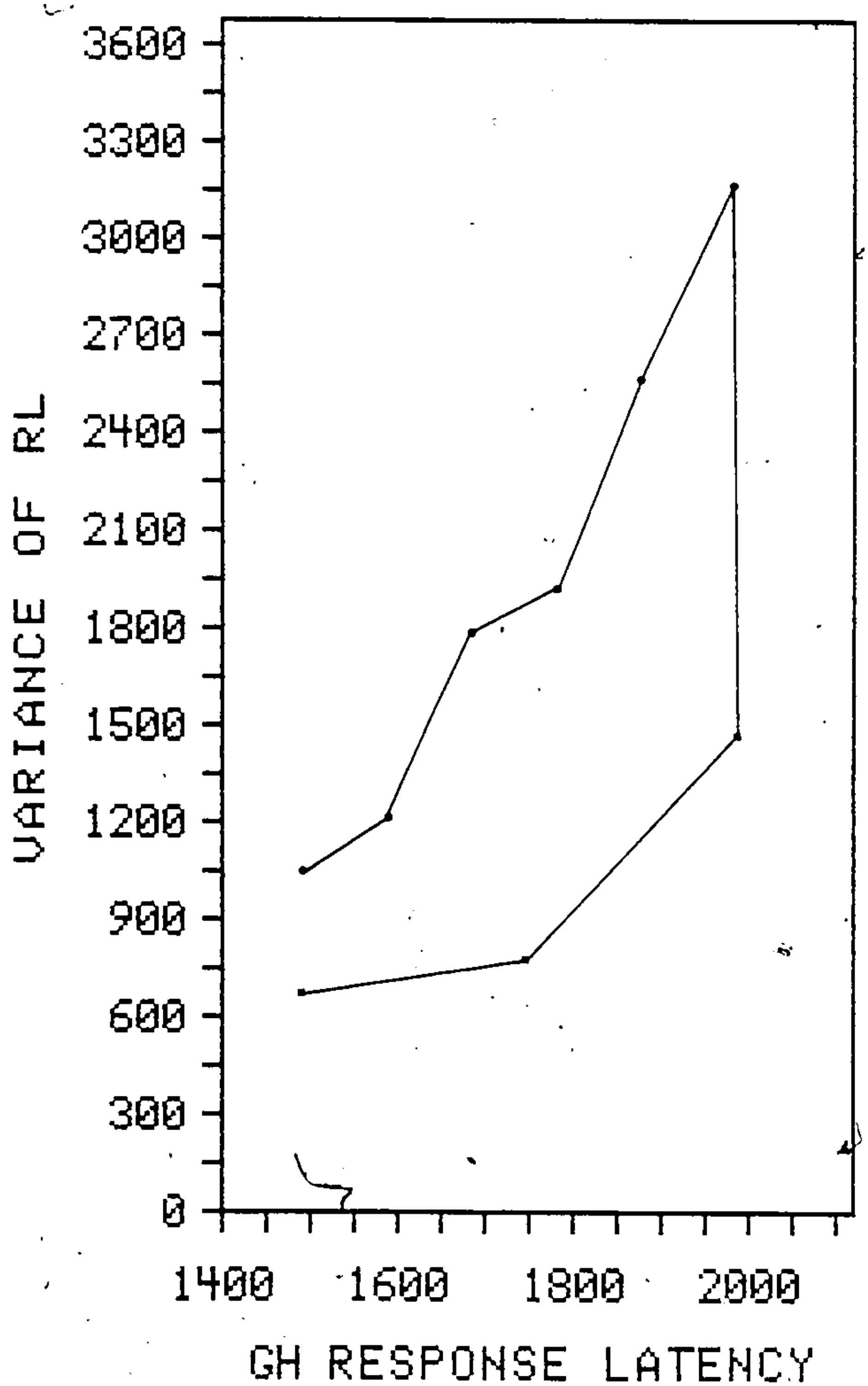

MEAN OF FP
1060
1040
1000
960
920
880
840
800
SESSION: 30 60 90 120 150 180 210 240 270 300

FIGURE 4

Mean within-session response latency variances (msec^2) as a function of mean response latency (msec). Filled squares show the descending series variances. Filled cirles show ascending series variances. The variances plotted are listed in Table 1.

Figure 4.1: Subject DG. Figure 4.2: Subject GH.


1800
1650
1500
1350
1200
1050
900
750
600
450
300
150
0
VARIANCE OF RL
1400
1600
1800
2000
DG RESPONSE LATENCY



VARIANCE OF RL
3600
3300
3000
2700
2400
2100
1800
1500
1200
900
600
300
0
1400
1600
1800
2000
GH RESPONSE LATENCY

TABLE 1

Mean within-session variances ($msec^2$), q estimates (msec), coefficients of symmetry (ROOT B1), of Kurtosis (B2) and of correlation between response latency measured from P1 and the foreperiod duration. Only data from intervals at which the subject spent two or more consecutive sessions were averaged for this table. The averages are based on the last five sessions at this interval before the subject moved to the next, or, if there were fewer than five, on all sessions at the interval.[4]

Estimates of q were obtained from the triangular variance relationship, q^2 = Variance/6, after subtraction of 25 $msec^2$ as an estimate of efferent latency variance. That is, if V is the sample variance, q was estimated from

$$q^2 = (V-25)/6.$$

Table 1.1: Subject DG. Table 1.2: Subject GH.

SUMMARY STATISTICS FOR DG AUDITORY
RESPONSE LATENCY MEASURED FROM P1

INTERVAL	VARIANCE	Q	ROOT B1	B2	CORR WITH FP
2000	1604	97.34	0.28	4.84	-0.03
1925	1098	80.23	0.00	3.15	-0.05
1900	1042	78.11	0.07	3.12	-0.01
1800	988	76.01	0.14	3.09	-0.08
1700	752	66.04	0.09	3.02	-0.05
1600	813	68.77	0.19	3.08	0.01
1500	798	68.11	-0.02	3.24	-0.03
1400	750	65.94	-0.06	3.78	-0.06
1425	729	64.98	0.00	3.49	-0.02
1450	690	63.18	-0.09	3.37	-0.02
1475	699	63.60	0.00	3.27	-0.05
1500	619	59.68	0.05	5.67	-0.03
1525	611	59.28	0.03	2.98	-0.06
1500	463	51.29	0.05	3.84	-0.04
1750	457	50.90	-0.03	2.98	-0.05
2000	594	58.42	0.02	2.99	0.02

SUMMARY STATISTICS FOR GH AUDITORY
RESPONSE LATENCY MEASURED FROM P1

INTERVAL	VARIANCE	Q	ROOT B1	B2	CORR WITH FP
1500	1054	78.59	0.02	3.28	0.04
1600	1214	84.47	0.05	3.25	0.01
1700	1786	102.79	0.04	3.52	0.03
1800	1920	106.62	-0.02	3.25	0.04
1900	2569	123.54	0.09	3.11	0.03
2000	3152	136.98	0.02	3.13	0.04
2100	3660	147.68	-0.04	3.13	0.10
2000	1475	93.28	0.15	2.89	0.04
1750	784	67.49	-0.02	3.26	0.03
1500	674	62.42	-0.05	3.60	-0.01

will discuss their results separately.

By about session 140, DG had achieved a stable level of variability, hovering about 500 msec². The variances at 1500 and 1750 msec are quite close (averaging 463 msec² at 1500 and 457 msec² at 1750, for the final five sessions). There is a slight increase at 2000 msec, to a final five session average of 594 msec², but there is no hint of a stepwise increase. He and I both felt that with further practice (impossible because DG had to leave to attend graduate school in California) this variance would have dropped further.

Figure 4, based on the variances reported in Table 1, highlights the effect of "scanning" on the data. DG's variance at 2000 msec appeared roughly stable at 1604 msec² before he practiced at the shorter intervals. After working with the shorter ones, his variance at 2000 was substantially less than half this value, and it was so even during the first sessions of the final series at 2000 msec (see Figure 3.1).

DG's q was very close to 50 msec at 1500 msec (51.3) and at 1750 (50.9). It was not much greater than 50 (58.4) at 2000 msec.

If DG was timing these intervals by counting quanta, by these estimates, at 1750 and at 2000 msec he was counting about 34 of them. There is absolutely no support in these data for the hypothesis of a maximum possible count of 16 q.

The Weber ratios (standard deviation/synchronization interval) for the final 5 sessions at 1500, 1750 and 2000 msec are 0.014, 0.012 and 0.012 respectively. Hopkins (1982) reported ratios as low as 0.016

in his subjects' synchronization performance. The lowest value obtained previously was 0.023, from Wing and Kristofferson (1973). Weber ratios obtained in discrimination tasks typically range from 0.06 to 0.10 according to Hopkins' review. Compared to these values, DG's performance is quite impressive. It is equally impressive when compared to the synchronization variances reported by Kristofferson (1976) over the same range of intervals (888 to 3283 msec²).

GH's performance was substantially more variable, in all respects. I think that part of the problem was that GH spread the sessions over a much longer period (he took almost a year longer than DG to complete the experiment). Further, he reported as late as session 187 that he was still experimenting with new response strategies, whereas most of the other subjects had settled into a routine approach much earlier in training. Whatever the problem, it is not clear that GH ever achieved a stable performance level. Some of his worst, and some of his best sessions occurred in his final ten.

Figure 3.2 paints a confusing picture of the relationship between synchronization interval and his variance. There are striking practice effects. The variance at 2000 msec dropped by more than half with practice. Variability declines from 2000 to 1750 msec, but this appears to be a continuous decline. Perhaps with more practice this would flatten out and we would see a step. Perhaps not. From 1750 msec downwards, the variance appears roughly constant.

Given the day to day high variability of GH's performance from day to day, I decided not to schedule a further series of sessions to examine the 1750 to 2000 msec region for a step in variance levels.

Even if there is one, without years' more data collection, I doubt that it would be evident in the results.

Table 1.2 and Figure 4.2 give the variances at the final five sessions at 1500, 1750 and 2000 msec intervals. It is hard to interpret the values at 1500 and 1750 msec. I think they are fortuitously low. The variance of the second last 5 sessions at 1500 msec was 1737 msec² (q = 101.4 msec), compared to 674 msec² in his last 5. At 1750 msec, the second last group of 5 yielded an average variance of 1142 msec² (q = 81.9 msec), compared to 784 msec² for the last group. I'm not saying that these are in any way "better" or "more representative" variance estimates. Instead, I'm saying that I'm not sure that values "representative" of asymptotic performance levels can be found in these data. Nor am I confident that further data collection would lead us to better data from GH.

If we do look only at the last 5 sessions at 1500, 1750 and 2000 msec, the Weber ratios are 0.017, 0.016 and 0.019 respectively. While not as good as DG's, these are as good as those reported by Hopkins' (1982) and are better than any reported previous to them. They are very respectable results. Further, GH's variances throughout the descending series (from 2100 msec down to 1500 msec) were typically better than those reported by Kristofferson (1976).

3.2.3 Weber's Law

Kristofferson (1976) reported that increases in synchronization variance beyond 550 msec followed Weber's Law, but there was very little practice at most of these intervals. The same was true for intervals in the 150 to 550 msec range, but there, constant variances were found, suggesting a transition in mechanisms. Kristofferson (1980) found that Weber's Law described discrimination performance quite well if only the first five sessions at each base duration were considered. In the present data, for both subjects, variance appeared to increase with duration before the subjects had practiced at the intervals. Perhaps Weber's Law should describe their unpracticed performance as well.

I checked this notion by examining the variances obtained during the first session at each interval studied during the first series (ascending for GH and descending for DG). I also excluded from this analysis data from the first interval studied (2000 msec for DG and 1500 for GH) because variances during the very first sessions were high due to the newness of the task, independently of the interval. I also excluded those sessions from which the raw data were lost (due to paper tape or disk failures) because the usual truncation procedures could not be carried out on these data. This sometimes resulted in artificially inflated variances, at least relative to the others, which would have clouded any relationship that exists between duration and variability.

To examine the fit of Weber's Law to the data, I fit a simple linear function to the mean latencies and the associated standard deviations. According to the modified form of Weber's Law,

Standard Deviation = k (mean latency) + c

where k and c are constants.

Table 2 presents the estimated Weber fractions, k, and the

Pearson correlations between standard deviations and mean latencies, for DG, GH, and for the main subjects of the later experiments, whose intervals ranged from 150 to 525 msec.[5] From the results of Kristofferson (1976), we should expect the correlations from the shorter interval experiments to be close to zero, whereas we should expect high correlations between standard deviation and mean latency for DG and GH.

Also presented in Table 2 are the correlations between mean latency and latency variance across the same sessions. I calculated these out of curiousity about comparisons between Creelman's theory and Weber's Law. Getty (1976) and Kristofferson (1976) reported that their standard deviations increased linearly with duration <u>and</u> that the variances increased nonlinearly. Other reports (eg. Creelman, 1962) indicate that variances can be described as increasing linearly with the mean, but to the best of my knowledge none of these explicitly tested for a nonlinear relationship between standard deviation and mean. The question is not sufficiently relevant to the data or to the main questions at hand to justify a simulation or other extended study here, but what I am curious about is whether, with noisy data, if both relationships were tested, it might appear that both are true. In that case, evidence of a linear increase in variance without concomitant evidence of nonlinearity in the standard deviations might provide only equivocal support for a Poisson process. As Kristofferson has stressed in discussions with me, the data might be equally compatible with Weber's Law, for which there is more supporting evidence.

Table 2

Correlations Between Response Latencies
and Their Standard deviations and Variances

Subject	Interval Range	Weber Fraction	Correlation Between Mean and Stand. Dev.	Variance
DG	1400-2000	.016	.823	.815
GH	1500-2100	.046	.942	.934
RW	150-210	.081	.798	.788
JB	150-200	.040	.277	.305
DK	300-500	.022	.453	.437
IS	300-500	.030	.626	.628
LL	300-500	.000	.013	.012
RW Visual	300-400	.040	.649	.643

The correlations between mean latency and either measure of variance are always positive, indicating that variance is an increasing function of duration for unpracticed performance. For the short intervals these correlations are not large, which suggests that neither the relationship between mean and standard deviation nor the relationship between mean and variance should be taken as linear.

The correlations are larger for the long durations (DG and GH), but here, as for the short P1-P2 interval data, the correlations between mean and standard deviation and between mean and variance are the same. Perhaps one of these relationships is linear, but it is impossible to tell which one. Looking at graphs for both subjects (not presented here but easily constructed from the data in Appendix 1), I am not convinced of linearity in either case. I should stress, though, that there is a great deal of random fluctuation in the variances, which are only based on a single session's data at each interval. Given this noise, I think the correlations are large enough to support the claim that the long interval data are compatible with (if not strongly suggestive of) Weber's Law, and with linearity between mean and variance.

The results of these analyses also provide some further grounds, albeit modest ones, for querying whether results thought of as compatible with a Poisson process model might not also be compatible with Weber's Law. The similarity of correlations between mean and variance and between mean and standard deviation.is quite striking.

3.2.4 Correlation Between Response Latency and Foreperiod Duration

There is no reason for the subject to time from the warning stimulus when the P1-P2 interval is 1400 msec or longer, so there should be no correlation between latency and foreperiod duration. The correlations are of interest in the later experiments so for comparison I report them here as well. Figures 5.1 and 5.2 display the correlations (upper panel) for each session. These are listed in Appendix 1 as well. Table 1 presents some averages across sessions, at practiced intervals.

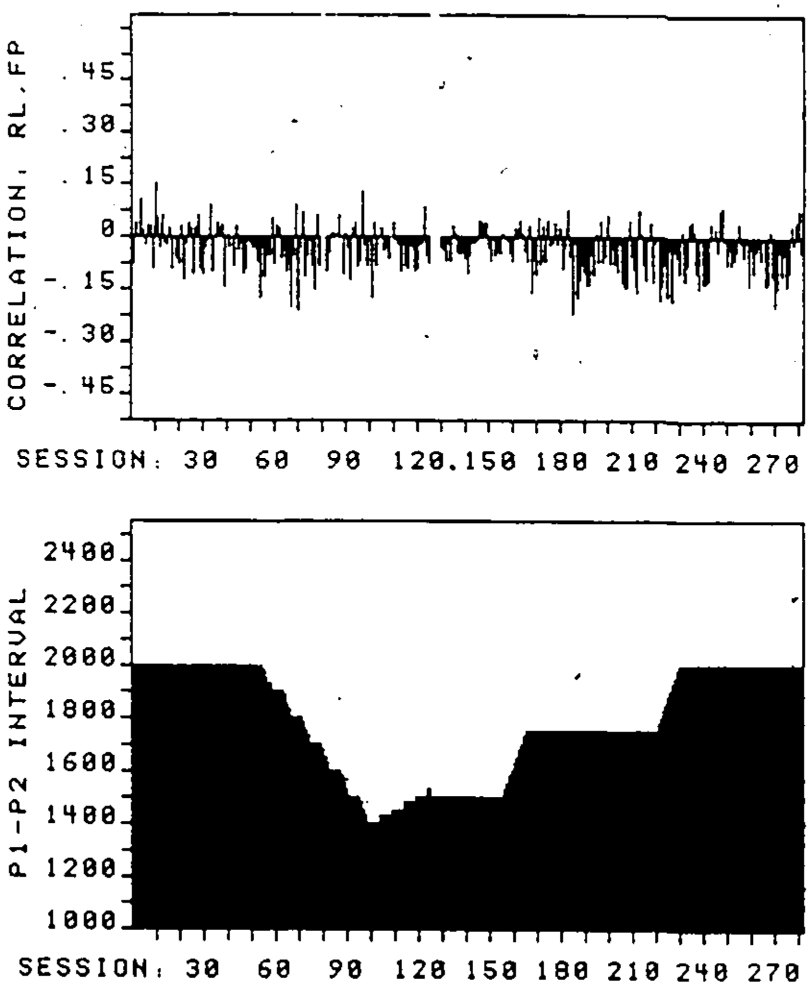
There is no relationship between correlation and synchronization interval, but the correlations, while very small, are consistently non-zero for both subjects. DG's correlations are negative, which would arise if he was timing from the warning stimulus (though they would be larger if he did this at all consistently). GH's correlations are fairly consistently positive. The correlations are quite small, and they account for very little variance. I will generally ignore them in discussing the data.

FIGURE 5

Upper panel: Correlation between response latency (from P1) and foreperiod duration for each session. Some sessions' raw data were lost and correlations could not be calculated. Gaps in the figure are due to lost sessions.

Lower panel: synchronization intervals, in milliseconds, of each session.

Figure 5.1: Subject DG. Figure 5.2: Subject GH.


CORRELATION, RL.FP
.45
.30
.15
0
-.15
-.30
-.45
SESSION: 30 60 90 120.150 180 210 240 270
P1-P2 INTERVAL
2400
2200
2000
1800
1600
1400
1200
1000
SESSION: 30 60 90 120 150 180 210 240 270
DG AUDITORY

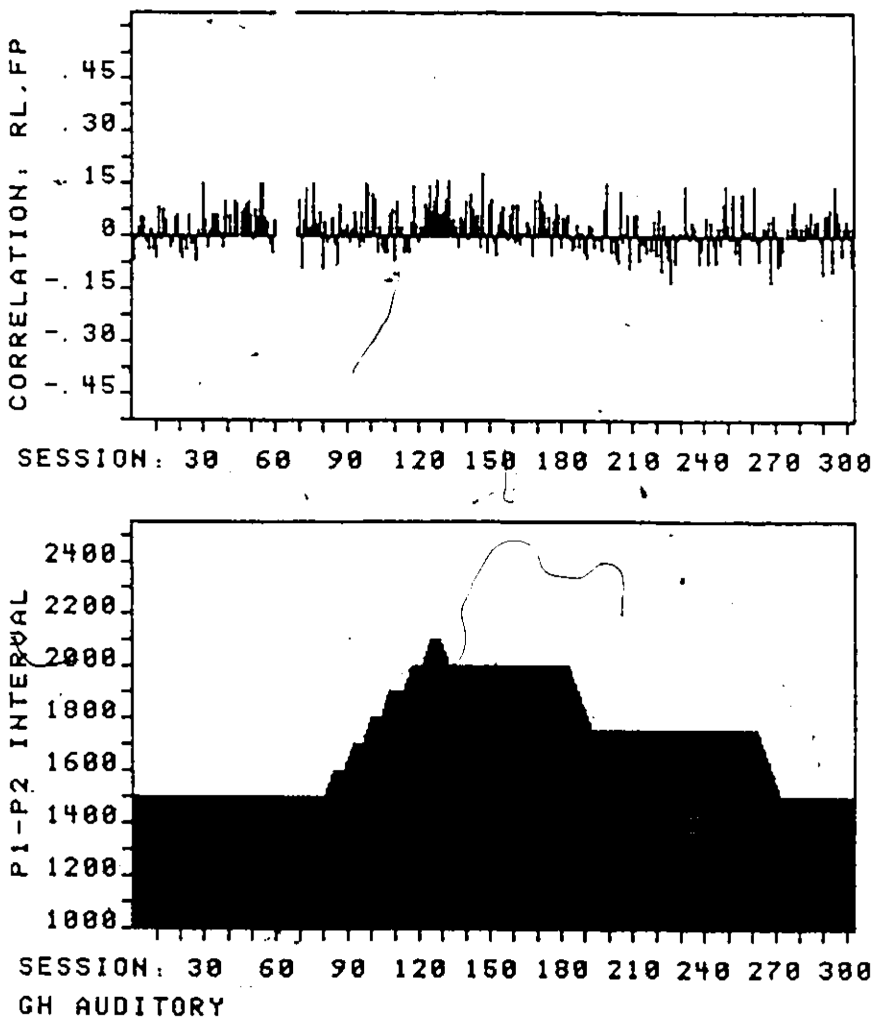

CORRELATION: RL,FP
.45
.30
.15
0
-.15
-.30
-.45
SESSION: 30 60 90 120 150 180 210 240 270 300
P1-P2 INTERVAL
2400
2200
2000
1800
1600
1400
1200
1000
SESSION: 30 60 90 120 150 180 210 240 270 300
GH AUDITORY

FIGURE 6

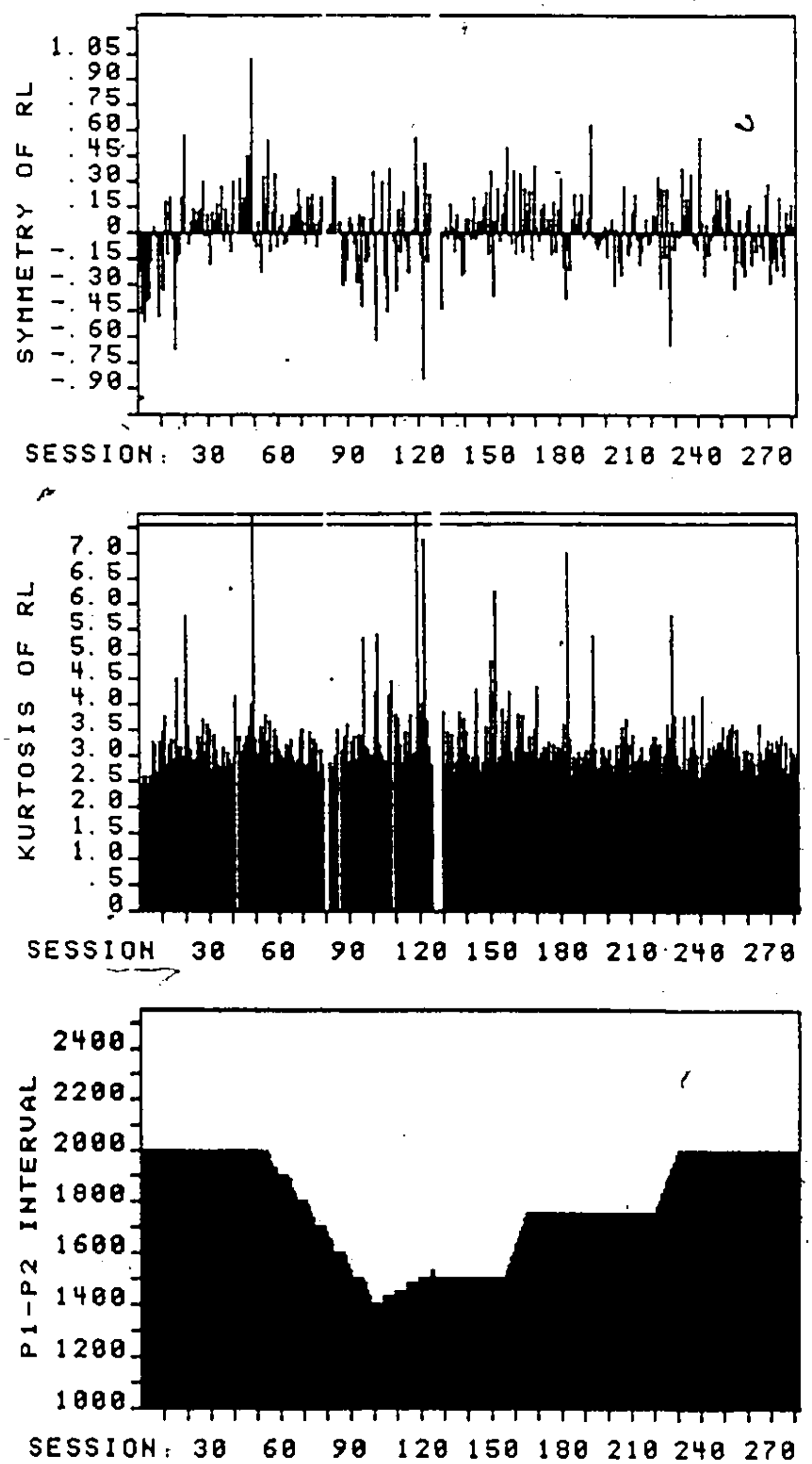
Upper panel: Symmetry coefficients of the response latency (from P1) distributions of each session.

Middle panel: Kurtosis coefficients of the response latency distributions of each session. Coefficients shown as extending to the topmost line of the figure were too large to be represented accurately at this scale. For exact values, see Appendix 1.

Some sessions' raw data were lost and symmetry and kurtosis coefficients could not be calculated. No values are plotted for these sessions. The lost sessions are indicated by gaps in the figures.

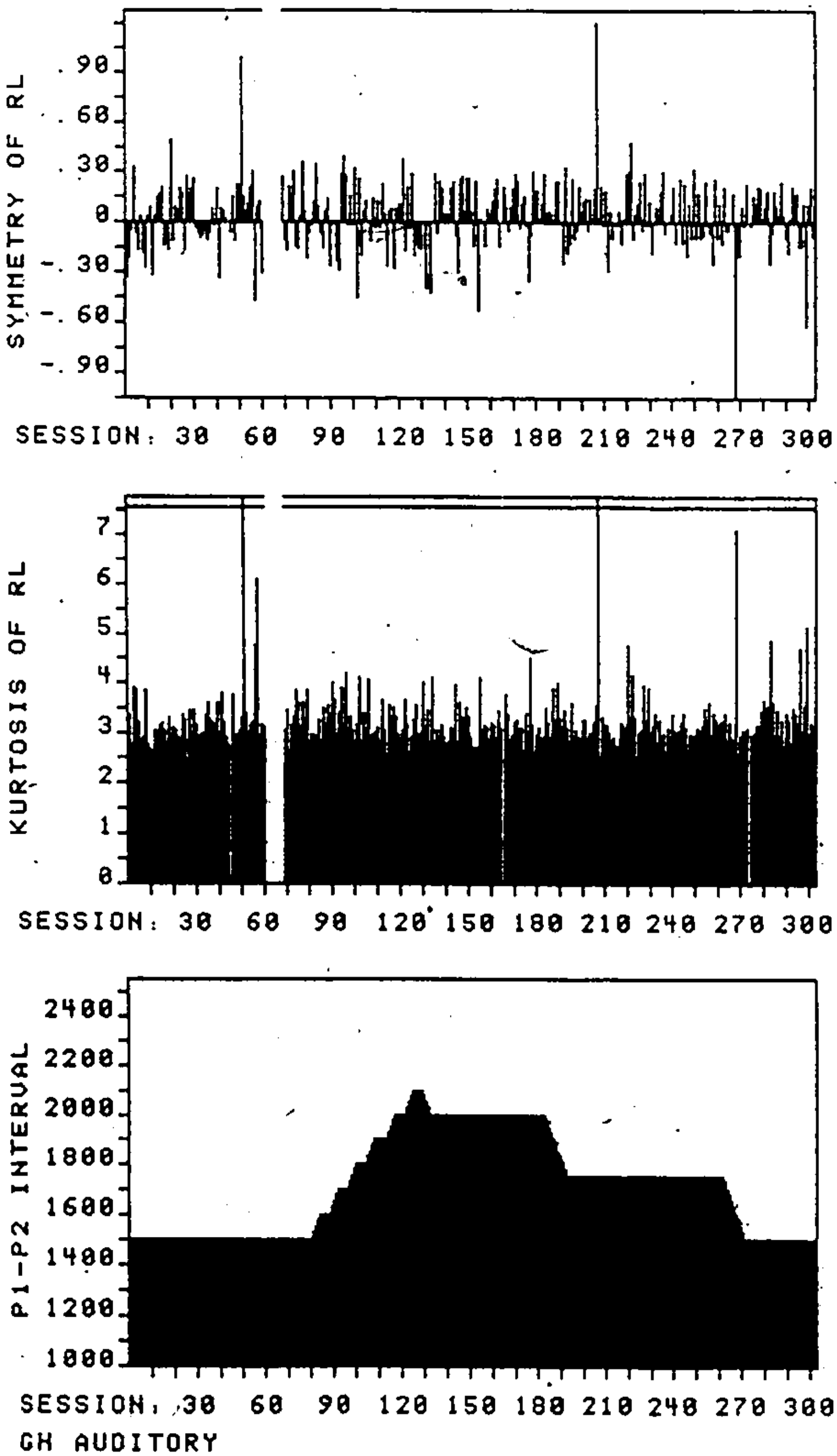
Lower panel: synchronization intervals, in milliseconds, of each session.

Figure 6.1: Subject DG. Figure 6.2: Subject GH.



SYMMETRY OF RL
1.05
.90
.75
.60
.45
.30
.15
0
-.15
-.30
-.45
-.60
-.75
-.90
SESSION: 30 60 90 120 150 180 210 240 270
KURTOSIS OF RL
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
.5
0
SESSION 30 60 90 120 150 180 210 240 270
P1-P2 INTERVAL
2400
2200
2000
1800
1600
1400
1200
1000
SESSION: 30 60 90 120 150 180 210 240 270

DG AUDITORY


SYMMETRY OF RL
.90
.60
.30
0
-.30
-.60
-.90
SESSION: 30 60 90 120 150 180 210 240 270 300
KURTOSIS OF RL
7
6
5
4
3
2
1
0
SESSION: 30 60 90 120 150 180 210 240 270 300
P1-P2 INTERVAL
2400
2200
2000
1800
1600
1400
1200
1000
SESSION: 30 60 90 120 150 180 210 240 270 300
GH AUDITORY

3.2.5 Distributional Shape

Table 1 presents symmetry and kurtosis coefficient averages for the practiced intervals. Session by session listings are available in Appendix 1. Figures 6.1 and 6.2 show these visually.

There is no apparent relationship between skewness and synchronization interval for either subject. The distributions of each subjects' responses are trivially but fairly consistently skewed positively rather than being perfectly symmetrical. In the histograms of the response distributions printed for each session, these distributions look quite symmetrical. Hopkins (1982) also reported a small positive skew in his data, with b_1 averaging .025 across all subjects and conditions.

There might be a small trend for DG's kurtosis to increase as stimulus duration decreases, but the kurtosis is at least roughly constant across the range, for both subjects.

Kurtosis coefficients of both subjects are typically slightly larger than 3 but they are usually 4.2 or smaller, which is consistent with the hypothesis that the response distribution can be described by a convolution of a triangular and a logistic variate. The very minor but consistent asymmetry suggests that this is not the perfect model for these data, but the imperfection of description may be due to the small foreperiod effects or to sequential effects in the data (as found by Kristofferson, 1976 and Hopkins, 1982).

Since the kurtosis of the response distributions is almost always larger than 3, a normal distribution would not describe these data. Nor would the convolution of a triangular variate with a normal variate, rather than a logistic, since the kurtosis of that convolved distribution should be between 2.4 and 3 (see Appendix 2). Individually, the kurtosis coefficients are generally close to 3 so this lack of fit would probably not show up in traditional goodness of fit tests such as chi-square. However, the consistency of the slightly too large kurtosis values weighs against this description.

Despite the fact that the kurtosis values fall within the range expected for a convolution of a triangular and a logistic variate, their magnitudes are difficult for Hopkins' model. The problem is that the kurtosis of such a distribution depends on the relative magnitudes of the triangular and logistic variances. The formulae for the variance and kurtosis of this distribution are given in Appendix 2. Using the notation of that appendix, let b^2 be the logistic variance and let V be the response latency variance, which is assumed to be the variance of the convolution of independent logistic and triangular random variables. Table 3 shows how the kurtosis of this convolution varies with the ratio b^2/V, i.e. with the proportion of the variance that is contributed by the logistic variate.

Table 3

Kurtosis of the Logistic + Triangular Distribution As a Function of b^2/V

b^2/V	Kurtosis
0.0	2.40
0.1	2.53
0.2	2.66
0.3	2.81
0.4	2.98
0.5	3.15
0.6	3.34
0.7	3.53
0.8	3.74
0.9	3.97
1.0	4.20

Suppose, for example, that the response latency variance is 500 $msec^2$ and that the Kurtosis is 3.15. These are common values in DG's data. According to the table, the logistic variable contributes 50% of this variance. Under Hopkins' model, this means that 50% of DG's variance (250 $msec^2$) should be attributed to variability in the response (the efferent latency) itself. The Kurtosis coefficients from GH's data are about the same, so the distributional model would lead us to estimate GH's efferent latency variances as 350 $msec^2$ or more. These are not very plausible values.

Hopkins could not encounter this difficulty because his subjects' variances were so low that any reasonable proportion of them would yield logistic variances lower than 50 $msec^2$. He reported 14 Kurtosis coefficients (1982, p. 180). Their average was 3.045 which is in line with the values reported here.

I am not arguing here that a convolution of a logistic variate and a triangular variate would not fit the data. I have every confidence that traditional goodness of fit tests would not reject this model. Further, I would not be at all surprised if traditional tests failed to reject a model of this type even if the logistic variance was restricted to low values during parameter estimation.

Hopkins (1982) used a minimum chi-square parameter estimation procedure to estimate q and b in his data. He pointed out that the parameter space associated with this procedure was quite flat. To see just how bad this situation was, I constructed an artificial data set (1500 responses, or 5 sessions' data pooled) that fit a logistic-plus-triangle distribution perfectly according to a chi-square test when the logistic variance was 50% of the total. I then varied the specified proportion of the variance contributed by the logistic, estimated q (and thus the triangular variance) by minimizing chi-square, and noted the final chi-square value obtained. The chi-square values never reached the number of degrees of freedom of the test, indicating an excellent fit, even when the logistic, which actually contributed 50% of the variance, was specified as contributing only 10%.

On the basis of this result, and of Hopkins' maps of the parameter spaces he studied, I concluded that chi-square testing of symmetrical distributions with reasonable (less than 4) kurtosis coefficients would not be very informative, and I have not conducted such tests on these data. From comparison of the Kolmogorov-Smirnov and chi-square statistics in a different context (Kaner and Lyons, Note 2), I doubt that a standard Kolmogorov-Smirnov test would be any more useful when parameters are estimated from the data. Simulations could be run to obtain better critical values for either test, given minimum chi-square or minimum Kolmogorov-Smirnov parameter estimation, but by my calculations it would take a few years of Apple computer time to do this properly. Instead of spending (I think wasting) this time, I am quite satisfied to accept the obtained values of symmetry and kurtosis as evidence of reasonable fit to some convolution, and thus to many convolutions, of logistic and triangular variates. Further, the kurtosis coefficients themselves point out the key problem, which might or might not become evident in a minimum chi-square estimation context: the convolution might describe the data acceptably, and this might be true even if the logistic variance is restricted to a value smaller than 50 msec^2, but it appears that the logistic variance should be larger, much larger, than this upper limit. On that basis, I suspect that something is wrong with this model.

3.3 Summary

A number of patterns in the data are in general agreement with those found in other experiments whose data were well described by quantal models.

Early in training, there was an increasing relationship between variance and duration, though it is not clear whether Weber's Law provides the correct description of this relationship.

As training continued, DG's variances declined substantially and are roughly constant from 1500 to 2000 msec. The variance at 2000 msec is slightly higher than the final variances at 1500 and 1750 msec, comparable to that obtained at 1500 msec earlier in training. The value of q appears close to 50 across the 1500 to 2000 msec range, after extended practice.

GH's variances appear to be roughly constant from 1500 to 1750 msec though there is much variability in performance from session to session. The variances increase beyond 1750 msec. The large changes in variance from session to session make it difficult to arrive at a final estimate of q. Past estimates in the literature were based on stable data, which is what quantal theory requires. GH's variances were not stable. It is not clear that the q estimates obtained are meaningful.

The variances of both subjects are lower than those previously reported for long duration synchronization performance, and they are much lower than we would expect from discrimination results at similar intervals. They are higher than those reported by Kristofferson (1976), Hopkins (1982), and Brewster (1983) for shorter intervals, and we will see below that they are higher than variances obtained in the present work at shorter intervals. There may be a step in variance levels somewhere between 150 and 1500 msec. However, as also found by Hopkins (1982), a quantal counting theory with a maximum count of 16 cannot predict this step. If the subjects are counting quanta, they are counting many more than 16 of them.

The response distributions of DG and GH are similarly shaped, as measured by coefficients of symmetry and kurtosis, and the coefficients are quite close to those reported by Hopkins (1982), the only other source of symmetry and kurtosis statistics in the synchronization literature. The distributions appear symmetric and peaked. They can be described in terms of a convolution of a triangular and a logistic variable, as also found by Hopkins. However, the variance of the logistic appears to be much larger than it should be if we are to interpret this as reflecting motor variance.

The basic phenomena: constant and low variances across a range of intervals, and symmetric distributions with thin tails appear confirmed in these data, for both subjects. The particular model suggested, which allows for two independent quantal stages (the triangle) and an independent motor component as the only sources of variability, may not be correct for these data. If it is not correct for these, given the similarity in shape between these distributions and those reported by Hopkins, it may not be correct for the short synchronization interval performance either.

4. Short Auditory Intervals: Experiments 2 and 3

These two experiments involved P1-P2 intervals from 85 to 350 msec. It is difficult to draw a rigid boundary between the experiments. Both involved the same subjects. Half of what I call Experiment 2 was conducted before Experiment 3, and half was conducted after it. From the subjects' point of view, this was one integrated experiment. I separate them here because of a conceptual difference between them.

Experiment 2 dealt with subjects' performance in this particular variant of the synchronization paradigm when P1-P2 intervals are short, but not so short that subjects cannot do the task as instructed. It is a control experiment, allowing comparison of variance levels obtained with this procedure to be compared to those obtained by Kristofferson (1976), Michaels (1977), Hopkins (1982; Hopkins and Kristofferson, 1980) and Brewster (1983), who all studied performance at short intervals. Experiment 2 was intended as a bridge between the rest of the literature and Experiments 4 and 5, on visual synchronization.

Experiment 3 was designed to study synchronization performance when the P1-P2 interval is so short that the subject cannot do the task as instructed. It is generally accepted that there is an absolute minimum reaction time to a stimulus. Reaction time to auditory stimuli depends on stimulus intensity. When extremely loud signals are used it is possible to obtain mean reactions as short as 105 msec. Based on such data, absolute minimum RT has been estimated as 100 to 105 msec (see Kohfeld, 1981, for a recent review). RT to 2000 Hz, 60 dB stimuli has been estimated at approximately 150 msec (Kristofferson, 1976). Presumably, as the P1-P2 interval is reduced below 150 msec, the subject will find it ever more difficult to respond in synchrony with P2 if he waits for P1 to signal P2's imminent occurence. When the P1-P2 interval is as short as 100 msec, this should be impossible for the subject. Instead, the subject should have to start timing from some event preceding P1 in order to respond at the same time as P2.

Hopkins (1982) showed that the subject can use his trial initiation response instead of P1 and that this adds no variance to his responses if there is no variance in the foreperiod. In the present situation, the subject may use that response, or the onset of the 100 msec auditory "honk", the warning stimulus (WS) which follows the response almost instantaneously, or he may use the offset of WS. All of these events are time-locked in this experiment so it is impossible to tell which controls behavior. All of these events occur before the foreperiod, which contains no other events that the subject could use as a response trigger, and which ends with P1. In the present context, the most conservative assumption is that if the subject starts timing from some event preceding P1, he is timing from the offset of the warning stimulus, rather than from the onset or the initiation response, which precedes it by 100 msec. To avoid redundant and awkward constructions below, I will restrict attention to timing from the offset of WS, ignoring timing from the initiation response and from

WS onset, when considering timing from events preceding P1.

The interval between WS and P2 contains a long foreperiod. If the P1-P2 interval is 100 msec then on average the WS-P2 interval, the "true" synchronization interval if the subject times from WS, is 1100 msec (1000 msec on the PDP-8). This is not too far from the intervals of Experiment 1, which were as short as 1400 msec. While Experiment 1 gives us grounds to question the applicability of discrimination-based variance estimates to synchronization performance, if we do follow Kristofferson's (1980) results and reasoning we should expect timing variance of practiced subjects to be the same at 1100 msec it is at 1500 msec. The finding of constant variance across the range from 1500 to 2000 msec for DG (his variance at 1400 was slightly higher, due to less practice at this interval), and of constant variance from 1500 to 1750 msec for GH lends credence to the idea that variance at 1100 msec is the same as that obtained with intervals a few hundred msec longer.

In effect, then, Experiment 3 is another study of long duration synchronization performance, with intervals which may be in the same range, so far as variance is concerned, as those of Experiment 1. The key difference between Experiment 1 and Experiment 3 lies in the instructions to the subject. In Experiment 1, the subjects knew they were timing long intervals. In Experiment 3, the subjects knew they were supposed to be timing short intervals.

In Experiment 1, DG's variances averaged about 500 msec^2. GH's variances were higher, as were those reported by Kristofferson (1976) for long intervals. DG's lowest variances were just above 300 msec^2. Variances at shorter intervals are typically smaller.

Kristofferson (1976) and Brewster (1983), who used Kristofferson's procedure, usually obtained variances between 100 and 200 msec². (One of Brewster's three subject's variances generally exceeded 200 msec²). Under Hopkins' (1982) procedure, variances were lower still. Michaels (1977) reported higher variances, generally between 400 and 1000 msec², but his subjects were less practiced and his feedback stimuli differed substantially from those used in other work. As will be seen shortly, the short duration variances from Experiment 2 were about 200 msec². These are larger than most previous results, but they are still substantially smaller than the variances of Experiment 1.

It appears that there is one variance level for synchronization intervals from 150 to 550 msec, the exact value depending on procedural details, and a different level for intervals ranging from 1500 to 2000 msec. We might suppose that somewhere between 550 and 1500 msec there is a stepwise variance increase, just as steps were found in discrimination performance. If variances are constant across these two ranges, it seems unlikely that variability would increase smoothly between 550 and 1500 msec. A stepwise increase seems more plausible. It's not clear why there should be a step, however. Kristofferson's (1980) quantal counting hypothesis accounted for steps in discrimination performance by assuming a maximum count of 16 quanta, but this maximum does not apply to synchronization. We could entertain a similar notion for synchronization, with a different maximum count, but why should the maxima differ across tasks?

One hypothesis about the difference at short and at longer intervals makes no reference to a quantal mechanism or to any fundamental internal limitations. Perhaps the difference reflects different expectations on the part of subjects about how variable their responses "should be" at short and at longer durations. There is a common expectation that measurements of big things will be more variable than measurements of small things. In many psychology courses it is routinely stated that internal measures of big things, i.e. perceptions of large magnitude stimuli, are more variable than internal measures of small things. The subjects of synchronization (and many other long term) experiments are rarely newcomers to psychology, or to this type of thinking. With particular reference to this experiment, different subjects volunteered the "explanation" for the obviously higher variances at long intervals that timing of longer intervals should be more variable than timing of shorter ones because the long intervals are longer (i.e. bigger) than the shorter ones, so <u>of course</u> the variances will be greater.

I will not attempt to detail a psychological model relating expectation and performance levels. I suppose that people have internal standards about what they consider to be acceptable levels of accuracy in their work, that those standards may vary across tasks, and in particular that larger synchronization errors might be considered more acceptable when the interval is long than when it is short. If so, asymptotic performance at longer intervals might be less accurate and more variable simply because the subjects are satisfied that this performance is fairly good, whereas at short intervals the subjects might try a bit harder to do better.

The subjects of Experiment 3 learned in Experiment 2 that small changes in the P1-P2 interval had no effect on their variance. This is what they saw in printouts of their own performance, for many sessions. In Experiment 3, I simply made further small changes in their P1-P2 intervals, reducing them in steps of 5 msec toward 100 msec and below. This should not have led subjects to expect and accept higher variances in the same way that increasing the interval in big steps to 1500 msec might.

From the subject's point of view, Experiment 3 involved a range of intervals from 85 to 200 msec. Given that the subjects cannot use P1 as a response trigger when the P1-P2 interval is very short, the actual range of synchronization intervals was probably closer to 150 - 1150 msec, with a steep shift somewhere between P1-P2 intervals of 85 and 150 msec. But this manipulation was not obvious to the subjects. If variances are higher at long intervals because subjects expect long interval variances to be higher, or due to other similar cognitive factors, then we should expect variances from 85 to 200 msec (that is, 150 to 1150 msec) to be constant. Alternatively, if some internal constraints limit accuracy and consistency as stimulus duration increases, we should see an increase in variance across this range, to a level comparable to that obtained from GH or DG.

In sum, my plan for Experiment 3 was to study synchronization at long intervals that the subjects thought were short intervals, avoiding the effects of any biases that the subjects might have about how good performance should or can be at long intervals.

It would be inaccurate to say that the subjects were totally unaware that they relied more and more on WS as P1-P2 was decreased. They volunteered that they did this. They also complained that the task was getting more and more difficult as the interval was reduced. I commisserated with them, complimented them on their efforts, asked them to please rely on P1 as much as possible, rather than on WS, agreed that they might need more practice before variances at 100 msec matched those at 200, and asked them to keep trying. The subjects were aware that they relied somewhat on WS, and that the task was difficult, but they tried very hard, extremely hard, to obtain the same variances at 100 msec as they produced at 150 to 200 msec. On this basis, I think this was a successful manipulation of their expectations about variance levels, and I think that they took the idea that they might achieve very low variances at what were in fact long intervals much more seriously than did DG and GH.

4.1 Method

4.1.1 Subjects

Four subjects started in this experiment: RW, JB, KC and KF. KC had just completed her first year as an undergraduate. RW was a male graduate student studying psychology. JB and KF were senior male undergraduates, interested in, but not majors in, psychology. These subjects were somewhat less familiar with the timing literature than the subjects of Experiments 1, 4 and 5. Excepting RW, I think they were almost completely unfamiliar with it. Excepting RW, they had participated in significantly fewer psychological experiments than the subjects of the other experiments.

Only RW and JB completed the experiments. KF left the experiment shortly after he dropped out of the university. KC left the experiment at my request. After 76 sessions, her variances were still quite high, her response distributions were skewed, and there were many extreme responses. There was no apparent trend toward improvement. I reluctantly concluded that her data would not provide a useful basis for comparison with long auditory or short visual results, the point of Experiment 2. Further, since she was unable to achieve low variance levels at 200 msec, it appeared pointless to look for low variances at shorter intervals, the goal of Experiment 3. In the context of these experiments, KC's data appeared uninterpretable, so I stopped collecting them.

4.1.2 Procedure

The general procedure was described in Chapter 2. Some further information on instructions in Experiment 3, has already been noted in this chapter. JB and KF started at 200 msec, while RW and KC started at a 150 msec P1-P2 interval. KC found 150 msec extremely short and difficult. I switched her interval to 200 msec after 9 sessions. She stayed at this interval until she left the experiment.

RW, JB and KF scanned the range from 150 to 200 msec. I then started Experiment 3, reducing the P1-P2 interval to 100 msec, in steps of 5 msec. KF left during the scan down to 100 msec, leaving RW and JB in the experiment. RW completed the first part of these experiments much earlier than the other subjects and was available to participate in more sessions than the others. After a few sessions at 100 msec I brought his interval back to 150 msec to check that performance at such short intervals had no deleterious effects on performance at longer ones. There appeared to be no problem, and his interval was again reduced to 100 msec, in steps of 5 msec. Both subjects practiced extensively at 100 msec and less extensively at shorter intervals. After this, I brought the interval back to 150 msec, ending Experiment 3, and continued increasing it, to 350 msec, with extended training at 300 msec, as the final part of Experiment 2, and mainly, as preparation for Experiment 5, in which the subjects were to transfer to visual synchronization. (RW actually did transfer. JB, who had left the university by this point, decided to stop at the end of Experiment 2.)

The exact schedules for all subjects, and various summary statistics for each session, are listed in Appendix 1. JB's and RW's schedules also appear visually in numerous figures below.

4.2 Results

As noted above, KC's results were poor. There is not much else to say about them, and they will not be discussed further. KF's performance was excellent but he left after only 82 sessions, during the early stages of the scan down to 100 msec. It appeared that his results would parallel those of RW, perhaps with lower variances. Unfortunately, there is not enough data for any firm conclusions, so his data will also be set aside. The tables in Appendix 1 list various statistics of each session's data for all subjects, including KF and KC. The reader who wishes to compare their performance to RW and JB's will find sufficient information in these tables to construct the same types of graphs and summary tables for these subjects as those presented below for RW and JB.

4.2.1 Latencies

Figures 7.1 (RW) and 7.2 (JB) show the relationship between synchronization latency (upper panel) and P1-P2 interval (lower panel) for each subject for each session. The relationship in each case is linear. Both subjects were typically able to produce mean latencies within 10 msec of the P1-P2 interval, even at the very short intervals.

4.2.2 Variances

Figures 8.1 and 8.2 show RW's and JB's variances for each session. The middle panels again show P1-P2 intervals. The lower panels show the mean foreperiod durations, which indicate which computer was used when. Performance was better when the experiments were controlled by the Apple, but this appears to be natural improvement with practice. There is no abrupt transition due to the change in the equipment.

Tables 4.1 (RW) and 4.2 (JB) give averaged variances, q estimates, shape statistics and correlation coefficients for each subject across the "practiced" intervals, the intervals at which the subjects spent two or more consecutive sessions. As in Table 1, if the subjects spent more than 5 sessions at an interval, only the last 5 were included in averaging.[4]

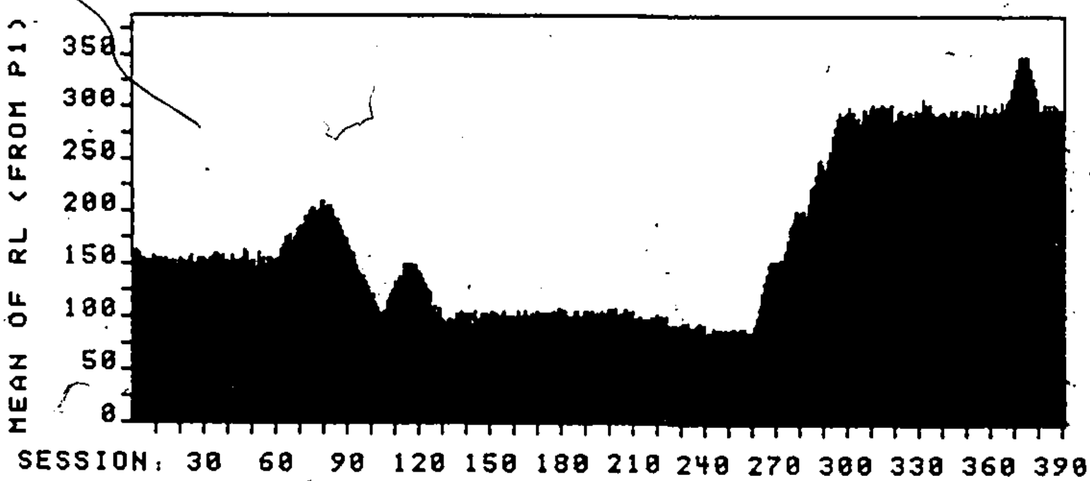
The tables list the same types of statistics twice for each

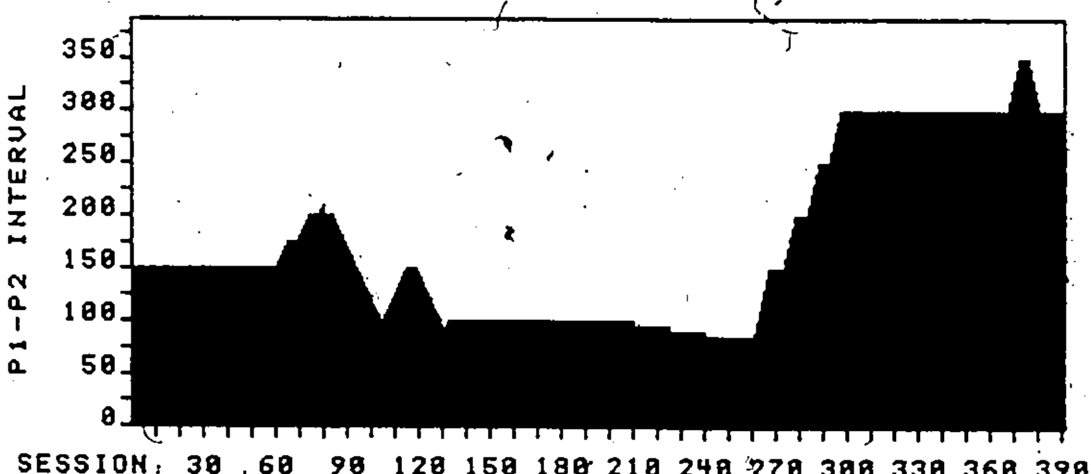
FIGURE 7

Upper panel: Mean synchronization latencies (relative to P1), in milliseconds, of each session.

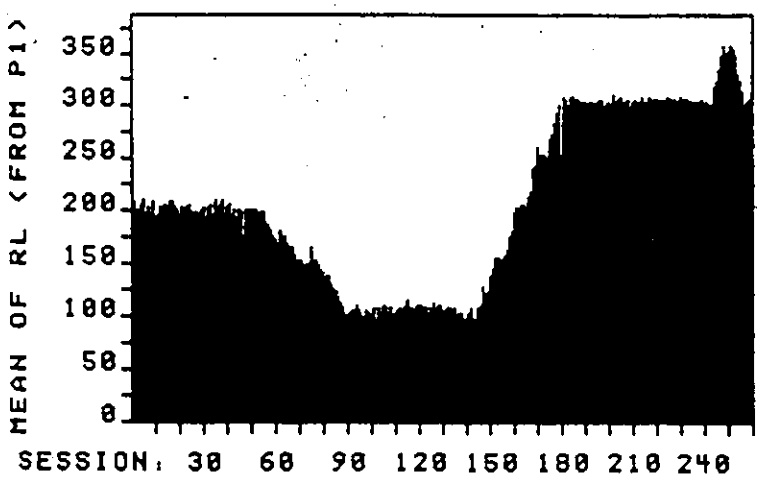
Lower panel: P1-P2 intervals (msec) of each session.

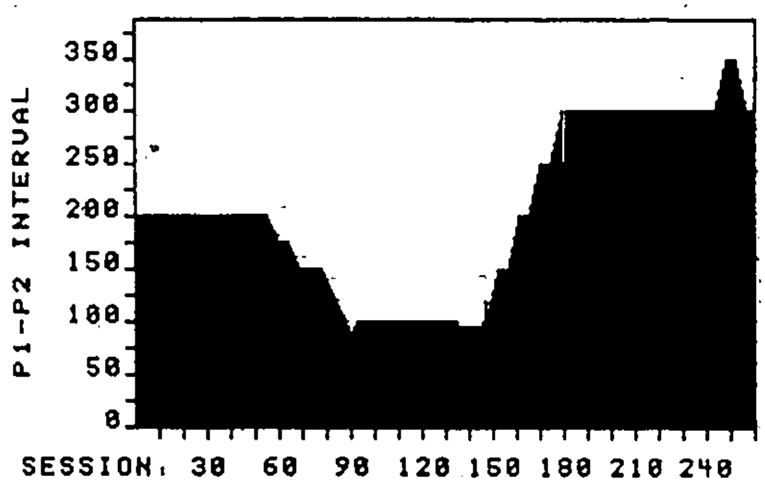
Figure 7.1: Subject RW. Figure 7.2: Subject JB.


MEAN OF RL (FROM P1)
350
300
250
200
150
100
50
0
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390


P1-P2 INTERVAL
350
300
250
200
150
100
50
0
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390

RH AUDITORY


MEAN OF RL (FROM P1)
350
300
250
200
150
100
50
0
SESSION: 30 60 90 120 150 180 210 240


P1-P2 INTERVAL
350
300
250
200
150
100
50
0
SESSION: 30 60 90 120 150 180 210 240

JB AUDITORY

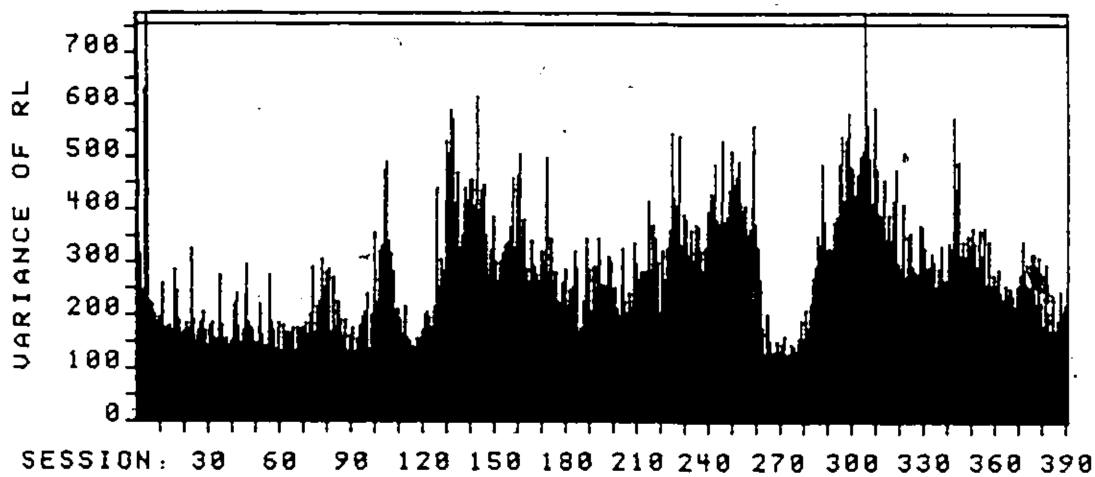
FIGURE 8

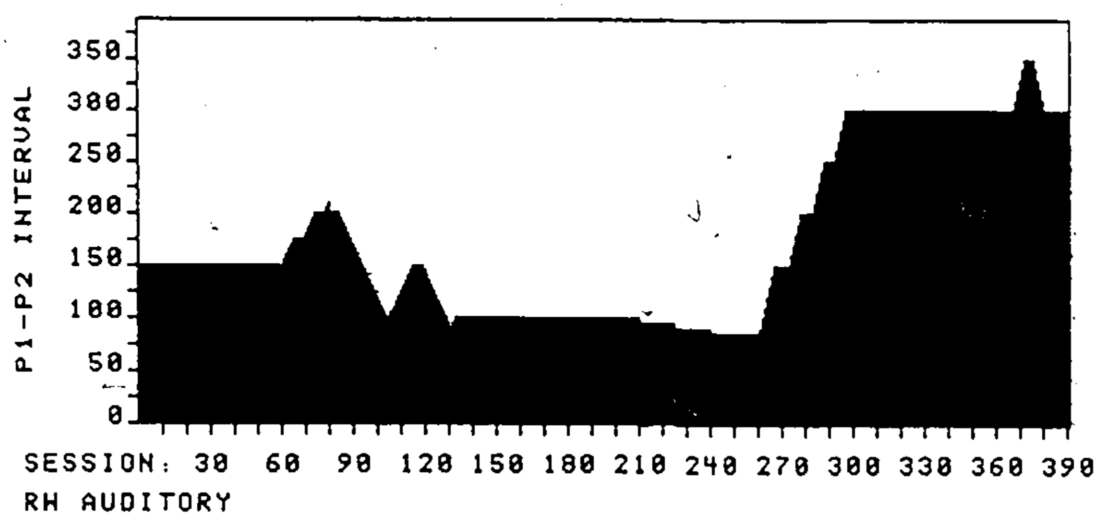
Upper panel: Response latency (from P1) variances, in $msec^2$, of each session. Note that there are two lines at the top of the panel. Variances shown as extending to the topmost line were too large to represent accurately on this scale. For exact values, see Appendix 1.

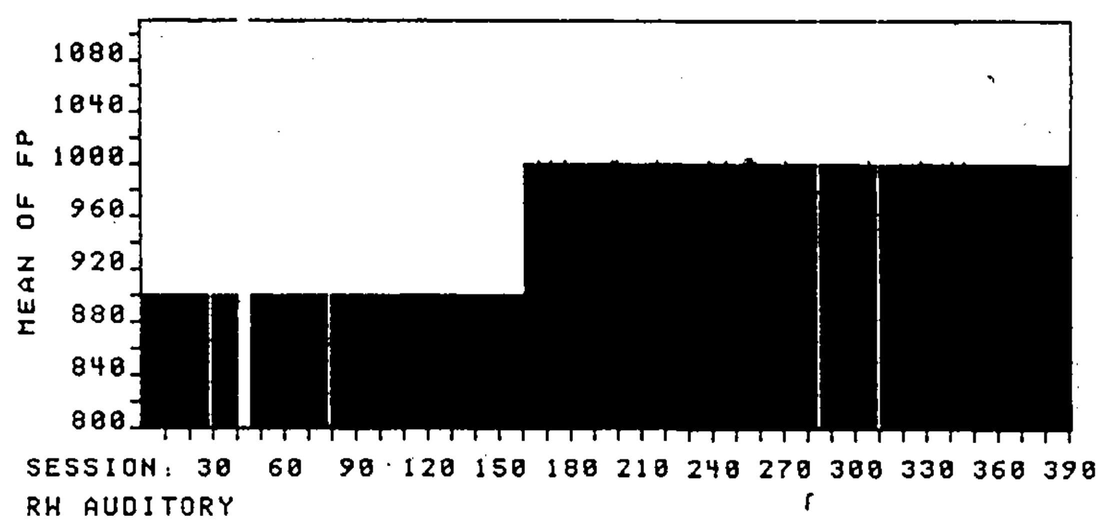
Middle panel: synchronization intervals, in milliseconds, of each session.

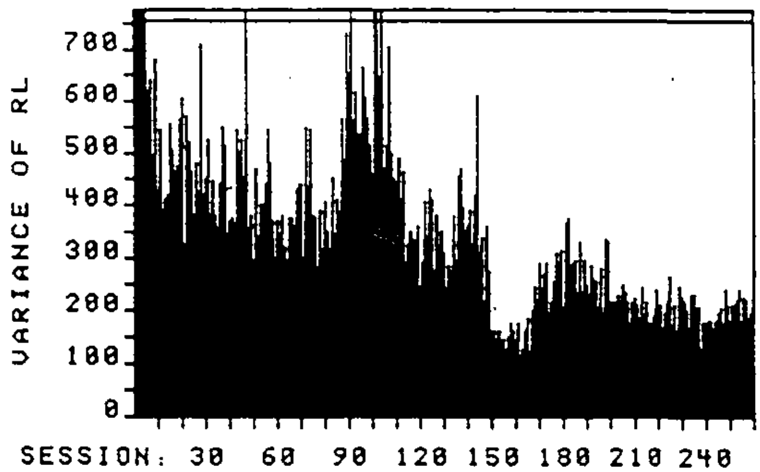
Lower panel: Mean foreperiod duration, in msec, of each session. The means were approximately 900 msec when the PDP-8 controlled sessions and 1000 msec when the Apple controlled sessions. Gaps in the figure (ostensibly 800 msec means) are due to lost raw data, making calculation of the sessions' mean foreperiod durations impossible.

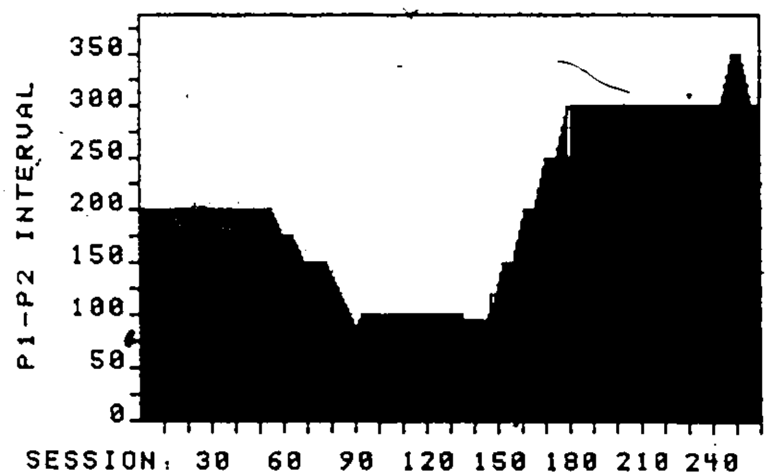
Figure 8.1: Subject RW. Figure 8.2: Subject JB.


VARIANCE OF RL
700
600
500
400
300
200
100
0
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390

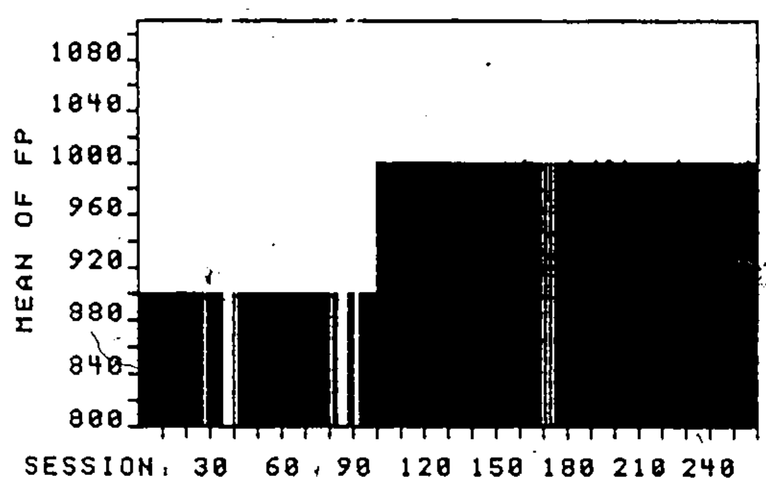

P1-P2 INTERVAL
350
300
250
200
150
100
50
0
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390
RH AUDITORY


MEAN OF FP
1080
1040
1000
960
920
880
840
800
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390
RH AUDITORY





JB AUDITORY



JB AUDITORY

TABLE 4

Mean within-session variances ($msec^2$), q estimates (msec), and coefficients of symmetry (ROOT B1), kurtosis (B2), and correlation between response latency and foreperiod duration. Only data from intervals at which the subject spend two or more consecutive sessions were averaged for this table. The averages are based on the last five sessions at the interval before the subject was transferred to the next, or, if there were fewer than five, on all sessions at the interval.[4]

Table 4.1: Subject RW. Table 4.2: Subject JB.

SUMMARY STATISTICS FOR RW AUDITORY
RESPONSE LATENCY MEASURED FROM P1

INTERVAL	VARIANCE	Q	ROOT B1	B2	CORR WITH FP
150	191	31.54	-0.46	4.38	0.05
175	163	28.77	0.15	3.86	0.11
200	240	35.91	0.36	4.07	0.11
200	224	34.55	0.36	3.58	0.11
100	483	52.42	-0.79	3.86	-0.22
150	147	27.03	-0.30	3.50	-0.07
100	255	37.18	-0.97	5.16	-0.22
95	363	45.00	-1.09	5.76	-0.37
90	336	43.22	-0.97	4.69	-0.40
85	409	48.00	-0.95	5.04	-0.34
150	142	26.44	0.06	4.26	0.05
200	188	31.31	0.19	3.01	0.11
250	364	45.11	0.16	2.97	0.06
300	241	36.01	0.13	2.95	0.07
350	290	39.84	-0.01	3.05	0.03
300	205	32.87	0.05	3.00	0.06

SUMMARY STATISTICS FOR RW AUDITORY
RESPONSE LATENCY MEASURED FROM WARNING STIMULUS

INTERVAL	VARIANCE	Q	ROOT B1	B2	CORR WITH FP
150	301	40.67	0.26	4.71	0.61
175	288	39.73	0.85	5.50	0.66
200	361	44.88	0.61	3.74	0.59
200	339	43.44	0.61	3.80	0.59
100	479	52.21	-0.56	3.79	0.20
150	218	34.07	0.21	3.78	0.58
100	274	38.66	-0.51	4.16	0.35
95	322	42.23	-0.43	3.76	0.17
90	288	39.73	-0.46	3.73	0.16
85	364	45.12	-0.82	4.94	0.12
150	257	37.32	0.81	5.80	0.66
200	309	41.31	0.52	3.47	0.63
250	478	52.11	0.26	3.05	0.49
300	358	44.68	0.55	4.15	0.57
350	388	46.69	0.36	3.92	0.50
300	306	41.08	0.39	3.51	0.58

SUMMARY STATISTICS FOR JB AUDITORY
RESPONSE LATENCY MEASURED FROM P1

INTERVAL	VARIANCE	Q	ROOT B1	B2	CORR WITH FP
200	409	48.01	0.06	3.55	-0.02
175	341	43.56	0.14	5.84	-0.06
150	394	47.04	-0.73	5.99	-0.17
100	295	40.25	-0.87	5.75	-0.15
95	411	48.11	-1.09	5.60	-0.19
150	144	26.71	-0.16	4.19	-0.03
200	151	27.52	0.13	2.93	-0.03
250	265	37.92	0.48	4.02	-0.01
300	175	30.04	-0.11	3.45	-0.04
350	210	33.34	-0.08	3.18	0.00
300	200	32.40	-0.11	4.05	-0.14

SUMMARY STATISTICS FOR JB AUDITORY
RESPONSE LATENCY MEASURED FROM WARNING STIMULUS

INTERVAL	VARIANCE	Q	ROOT B1	B2	CORR WITH FP
200	494	53.07	0.36	3.88	0.41
175	409	47.98	0.42	5.80	0.41
150	421	48.74	-0.23	5.52	0.31
100	333	42.97	-0.41	5.04	0.37
95	422	48.84	-0.56	4.41	0.26
150	223	34.48	0.36	3.78	0.59
200	244	36.21	0.62	3.88	0.61
250	348	44.05	0.57	3.92	0.49
300	247	36.51	0.19	3.82	0.54
350	299	40.55	0.33	3.59	0.54
300	248	36.62	0.17	4.77	0.46

group of sessions. The upper section of each table gives statistics computed on latencies measured from P1. The lower section of each table gives statistics computed on latencies measured from WS. The distinction between latency from WS and latency from P1 is a critical one for comprehension of the rest of this chapter. Here is a numerical example. Suppose that in a given trial the foreperiod is 950 msec, the P1-P2 interval is 100 msec, and the response occurs 10 msec after P2. If we measure the latency from P1, it is 110 msec. If we measure the latency from the offset of the warning stimulus, it is 1060 msec. The difference between the two values is that the foreperiod duration (here, 950 msec) is added to the latency as measured from P1 (110 msec) to give us the latency from WS (1060 msec).

The foreperiod duration is random, geometrically distributed. Many of the statistics of the latencies should differ substantially depending on whether the subject is timing from WS or from P1. At this point, I will focus on the variances. The variance of the foreperiod is, theoretically and on average, 90 msec². The actual variances per session are listed in Appendix 1.

If the subject is timing from P1, his performance should be unaffected by the foreperiod duration and foreperiod variability should not show up in the variance of latencies measured from P1. Hopkins (1982) demonstrated this empirically for uniformly distributed foreperiods with a 33 msec² variance. If the subject is timing from P1 and we measure his latency from WS, we add an independent source of variance to his responses. On average, the variances measured from WS should be 90 msec² larger than those measured from

P1.

Now suppose that the subject is timing from WS. If the average foreperiod is 1000 msec and the P1-P2 interval is 100 msec, the subject waits for an average 1100 msec after WS before responding. The response is time-locked to WS, independent of the time of P1, which occurs too late to influence the response. As usual for synchronization latencies, the distribution of latencies as measured from WS should be symmetrical and highly peaked. Latencies as measured from P1 should not look like this however. If the subject times from WS and we measure latency from P1, we are subtracting a geometric variate (the foreperiod duration) from the waiting times generated by the subject. The latencies from P1 should, in this case, be more variable than those measured from WS, again by 90 msec^2.

These are not the only two ways that the subjects could perform the task, though these alternatives do describe the two response strategies obtained by Hopkins (1982) if we replace "timing from WS" with "timing from the initiation response" in his case. I will very briefly consider some alternative models later, after showing that in fact the subjects did not time exclusively from WS, ignoring P1, even when the P1-P2 interval was less than 100 msec. For now I will consider only these two alternatives. They are the clearest ones, I considered them the most likely, and I want to make sure that they are understood before rejecting them.

Table 5 briefly characterizes the distributions that we should obtain under these two strategies, depending on whether we measure latencies from WS or from P1. Supporting derivations are given in

Appendix 2. Numerical values and formulae are presented in the text as they are needed.

Table 5

Response Distributions if Timing is From WS or From P1

Latency Measured From:	The Subject Times from: WS	P1
WS	Low variance Symmetrical Low kurtosis No correlation between latency and foreperiod duration	Higher variance Positively skewed Higher kurtosis Positive correlation between latency and foreperiod duration
P1	Higher variance Negatively skewed Higher kurtosis Negative correlation between latency and foreperiod duration	Low variance Symmetrical Low kurtosis No correlation between latency and foreperiod

4.2.2.1 Experiment 2 Variances

When P1-P2 intervals are 150 msec or longer, the variances of latencies measured from WS are substantially larger than those of latencies measured from P1. The differences are not exactly 90 msec^2, indicating some effect of the foreperiod even when the intervals are as long as 300 msec. RW's differences are larger than 90 msec^2, which we would expect if foreperiod duration and latency from P1 were positively correlated, which they are. JB's differences are smaller than 90 msec^2, reflecting a negative correlation between latency from P1 and foreperiod duration across the range. I'll return to the correlations later. They are consistent, and they are larger than those obtained from DG and GH, but they are not very large, especially in the final ascending series, which reflects the most practiced and best performance. For now, I will set aside these small correlations.

From 150 to 200 msec, at which both subjects practiced most extensively, final variances were generally between 150 and 200 msec². At the longer intervals, they were initially larger but with practice the variances of both subjects at 300 msec dropped to 200 msec². These are much higher than Hopkins' variances. They are slightly larger than those reported by Kristofferson (1976) and than the results from two of Brewster's (1983) three subjects. Kristofferson, Brewster and I all used 1000 msec foreperiods. Hopkins' foreperiods were an order of magnitude smaller. In simple reaction time, short foreperiods lead to faster and lower variance reactions than long foreperiods (see Niemi and Naatanen's, 1981 review). Perhaps this is at the root of the difference between Hopkins' results and the others, including the present ones. As to the difference between the present results and those of Brewster and Kristofferson, their foreperiods did not vary. The small foreperiod - latency correlations in RW and JB's data indicate that foreperiod variability has some effect on their performance and that they are not always simply timing from P1. It is impossible to tell whether Brewster's and Kristofferson's subjects always timed from P1. Since all stimulus events in their experiments were fully time-locked to each other, subtle shifts in strategy from trial to trial may have had no impact on variances. I suspect that the relatively high foreperiod variance in the present case is the main contributing factor to the difference in variance between RW, JB and the subjects of Kristofferson's and Brewster's research.

4.2.2.2 Experiment 3 Variances

As the P1-P2 interval was reduced, variances increased and sizable negative correlations were obtained between response latency as measured from P1 and foreperiod duration, indicating an increasingly important role for the warning stimulus. The correlations do not approach -1.0, which would indicate perfect and nonvariable timing from WS rather than from P1, but since there is timing variance the correlations should not be -1 when subjects time from WS. A formula and examples of expected values for the correlations will appear in the next section. For now, it suffices to say that the correlations are negative at short intervals, larger than those obtained at slightly longer intervals, and that this is the general pattern we should expect if WS eventually takes over as the stimulus controlling behavior as P1-P2 shrinks.

Examining the variances, RW's and JB's variances at 100 msec are actually smaller when latencies are measured from P1 than when they are measured from WS. The difference is not very large but it is in a surprising direction. It suggests that the response latencies are more heavily determined by the time of P1 than by the time of WS even when P1-P2 is a mere 100 msec.

However we measure the latencies at 100 msec, JB's and RW's variances declined to about 300 msec² after much practice. This is about 200 msec² better than DG's performance. Variances at P1-P2 intervals of 100 msec, which should be variances at synchronization intervals of 1100 msec, are substantially lower than those obtained at 1500 msec. RW's variances are comparable to his performance at 300 msec.

Both subjects worked with shorter intervals than 100 msec, though they did not practice at these intervals as much as they did at 100 msec. At 90 msec, RW's variances as measured from P1 finally took on larger values than his variances measured from WS, suggesting that the time since WS was a more important determinant of his response latencies than the time of P1. Even at 85 msec, though, his variances were smaller than those obtained in Experiment 1. Whether we measure latencies from P1 or from WS, the variances are definitely greater than those he produced at longer intervals.

If the subjects were timing from WS and were ignoring P1, as did Hopkins' visual synchronization subjects, these low variances would indicate that at synchronization intervals as long as 1100 msec, variances even lower than DG's at 1400 and 1500 msec can be obtained. The variances are larger than those obtained in Experiment 2. This could be interpreted as suggesting that variances at 1100 msec are intermediate to those we should expect at 150 - 550 msec and at 1500 - 2000 msec, or it could be interpreted as suggesting that the variances obtained at 1500 msec from DG and GH could be improved upon if they practiced further or if their expectations in the task were changed. However, it appears that the subjects did not base their responses exclusively on the time since WS, even when the P1-P2 interval was as short as 85 msec. Presumably, some of the responses were reactions to P1 and some were based on the time since WS. If simple reactions are less variable than long interval synchronizations, the intermediate variance obtained might be due to a mixture of a high variance and a lower variance distribution. Under that view, it could be argued that internal timing variance at 1100 msec might indeed be the same as that at 1500 - 2000 msec. I will return to this notion, and to mixture hypotheses, below.

4.3 Correlations Between Response Latency and Foreperiod Duration

Figures 9.1 and 9.2 present RW's and JB's correlations for each session. The upper panels show the correlation between foreperiod duration and response latency as measured from the warning stimulus. The middle panels show the correlation between foreperiod duration and latency as measured from P1. The bottom panel again shows the P1-P2 interval.

If the subject bases his response exclusively on the time since P1, and if we measure response latency since P1, or if he bases his response exclusively from the time since WS, and we measure latencies from WS, then the correlation between latency and foreperiod duration should be zero. What should the correlations be if the subject times from P1 and we measure latency from WS or if the subject times from WS and we measure the latency from P1?

A brief derivation of the population correlation values is given in Appendix 2. The magnitudes are the same in both cases, and they depend on th relative variance of the timing distribution

FIGURE 9

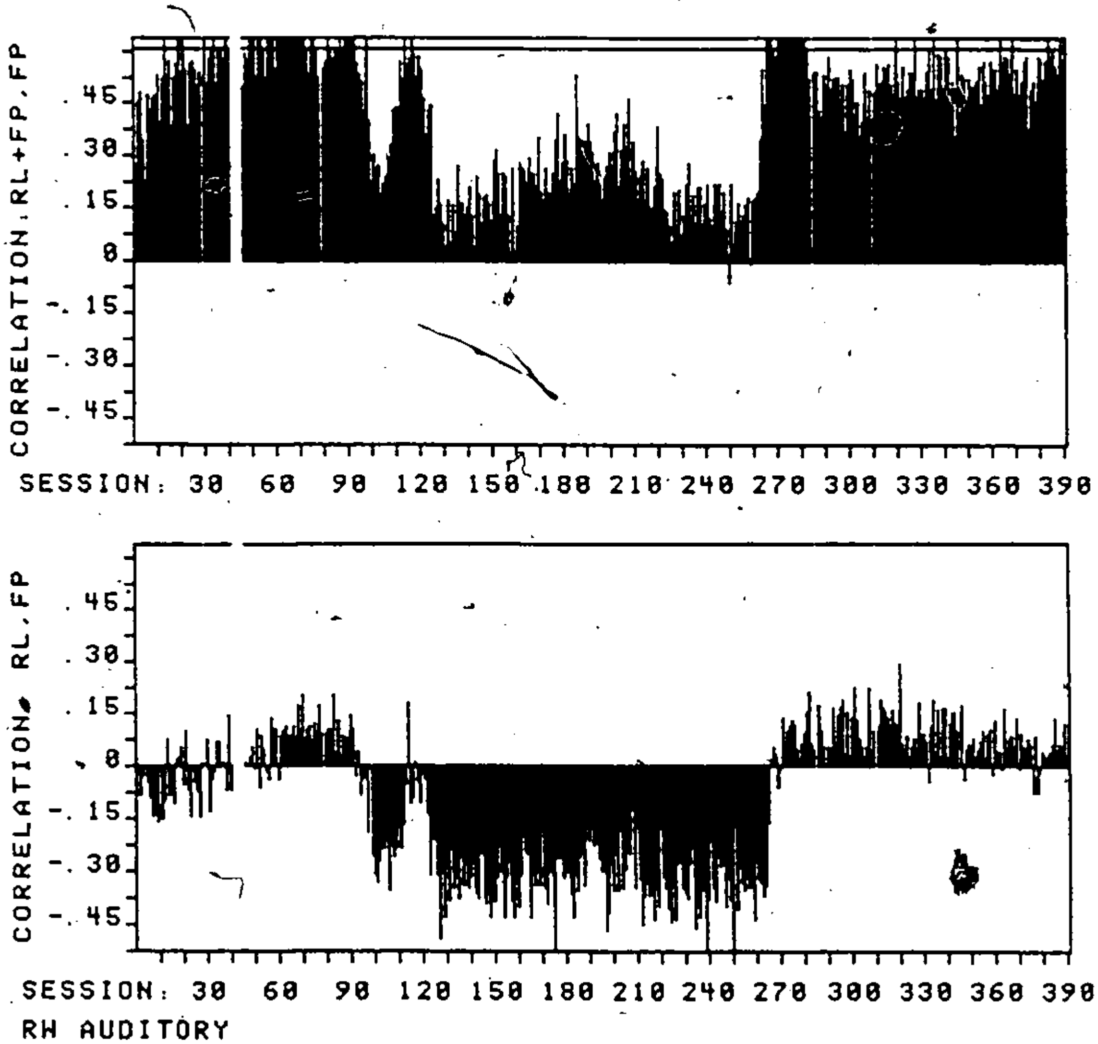
Upper panel: Correlation between response latency (from WS) and foreperiod duration for each session. Correlations extending to the topmost line of the figure were too large to represent accurately at this scale. For exact values, see Appendix 1.

Middle panel: Correlation between response latency (from P1) and foreperiod duration for each session.

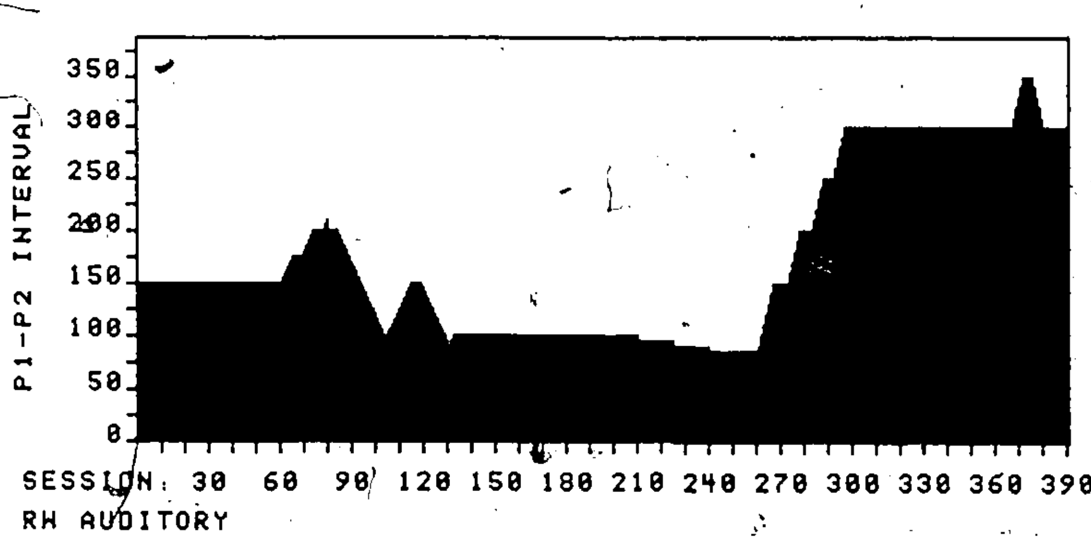
Some sessions' raw data were lost and correlations could not be calculated. No values are plotted for these sessions. They are indicated by gaps in the figures (sometimes most easily seen as breaks in the top lines of the figures.)

Lower panel: synchronization intervals, in milliseconds, of each session.

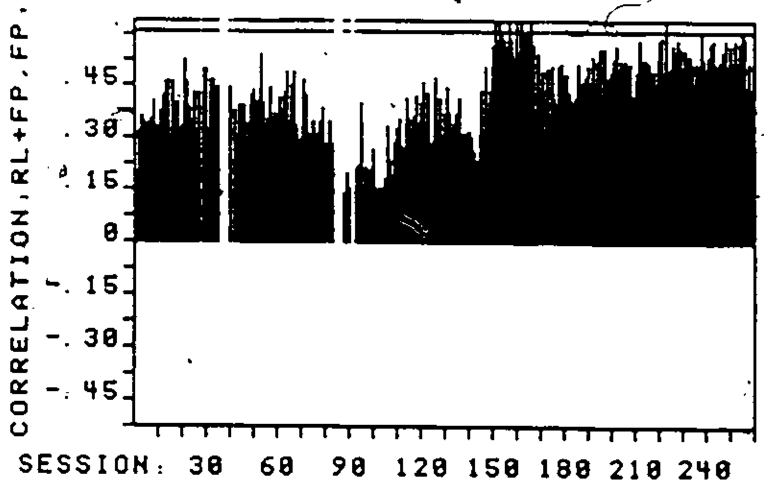
Figure 9.1: Subject RW. Figure 9.2: Subject JB.

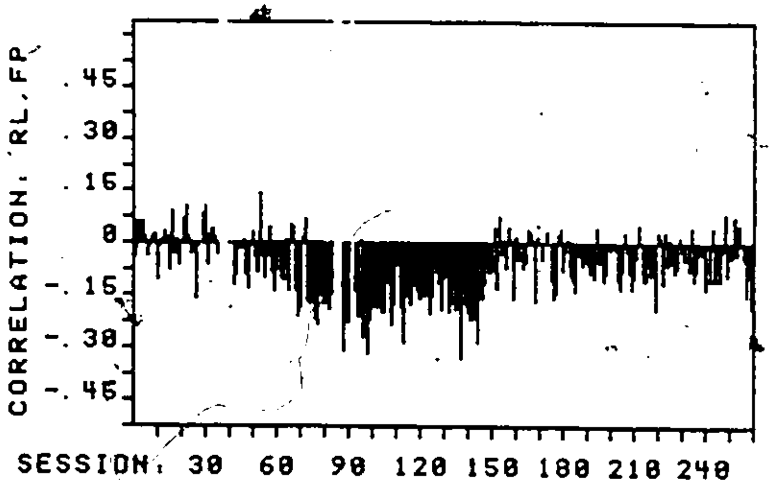


CORRELATION, RL+FP, FP
.45
.30
.15
0
-.15
-.30
-.45
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390
CORRELATION, RL, FP
.45
.30
.15
0
-.15
-.30
-.45
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390
RH AUDITORY

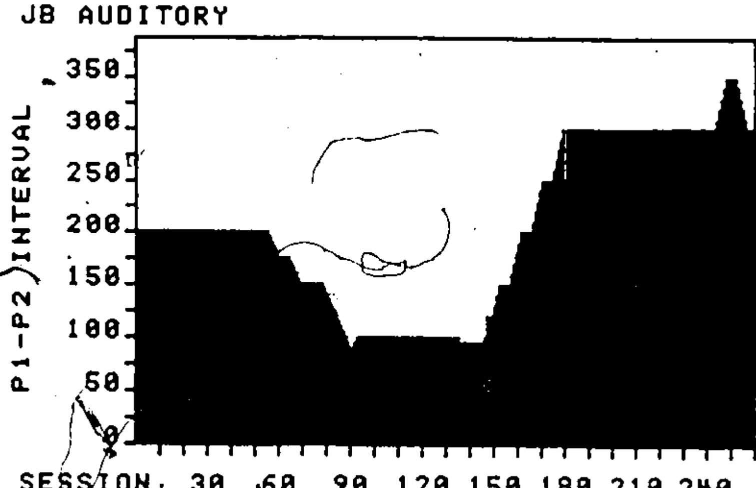


P1-P2 INTERVAL
350
300
250
200
150
100
50
0
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390
RH AUDITORY





JB AUDITORY



JB AUDITORY

(unknown) and the foreperiod distribution (90 $msec^2$). Let C be the population correlation coefficient and let VT and VF be the timing (including motor variance) and foreperiod variances respectively. The magnitude of the correlation is given by:

$$\text{Absolute Value of } C = \sqrt{\frac{VF}{VT+VF}}$$

If the subject is timing from WS and we measure latency from P1, C is negative. If the subject times from P1 and we measure latency from WS, C is positive. Table 6 presents some sample correlation magnitudes, for comparison with the statistics reported in Tables 4.1 and 4.2.

Table 6

Expected Correlations as a Function of Timing Variance

Variance	Correlation (Absolute Value)
100 $msec^2$	.688
125 $msec^2$	.647
150 $msec^2$	.612
175 $msec^2$	.583
200 $msec^2$	.557
225 $msec^2$	.535
250 $msec^2$	.514
300 $msec^2$	.480
500 $msec^2$	.391
750 $msec^2$	.327

Consider first the data of Experiment 2, i.e. the results from 150 to 350 msec. In RW's case, the correlations between latency (from P1) and the foreperiod are small but positive. The correlations between latency measured from WS and foreperiod duration are quite large, generally larger than .50 and often larger than .60 (see Table 4). While there seems to be some effect of the foreperiod on the latencies, the responses are mainly determined by the time of P1.

In JB's case, there are negative correlations between latency from P1 and foreperiod duration across the range. (I should note that the final five session average correlation at 300 msec, of -.14, is stronger than the value obtained during most sessions at 300 msec. See Appendix 1's listings.) If we examine correlations between foreperiod duration and latency measured from P1, from 150 to 350 msec these are typically large and positive, always exceeding .40 and usually exceeding .50. They are smaller than the correlations obtained from RW and they are smaller than we would expect if JB timed exclusively from P1, since his response latency variances are generally around 200 $msec^2$ or less. There is some indication of a consistent effect of the foreperiod duration on latency, but it is not a very sizeable effect.

Now let us examine the data in the 85 to 100 msec P1-P2 interval range. The variances are larger here, but from Table 6 we should still expect to find correlations of at least -.45 between foreperiod duration and latency measured from P1 and and we should expect to find negligible correlations between the foreperiod and latencies measured from WS. That is, this is what we should expect to find if the subject times exclusively from WS. These expectations are the mirror image of those of Experiment 2. We know from Experiment 2 that such correlation magnitudes are not merely hypothetical. The right correlations were obtained, at least approximately, for intervals longer than 150 msec. Examining the Experiment 3 results, the correlations between latency (from WS) and foreperiod duration do not drop to zero. Nor do they drop to levels comparable to the correlations between foreperiod and latency from P1 obtained in Experiment 2. There are consistent positive correlations between foreperiod and latency (from WS) even when P1-P2 is 85 msec. At an interval of 100 msec, the correlations are fairly large, .35 for RW and .37 for JB. The correlations between foreperiod duration and latency from P1 are negative but they are too weak. RW's values reached -.40, but JB's didn't even reach -.20.

The correlations between latency from P1 and foreperiod duration are too weak and those between latency from WS and the foreperiod are too strong for me to accept the hypothesis that when the P1-P2 interval is very short the subject will time an interval from WS and will respond exclusively on that basis. The time of P1 appears to play an important role in the subject's behavior, even when the P1-P2 interval is as short as 85 msec.

It seems that to describe this behavior we need a model that gives both WS and P1 a role in determining the time of the subject's response. There are models of this class for simple reaction time, developed because subjects' reaction times are correlated with the duration of the foreperiod preceding presentation of the stimulus. Niemi and Naatanen (1981) review that very extensive literature in detail. One line of work within that literature led to the development of the synchronization procedure. Rather than instructing their subjects to respond as soon as they perceived a stimulus, some experimenters instructed their subjects to respond at some time, or within some narrow range of times, after that stimulus. This line of work includes research by Snodgrass (1969, Snodgrass et. al., 1967), Naatanen et. al. (1974), and Saslow (1974). Kristofferson (1976) reviewed the relationship between synchronization as a procedure for studying timing and synchronization as a procedure for studying reaction time. Further discussion can be found in Hopkins and Kristofferson (1980) and Hopkins (1982).

I am reluctant to venture into that literature in any great detail here. Detailed consideration of the microstructure of reaction time *per se* is beyond the scope of the present work (and of the main stream of my research interests). Extensive further empirical work would be required in the development of a satisfactory model for data such as these: there is not an appropriate model extant in the RT literature. As an example of the difficulties, and of what appeared to be a very promising idea, consider the following approach, suggested by Kornblum (1973; see also Ollman and Billington, 1972).

In a reaction time task, the subject's goal is to respond as soon as possible after the presentation of the reaction stimulus (analogous to P1 when the P1-P2 interval is extremely short). If he waits until he perceives P1 before responding, he will respond some time after P1, because of afferent and efferent delays. Alternatively, he could use the warning stimulus. (Niemi and Naatanen, 1981, make an effective argument that there is always some stimulus in RT situations that the subject can use as a warning stimulus. Usually, the experimenter provides an explicit one, to prepare the subject to respond.) If the subject knows that the reaction stimulus will occur 1000 msec after WS, he can time an interval from WS and at some point after WS offset he can initiate a response which should be completed just as P1 is presented. If he could time the required interval perfectly, and if there is no variance in the foreperiod, he could produce any apparent reaction time desired. Subjects' timing is not variance free, however, and foreperiods are often variable. If the subject tries to appear to have too short a reaction time, his responses will sometimes precede the reaction stimulus, revealing the strategy. With practice and feedback from the experimenter that discourages early responding, the experienced subject may refine the strategy, trying to respond a bit later, at a point when the response can always or almost always be expected to occur after P1, but not much after P1. For example, rather than trying to respond 1000 msec after WS, if P1 never follows WS by more than 1050 msec, the subject might try to respond 1050 msec after WS even though this would yield some late reactions if P1 occurs much earlier than this.[6] Now suppose that the subject uses this strategy but on one trial, while waiting out the 1050 msec, P1 is presented 900 msec after WS. There's no point waiting another 150 msec. The subject should respond immediately instead.

Under Kornblum's analysis, if the foreperiod is variable, we should expect two types of response triggers. The subject generates a criterion interval internally, initiating the response at the end of this interval if he has not initiated the response already. If P1 is perceived before the internal interval ends, he responds immediately to that stimulus instead.

Kornbl ''s hypothesis is quite similar to Kristofferson's

(1977) theory of discrimination performance. In that case, the subject generates a criterion interval and decides whether a stimulus interval is long or short on the basis of which ends first, the criterion or the stimulus. The criterion can be studied by asking the subject to respond as soon as he can. Kristofferson found that "long" responses (arising when the criterion ends before the stimulus) were time-locked to the stimulus initiating the interval (analogous to WS). "Short" responses were time-locked to the offset of the stimulus interval (analogous to reactions to P1). In the reaction time situation, the subject is not required to make a discriminatory response, but he is required to speed the response that he does make and under Kornblum's model the basis of the response is the same as in the discrimination setting. The subject responds as soon as the criterion interval ends or as soon as he perceives the end of the interval between WS and the reaction stimulus (by detecting P1), whichever comes first.

If the subject does the task this way, we should still see a negative correlation between response latency and foreperiod duration. Kornblum's model was explicitly designed, as was Ollman and Billington's (1972), to explain this correlation. If the foreperiod is long, P1 will be delayed relative to the end of WS. The subject's response, based on the time since WS, will be early relative to the time of P1. If the foreperiod is short, the subject will respond to P1 itself. Since the subject will always respond to P1 if he perceives it before the criterion interval ends, his responses to P1 should never have a shorter latency (measured from P1) than his responses based on the end of the criterion interval. There may be a few exceptions due to motor and timing variability but in general responses triggered by P1 should occur later, relative to P1, than responses triggered by a criterion interval following WS. The longer the foreperiod the earlier the responses triggered by this interval will be, relative to P1.

It is not easy to predict the exact magnitude of this negative correlation. When P1 occurs before the end of the criterion interval, the response time to it should be approximately constant. Across the range of foreperiods over which P1 will occur before the end of the interval, response latency and foreperiod duration should be uncorrelated. Combining these latencies with the negatively correlated latencies time-locked to WS, we should obtain a smaller correlation than would be obtained if all of the subject's responses were time-locked to WS. The exact correlation will depend on the variance and range of the foreperiod, the variance of the subject's criterion, and the mean of the criterion. Whatever the exact value is, however, it should never be positive.

Kornblum's hypothesis appears plausible as an explanation of JB's and RW's relatively low correlations between foreperiod duration and latency from P1 for very short intervals. But from 140 msec upwards, RW's correlations are neither negative nor zero. They are positive. Is a different mechanism responsible for RW's small positive correlations at longer intervals than that responsible for his small negative ones at shorter intervals? Perhaps. But if so, and if Kornblum's model describes the mechanism underlying the negative correlations, this is only half of the story for these data. Given that RW's correlations appear to vary continuously as the P1-P2 interval is changed (see Figure 9.1) a complete model would in this case require specification of a slow transition from one mechanism to another that induces positive correlations, and would include a range of P1-P2 intervals over which both mechanisms or strategies were operative in the same sessions.

A further difficulty posed by the present data that is not escaped by Kornblum's model lies with the actual reaction times obtained. Suppose that some of the subject's responses are in fact simple reaction responses to P1. These should take a long time relative to an 85 msec P1-P2 interval. Yet RW's longest mean response time when the interval was 85 msec was 91 msec, and means shorter than 85 msec, such as 82 msec, were also obtained. None of RW's latencies (from P1) was longer than 140 msec when P1-P2 was 85 msec, and exceedingly few were longer than 120 msec. Most were shorter than 100 msec. According to the standard summaries, reaction time varies with stimulus intensity and to reliably obtain reaction times as short as 105 msec you should present stimuli on the order of 110 dB. These are extremely intense. In terms of sound pressure, they are more than 100 times as intense as the 68 dB stimuli used in this experiment. Reaction time to 68 dB stimuli has been estimated at 150 msec for practiced subjects. How can RW be emitting simple reactions to a 68 dB P1 this quickly? (And JB's performance at 95 msec is not much less striking.) I don't know. Perhaps such short reaction times can be obtained with moderately intense stimuli under optimal conditions and perhaps these were optimal conditions. Certainly, synchronization yields much lower variances than those obtained in any other type of reaction time task (see Kristofferson, 1976; Hopkins and Kristofferson, 1980). Perhaps this procedure can elicit faster responses as well. That conclusion is certainly suggested by these data, though I am not convinced that it is forced by them.

4.2.4 Distributional Shape

Figures 10 show RW's and JB's symmetry coefficients for each session. Figures 11 show the kurtosis coefficients. The upper panels are based on latencies measured from the warning stimulus. The middle panels are based on latencies from P1. The lower panels show the correlations between latency (from P1) and foreperiod duration. The coefficients should vary as a function of this correlation. In Appendix 2, I derive expressions for population symmetry and kurtosis coefficients for convolutions of logistic and triangular distributions and for convolutions of logistic, triangular and geometric distributions. The latter convolution, of the three distributions, should describe performance if the subject times from WS, with the usual triangular + logistic latency distribution assumed for synchronization latencies, and we measure latency from P1 rather than from WS. Equivalently (except that the geometric foreperiod distribution was subtracted in the convolution above and will be added in this one), it should describe the latency distribution as measured from WS if the subject is timing from P1. The coefficients all depend on the relative variances of the logistic, triangular and geometric variates convoluted. Some sample values are calculated in the appendix. Having rejected this simple model of the subject's behavior,

FIGURE 10

Upper panel: Symmetry coefficients of the response latency (from WS) distributions of each session.

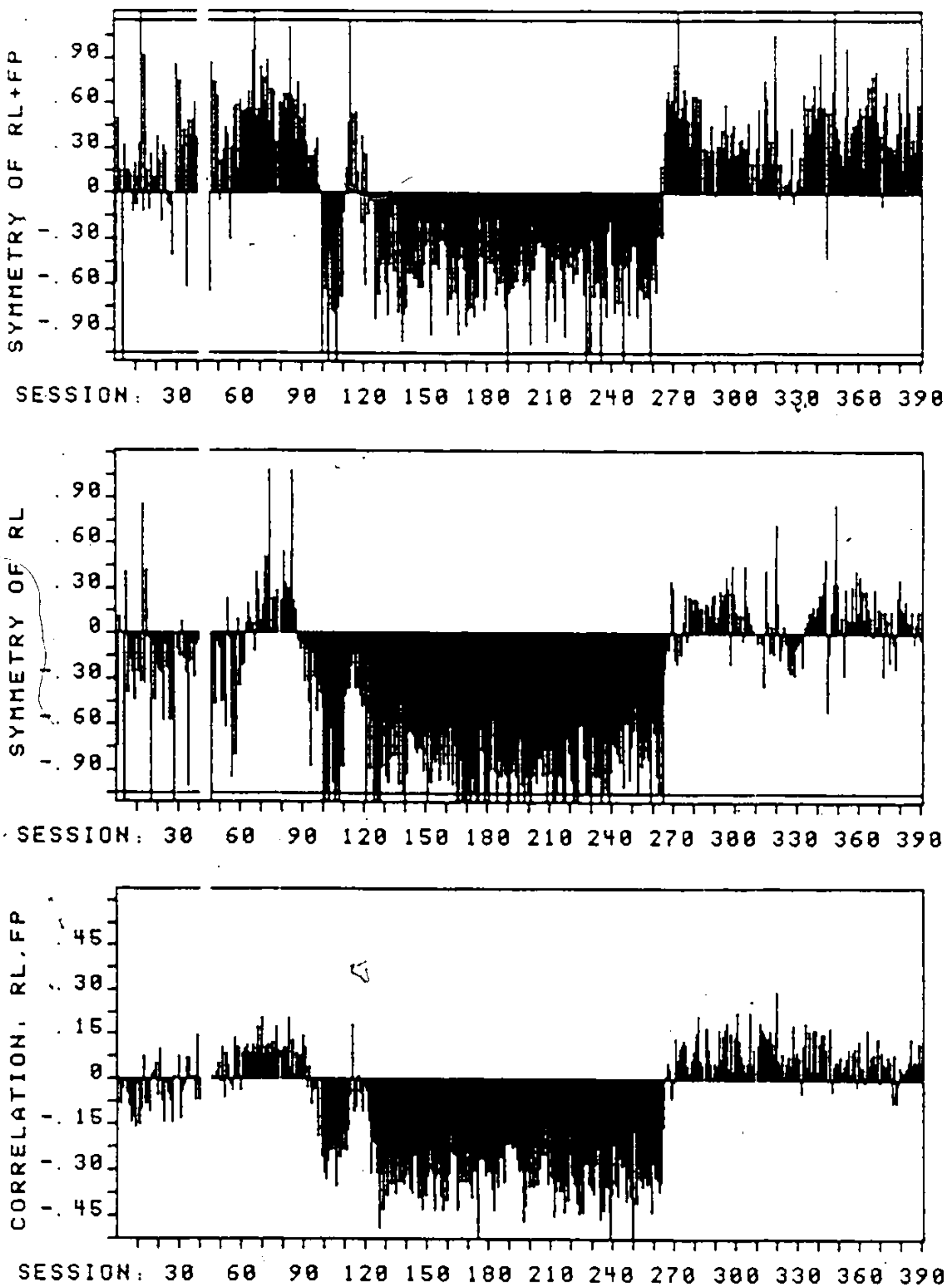
Middle panel: Symmetry coefficients of the response latency (from P1) distributions of each session.

Some of the symmetry coefficients were too large in absolute magnitude to represent accurately in these figures. Where there are two lines at the top or bottom of a figure, and a symmetry value extends to the outermost line, the actual value should be shown as extending further. For exact values, see Appendix 1.

Some sessions' raw data were lost and symmetry coefficents could not be calculated. No values are plotted for these sessions, which are indicated by gaps in the figures.

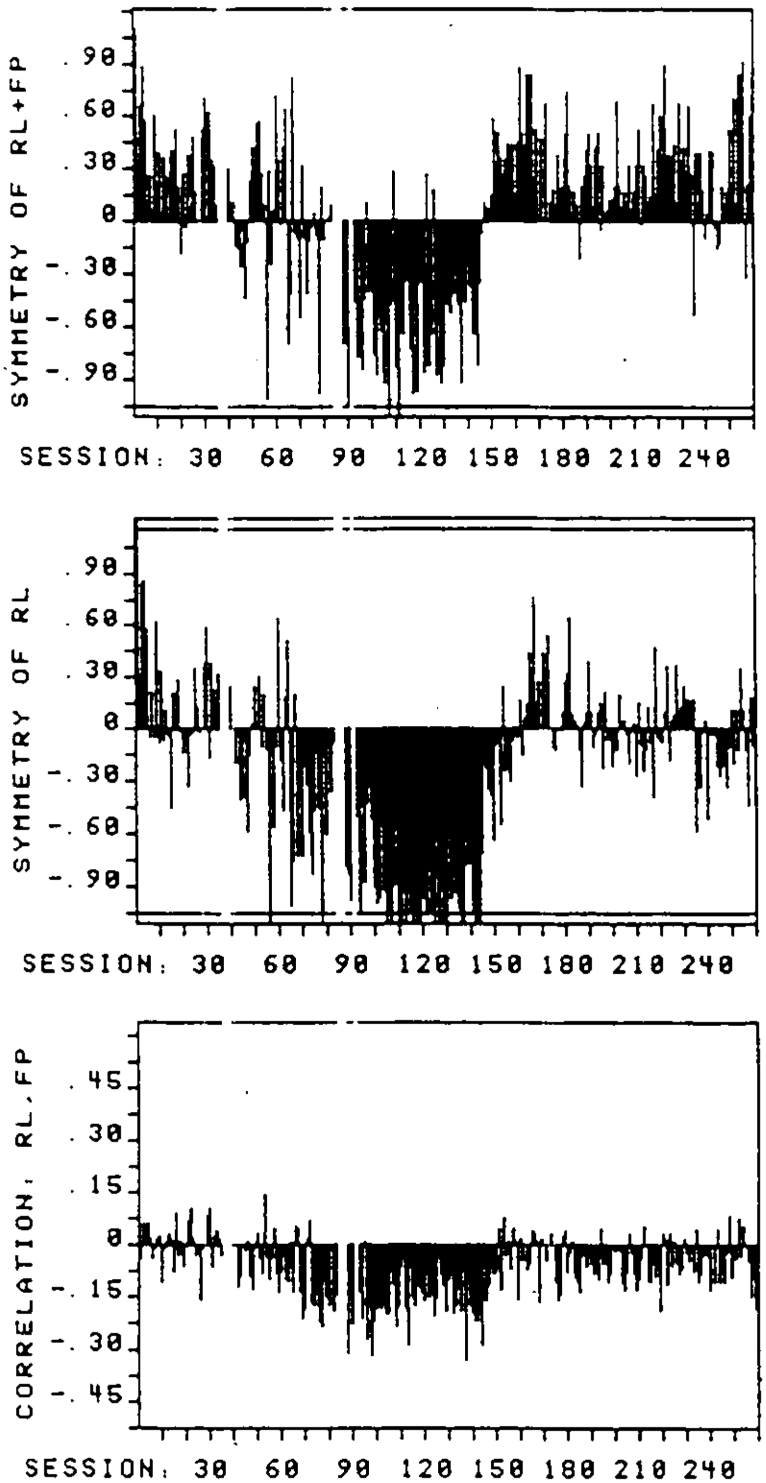
Lower panel: Correlation between response latency (from P1) and foreperiod duration. Repeats the middle panel of Figure 9.

Figure 10.1: Subject RW. Figure 10.2: Subject JB.



SYMMETRY OF RL+FP
.90
.60
.30
0
-.30
-.60
-.90
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390
SYMMETRY OF RL
.90
.60
.30
0
-.30
-.60
-.90
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390
CORRELATION, RL,FP
.45
.30
.15
0
-.15
-.30
-.45
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390

RH AUDITORY


SYMMETRY OF RL+FP
.90
.60
.30
0
-.30
-.60
-.90
SESSION: 30 60 90 120 150 180 210 240
SYMMETRY OF RL
.90
.60
.30
0
-.30
-.60
-.90
SESSION: 30 60 90 120 150 180 210 240
CORRELATION, RL,FP
.45
.30
.15
0
-.15
-.30
-.45
SESSION: 30 60 90 120 150 180 210 240

JB AUDITORY

FIGURE 11

Upper panel: Kurtosis coefficients of the response latency (from WS) distributions of each session.

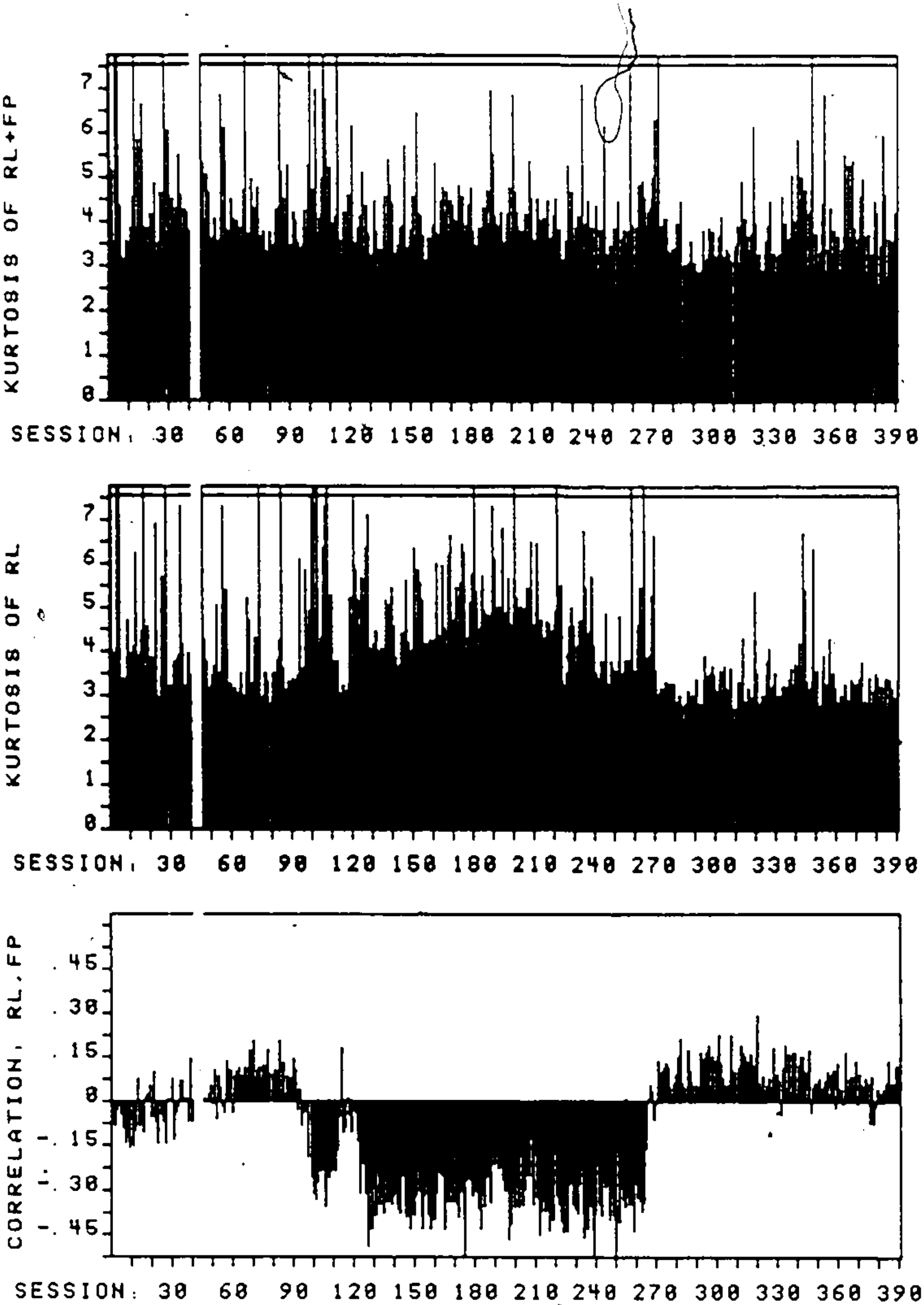
Middle panel: Kurtosis coefficients of the response latency (from P1) distributions of each session.

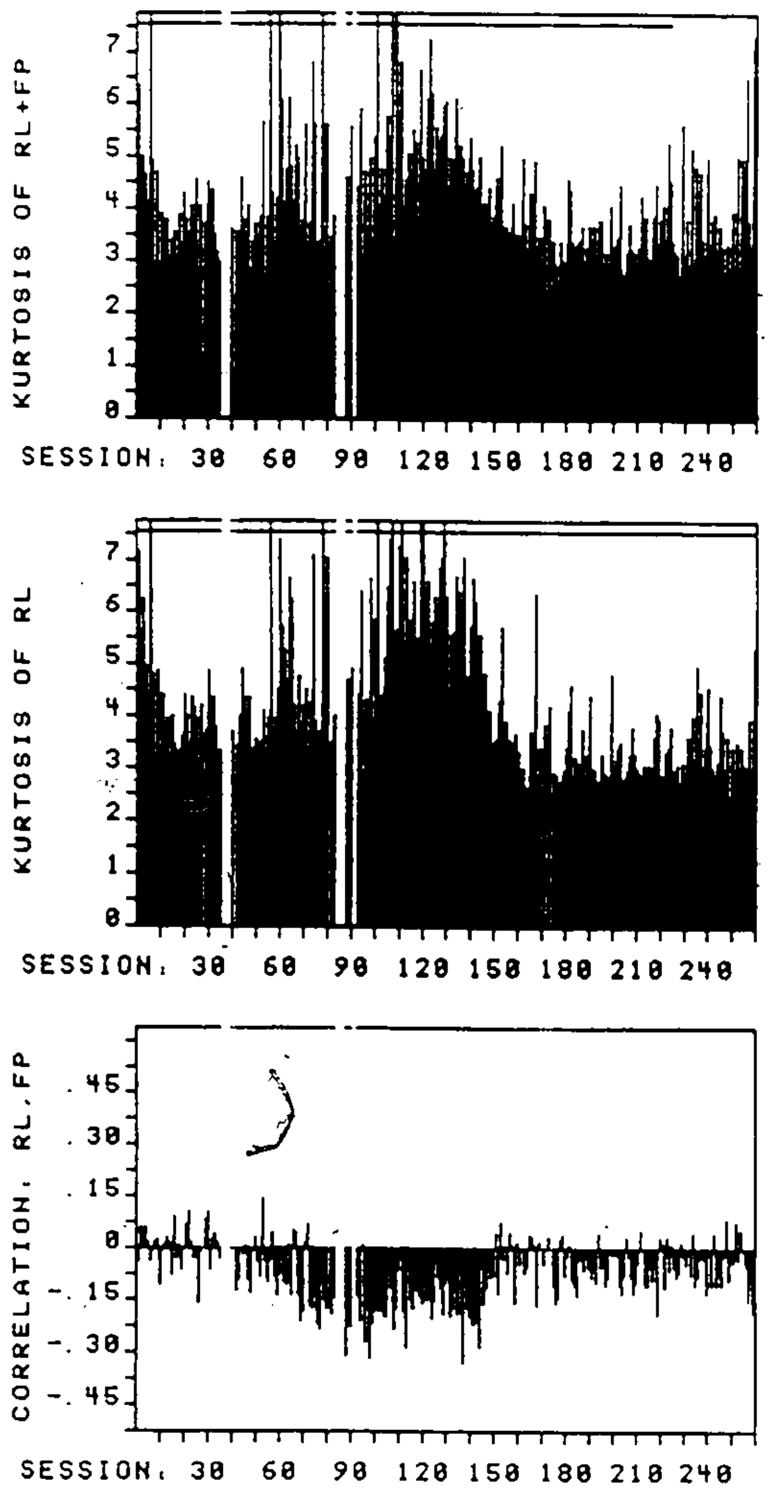
Some of the Kurtosis coefficients were to large to represent accurately in these figures. Kurtosis values shown as extending to the topmost line of a figure are larger than they appear. For exact values, see Appendix 1.

Some sessions' raw data were lost and Kurtosis coefficients could not be calculated. No values are plotted for these sessions, which are indicated by gaps in the figures.

Lower panel: Correlation between response latency (from P1) and foreperiod duration. Repeats the middle panel of Figure 9.

Figure 11.1: Subject RW. Figure 11.2: Subject JB.


KURTOSIS OF RL+FP
7
6
5
4
3
2
1
0
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390
KURTOSIS OF RL
7
6
5
4
3
2
1
0
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390
CORRELATION, RL,FP
.45
.30
.15
0
-.15
-.30
-.45
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390
RH AUDITORY


KURTOSIS OF RL+FP
8 1 2 3 4 5 6 7
SESSION: 30 60 90 120 150 180 210 240
KURTOSIS OF RL
8 1 2 3 4 5 6 7
SESSION: 30 60 90 120 150 180 210 240
CORRELATION, RL,FP
.45 .30 .15 0 -.15 -.30 -.45
SESSION: 30 60 90 120 150 180 210 240
JB AUDITORY

I will not detail those results here. The graphs, however, show up a few aspects of the data that should be mentioned.

Consider first the data of Experiment 2, from 150 to 350 msec. The distributions of both subjects' latencies do not appear symmetric from these figures. Early in practice, RW's latencies (from P1) were clearly negatively skewed, and substantially so. After much practice, this relationship changed sign. JB's symmetry coefficients change sign more frequently. In both cases, the distributions seem more skewed than those obtained by Hopkins (1982) and than those obtained in Experiment 1. There is some tendency for the skewness coefficients to follow the correlation coefficients, in sign and in magnitude, and this makes sense. If latencies are positively correlated with foreperiod duration, and the foreperiod duration is positively skewed, the latency distribution should be positively skewed. If the correlation is negative, long foreperiods translate into short latencies, so the latency skew should reverse. Whatever model explains the correlation between latency and foreperiod duration should have no difficulty with these asymmetries in the data.

The kurtosis coefficients of both subjects were also a bit large in Experiment 2, but this may again be due to foreperiod effects. RW's kurtosis averages in the 200 to 300 msec range were close to 3 (see Table 4), which matches other synchronization results nicely. JB's averages were higher but from Figure 11.2 (or from Appendix 1) we can see that kurtoses near or smaller than 3 were not unusual in his data.

The Experiment 3 symmetry coefficients (85 to 150 msec intervals) are more curious. They are not due to computational errors in the computer program, which I rechecked after examining the graphs. When (as in Experiment 2) the correlation between response latency (from P1) and foreperiod duration is positive, zero, or only slightly below zero, we should expect foreperiod duration and latency from WS to be strongly positively correlated. Since the foreperiod distribution is positively skewed, we should expect the latency (from WS) distribution to be positively skewed and it is. The curious finding is what happens when the correlation between latency (from P1) and foreperiod duration becomes quite negative. If the subject is timing from WS then his latency distribution, measured from WS, should be symmetrical. The correlations (foreperiod and latency from P1) are too weak to support the hypothesis that he is timing from WS exclusively, so we should not expect perfect symmetry. The correlations between foreperiod duration and latency from WS are still positive, though less large, so we should find that the latency distributions (from WS) are positively skewed, though less skewed than at the longer interval. But they are not positively skewed, nor symmetrical. Instead they are very negatively skewed. I do not know why these data look this way. I think this will prove to be a very difficult problem and it may be the critical feature of the data for discriminating between alternative hypotheses designed to describe foreperiod-latency correlations.

4.3 Concluding Comments

The variance levels in Experiment 2 were higher than those typically obtained in synchronization experiments, probably because of the long and variable foreperiod. This will pose some difficulties in interpreting the visual synchronization results, though given those data, the difficulties will not be as great as they could be. The problem is whether we should compare the visual variances with these data or with variances from the rest of the literature. For future reference I will note that RW's best variances were 123 msec^2 (twice) and JB's were 113 and 125 msec^2. (KF's were 156 and 160.)

The correlations between latency and foreperiod across the 85 to 350 msec range appear to be reflected in all aspects of the latency distributions' shapes (variance, symmetry, kurtosis) but not always in easily predictable ways.

These data raise more questions than they answer. In particular, is minimum response time for moderately loud stimuli subtantially shorter than is currently believed? Should we still accept 100 to 105 msec as an absolute minimum on reaction time, given that reaction time to these less than maximally intense stimuli may be at this level or shorter? Finally, what are the contributing processes or strategies that yield negative, zero, or positive correlations between latency and foreperiod, depending on P1-P2 interval? Unambiguous answers to these will require much further work and thought but they are important questions for those interested in determinants of reaction time.

Estimates of q in Experiment 3 were generally between 40 and 50, however the latencies were measured. These are smaller values than those obtained with long auditory intervals and larger than those obtained with short intervals.

Experiment 3 involved a trick and a gamble. The trick lay in manipulation of the subjects' conscious attitudes. If they could be convinced that their synchronization variances should be at very low levels, at levels they knew they could attain under conditions they were led to consider similar, then perhaps they could achieve those levels. The gamble was that the subjects would not be so resourceful that they would develop uninterpretably complex strategies for achieving this.

The trick worked: the subjects tried very hard to attain low variances and their performance at P1-P2 intervals of 100 msec is impressive.

The gamble failed. I opened the discussion of possible results for this experiment with three alternatives: subjects might time these long WS-P1 intervals at the same q level as they used with short but timeable P1-P2 intervals (such as 200 msec), or their internal timing variability might be intermediate to the levels seen at the short and long intervals, or variability might rise to the same level as found in Experiment 1, suggesting a stepwise increase between 550 and 1100 msec, with constancy from 1100 (or so) msec out to 1750 or 2000 msec. None of these hypotheses is incompatible with the present data.

Suppose first that the subjects in fact operated at a q level of 25 or 30, i.e. at the level typical of short interval auditory performance. If this is true then the measured latency variances include more than just internal timing variance and a low level of motor variance, i.e. for our purposes the measured variances are inflated. The measured variances almost certainly are inflated. Here are five extra sources of variance that I consider likely, and there are probably more:

(1) The subjects sometimes timed from WS and sometimes timed from or reacted to P1. If we measure latency from WS and the subject times from P1, or if we measure latency from P1 and the subject times from WS, we add the variance of the foreperiod to the variance of the response latency itself in estimating latency variance. The degree of inflation of our estimate depends on how often the subject timed from the stimulus we assume he ignored.

(2) There must be some lower limit on mean reaction time and the assumption that it is as low as 100 msec at 68 dB flies in the face of much reaction time data. If it is not this low, then mean latency (relative to P1, at a P1-P2 interval of 100 msec) when the subject is timing from WS should be different from mean latency when the subject is reacting to P1. When the subject is timing from WS, he can typically achieve a 100 msec latency (relative to P1). When reacting to P1, he typically cannot. Distributions of a mixture of both types of responses should be bimodal, with high variance, even if the variances of the component distributions (timing from WS, reactions to P1) were identical and low. The degree of variance inflation should depend mainly on the separation between the two means. The expectation of bimodality is a natural outgrowth of analysis of the task demands along the lines suggested by Kornblum. I cannot say that this expectation is forced by that line of thought, but it is highly compatible with it. I have examined the histograms of the response distributions and was surprised that this is not apparent in them.

There are long tails in the distributions, but they appear unimodal. Still, this might be masked by the one discussed next.

(3) The interval between P1 and P2 is an "empty" interval. The interval between WS and P2 is a "divided" or "filled" interval: P1 is interpolated between these stimuli. The presence of an interpolated stimulus typically affects the judged duration of that interval. A divided interval is judged longer than an empty one of the same physical duration, the simplest example of the filled duration illusion (see Fraisse, 1963, for a review). A divided interval in which the stimulus occurs early is generally judged longer than an equally long one in which the interval occurs late (eg. Buffardi, 1971; Israeli, 1930). Suppose that the subject is timing a synchronization response from WS and that he is subject to this illusion, due to the presence of P1.[7] The later that P1 occurs, relative to WS, the shorter the perceived interval between WS and P2. If the subject is attempting to produce an interval of 1100 msec, to coincide with P2, but his perception of the time elapsed to this point has been influenced by the time of presentation of P1, he may respond at the wrong time. If P1 occurs early, he may overestimate the time elapsed so far, responding early. If P1 occurs late, he may underestimate elapsed time and respond late. Brewster (1983) used a three stimulus synchronization task, with a P3 interpolated between P1 and P2 and did find that synchronization latency (responses were to be synchronous with P2) was positively correlated with the interval between P1 and P3. She did not interpret her result in terms of the filled duration illusion but consider ion of the various possible explanations would take us far

afield. If the subject is timing from WS and his latency varies as a function of the time of P1 (because of an illusion, because P1 interrupts processing of the interval, for whatever reason), then the response latency distribution is a mixture of many distributions (one for each WS-P1 interval) with many means, and even if they all had the same variance we would not obtain a measure of this common variance but of a larger one, the variance of the mixture.

(4) Kristofferson (1976) found serial dependencies in one of his subject's response distributions. Successive trials' latencies were positively correlated. Hopkins (1982) also found this but the correlations diminished to negligible values with practice. I have not looked for sequential dependence in the data -- this is a common source of noise in many paradigms (see, eg. Ward's 1979 review of the scaling literature), depending on the specifics of the procedures involved -- but it would not be surprising if it was unusually (for synchronization) strong when P1-P2 intervals are almost impossibly short.

(5) The very short P1-P2 interval task was more stressful than those involving longer intervals. The subjects sometimes reported that they felt "hyper" after a session. I informally noted unusual palmar sweating after sessions from one subject. The other sometimes jokingly noted that he performed best if he had a few beers first (presumably, to relax) and I think he was right. Startle responses, hand twitches and so forth are probably more likely to arise in stressful situations and these may have played a role in increasing the apparent variance of the subjects, though most of these were removed from the data via the

truncation algorithm.

It is hardly inconceivable that these sources of extra variance could jointly contribute 100 to 300 msec^2 to the measured latency variances. Accordingly, it seems quite plausible that the subjects were operating at a q level of 25 or 30 (timing variances of 100 to 150 msec^2) despite the much higher latency variances.

The second hypothesis, that internal variances are higher than those at short P1-P2 intervals (150-550 msec) and smaller than at long ones, is certainly concordant with the results. The latency variances measured were intermediate so the underlying variances may well have been.

The third hypothesis is that the subjects, when timing from WS, operated at the same q level (50 or so) as they would operate at in the 1500 to 1750 msec P1-P2 region. Suppose that the subjects sometimes timed from WS, with a q of 50 (variance of about 417 msec^2) and other times they reacted to P1. Suppose further that their fast responses to P1 were less variable than their timed responses to WS, and that their mean reaction latency was not much different from the mean latency (relative to P1) of responses from WS, so the variance is not inflated due to bimodality of the mixture. In this case the variance of the mixed distribution would be between the variances of the two component distributions, the exact value depending on the relative number of responses of each type. (The problem of added foreperiod variance on some trials still remains, but this cannot add more than 90 msec^2 (the variance of the foreperiod) and it probably adds less since it is not a factor in all trials.)

I have some theoretical difficulties with this hypothesis. In particular, q is conceptualized in terms of waiting times in the nervous system. Information about a stimulus is delayed by up to q msec before it can be passed to another stage of processing. How can q be small when the subject reacts to P1 but large when he times from WS? Especially if we follow Kornblum's reasoning and suppose that the subject is timing from WS on all trials, reacting to P1 only when it arrives earlier than expected. This is a remarkably fast switch of q levels, within the same trial.

At the empirical level, Kristofferson (1977, 1983) found that something very much like this occured in speeded duration discrimination. When the subject responded "long" (the internal criterion interval, corresponding to the time since WS, ends before the stimulus marking the end of the interval), his latency variance depended on the stimulus interval, increasing in a stepwise manner, with obtained q values ranging from 25 to 200 msec. When the subject responded "short", as a reaction to the marker ending the stimulus interval, his variance was about 280 msec^2, and this was independent of the duration of the stimulus interval.

Given the empirical demonstration, the theoretical objection that the subject's variance in reacting to P1 should not be lower than the variance of his response from WS has no force.[8] Accordingly, while this imposes its own theoretical difficulties, it is not implausible to suppose that the subject timed from WS at a q level near 50, the lower latency variances being due to a mixture of responses determined this way with less variable responses triggered by P1.

I find it impossible to discriminate between the three alternative views of this experiment's data because of the complexity of the subjects' response strategies. They evidently neither timed exclusively from WS nor exclusively reacted to or timed from P1 nor mixed responding in both ways in the way that seems optimal to me, i.e. in the way suggested by Kornblum. (The negative skew of the distributions from WS, noted above, seems just as difficult for this hypothesis as for the others.) I am impressed by how well the subjects performed in this task, but I am a complete loss as to how, exactly, they did it.

5. Short Visual Intervals: Experiments 4 and 5

These two experiments used visual P1 and P2 stimuli. Experiment 4 was an extended study of performance across the range from 275 to 550 msec. Experiment 5 was a much briefer transfer experiment, examining the performance of one subject who had participated in Experiments 2 and 3.

There are fewer long term and moderately long term visual timing experiments than auditory experiments. The only visual synchronization data come from Hopkins (1982). In that experiment Hopkins showed that the subjects' behavior was not controlled by the visual stimuli, so, in effect, there are no visual synchronization data. There are visual discrimination experiments, but none as extensive as Kristofferson's (1973, 1977, 1980, 1983) auditory experiments. None of the visual discrimination experiments involved speeded responding, which yields response latency distributions, and so there are no tests of the real time criterion theory for visually bounded intervals. There are suggestions of steps in variance with duration, but no orderly pattern has emerged from visual data. Again, the necessary proctracted studies of single subjects' data have not been conducted. The evidence for a continuously adjustable source of internal delays is also fairly weak for visual stimuli. From single stimulus studies, which involve few different test stimulus durations per base duration, one can roughly estimate the shape of the internal distribution, and the mean of the distribution. The distributions appear symmetrical with means quite close to the midpoint of the single stimulus series (eg. Allan, et. al., 1971), which suggests that fine tuning of the type found in audition probably occurs in visual timing as well. The stronger tests of continuity, long term production tests across a number of different, but not very different, intervals, have not been conducted.

My goal in Experiment 4 was to demonstate that response distributions in the visual synchronization situation are the same as those obtained when auditory stimuli are used. If enough similarities (and few enough dissimilarities) between visual and auditory performance can be found, it would seem logical to suppose that the same mechanism underlies performance in both modalities.

A vast number of comparisons between visual and auditory performance could probably be made. I chose to examine the following aspects of the data:

A. Reliance on P1: The experiment fails if subjects rely on the warning stimulus for timing rather than on P1. Hopkins' subjects did not use the visual P1 as the stimulus marking the start of their synchronization intervals. Instead, they used the tactile feedback available from their trial initiation responses. It hasn't yet been demonstrated that subjects can synchronize to visual stimuli. While we should not be surprised to find that subjects can time out intervals using visual P1 and P2 stimuli, given that Hopkins' subjects didn't do this, this aspect of performance must be examined. It is unfortunate that the present procedure appears to induce some reliance on the warning stimulus, but this <u>was</u> found in both Experiments 1 and 2, so we should probably find a small correlation between response latency (from P1) and foreperiod duration in this experiment as well. The point is that this correlation should be small. If is isn't, we are studying timing from an auditory warning stimulus or from a tactile trial initiation response, which is not what we want here. I will predicate the rest of this discussion on the (in fact, correct) assumption that the correlations will be small.

<u>B.</u> <u>Variance Levels:</u> It is difficult to settle on precise criteria for absolute variance levels for a number of reasons. First, there are individual differences, as seen in the data of Experiments 1, 2 and 3 already. Brewster (1983), Hopkins (1982), Kristofferson (1976) and Michaels (1977) also obtained different results from different subjects. Further, the difference across their experiments, apparently due to differences in procedure, spans more than an order of magnitude. Variances in Experiment 2 at the most practiced intervals were generally between 100 and 200 $msec^2$. Most of Kristofferson's and Brewsters' subjects typically operated at 100 to 150 $msec^2$ levels. One of Brewster's subjects' variances were generally just above 200 $msec^2$.

<u>C.</u> <u>Estimates of q:</u> These should settle to levels close to 25, 50 or 100 msec after practice. Again, we should not be surprised by individual differences.

<u>D.</u> <u>Symmetry:</u> Distributions should appear symmetrical. From Hopkins' data and the results of Experiment 2 we should expect that if there is a slight degree of asymmetry, the skew should be positive.

E. Kurtosis: Kurtosis coefficients should be between 2.4 and 4.2, though, given the variance and positive skew of kurtosis statistics, occasional higher values are not unreasonable. From Experiments 1 and 2 we should expect that kurtosis coefficients will generally be slightly higher than 3.

F. Stability of Performance Across a Range: Ideally, the distributions will be the same in variance, symmetry, kurtosis, and correlation with the foreperiod, across the 275 to 500 msec range. We should not expect this to be true of the performance of all subjects. One of Kristofferson's (1976) subjects' variances declined as the P1-P2 interval increased from 150 to 300 msec, staying constant only from 300 to 550 msec. A different subject's variances did not increase at the shorter intervals. Individual differences are also evident in Hopkins' and Brewster's data. In Experiment 1, DG's variances were roughly constant from 1500 to 2000 msec whereas GH's variances appeared constant only from 1500 to 1750 msec, increasing beyond this. In Experiment 2, variances at intervals longer than 200 msec were generally higher than at shorter intervals, again with differences between the subjects. There are also individual differences in visual discrimination data (Allan et. al., 1971; Allan and Kristofferson, 1974). (The comparable auditory research all involved a single very long term subject, so comparisons across subjects are not available.) The basic phenomenon demonstrated in all of these experiments is that there is constancy of performance across some range of intervals that is wide enough to be called a range. That much we should expect from all subjects. We can hope, but cannot expect on the basis of previous results, that all subjects will show constancy across the entire range.

G. Continuous Adjustability: The finding that response distributions are the same (except for mean latency) at widely separated intervals would not in itself imply that distributions would not vary with small changes in the interval. The simplest quantal counting models very definitely would not predict constancy across small changes (smaller than one quantal unit) in the interval. It was on this basis that Stroud's model was rejected in the introduction. Practiced performance was examined at a number of intervals differing by only 5 msec. We should expect mean latencies to track these changes, but variances and coefficients of skew, kurtosis and correlation should be unaffected by them.

H. Practice: In auditory synchronization (eg. Experiments 1 and 2; Kristofferson, 1976) and in speeded discrimination (Kristofferson, 1983), variances at intervals at which there was extensive previous practice are generally lower after a scan across a range of other intervals than they were at the end of a long initial practice series. In Experiment 1, variances did not appear constant, or even roughly constant, until the final scan back to the initial interval. During the scan toward longer (GH) or shorter (DG) intervals than the original interval, variances increased with increasing stimulus duration. Kristofferson (1983) found that response latency variances in a speeded discrimination task initially increased with the separation of the stimuli, eventually settling at low and constant values only after two full scans (up and down twice) of the range. It is not clear why scanning should have such a beneficial result on performance. I find it hard to believe that this is simply a general practice effect, resulting for example, in a decline of motor variability. After 50 sessions' initial practice at an interval the task is rather well learned already and motor variability should already have dropped to a rather low level. Whatever the basis of this phenomenon, it is quite noticeable in a fair bit of auditory data. It should be evident in the visual data as well.

These expectations for the visual results are not as precise as I would like them to be. It is fairly clear what "perfect" performance would entail: variances in the 100 to 150 msec^2 range, yielding q estimates close to 25, symmetry coefficients averaging about .05 or perhaps .10, average kurtosis coefficients between about 2.9 and 3.4, and average correlation coefficients smaller in absolute value than .15 or .10, with no change in any of these as the interval is varied in small steps across the range, once an initial scan of the range has been completed. Given the individual and procedurally based differences found in auditory work, however, I would not expect to find this perfect pattern, or, at least, not for all subjects. Despite the mass of data collected in Experiment 4, we will be confronted with a subjective judgment at the end, about whether the results are in good enough general agreement with the prototypic pattern to warrant a conclusion that visual and auditory performance are the same. In the event, the data from the two subjects who completed both full scans of the range, IS and DK, were quite similar, and were similar enough to the prototype that this subjective decision should be a relatively easy one to make. That is a fortunate result, and the discussion below is fairly straightforward because of it, but the above notes outline what I thought (and think, if we consider replications in the future) should be obtained, not what was obtained. Given the variation in auditory results across subjects and experiments, a poorer match between expectations and data could well have been obtained, and could be obtained in the future, even if the underlying timing mechanism is the same across modalities.

There is one final point that I wish to make explicit about the list of expected outcomes above. The list of possible comparisons is probably endless. I have certainly not made all of the comparative analyses that were possible. When confronted with a selected series of comparisons from a much larger pool, a reader might wonder whether other comparisons were made, and if so, why they weren't reported. Sometimes this is justified: the practice of reporting only those "predictions" actually met by the data, leaving unmentioned the predictions not met or the results which might be considered unfavorable, is not unheard of. I consider such practices fundamentally dishonest and I do not engage in them. If there are unmentioned aspects of the data that in any way conflict with the conclusions drawn, they are unmentioned because I am unaware of them.

5.1 Method

5.1.1 Subjects

Five subjects started Experiment 4. DK, LL and IS participated throughout the experiment. AP, a female undergraduate, vanished after 39 sessions. JS, a male graduate student, started a few months later, as a replacement for AP. By the time he had completed 75 sessions, the data from the other subjects indicated that this experiment would require more than twice as many sessions as I had originally anticipated. While JS very reliably completed the sessions for which he was scheduled each week, by that schedule he could not complete even half of the experiment. I gave him the choice of increasing his number of sessions per week or of leaving. Having other more pressing commitments, he left the experiment.

DK and LL are female, IS is male. DK and IS are senior graduate students. LL is a research technician. All had participated in other experiments involving duration perception.

5.1.1.1 Experiment 5

RW, the subject of Experiment 5, is a senior male graduate student, who had already participated in Experiments 2 and 3.

5.1.2 Procedure

5.1.2.1 Experiment 4

In the previous experiments, scanning across a range was done as quickly as possible, with extended practice only at a few intervals and very little practice at other intervals. In this experiment, the highly practiced intervals were 300, 400 and 500 msec. Extra practice, though not as much as at these three, was also given at 305, 310, 315, 320, 325, 475, 480, 485, 490 and 495 msec. My intention was to pay careful attention to performance at these intervals, in order to test for continuous adjustability.

Originally, I planned only one scan upward, to 500 msec, and a return to 300 msec, as in Experiment 1. The variances did not drop to a constant level during the return scan, but they did drop substantially, and the reduction was evident across the 6 very close intervals, 500 to 475 msec, at which extra training was being given. I increased the number of sessions per interval to 5, at each interval planned during the scan down for subjects DK and IS. These two subjects were willing to participate in an extraordinary number of sessions, allowing me to take a detailed look at this reduction in variance, which had been quite striking over the short range from 500 to 475 msec. The variances tended to level off eventually. In IS's case, they appeared constant from 400 to 275 msec during this scan down. It appeared that they might level off completely if the scan was repeated, and I had them conduct a full, slow, second scan back up to 500 msec. DK completed the scan. IS has progressed to 430 msec at this date. Due to illness and to other commitments, he has completed very few sessions in the past three months. I don't know at the time of this writing whether he will complete the full series or, for that matter, whether he will complete any further sessions. While I will still collect the data if he generates it, he participates so infrequently now that it seemed unwise in the extreme to delay describing this work until he does complete the series. If there are substantially more data from IS, I will discuss them during the oral examination and will append a summary of them to the dissertation at that time.

While DK and IS were willing to take part in more than twice as many sessions as originally anticipated, LL could not do so. For her to complete a full scan up and down, it was necessary to abbreviate her schedule slightly, relative to the original plan, omitting the extra practice across the short range from 300 to 325 msec.

JS left the experiment during the first stages of his first scan up the range. AP left during stabilization training with her first interval.

5.1.2.2 Experiment 5

RW completed Experiments 2 and 3 far too late for extensive work in Experiment 5. I originally intended to examine his performance only at a single interval, 300 msec, which was the last interval he worked with in Experiment 2. His responses were correlated with the foreperiod at 300 msec, and his variances were high, so I conducted a very brief scan to 400 msec and back in the hope that this would yield better results at 300.

5.2 Results

Tables of the session by session data appear in Appendix 1. JS's results appear there only. I have not generated such a listing for AP's results, nor examined them in any detail, and there is thus no listing of her data in the appendix. She left the experiment after so few sessions that there isn't anything to learn from the data.

5.2.1 Latencies

Figures 12.1 (DK), 12.2 (IS), 12.3 (LL) and 12.4 (RW) show the response latencies (upper panels) compared to the synchronization intervals (lower panels). All of the subjects' latencies tracked the intervals closely. The mean latencies were typically within 10 msec of perfect synchrony with the onset of P2.

5.2.2 Variance Levels and q

Figures 13.1 (DK), 13.2 (IS), 13.3 (LL) and 13.3 (RW) show each session's variance (upper panel) and synchronization interval (lower panel). In preceding figures of this type, for Experiments 1 to 3, I showed foreperiod durations in a third panel, at the bottom of the page.. There is little point to such a display here because almost all of the sessions were controlled by the Apple. Apple mean foreperiods were all quite close to 1000 msec. The only sessions in which the PDP-8 was used were IS's first 8 and DK's first 6. Accordingly, I have omitted this graph for these experiments.

Tables 7.1 (DK), 7.2 (IS), 7.3 (LL) and 7.4 (RW) give average values of variance, q, coefficients of symmetry ($\sqrt{b_1}$), kurtosis (b_2), and correlation with the foreperiod, averaged across the final five sessions at each of the practiced intervals.[4] All statistics are based on latencies as measured from P1. Session by session listings of statistics concerning latencies measured from WS are in Appendix 1 but these are of little or no interest because the correlations between response latency and foreperiod duration were generally quite small.

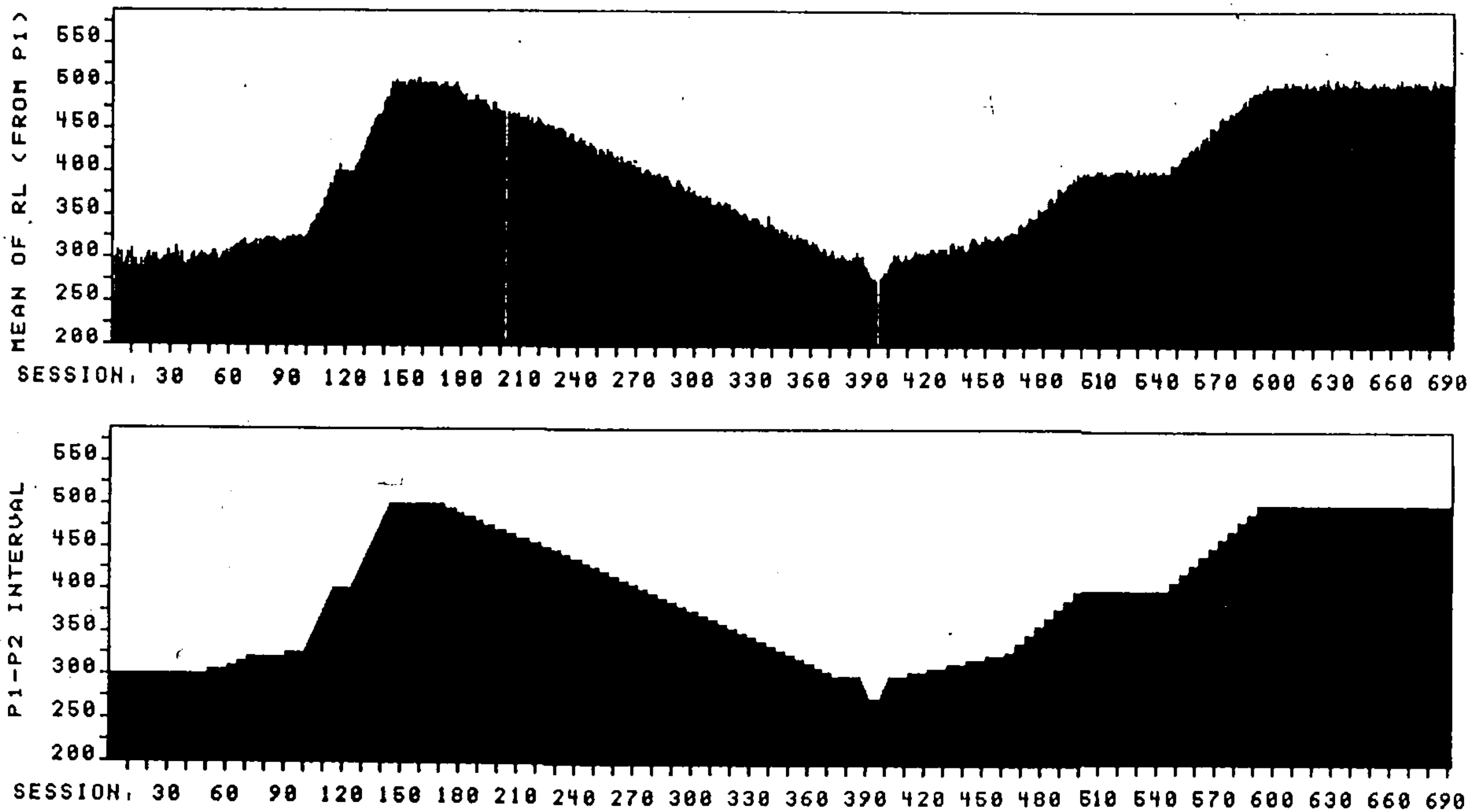
Figures 14.1 (DK), 14.2 (IS), 14.3 (LL) and 14.4 (RW) display the average variances listed in Tables 7.

FIGURE 12

Upper panel: Mean synchronization latencies (from P1), in msec, of each session. Two sessions' data are missing and are indicated by gaps in the figure.

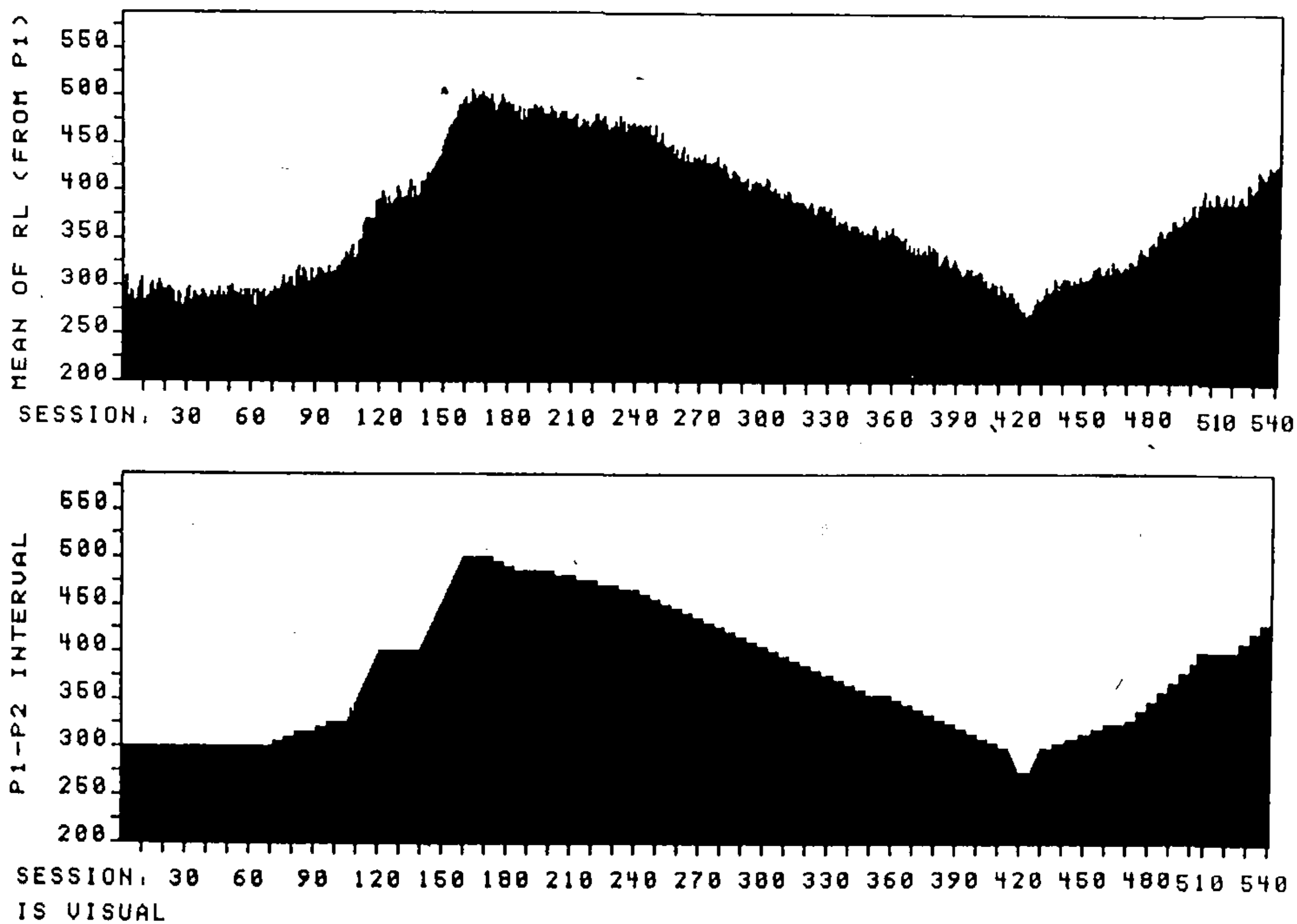
Lower panel: synchronization intervals, in milliseconds, of each session.

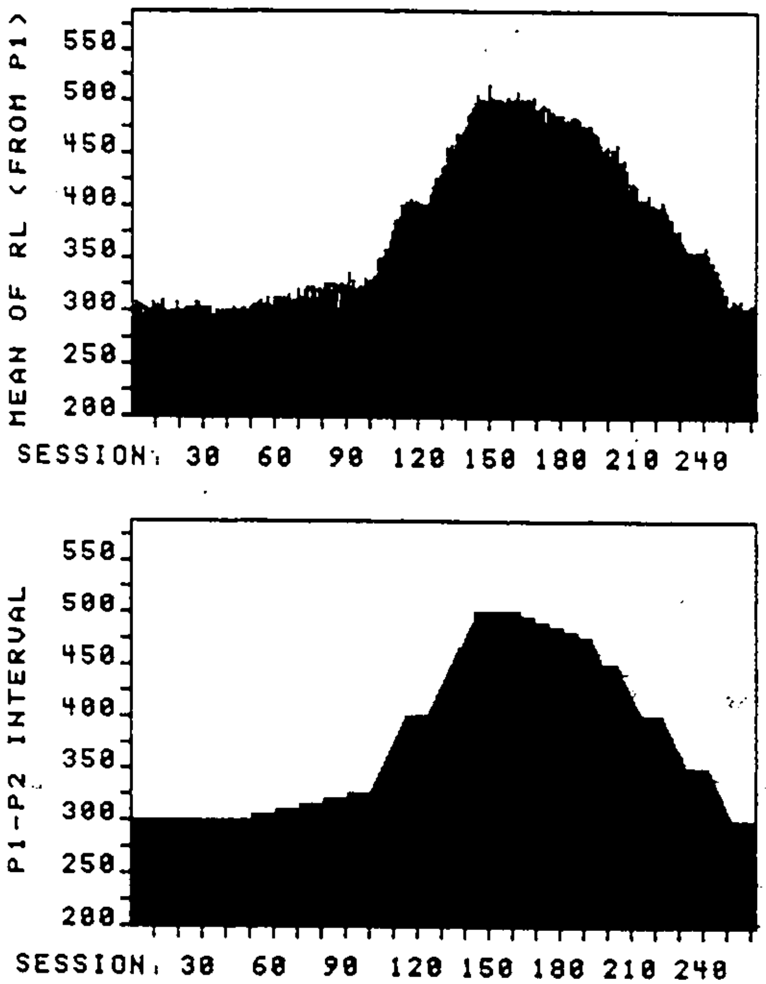
Figure 12.1: Subject DK. Figure 12.2: Subject IS.
Figure 12.3: Subject LL. Figure 12.4: Subject RW.



MEAN OF RL (FROM P1)
550
500
450
400
350
300
250
200
SESSION, 30 60 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540 570 600 630 660 690
P1-P2 INTERVAL
550
500
450
400
350
300
250
200
SESSION, 30 60 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540 570 600 630 660 690

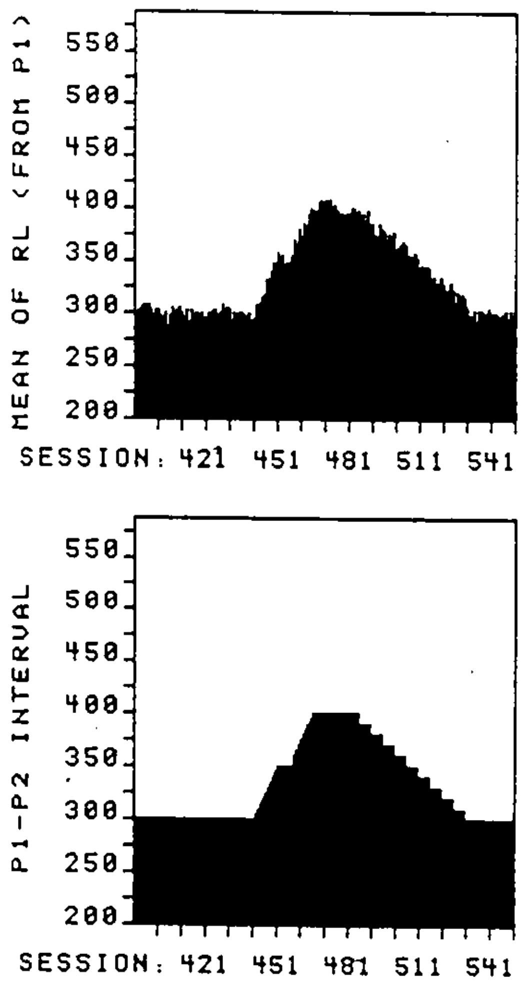
DK VISUAL


MEAN OF RL (FROM P1)
550
500
450
400
350
300
250
200
SESSION, 30 60 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540
P1-P2 INTERVAL
550
500
450
400
350
300
250
200
SESSION, 30 60 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540
IS VISUAL



MEAN OF RL (FROM P1)
550
500
450
400
350
300
250
200
SESSION: 30 60 90 120 150 180 210 240
P1-P2 INTERVAL
550
500
450
400
350
300
250
200
SESSION: 30 60 90 120 150 180 210 240

LL VISUAL


MEAN OF RL (FROM P1)
550
500
450
400
350
300
250
200
SESSION: 421 451 481 511 541
P1-P2 INTERVAL
550
500
450
400
350
300
250
200
SESSION: 421 451 481 511 541

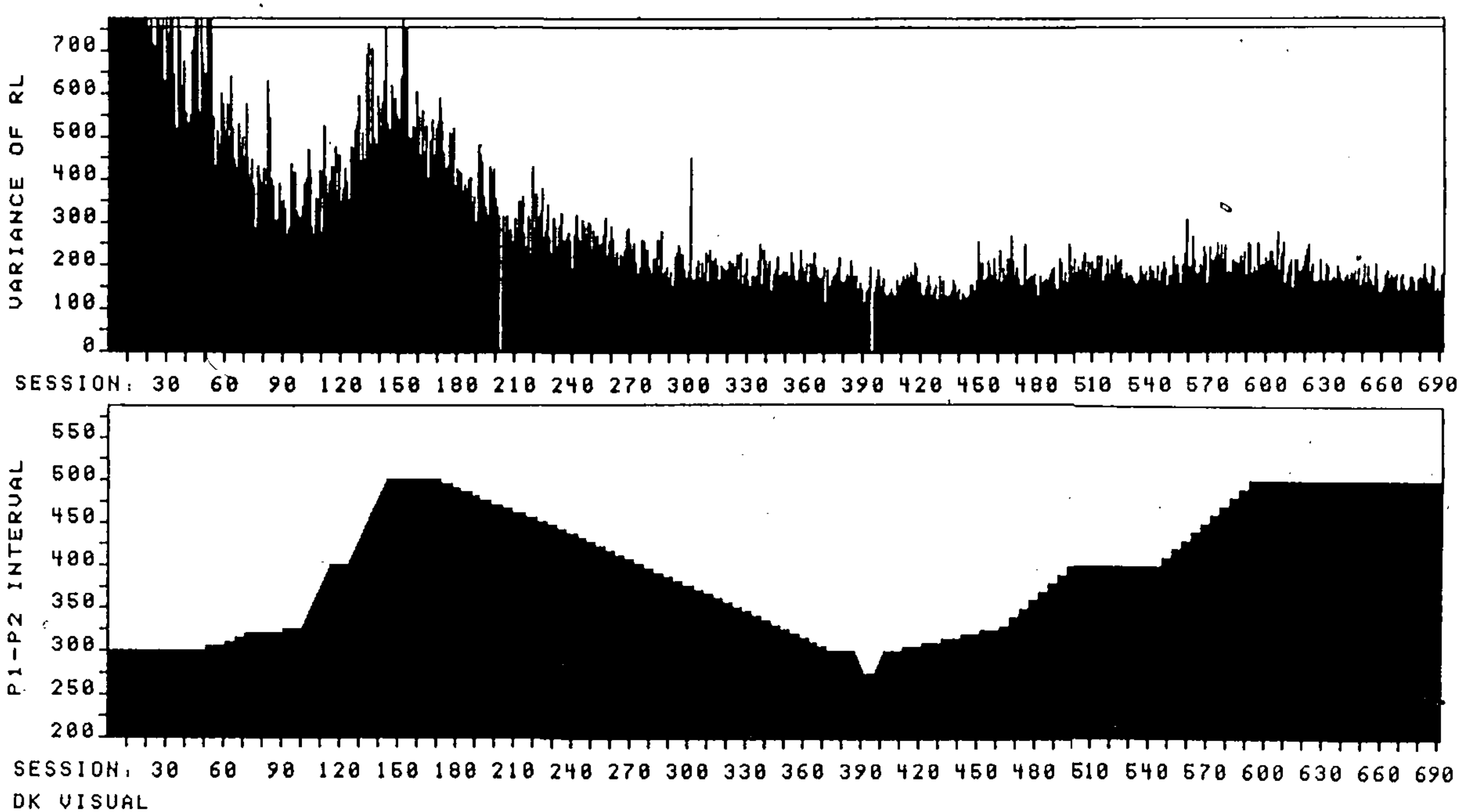
RH VISUAL

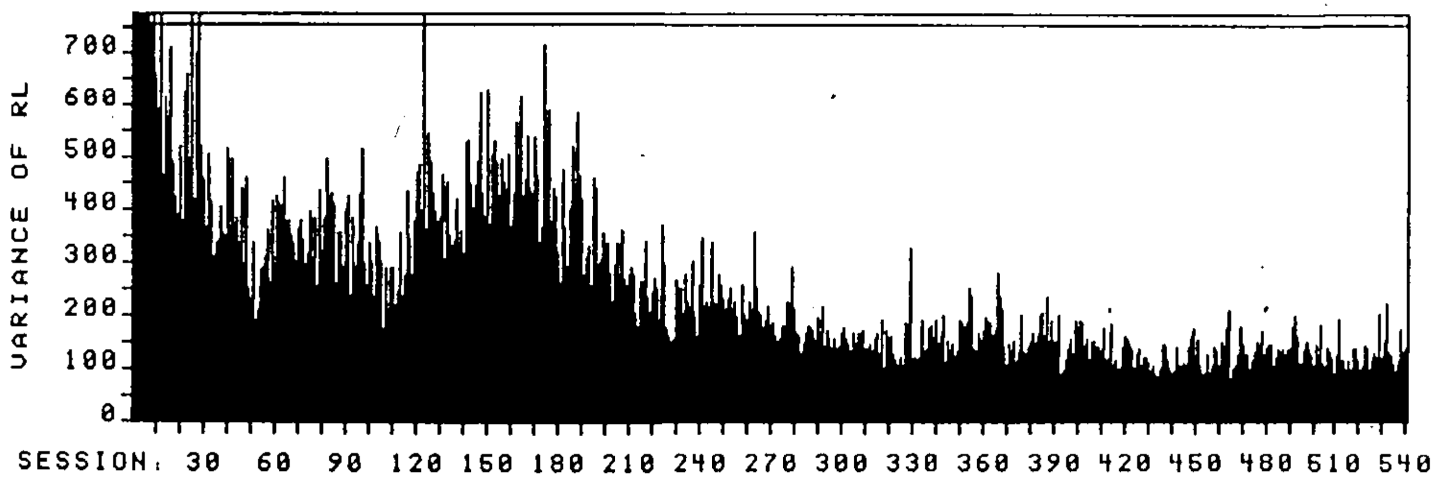
FIGURE 13

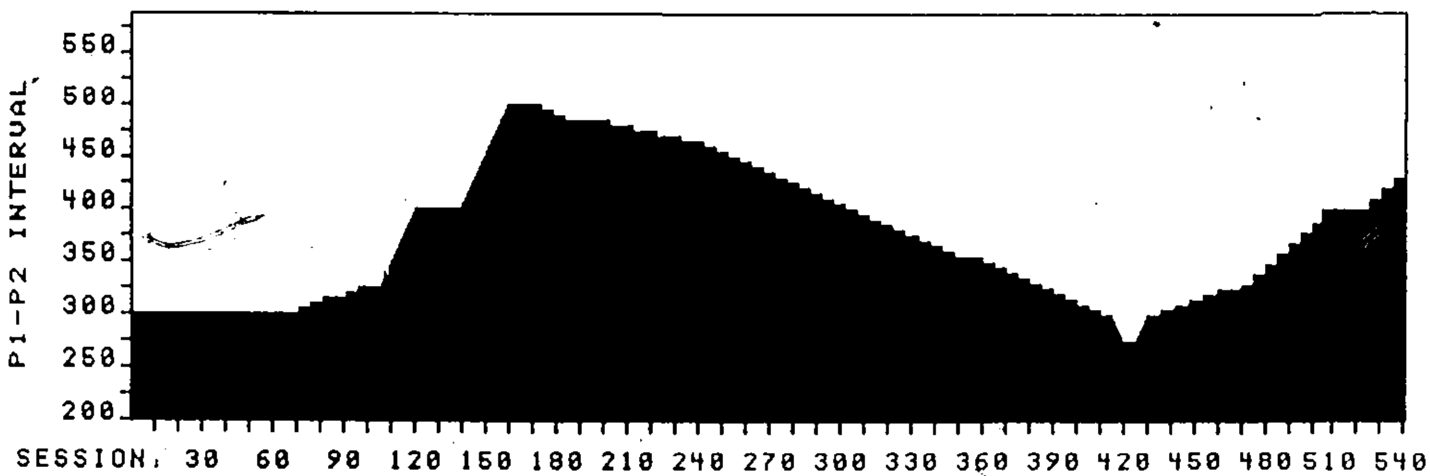
Upper panel: Response latency variance ($msec^2$) of each session. Two sessions' data are missing and are indicted by gaps in the figure. Variances shown as extending to the topmost line of the figure are larger than they appear. For exact values, see Appendix 1.

Lower panel: synchronization intervals, in milliseconds, of each session.

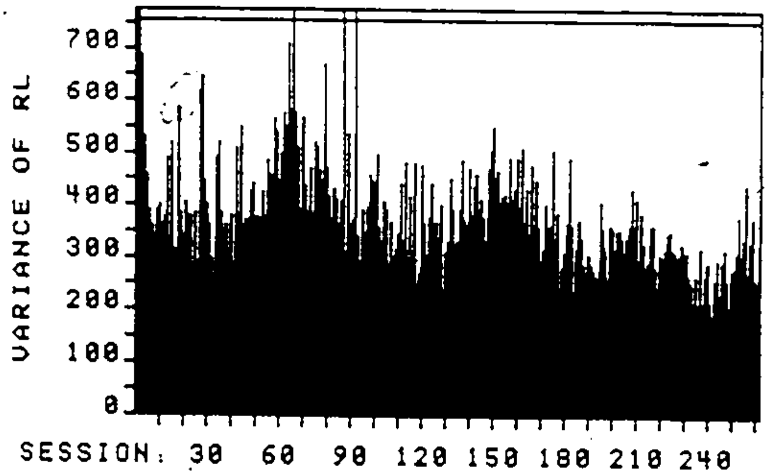
Figure 13.1: Subject DK. Figure 13.2: Subject IS.
Figure 13.3: Subject LL. Figure 13.4: Subject RW.

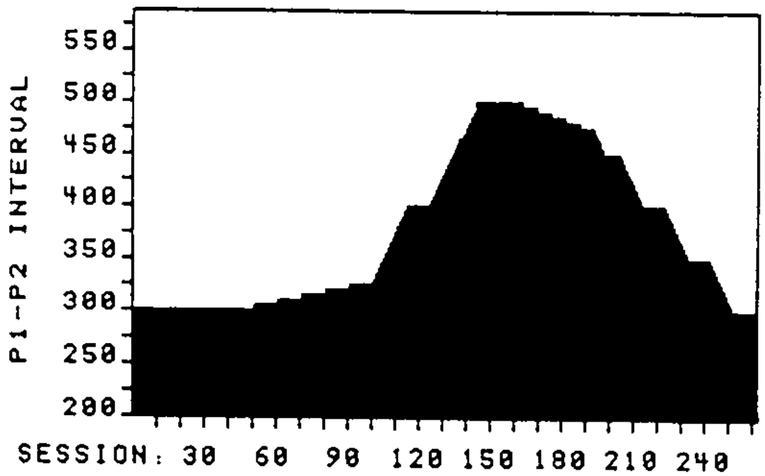

VARIANCE OF RL
700
600
500
400
300
200
100
0
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540 570 600 630 660 690
P1-P2 INTERVAL
550
500
450
400
350
300
250
200
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540 570 600 630 660 690
DK VISUAL


VARIANCE OF RL
700
600
500
400
300
200
100
0
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540

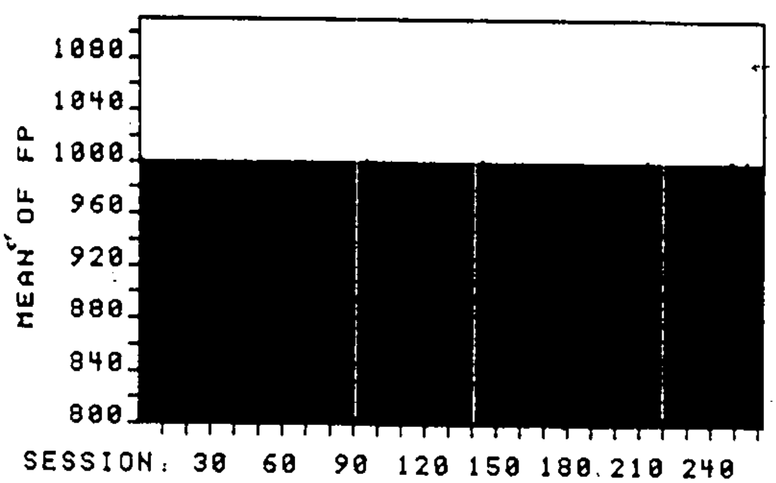

P1-P2 INTERVAL
550
500
450
400
350
300
250
200
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540

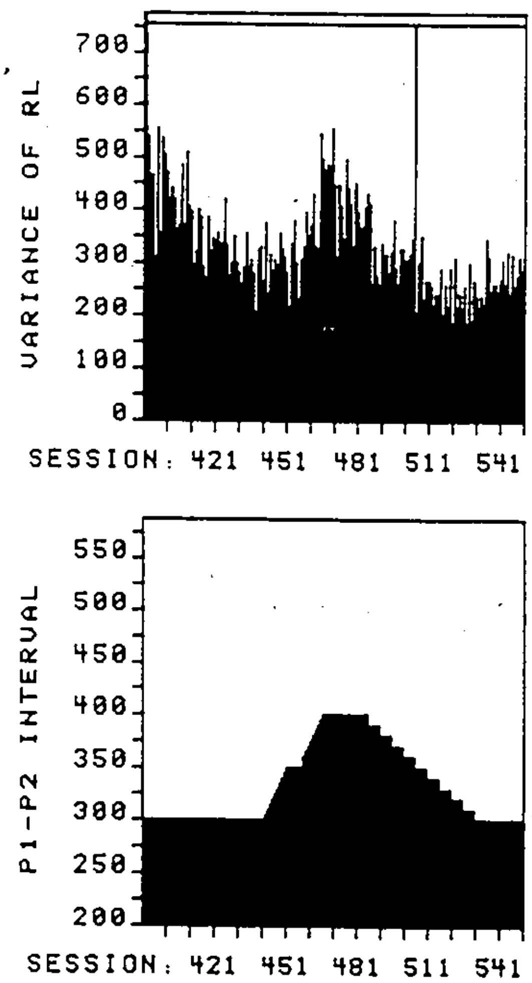
IS VISUAL


VARIANCE OF RL
700
600
500
400
300
200
100
0
SESSION: 30 60 90 120 150 180 210 240


P1-P2 INTERVAL
550
500
450
400
350
300
250
200
SESSION: 30 60 90 120 150 180 210 240

LL VISUAL


MEAN OF FP
1080
1040
1000
960
920
880
840
800
SESSION: 30 60 90 120 150 180 210 240



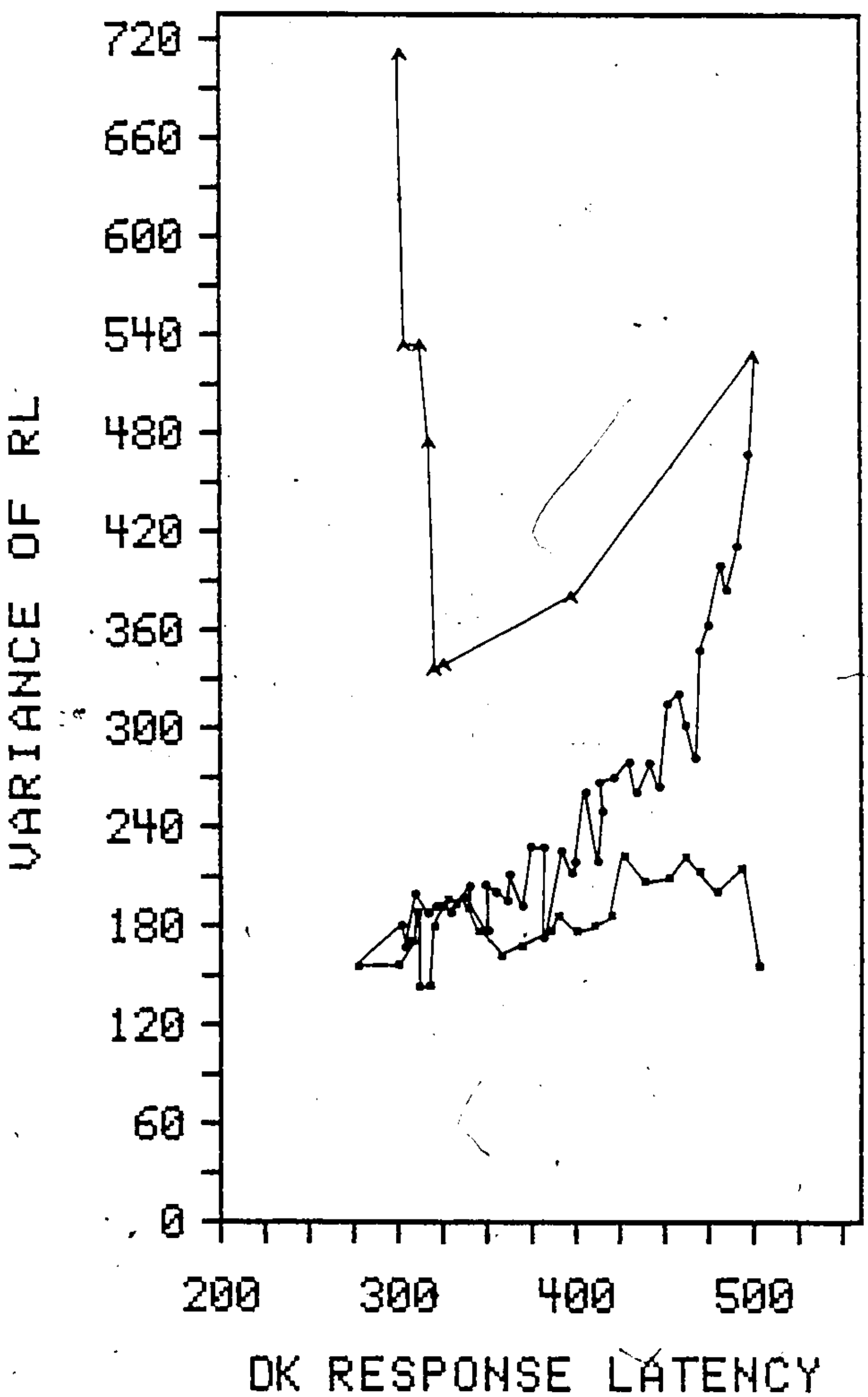
VARIANCE OF RL
700
600
500
400
300
200
100
0
SESSION: 421 451 481 511 541
P1-P2 INTERVAL
550
500
450
400
350
300
250
200
SESSION: 421 451 481 511 541

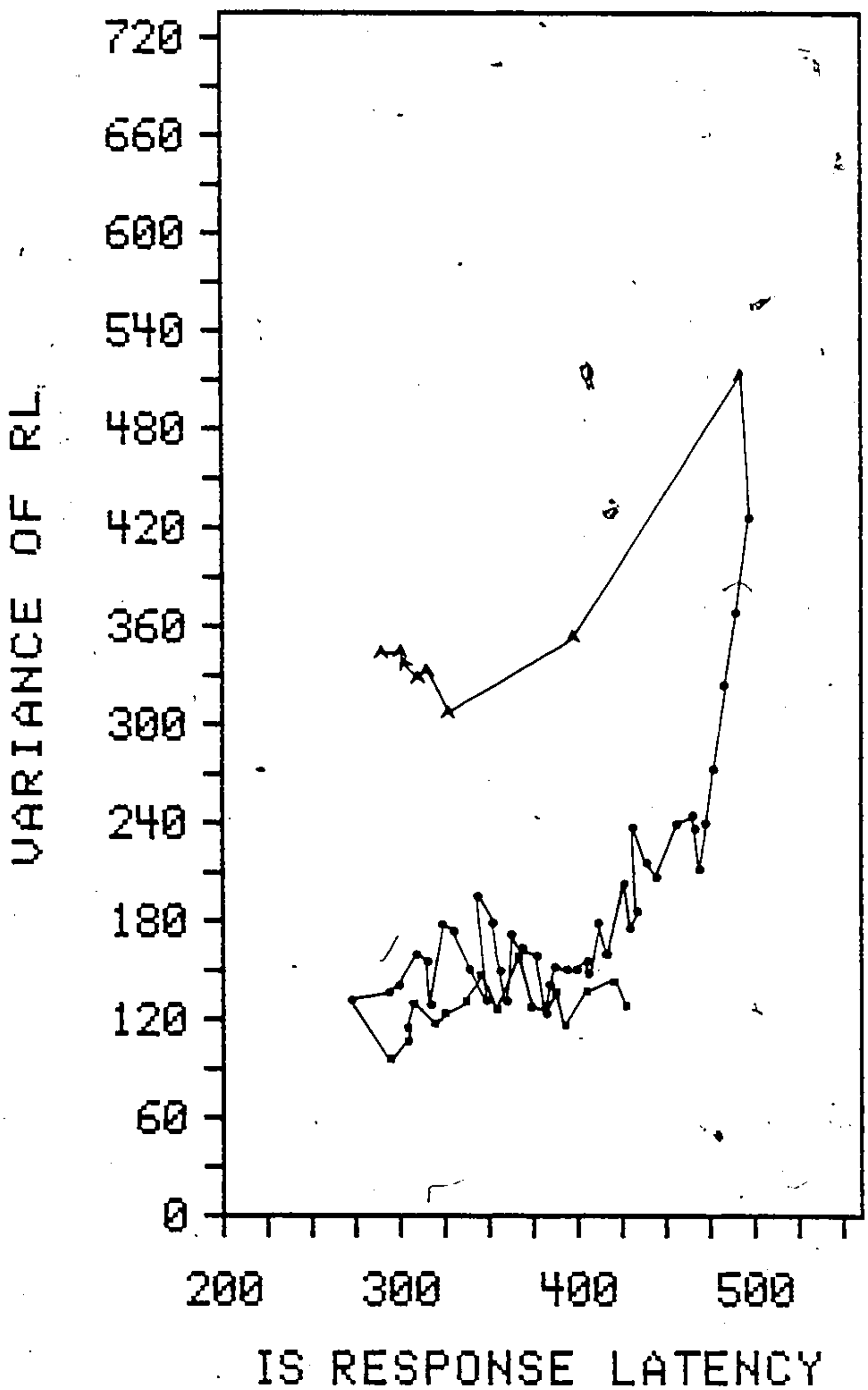
RH VISUAL

FIGURE 14

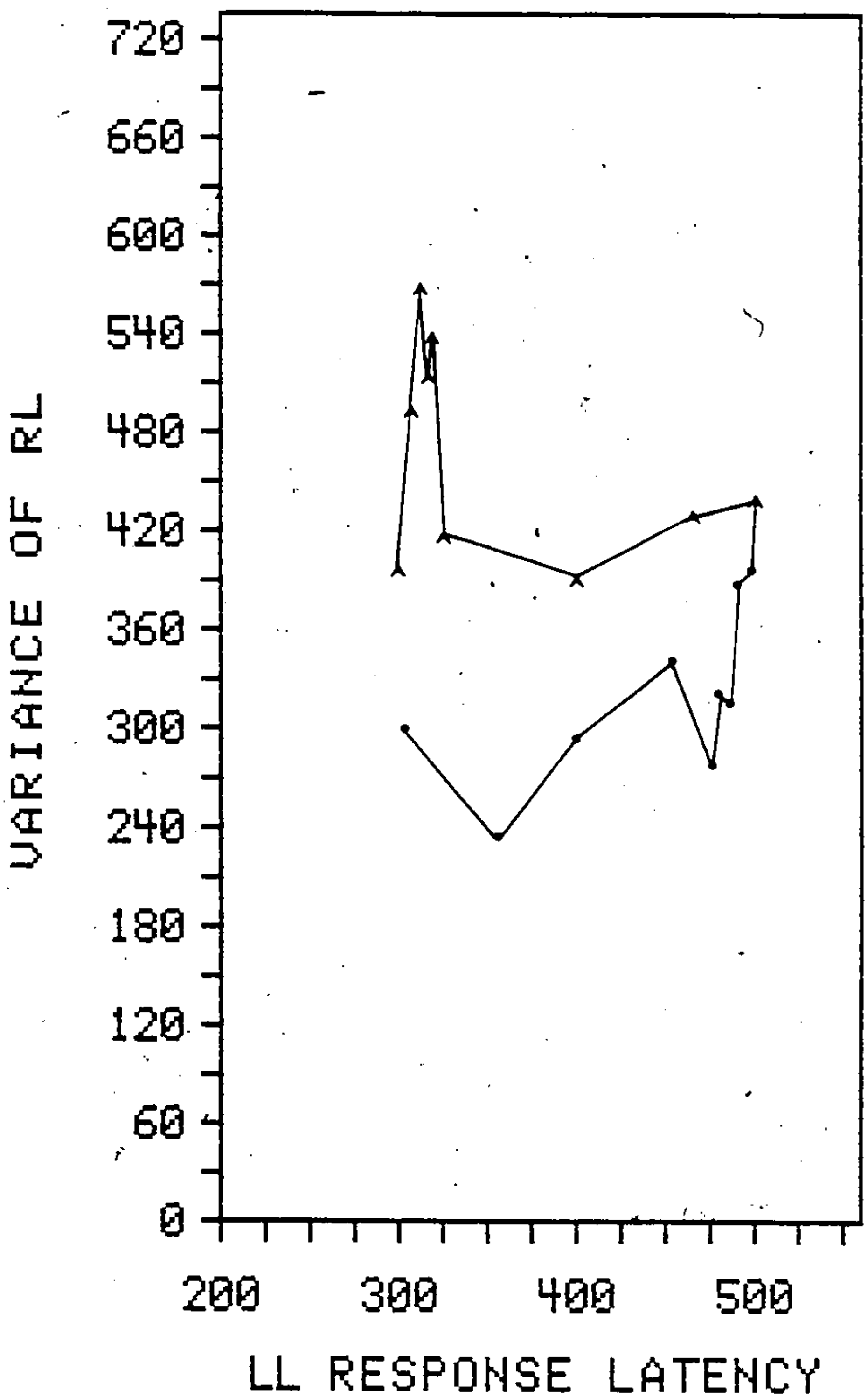
Mean within-session response latency variances (msec^2) as a function of mean response latency (msec). Arrowheads show the first ascending series. Circles show data from the descending series. Squares show data from the second ascending series. The variances plotted are listed in Tables 7.

Figure 14.1: Subject DK. Figure 14.2: Subject IS.
Figure 14.3: Subject LL. Figure 14.4: Subject RW.

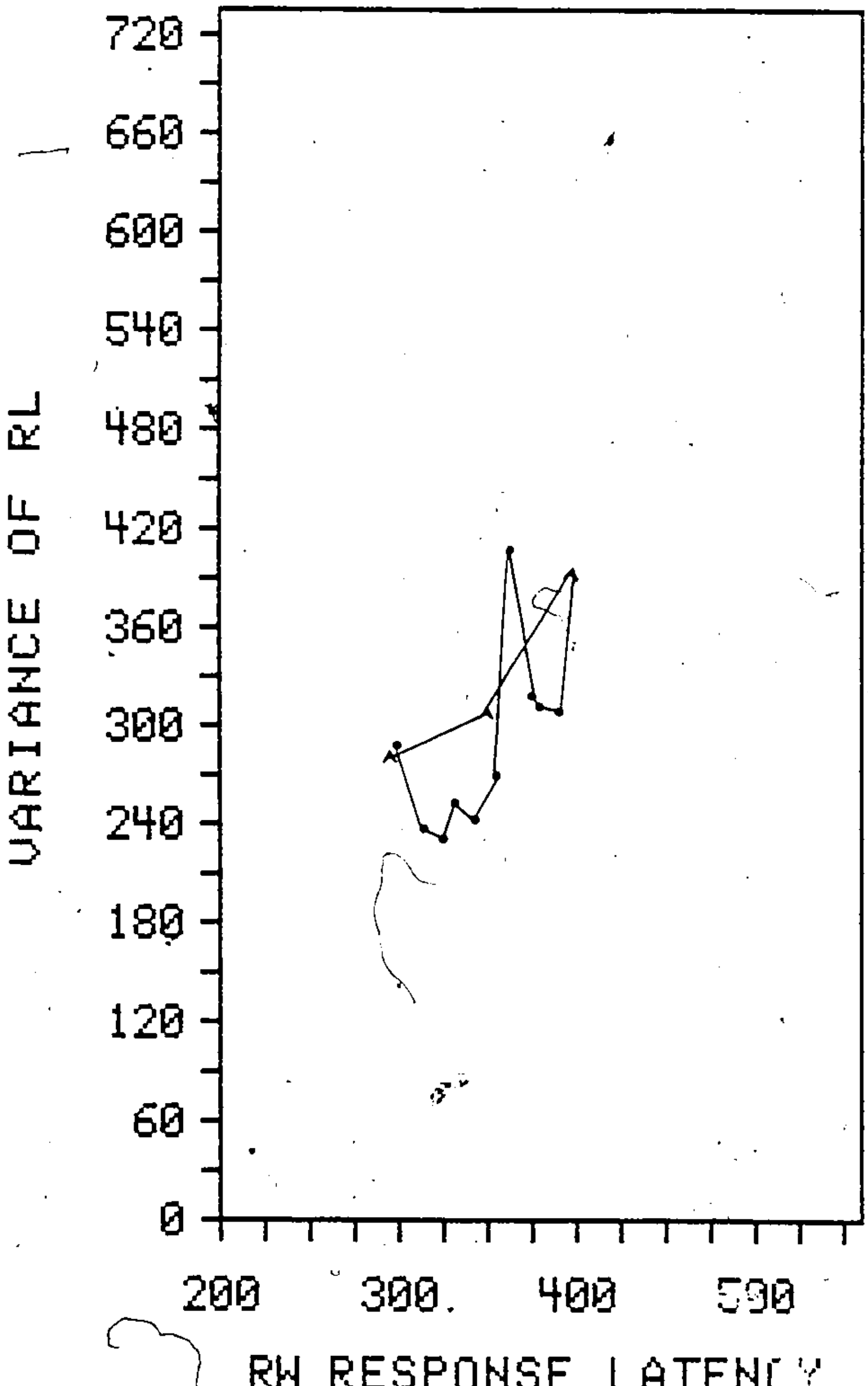

VARIANCE OF RL
720
660
600
540
480
420
360
300
240
180
120
60
0
200
300
400
500
DK RESPONSE LATENCY



VARIANCE OF RL
720
660
600
540
480
420
360
300
240
180
120
60
0
200
300
400
500
IS RESPONSE LATENCY



720
660
600
540
480
420
360
300
240
180
120
60
0
VARIANCE OF RL
200
300
400
500
LL RESPONSE LATENCY



720
660
600
540
480
420
360
300
240
180
120
60
0
VARIANCE OF RL
200
300.
400
500
RW RESPONSE LATENCY

TABLE 7

Mean within-session variances ($msec^2$), q estimates, coefficients of symmetry (ROOT B1), of Kurtosis (B2) and of correlation between response latency measured from P1 and the foreperiod duration. Only data from intervals at which the subject spent two or more consecutive sessions were averaged for this table. The averages are based on the last five sessions at this interval before the subject was transferred to the next, or, if there were fewer than five, on all sessions at the interval.[4]

Table 7.1: Subject DK. Table 7.2: Subject IS.
Table 7.3: Subject LL. Table 7.4: Subject RW.

SUMMARY STATISTICS FOR DK VISUAL
RESPONSE LATENCY MEASURED FROM P1

INTERVAL	VARIANCE	Q	ROOT B1	B2	CORR WITH FP
300	711	64.16	0.06	2.78	-0.04
305	535	55.33	0.02	3.20	-0.07
310	534	55.27	0.10	2.93	-0.04
315	474	51.91	-0.19	3.54	-0.06
320	337	43.26	-0.06	3.78	0.02
325	340	43.48	-0.10	3.58	-0.01
400	380	46.16	0.05	3.43	0.01
500	528	54.94	0.04	3.33	-0.04
495	468	51.53	-0.02	2.92	-0.03
490	412	48.21	0.06	2.89	-0.10
485	383	46.33	0.03	3.14	-0.02
480	399	47.37	0.05	2.92	-0.07
475	364	45.10	0.00	3.10	-0.03
470	349	44.12	0.06	3.15	-0.03
465	281	39.19	-0.11	3.11	-0.04
460	303	40.82	0.02	3.26	-0.07
455	320	42.09	0.03	3.16	-0.05
450	316	41.81	0.00	3.25	-0.01
445	265	37.92	0.11	3.21	-0.05
440	279	39.02	0.17	3.42	-0.04
435	262	37.67	0.01	2.90	-0.03
430	278	38.97	0.05	3.19	-0.05
425	269	38.24	0.18	3.11	0.00
420	269	38.25	-0.02	3.26	-0.02
415	249	36.63	0.12	3.11	-0.05
410	220	34.24	0.06	3.28	-0.02
405	260	37.55	-0.01	3.21	-0.01
400	219	34.08	0.11	3.27	0.01
395	212	33.49	0.12	3.47	0.01
390	226	34.73	0.09	3.41	0.01
385	176	30.10	0.02	3.12	-0.01
380	229	34.95	-0.09	3.04	0.05
375	227	34.84	0.17	3.93	0.02
370	191	31.55	-0.09	3.46	-0.02
365	210	33.28	-0.06	3.14	-0.04
360	196	31.99	-0.16	3.35	-0.04
355	200	32.36	-0.11	3.09	-0.06
350	203	32.69	0.09	3.08	-0.10
345	177	30.25	-0.23	3.36	-0.05
340	193	31.79	-0.01	2.97	-0.09

SUMMARY STATISTICS FOR DK VISUAL
RESPONSE LATENCY MEASURED FROM P1

INTERVAL	VARIANCE	Q	ROOT B1	B2	CORR WITH FP
335	198	32.19	-0.20	3.64	-0.08
330	189	31.37	-0.12	3.04	-0.10
325	192	31.62	0.04	3.13	-0.06
320	193	31.78	-0.01	3.43	-0.08
315	189	31.39	-0.04	2.87	-0.01
310	199	32.34	0.15	3.22	-0.09
305	168	29.24	0.04	2.89	-0.15
300	181	30.57	-0.08	3.26	-0.08
275	157	28.16	-0.20	3.33	-0.08
300	156	28.04	0.01	3.09	-0.06
305	171	29.62	-0.11	3.31	-0.14
310	145	26.84	-0.03	2.86	-0.10
315	145	26.81	0.12	4.24	-0.03
320	179	30.41	-0.03	3.03	-0.06
325	195	31.94	-0.09	3.25	-0.09
330	192	31.65	0.01	3.16	-0.06
340	204	32.79	-0.01	3.30	-0.08
350	178	30.28	0.00	3.51	-0.08
360	163	28.76	0.19	3.20	-0.07
370	167	29.20	0.08	3.09	-0.08
380	173	29.78	0.03	3.30	-0.05
390	185	30.98	0.11	3.00	-0.07
400	178	30.25	0.08	2.78	-0.12
410	179	30.42	0.04	3.06	-0.11
420	187	31.22	0.03	2.95	-0.11
430	223	34.51	-0.02	3.10	-0.12
440	207	33.02	-0.02	3.03	-0.02
450	209	33.22	-0.04	2.96	-0.07
460	221	34.27	0.01	2.73	-0.13
470	213	33.58	0.01	3.09	-0.09
480	200	32.44	-0.04	2.95	-0.10
490	215	33.79	-0.11	3.18	-0.11
500	156	27.99	-0.10	3.58	-0.09

SUMMARY STATISTICS FOR IS VISUAL
RESPONSE LATENCY MEASURED FROM P1

INTERVAL	VARIANCE	Q	ROOT B1	B2	CORR WITH FP
300	345	43.82	0.05	3.72	0.02
305	346	43.89	0.16	3.61	-0.01
310	339	43.42	-0.13	3.81	-0.06
315	331	42.83	0.46	3.88	-0.02
320	333	43.01	0.25	3.46	-0.02
325	308	41.17	0.04	3.26	0.00
400	355	44.52	0.26	3.07	0.10
500	427	49.10	0.07	3.18	0.00
495	513	54.09	0.25	3.42	0.04
490	370	45.47	-0.04	2.97	-0.05
485	323	42.26	0.00	2.98	0.07
480	272	38.52	0.08	3.43	0.01
475	240	35.94	-0.01	2.98	-0.03
470	214	33.67	0.00	3.26	0.01
465	236	35.60	-0.13	3.08	0.02
460	244	36.27	-0.21	3.15	-0.03
455	241	35.98	0.00	3.16	0.03
450	207	33.07	-0.03	3.36	0.03
445	216	33.81	0.44	5.32	-0.01
440	237	35.66	0.00	3.03	-0.01
435	186	31.04	0.01	2.82	-0.01
430	178	30.27	0.07	3.01	0.06
425	203	32.66	-0.15	2.95	-0.04
420	159	28.35	-0.08	3.15	-0.03
415	180	30.49	0.23	3.07	-0.03
410	151	27.52	0.06	3.60	0.01
405	155	27.89	-0.10	2.94	0.04
400	150	27.38	0.01	2.93	-0.02
395	149	27.28	0.12	3.26	0.02
390	153	27.76	-0.08	2.95	0.00
385	142	26.47	0.05	3.30	0.00
380	127	24.69	0.00	3.06	-0.02
375	159	28.38	-0.14	3.41	-0.02
370	162	28.66	-0.04	3.36	-0.01
365	170	29.45	-0.10	3.07	-0.08
360	132	25.28	0.04	3.15	-0.06
355	150	27.39	-0.05	3.32	0.01
350	179	30.40	-0.18	3.37	-0.06
345	194	31.84	-0.03	3.46	-0.11
340	133	25.44	0.01	3.71	-0.02

SUMMARY STATISTICS FOR IS VISUAL
RESPONSE LATENCY MEASURED FROM P1

INTERVAL	VARIANCE	Q	ROOT B1	B2	CORR WITH FP
335	149	27.32	0.07	3.40	0.01
330	174	29.93	0.04	3.41	-0.10
325	177	30.20	0.08	3.53	-0.05
320	129	25.02	0.03	3.37	-0.09
315	156	28.03	-0.06	3.53	-0.03
310	158	28.21	-0.04	4.55	0.06
305	141	26.34	0.08	2.93	0.05
300	139	26.13	-0.01	3.58	-0.06
275	132	25.31	-0.17	3.44	-0.03
300	95	20.52	-0.03	3.24	-0.03
305	109	22.51	0.08	3.08	0.02
310	113	22.92	0.18	3.40	0.02
315	129	25.02	0.13	3.61	0.02
320	116	23.37	0.11	3.76	0.01
325	117	23.51	-0.28	4.16	-0.04
330	122	24.17	0.05	3.39	0.02
340	142	26.44	-0.11	3.19	0.03
350	131	25.19	0.14	3.11	0.04
360	132	25.29	0.11	3.07	-0.01
370	159	28.34	0.10	3.30	0.05
380	130	25.11	0.22	3.44	-0.02
390	137	25.88	0.11	3.10	-0.04
400	118	23.68	0.17	3.40	-0.01
410	139	26.12	0.15	3.46	-0.02
420	148	27.18	0.20	3.76	-0.03
430	130	25.12	0.11	3.12	0.01

SUMMARY STATISTICS FOR LL VISUAL
RESPONSE LATENCY MEASURED FROM P1

INTERVAL	VARIANCE	Q	ROOT B1	B2	CORR WITH FP
300	397	47.21	0.04	3.54	-0.02
305	493	52.99	0.31	3.58	-0.03
310	566	56.95	0.41	4.27	0.00
315	513	54.11	0.11	4.44	0.01
320	538	55.46	0.32	3.77	-0.01
325	416	48.41	0.10	3.06	-0.02
400	393	46.99	0.18	3.29	-0.02
465	428	49.19	0.30	3.32	-0.18
500	438	49.78	0.42	3.60	0.01
495	396	47.16	0.30	3.73	-0.01
490	386	46.56	0.30	4.31	-0.07
485	316	41.81	0.36	3.80	-0.01
480	321	42.14	0.08	3.15	-0.03
475	280	39.11	0.24	3.20	0.01
450	341	43.55	0.28	3.53	-0.02
400	295	40.27	0.22	3.34	-0.06
350	233	35.29	0.17	3.42	-0.05
300	299	40.52	0.12	3.17	-0.02

SUMMARY STATISTICS FOR RW VISUAL
RESPONSE LATENCY MEASURED FROM P1

INTERVAL	VARIANCE	Q	ROOT B1	B2	CORR WITH FP
300	281	39.22	0.12	3.24	-0.11
350	310	41.37	-0.02	3.00	-0.06
400	392	46.93	0.22	3.45	-0.09
390	308	41.22	0.09	3.22	-0.07
380	312	41.50	0.05	3.01	-0.09
370	317	41.87	0.04	3.11	-0.07
360	405	47.74	-0.08	3.55	-0.10
350	269	38.30	0.03	2.99	-0.14
340	244	36.28	0.07	3.13	-0.16
330	251	36.82	0.06	3.13	-0.12
320	232	35.23	-0.03	3.13	-0.12
310	238	35.71	0.04	3.25	-0.15
300	287	39.64	0.22	3.77	-0.18

The results from DK and IS are quite similar. DK's final variances (averaged across the last 5 sessions per interval) ranged from 156 to 223 msec². The variances at the intervals at which extensive stabilization training was done, 300, 400 and 500 msec, were 156, 178 and 156 msec² respectively. Average estimates of q during the final scan upward range from 28.0 to 34.5, hovering about 30. IS's variances were lower, ranging from 95 msec² to 148 msec². At the two intervals at which there was long practice, 300 and 400 msec, his variances were 95 and 118 msec² respectively. Estimates of q for IS range from 20.5 to 28.3, generally quite close to 25.

IS's variances were lower than any obtained in Experiment 2 and they compare well with the previous auditory results of Brewster (1983) and Kristofferson (1976). His q is right where it should be: close to 25. DK's variances were higher, but they were certainly as good as those obtained in Experiment 2. They are slightly better than those obtained from one of Brewster's subjects. DK's q is not 25. I doubt that her variability would decline much further with more practice, so I would not expect her q estimates to drop to 25.

If we interpret the data in terms of Hopkins' model, q is the scale parameter of a triangularly distributed variable, which is convoluted with a logistic variable to yield the actual response distribution. I estimate q by subtracting 25 msec² from the response latency variance, assuming that this is the variance of the logistic motor component. The remaining variance is assumed to be that of the triangle, which is specified by the formula: Variance = $q^2/6$. This is a rough estimation procedure. One might under whether DK's motor variance is not higher than IS's, in which case her q estimate would be higher than his simply because not enough motor variability was subtracted from her latency variance. This is not the explanation. DK's kurtosis coefficients are not higher than IS's -- if they are different, DK's are lower -- and we should find kurtosis increasing with increasing motor variance, i.e. with increasing contribution of the higher kurtosis logistic variable to the overall variance of the data. If DK's motor variance is so high that subtraction of all of it would result in a drop in the q estimate to 25, then IS's q should drop to 20, and we would face the same difficulty. Supposing that DK's q is 30, the question is, is this "close" to 25 or not? I don't know. The estimates of 12.5, 25, 50 and 100 for q levels are empirical. There is no theory that forces q to take on these particular levels. Values of 15, 30, 60 and 120 would be every bit as compatible with Kristofferson's (1980) quantal counting with steps model, for example. There is no quantitative theoretical expectation regarding variability of q across people, although given that quantal theory ties the q level to a fundamental (if hypothetical) physiological process, we should not expect "too much" variance. Is a deviation of 20% from the 25 msec level "too much"?

In terms of overall variance levels, I conclude from IS's and DK's data that visual and auditory synchronization variances are, or at least can be, the same. There is no evidence in these data that visual variances are higher than auditory variances. With respect to q, IS's results are unambiguous and, given these, I hesitantly interpret DK's q of 30 as passably close to 25.

LL's variances are higher than those of IS and DK but it must be remembered that she completed fewer than half as many sessions (261 compared to DK's 691 and IS's 540). Her variances during the initial scan upward, when she and the other subjects were on the same training schedule, are quite comparable to those of the other subjects, ranging from 393 to 566 $msec^2$, compared to DK's first scan range of 337 to 711 $msec^2$ and IS's 308 to 427 $msec^2$. LL's scan back to 300 msec was much faster than IS and DK's. Her variances on the way down the range were lower (280 to 396 $msec^2$, compared to 393 to 566 $msec^2$ during the scan up). Presumably they would drop further with further practice. Given that this is not asymptotic performance, I am not concerned that the q estimates are near 40 msec, with one value near 35. Values slightly higher than 40 might be acceptably close to 50 or they might not, but these variances have not settled down to a final level and the 25, 50 or 100 msec q values are predictions about final level performance.

LL's data highlight one problem with comparison of visual and auditory performance. The visual results may drop to the auditory levels, but it takes a long time to get them this low. It may take twice as many sessions, depending on the subject, before the low variance levels are reached. Perhaps with this much practice with auditory intervals, lower auditory levels would be reached.

I take it as granted that visual synchronization is more difficult than auditory synchronization. If there was no difference, Hopkins' subjects would have used the visual stimuli, not the tactile feedback from the trial initiation response, and the delayed (auditory and visual) feedback given after P2. I noted in the introduction a number of sources of difficulty, for the subject, in the visual situation. I don't think that these differences between the auditory and visual tasks can be eliminated, though perhaps a huge visual display (a wall, rather than a degree visual angle) would minimize them. It would be most pleasant, theoretically and practically, if visual subjects' variances declined at the same rate as auditory subjects' variances. But given the differences in physical variability (due to the changing posture of the subject) and of salience between the visual and auditory stimuli, the finding that subjects take longer to finally bring their visual synchronization standard deviations down to 10 msec, a remarkable level of precision whatever the stimulus modality, cannot be taken as an important difficulty for theory.

Turning to Experiment 5, RW's data were more variable than his auditory data, and they remained more variable. His responses were correlated with foreperiod duration, negatively, as in his Experiment 3 data, rather than positively as they were in his comparably long Experiment 2 performance. I'll return to this later. For now I will note that the variances of the latencies measured from the warning stimulus are higher than the variances from P1. His variances are frankly disappointing, however they are calculated.

5.2.3 Variances Across the Range

The relation between duration and variance was not monotonic in LL's data. The variances differed so much from interval to interval that I am wary of calling them constant across the range. Figures 13.3

and 14.3 describe LL's results better than I can verbally and I will say no more about them.

DK and IS showed an increasing relation between duration and variance during their initial scan up to 500 msec. This was also evident in the scan down, at least to 400 msec. From 400 to 275 msec the variances change little in either subject's data.

During the final scan upward, there was some tendency for the variances to increase again. As the intervals were lengthened, the variances of the first session or two were often higher than those obtained later, especially in DK's data. IS's variances were more stable and fluctuation in his variance at a given interval often appeared random.

The increase in DK's variances is most evident in her final five session averages from 400 to 500 msec. Variances rose from 178 msec² to values quite consistently, if sometimes only slightly, greater than 200 msec². The abrupt drop to 156 msec² at a P1-P2 interval of 500 msec from 215 msec² at 490 is not due to random fluctuation in the data. DK ended the experiment with 100 sessions at 500 msec. Her variances slowly declined from the low and mid 200's to values around 175 msec², and, finally, to values around 155 msec², the same as her performance at 300 msec. Transfer of training, and previous training at these intervals, did yield a substantial drop in variance relative to her earlier performance, during the first ascending series, but this transfer effect seemed to be limited. It appeared that to achieve levels below 200 msec², DK required extensive recent practice at the interval under study. Kristofferson (1976) and Hopkins (1982) were more successful in transfer studies. Across the 150 to 550 msec auditory range, it appears that once a subject achieves a low level of variability, that level can be maintained across the range, even with changes of 100 msec in the P1-P2 interval. That degree of success was not evident in Experiment 2 (or Experiment 1), but so little practice was given at intervals other than the highly practiced ones that we have little basis for comparison in those data. It is at least possible, given DK's results, that to achieve asymptotic visual performance levels one requires more training at the specific interval under study, as well as more training across the range, than is true for auditory synchronization. I am not certain that this is a "real" difference between auditory and visual results. This may merely reflect a difference between subjects. Supposing that the difference is replicable, and the slight increasing trend in IS's data suggests that it may well be, I am not at all sure that it should be considered an important difference.

I think that the key finding in these data is that after much training at specific intervals (300, 400, 500 msec), variances do not differ. Nor is there any trend in the coefficients of skewness (DK's were .01, .06, and -.10 at the three intervals; IS's were -.03 at 300 and .17 at 400, but they were generally positive from 300 to 430 msec) or in the coefficients of kurtosis (DK: 3.09, 2.78, 3.58; IS: 3.24 and 3.40, but there is no hint of an increasing trend from 300 to 430) or in the correlation between latency and foreperiod duration (DK: -.08, -.12, -.09; IS: -.03, -.01). The distributions are very similar in scale and shape at each of the practiced intervals. This is precisely what we should expect on the basis of the auditory results.

RW's transfer data again tell a different story. His variances are roughly increasing with duration, during the scan up and back down. His timing variances may have been constant from 350 to 300 msec, i.e. across half of the range studied, but I wouldn't argue forcefully that this was the case.

5.2.4 Scanning of the Range

All subjects' variances were lower during the descending series than they were during the initial ascending series. Variances tended to level off across a range over which they had previously been increasing in IS and DK's data (see Figures 14). LL's variances varied less during the descending series, and in this sense they approached constancy as well. During the final ascending series, DK and IS's variances declined further and they varied less over a wider range. This is all in accord with the expectations from the auditory data.

5.2.5 Continuous Adjustability

The question in this case is whether very small changes in the synchronization interval will have effects on the response distribution's scale and shape. If the subject can change her mean by a few msec without changing any other aspect of the distribution, we have evidence of a process that can generate delays on a continuous (rather than discrete, as in quantal) scale. If the subject can also produce widely different intervals without changing the scale (variance) or shape of the distribution, which we have already seen can be done in visual synchronization, we have evidence for a deterministic source of internal delays, i.e. one which times intervals without variability. If the same process is involved in timing similar intervals and more widely separated intervals (and if the response distributions are all the same except for the means, why would we want to assume that different processes are involved?), then we have evidence for a source of continuously adjustable deterministic delays.

The relevant data come from DK and IS, especially at 300, 305, 310, 315, 320 and 325 msec. These subjects practiced for extra sessions at these intervals so if there are effects of shifting the P1-P2 interval slightly (by 20% or less of q), they should show up here more clearly.

Examining DK's data first, from 300 to 325 msec we find variances of 156 (181), 171 (168), 145 (199), 145 (189), 179 (193) and 195 (192) $msec^2$ respectively. The bracketed values are from the end of the descending series. The values not bracketed are from the start (final five sessions, but among the first intervals) of the final ascending series (which immediately followed the descending series). There is no greater variation across intervals than there is from replication (last 5 sessions, descending) to replication (last 5 sessions, ascending) at the same intervals. There is no trend in the symmetry coefficients either. The ascending and (bracketed) descending series values are .01 (-.08), -.11 (.04), -.03 (.15), .12 (-.04), -.03 (-.01) and -.09 (.04). The kurtosis values are 3.09 (3.26), 3.31 (2.89), 2.86 (3.22), 4.24 and 2.87, 3.03 (3.43) and 3.25 (3.13). These coefficients are highly variable (as they should be) but the variation does not look systematic. The correlations are all nearly the same.

I'll repeat this listing for IS in the next paragraph. There is no indication of a shift in scale, shape or correlation in his data either. The other way to look for trends, and probably the most powerful way, is to scrutinize Figures 13 (variance per session), 14 (average variances across the final five sessions at each interval), 15 (correlation), and 16 (symmetry and kurtosis) for periodic or monotonic changes in the distributions as the interval was changed during the final ascending series. Except for a slight increase in variance with duration, I see no trends in DK's or in IS's data in any of the graphs.

Returning to IS's data, from 300 to 325 msec, during the ascending and (bracketed) descending series the respective variances are 95 (139), 109 (141), 113 (158), 129 (156), 116 (129) and 117 (177) $msec^2$. The descending series variances are higher. That's the only trend that I see here. The symmetry coefficients are -.03 (-.01), .08 (.08), .18 (-.04), .13 (-.06), .11 (.03) and -.28 (.08). The kurtosis coefficients are 3.24 (3.58), 3.08 (2.93), 3.4 (4.55), 3.61 (3.53), 3.76 (3.37) and 4.16 (3.53).

If we accept the conclusion that there is a source of continuously adjustable internal delays for timing auditory intervals, we must also accept the conclusion that there is one for visually bounded intervals.

If we accept Kristofferson's (1976) hypothesis that these internal delays are generated in the afferent component of the stimulus response chain, then either visual afferent latencie are not variable or there is a temporally variable and a nonvariable subsystem(s) in the visual system, with recycling of the stimulus information (the basis of the delay) only being done in the nonvariable subsystem. To turn this around, Hopkins argued that visual latencies must be more variable than auditory latencies (which appear to be constant) because visual synchronization variances appeared greater than auditory variances. The poor visual performance in his task appears, from the results discussed so far, to have been due to the details of his procedure and stimuli, not to any problem intrinsic to the visual system. There is no reason to suppose, from these data, that visual afferent latencies are variable, or, if they are variable, that they are more variable than auditory latencies. Visual synchronization data, then, in no way conflict with Kristofferson's hypothesis that continuously adjustable internal delays (now equally strongly demonstrated in the visual and auditory modalities) are generated at the afferent level.

5.2.6 Correlations

There are indeed mild correlations between latency and foreperiod duration in the data of Experiment 4. Figures 15 display the correlations obtained during each session. Tables 7 list the averages at the practiced intervals. The correlations are no greater than those obtained in Experiment 1, when very long auditory intervals were studied. They are sufficiently small that we can consider the dominant controlling stimuli in the task the visual stimuli, i.e. Experiment 4 was in fact as well as in name a study of visual synchronization. There is no evident relation between correlation and

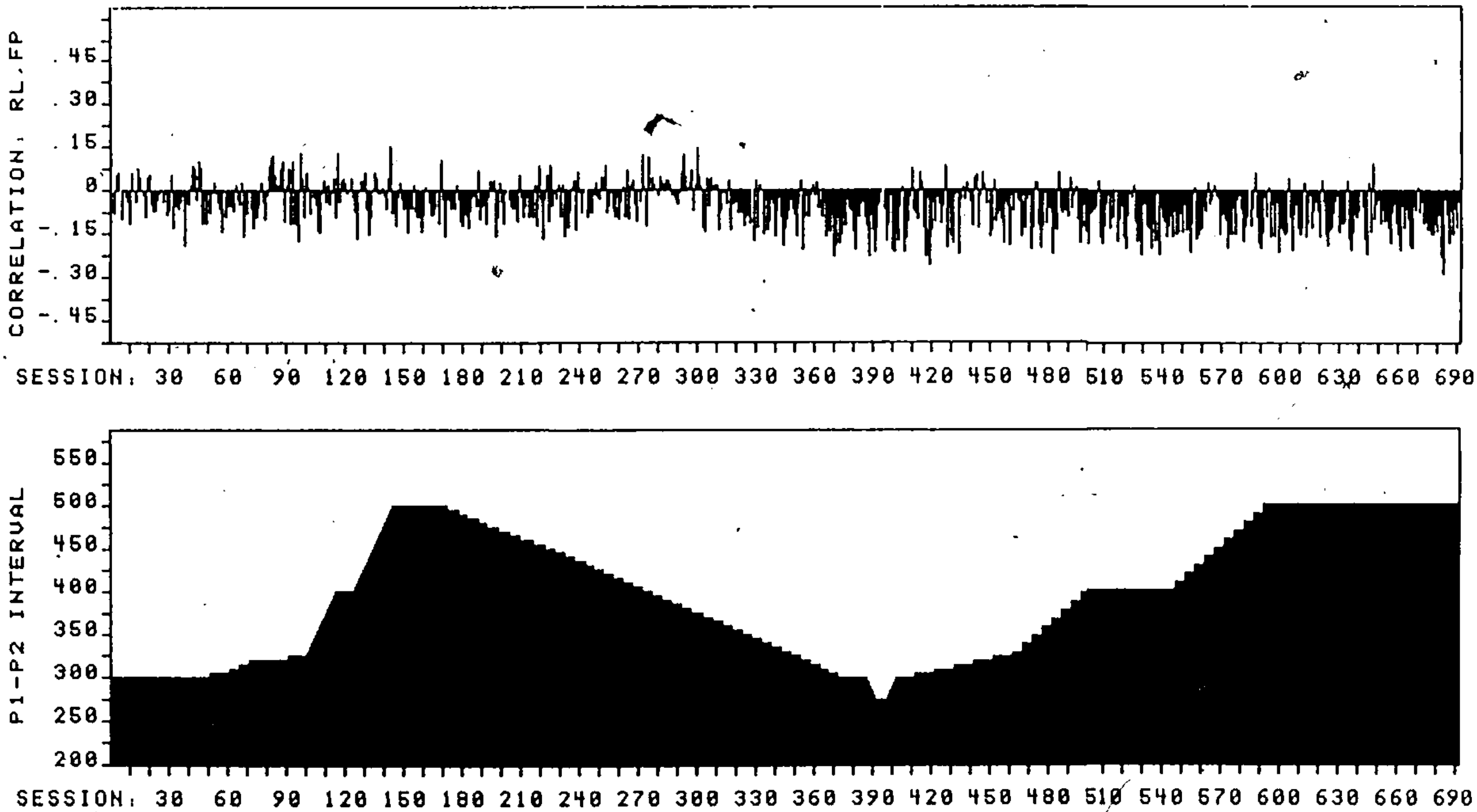
FIGURE 15

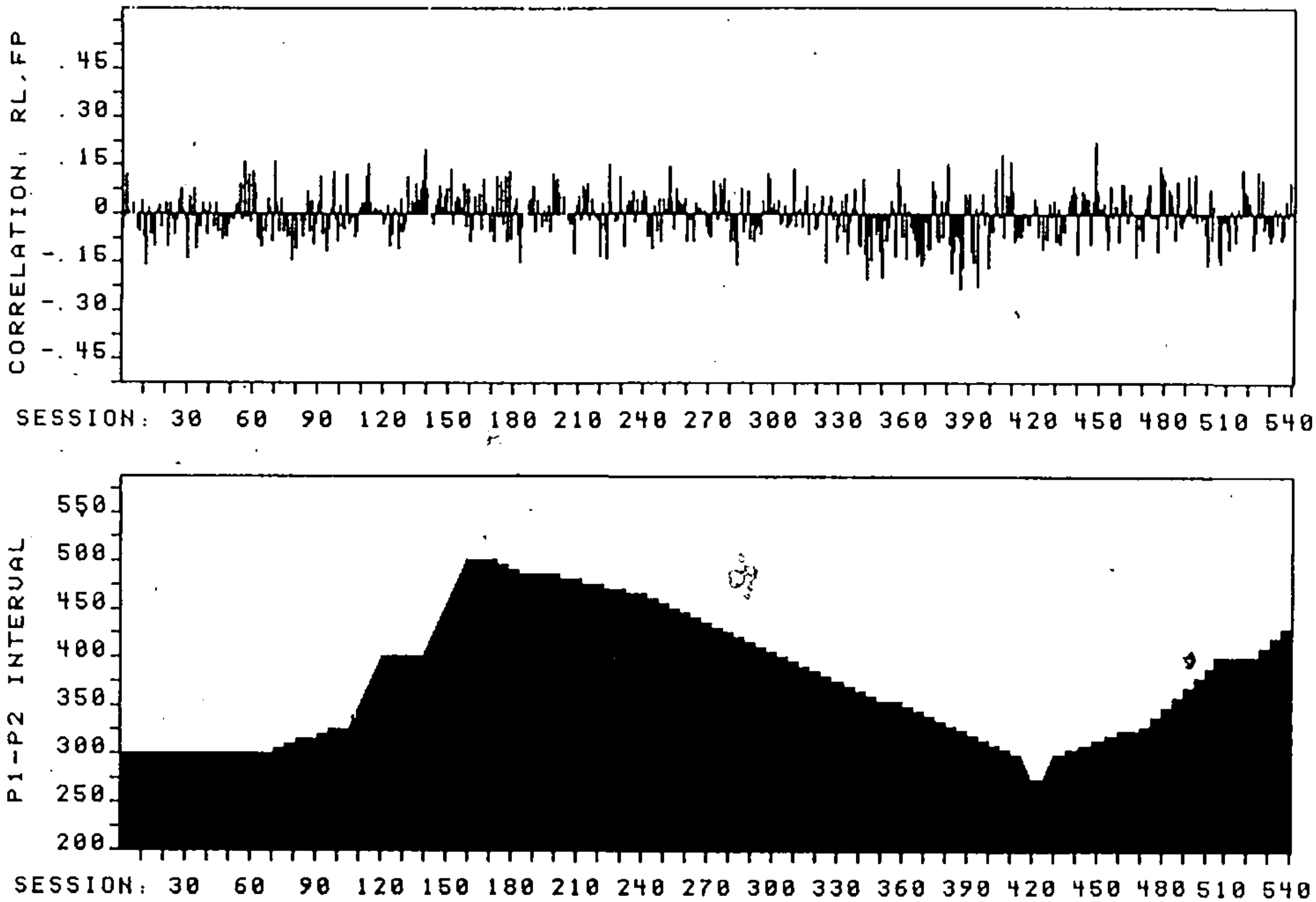
Upper panel: Correlation between response latency (from P1) and foreperiod duration for each session. Some sessions' raw data were lost and correlations could not be calculated. These are indicated by gaps in the figure.

Lower panel: synchronization intervals, in milliseconds, of each session.

Figure 15.1: Subject DK. Figure 15.2: Subject IS.

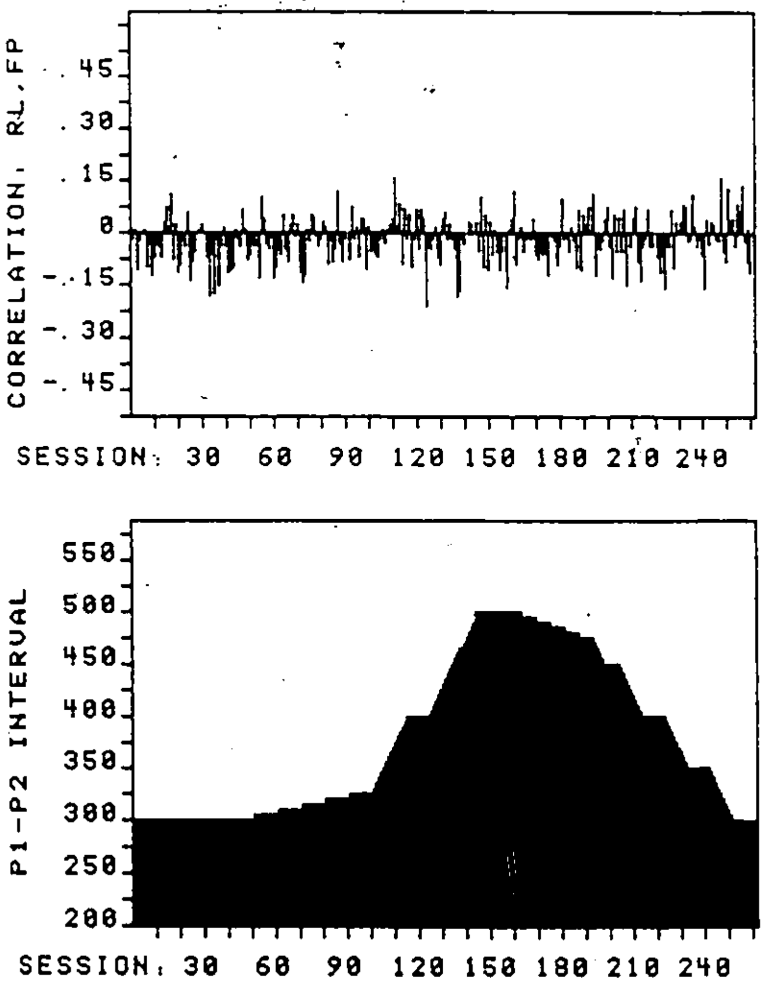
Figure 15.3: Subject LL. Figure 15.4: Subject RW.


CORRELATION, RL.FP
.45
.30
.15
0
-.15
-.30
-.45
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540 570 600 630 660 690
P1-P2 INTERVAL
550
500
450
400
350
300
250
200
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540 570 600 630 660 690
DK VISUAL



CORRELATION, RL,FP
.45
.30
.15
0
-.15
-.30
-.45
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540
P1-P2 INTERVAL
550
500
450
400
350
300
250
200
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540

IS VISUAL


CORRELATION, RL, FP
.45
.30
.15
0
-.15
-.30
-.45
SESSION: 30 60 90 120 150 180 210 240
P1-P2 INTERVAL
550
500
450
400
350
300
250
200
SESSION: 30 60 90 120 150 180 210 240
LL VISUAL

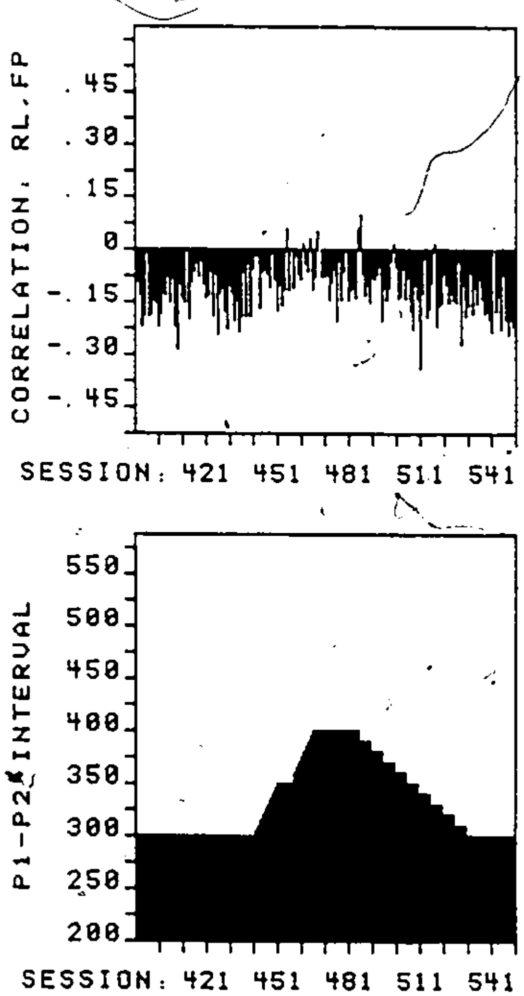

CORRELATION, RL, FP
.45
.30
.15
0
-.15
-.30
-.45
SESSION: 421 451 481 511 541
P1-P2 INTERVAL
550
500
450
400
350
300
250
200
SESSION: 421 451 481 511 541
RH VISUAL

FIGURE 16

Upper panel: Symmetry coefficients of the response latency (from P1) distributions of each session.

Lower panel: Kurtosis coefficients of the response latency (from P1) distributions of each session.

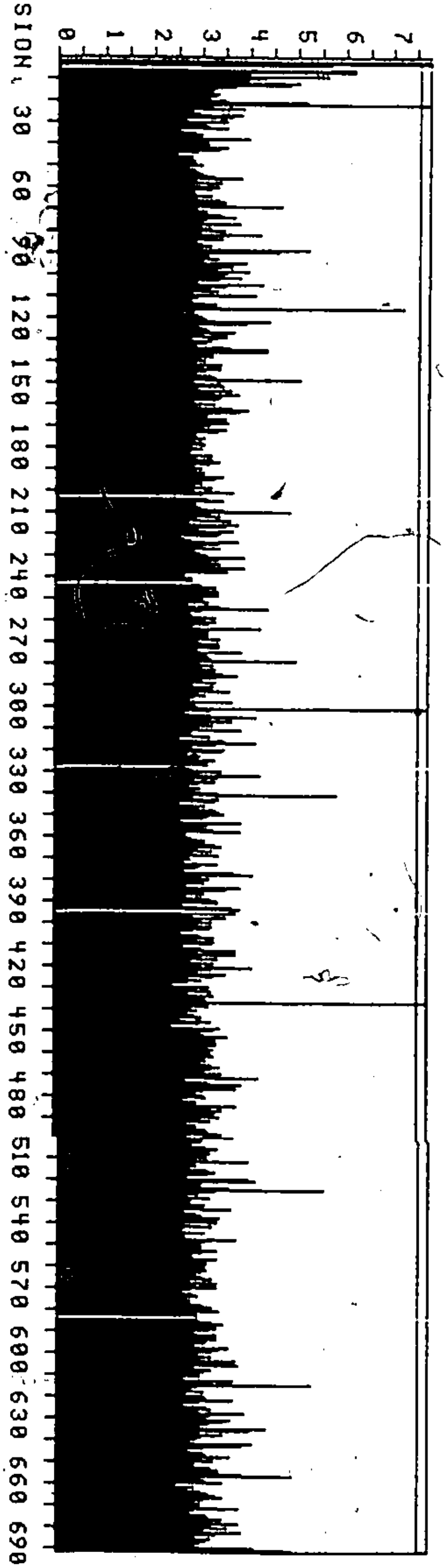
Some of the coefficients were too large in absolute magnitude to be represented accurately in these figures. Where there are two lines at the top or bottom of a figure, and a value is shown as extending to the outermost line, it is larger than it appears. For exact values, see Appendix 1.

Some sessions' raw data were lost and symmetry and kurtosis coefficients could not be calculated. No values are shown for these sessions, which are indicated by gaps in the figures.

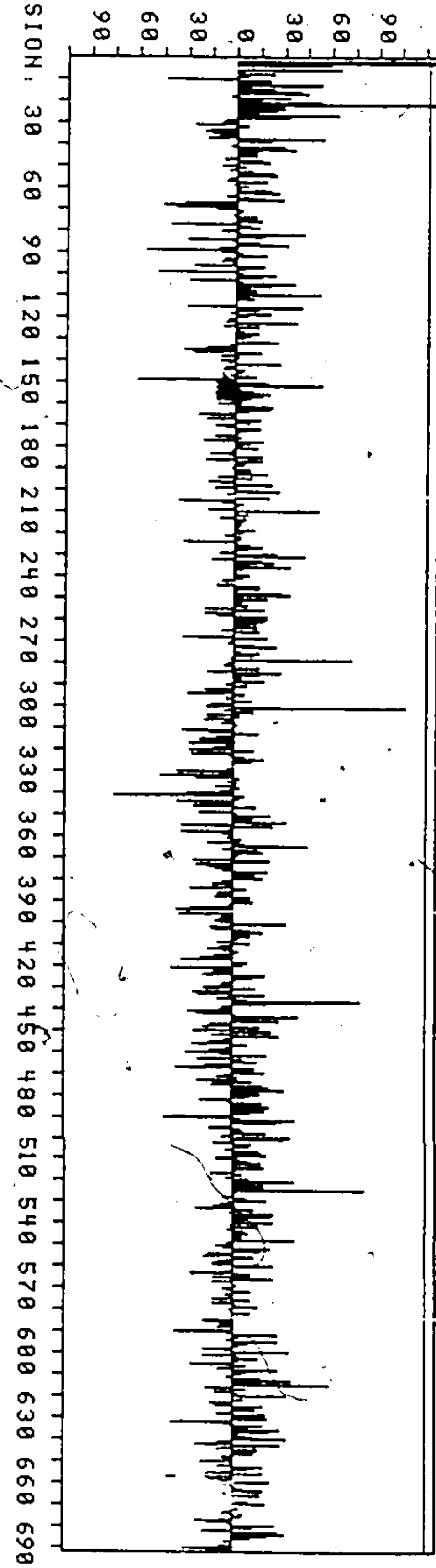
Figure 16.1: Subject DK. Figure 16.2: Subject IS

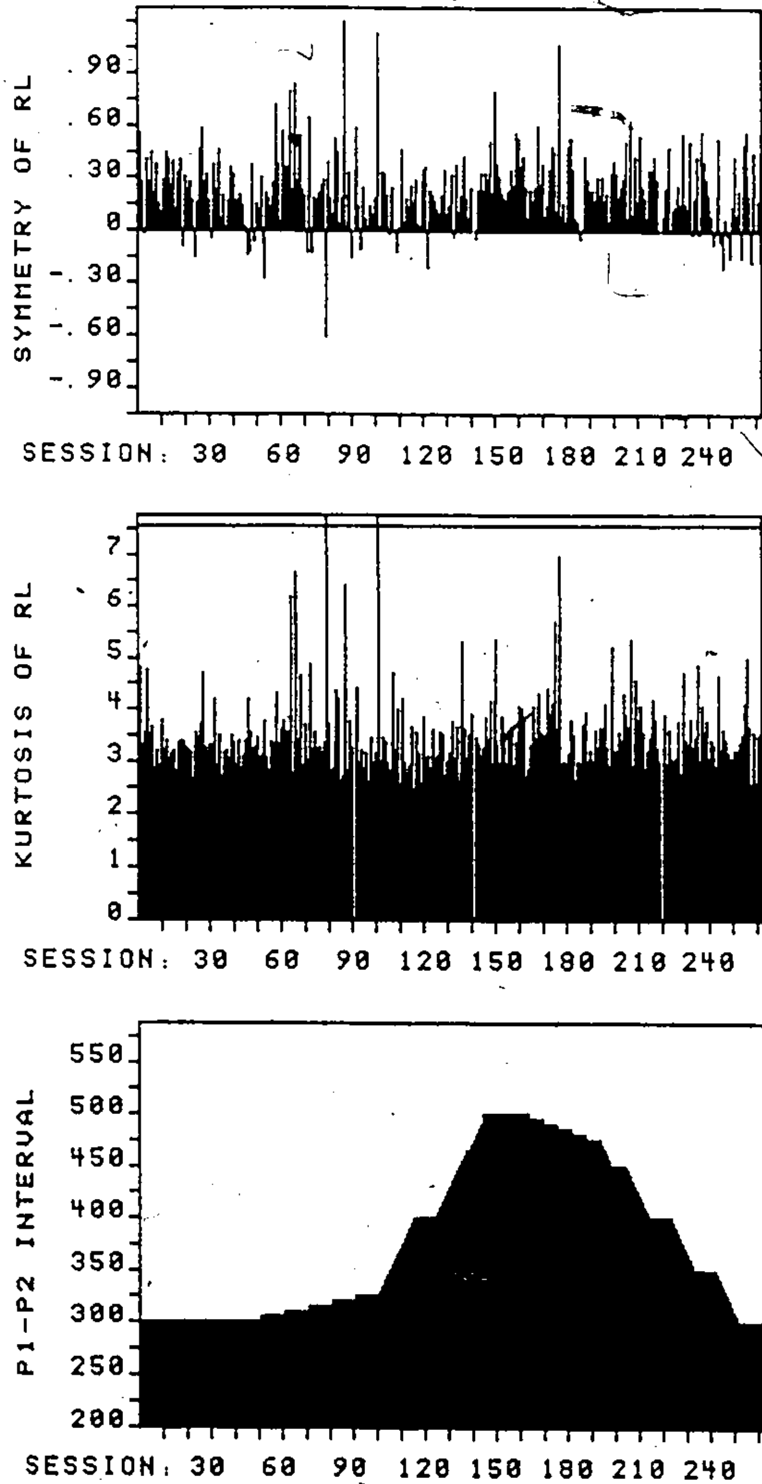
Figure 16.3: Subject LL. Figure 16.4: Subject RW.

KURTOSIS OF RL



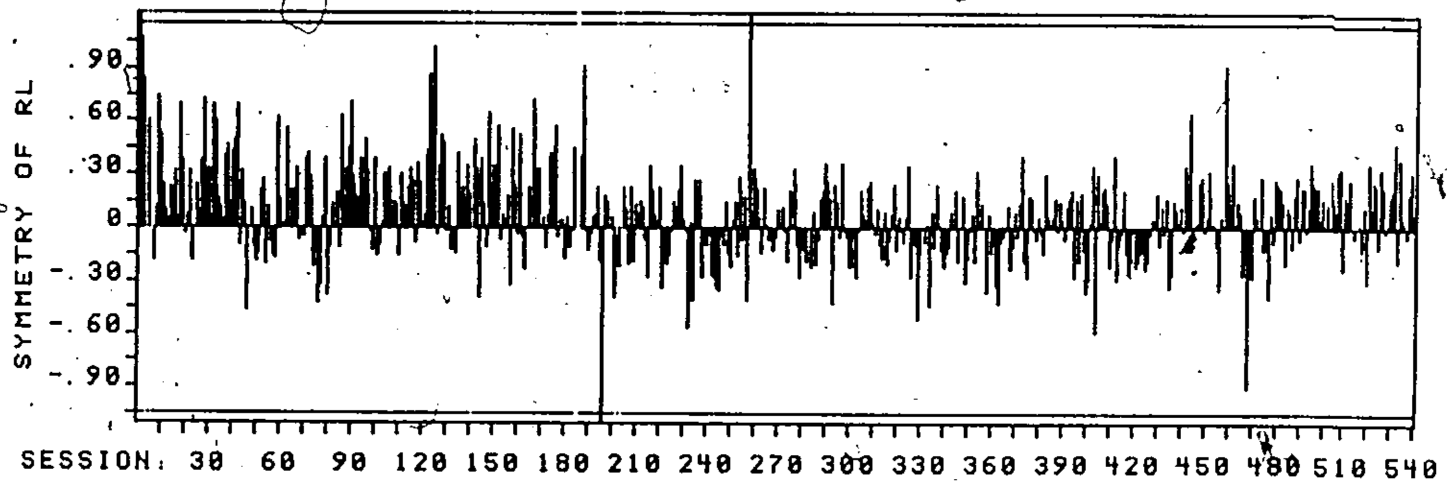
SYMMETRY OF RL

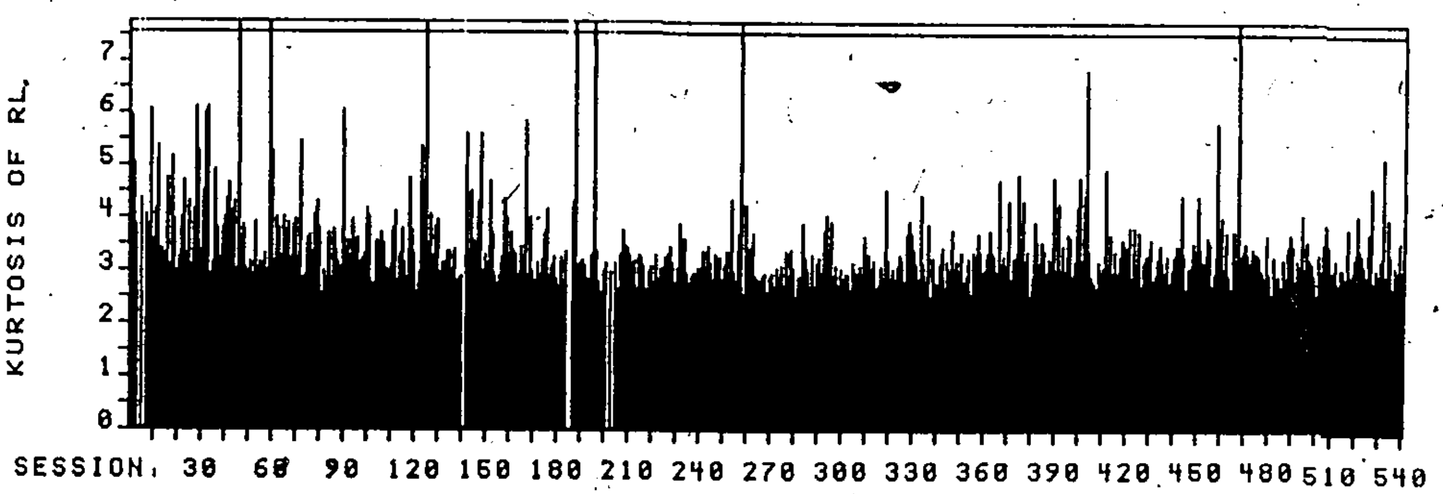




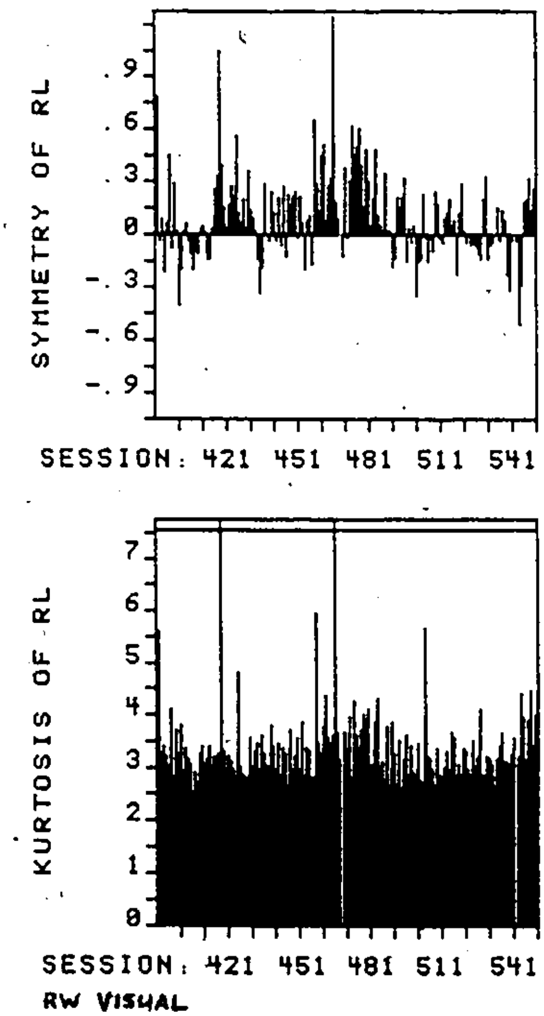
SYMMETRY OF RL
.90
.60
.30
0
-.30
-.60
-.90
SESSION: 30 60 90 120 150 180 210 240
KURTOSIS OF RL
7
6
5
4
3
2
1
0
SESSION: 30 60 90 120 150 180 210 240
P1-P2 INTERVAL
550
500
450
400
350
300
250
200
SESSION: 30 60 90 120 150 180 210 240

LL VISUAL


SYMMETRY OF RL
.90
.60
.30
0
-.30
-.60
-.90
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540


KURTOSIS OF RL
7
6
5
4
3
2
1
0
SESSION: 30 60 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540

IS VISUAL


SYMMETRY OF RL
.9
.6
.3
0
-.3
-.6
-.9
SESSION: 421 451 481 511 541
KURTOSIS OF RL
7
6
5
4
3
2
1
0
SESSION: 421 451 481 511 541
RW VISUAL

P1-P2 interval duration in Experiment 4.

RW's data are different. His correlations are substantial, comparable in sign and size to his performance at the very short intervals of Experiment 3. His variances are also at the Experiment 3 (eg. 100 msec P1-P2) levels. As in Experiment 3, RW is not relying exclusively on the warning stimulus. This can be checked by examining the variances of his latencies measured from WS, which are higher than those obtained from P1 (see Appendix 1's tables). Further, and surprisingly given the correlatations, RW's distributions (latencies from P1) are not negatively skewed, as they should be if he is timing from WS. They are positively skewed or symmetric. The kurtosis coefficients are not as large as they should be (or as they were in Experiment 3). Whatever RW was doing in Experiment 3, he is doing something similar, but it is not the same thing, in this experiment. He is in some way mixing a strategy of timing from P1 with one of timing from WS. This is evident in the correlations, such as -.18 at his most practiced interval (300 msec). I have no suggestions to offer about the details of this strategy.

RW was trained in Experiment 3 to use the warning stimulus instead of P1. It is unfortunate that RW's training with auditory stimuli transferred in this way, and it is somewhat surprising that it would transfer in this way since he was not timing from WS at the end of Experiment 2, at 300 to 350 msec intervals, with which he finished working only a few days before starting Experiment 5 at 300 msec. However, given that RW is relying more heavily on WS than the subjects of Experiment 4, it is not surprising that his pattern of results is different from theirs.

5.2.7 Symmetry and Kurtosis

As in the previous experiments, there is a very slight positive skew to the response distributions. This can be seen in Figures 16 (upper panel) and in Tables 7. The skew is unusually large (relative to the other subjects: these are not very skewed distributions) and consistent in LL's case. DK's and IS's symmetry coefficients are no different from those of Experiments 1 and 2.

As in the previous experiments, the kurtosis coefficients are usually between 2.4 and 4.2 (the logistic plus triangle limits) and the five session averages are usually between 2.9 and 3.4.

LL's kurtosis coefficients are larger and they are larger than those obtained from IS and DK during their initial ascending and descending series. This is not strictly idiosynchratic. JS's data look the same. His final averages at the 5 intervals (300 to 320 msec) at which his performance was studied ranged from .12 to .23 for the symmetry coefficients and from 3.23 to 3.75 for the kurtosis coefficients. However, these were not obtained after much practice (only 75 sessions total). IS's coefficients were also large during his first 75 sessions and his distributions eventually became symmetric and reasonably peaked, so perhaps JS's distributions would have shifted in shape as well.

On the basis of the data at hand, two different descriptions of visual synchronization distributions are defensible. One set of distributions is as symmetric and peaked as we find in auditory synchronization. The other set are more positively skewed and they are less peaked. The distributions which look most like the auditory distributions come from the most practiced subjects, whose data look like auditory data in most other respects as well.

5.3 Summary

There were individual differences. What is true of the performance of IS and DK is often not true of the performance of LL, in Experiment 4. RW's performance was different again but the relatively high correlation between response latency and foreperiod duration in his case indicates that he was relying to a large degree (as much as when P1-P2 was 100 msec) on the auditory WS or on tactile feedback from his trial initiation response as well as on the visual P1. There are curious aspects of his performance, such as the lack of negative skew in his response distributions, expected given the correlation, but conclusions about these data should be with reference to a multi-modality synchronization task, not to a unimodal visual synchronization task which was the desired object of study.

Considering only the data of Experiment 4, from IS and DK we see almost all of the same trends as are evident in auditory synchronization. The effects of practice are not quite the same. Scanning is effective, but there is less transfer of training from interval to interval, and more practice at any given interval seems necessary before asymptotic performance levels can be reached. Perhaps these differences would disappear if a bigger, brighter stimulus was used, assuming that that stimulus didn't have other deleterious effects on performance. The main points of comparison, variance, symmetry, kurtosis, foreperiod correlation, variability and shape across narrow and wide ranges, scanning effects and absolute levels of q (with the possible reservation about DK's 30), all appeared to match the auditory results of Experiments 1 and 2 and of Kristofferson (1976) and Brewster (1983) acceptably. In terms of shape coefficients, the data are near Hopkins' values.

As noted in Experiment 1, if we accept Hopkins' model, the relatively high kurtosis values (but not higher, or not much higher, than Hopkins') would suggest substantial motor variability, on the order of 50 to 100 msec^2. DK and IS participated in so many sessions that I find it extremely difficult to believe that their final motor variances were this high. However, despite the finding that their data do not fit well with the model constructed to describe Hopkins' (and Kristofferson's 1976) data, they are, except in variance level, very similar to Hopkins' data.

LL's data, and, with reservations due to the small number of sessions, JS's data, may indicate that there is more than one way to do the visual synchronization task. Their distributions were more skewed and less peaked than the others, auditory or visual. It is interesting that JS's and LL's variances were also relatively high. It is tempting to conjecture that IS's and DK's performance is better because they relied on the same timing mechanisms used by the auditory subjects, whereas JS and LL followed a suboptimal strategy.

However we interpret JS's and LL's performance, the results from DK and IS make the point of the experiment. To the degree that we are justified in concluding, on the basis of multiple similarities in performance across modalities that there is a common underlying mechanism across modalities, we are justified in concluding that the same mechanism is available to be used by auditory and visual synchronization subjects. Given the many dimensions of similarity, I would find it very difficult to believe that different mechanisms were responsible for auditory and visual synchronization performance, as obtained in the visual case from DK and IS.

6. Conclusions

My conclusions are based mainly on the data from three subjects of the seven discussed in detail in the body of this work.

Two subjects failed to achieve stable performance levels, GH for reasons unknown, and LL almost certainly because of insufficient training.

The two subjects of Experiments 2 and 3 were probably transferred too quickly to Experiment 3 (though "quickly" is a relative term and in practical terms, if they had spent more time in Experiment 2 pretraining, they would never have made it through Experiment 3 and Experiment 2 retesting. Hundreds of sessions' data take years to collect. Both of these subjects would have preferred to have participated in fewer sessions than they did and they would not have participated in substantially many more.) In both cases, performance at intervals of 150 msec or longer was better after Experiment 3 than before, indicating that they were transferred to Experiment 3 before they had achieved final variance levels at the longer intervals. I hesitate to take their post-Experiment 3 data at face value. I don't know what transfer effects from that extremely difficult task may be hidden in their performance. I compared Experiment 4's visual results to published auditory data as much as to those from Experiment 2 because of my concern that the relatively high variances obtained in Experiment 2 may not only have been due to the specific differences between my version of synchronization and the others, but also to transfer effects.

This leaves three key subjects, DG from Experiment 1, and IS and DK from Experiment 4, whose data have guided my conclusions. Their data strongly support the thesis. The data from the other subjects do not strongly conflict with it, but I would not accept it on the basis of those results alone.

There are three classes of findings that I consider firm in this work, one important hypothesis that is suggested by the results, and one finding that poses some difficulties. The three positive findings are:

(1) <u>Equivalence of long and short interval synchronization:</u> There is every indication in Experiment 1's data, especially in DG's performance, that auditory synchronization is based on the same mechanisms at 2000 msec as it is at 200 msec. Variances were constant from 1500 to 1750 msec, with a strong suggestion of constancy out to 2000 msec in DG's data. DG's q estimates of 51.3, 50.9 and 58.4, at 1500, 1750 and 2000 msec respectively, are near 50, one of the values we should expect q to hover about from other quantally-related data and theory. The distributions are symmetrical and the kurtosis values are reasonably low: 3.84, 2.98 and 2.99 at the three intervals. The average kurtosis of 3.84 over DG's last 5 sessions at 1500 msec is high, but from examination of the graph of kurtosis from each session I consider this random variation, undisturbing in a statistic known to be highly variable.

There is no support in these data for the hypothesis of a transition in timing mechanisms in the neighbourhood of 550 msec. That idea has waxed and waned in popularity over the years, most recently being supported by scaling data from Michon (1967) and, I think more strongly, by Kristofferson's (1976) synchronization results.

I do <u>not</u> conclude from these data that there are never transitions at 550 msec. I believe that people can time intervals in many different ways, and some of those may not be possible at very short intervals. The point, though, is that a transition is not <u>necessary</u>. If there is a transition, it reflects a shift in strategy, not a boundary condition on ability. DG's performance at the long intervals is less variable than any reported previously in the temporal literature, and on good days GH's performance was not much worse. It takes work, or at least much practice, to use the precise timing mechanisms at the longer intervals that may be more readily available at the shorter ones, but they are available at the longer intervals nevertheless.

(2) <u>Equivalance of visual and auditory synchronization:</u> The variances of DK and IS were constant, or very nearly so, as were the symmetry and kurtosis coefficients. The variances were low and compare well with those reported by Kristofferson (1976) and Brewster (1983) for auditory synchronization in this range. The key difference is that DK and IS needed a great deal of practice before they showed the same trends visible in the data of excessively practiced, but not this excessively, auditory synchronization subjects.

Hopkins (1982; Hopkins and Kristofferson, 1980) showed that synchronization performance with tactile stimulation is also equivalent to auditory performance. This equivalence across three modalities suggests to me that there is a common central mechanism that can be used for timing.

(3) Continuously adjustable deterministic delays: The finding of distributional (shape and variance) constancy across a relatively wide range of intervals suggests that the added timing delays at the long end of the range are produced by a deterministic mechanism. The finding of distributional constancy over very small changes in the interval suggest a continuously adjustable mechanism. Both findings are well established with auditorily bounded intervals. Hopkins' finding of identical auditory and tactile synchronization variances suggests that the same will be true for intervals marked by tactile stimuli. The data of IS and DK establish continuous adjustability and deterministic timing in the visual modality as firmly as they are established in the auditory modality. (That there are convincing demonstrations in the auditory case in two further paradigms, speeded and very long term non-speeded discrimination, does not make the auditory case stronger but instead makes it more general.) Neither characteristic of timing had been strongly demonstrated for visually bounded intervals previously. Given the number of differences reported between visual and auditory timing and time perception, this result is neither obvious nor trivial.

Kristofferson (1976; Hopkins and Kristofferson, 1980) has argued that continuous adjustability is achieved via recycling of information at the afferent level. Auditory afferent latency variance is generally accepted to be negligible. On the grounds of equivalent variability, he and Hopkins have argued that tactile latency variance must also be negligible. On the same grounds we could conclude that visual latency variances are negligible. Alternatively, and despite the difficulties this poses for quantal counting models, continuous adjustability may be a property of a central mechanism that is independent of input modality. I prefer the latter hypothesis, though I have no grounds for insisting upon it. With respect to quantal counting models, these have been most strongly supported by discrimination data which show stepped variances and which suggest, as the basis for each step, a maximum count of 16q. The hypothesis of a maximum of 16 does not fare well in synchronization, in the present data or in Hopkins' (1982). It is not at all clear why the maximum possible count should vary across tasks.

The hypothesis that I say is "suggested" by the present data is that we have seriously overestimated minimum reaction time. Minimum mean RT may be shorter than 100 or 105 msec. Further, with practice, moderately intense stimuli may be processed as quickly as extremely intense stimuli. There is little or no support for either suggestion in the RT literature, and there is much data to indicate that they are wrong.

I <u>think</u> that there were some very fast reactions in Experiment 3. There weren't any slow ones. If the subjects reacted to P1, their mean RT was short, perhaps as short as 85 msec, which is probably beginning to push the physical limits imposed by neural conduction times (I often hear 60 - 65 msec suggested as a value for the auditory system. Visual latencies are longer.)

I would be more inclined to press the argument that minimum RT has been overestimated if I had been able to develop a convincing model for the subjects' performance in Experiment 3. The negative skew of their latencies (from WS) fit with none of my notions and I eventually abandoned the attempt. Making the highly controversial assumption that mean RTs of 85 msec are possible bought little explanatory power. I see no alternative to this assumption (though 85 msec may be a bit low in any case), but my inability to arrive at an alternative does not imply that there is none.

The difficulty arising from the present data is that the kurtosis coefficients, from all of the experiments, are too high for Hopkins' (1982) model. I call the hypothesis of a triangle plus logistic distribution Hopkins' because he expressed it most formally and tested it. Kristofferson (1976) proposed much the same idea. If we accept that the logistic variance is motor variance, the kurtosis values suggest that motor variance may be as high as 250 $msec^2$ in this task, after extensive practice. Previous results (such as Wing's, 1973) indicate that motor variances should be between 10 and 50 $msec^2$. The average of Hopkins' estimates for synchronization was close to 25 $msec^2$. A motor variance of 250 $msec^2$ is not plausible for this task.

It is unfortunate that the only other report of kurtosis values comes from Hopkins (1982), whose subjects' latency variances were so low that almost any estimate of motor variance would be low. Kristofferson (1976) and Brewster (1983) described the shapes of their distributions with graphs and with tables that collapsed latencies into 5 msec bins. I have estimated the kurtosis coefficients from one table of Kristofferson (1976), which provided four grouped latency distributions for one subject, GH, who later participated in Hopkins' research. (This is not Experiment 1's GH.) My estimates cannot be exact because of grouping, but they should not be too far off.

Table 8

Distributional Statistics for Subject GH

Interval	Variance (Grouped)	Variance (Reported)	Symmetry	Kurtosis	Logistic Variance
A. Kristofferson (1976)					
175 msec	136	126	-.20	3.42	87
310 msec	106	112	-.05	2.97	42
360 msec	108	103	.03	3.21	58
405 msec	129	125	.06	2.90	45
B. Hopkins (1982)					
460 msec		41	-.00	2.87	10

The values from Hopkins (1982) are from his Tables 12 and 13. An estimate of logistic variance based on the kurtosis would be slightly higher than his value of 10, based on minimum chi-square (as often as not my estimates from his data are lower than his), but the conclusion would not be changed by this, nor by selection of any other comparison data from Hopkins. As the variance of the same subject increases, so does the "motor" variance, all the way up to 87 $msec^2$. The same difficulty appears to be present in Kristofferson's (1976) data as is present in the data reported here.

I should also note that the autocorrelations of GH, not measured in the present data, were insignificant. This is not the reason for the high kurtosis values in Kristofferson's (1976) data, and it is probably not the reason for them in the present data. I doubt that the small foreperiod correlations added much to the present data's kurtosis estimates either.

On the grounds of implausibly high estimates of motor variance, especially in Experiment 1, I think we should reject Hopkins' model.

I do not think that we should throw out quantal theory on the basis of the failure of the model, nor do I think that this failure is particularly damaging to the theory. The findings of distributional constancy across wide ranges of duration, and of consistent values of q (for spectacular examples, see Kristofferson (1983) for various data from the same subject) are the findings that I consider most supportative of the theory. The possibilities that the logistic (or the normal) is the wrong motor distribution, or that there is some further source of variability in the task, not a large one but with a thick tail, do not seem unreasonable for synchronization.

I do not have an alternative model to propose, nor was my intention in this research to search for one. My intention was to show that whatever model applies, it will apply equally to long and short interval timing, whether the intervals are bounded by visual or auditory markers.

Reference Notes

1. Kaner, H.C., & Vokey, J.R. A better random number generator for Apple's Floating Point Basic. Manuscript submitted to Nibble. As a Contributing Editor of Nibble I expect this will be published. In the event that it is too technical for that magazine, a copy of the manuscript can be obtained from me, or a preliminary draft may be obtained from the Library of the American Society for Psychical Research, New York.

2. Kaner, H.C., & Lyons, J.C. Tables and Power Comparisons for Different Versions of the Kolmogorov-Smirnov and Schuster Statistics. Technical Report No. 67, Department of Psychology, McMaster University, Hamilton, Ontario, Canada, 1979.

3. Kristofferson, A.B. A Theory of Timing in Human Information Processing. Unpublished manuscript, 1981.

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Footnotes

1. One issue often discussed in the context of time perception is whether there is such a thing as time perception. I don't think that this issue can be resolved with data and I have lost patience with it. It will not be discussed in the body of the thesis. However, the considerations component to this have had an impact upon the stated positions of many authors in the field. To be fair to those positions, I should address a few points here.

An internal measure of the duration of an interval can be taken without being translated by the observer into a sensation or perception of that duration. This is especially evident in some of the cognitive positions. The measure of an interval is based on the amount of information that the observer remembers having processed during the interval. The judgment of the interval's length can be done solely on that basis, without at all involving a subjective experience of duration. Similarly, if the measure of an interval is the number of pulses counted within it, the count could be used without reference to a subjective impression of anything other than the count. There may or may not be a duration percept and if there is one it may or may not be epiphenomenal.

At the purely formal level, it doesn't matter in many theoretical positions whether or not duration perceptions are assumed. We could agree that a poisson process describes the characteristics of a counting mechanism and that discrimination judgments are based on the count without deciding whether the count is translated into a duration percept or not. (The count may or may not be consciously experienced and the conscious experience associated with it may or may not be a duration percept *per se*.) The mathematics will not change as a function of this. The same judgment theories (eg. Signal Detection Theory) can be applied in either case. Experimenters can take a neutral position and avoid the perceptual issue when describing their formal models, or they can take either side, without limiting the utility of their ideas about mechanism for theorists holding opposite views on the perceptual issue.

In the body of the thesis, I will refer to internal clocks as mechanisms which give rise to subjective experiences of duration, i.e. to duration percepts. On introspective grounds, I believe that I have duration percepts and that they are no less immediate or "perceptual" than percepts of size or color. More strictly, internal clocks are mechanisms which yield information that can be used as a basis for judgments about duration. The subjective experience associated with this information is a subject of controversy.

To keep the record straight on the positions of the main theorists cited, I should note that Creelman (1962) did not explicitly claim that his poisson count was translated into a duration percept. He merely claimed that the count was the basis of duration discrimination judgments. Stroud (1956) talked about subjective "dates" of events, but avoided the issue of subjective duration altogether. Kristofferson's (1977) real-time criterion theory explicitly denied the need for a duration perception as a basis for discrimination judgments in the single stimulus situation.

2. Latency variance could remain constant despite an increasing variance clock if the motor and timing variances were negatively correlated to a degree that changed in just the right way as clock variance changed. Kristofferson (1983) has wondered how such a hypothesis would address quantal steps in variance. I wonder why the response distributions don't change shape as the timing variance and timing - motor covariance change with duration. I don't consider this alternative to deterministic timing credible and to the best of my knowledge it has no advocates, but it is not logically impossible.

3. This does not imply that there are no quantal delays in the system in naturalistic situations. Some components of even the most complex stimulus-response chains might still be timed internally using a quantal clock. My point is that there will be very few cases in which the main source of timing variance in the stimulus-response chain will be quantal.

4. The raw data from some sessions was lost due to unreadability of PDP-8 paper tapes, and, less frequently, to disk problems of various types on the Apple. It is impossible to estimate symmetry, kurtosis, etc., from these data, so these values could not be included in the averages. Variances of the nontruncated data are available for these sessions, from the printouts obtained at the end of each session, but I excluded these from the averages as well, feeling that all averages reported together should be based on the same sessions' data.

Accordingly, the statistics are usually averaged across the last 5 sessions run at a given interval, but if some (rarely more than one) of these sessions were lost, the averages are based only on the remaining sessions. Similarly, if there were fewer than five sessions, the averages are across all consecutive sessions at this interval for which the raw data are still available. The tables in Appendix 1 list the intervals, means and variances for the lost sessions. It is evident in these tables which sessions' raw data were lost because no other statistics of the data are reported for them.

5. I have not performed this analysis for data from Experiment 3, which included P1-P2 intervals in the 85 - 150 msec range. The subjects often responded on the basis of time elapsed since the warning stimulus (WS), so the "real" latencies probably range from 1085 - 1150 msec. If they timed from WS onset rather than offset, these latencies would be 1185 - 1250 msec. The subjects did not always time from WS. Sometimes the actual latencies may be in the 85-150 msec range. In short, it is impossible to tell what the "real" mean latencies were, and, accordingly, it is impossible to express variance as a function of these latencies.

6. I do not imply that subjects adopt this strategy consciously (though some probably do). Hopkins (1982) noted that his subjects responded on the basis of time since their trial initiation response, ignoring visual P1 completely, but that they felt they were using P1, not the response. As a past subject in speeded tasks I will report that it can be very hard to tell what stimulus is controlling behavior. With practice the task become rather automatic and one doesn't think much

about how it's being done. One simply does what appears to work best, and faster is, in the reaction time case, better. Standard operant conditioning principles, assuming that shorter RTs are more reinforcing (they are, or were to me), could probably account for the development of such a strategy on a wholly unconscious level.

7. I say little in the text about duration illusions but I think that synchronization is a natural procedure to use to study them. Studies involving direct comparison of a filled and an empty interval are open to the critical suggestion that the filled interval is reported longer not because it was perceived as longer but because it is remembered as longer. The effect is on memory, not on perception. There may well be effects on memory, and many other biasing effects, but I doubt that these fully explain the illusion. Production tasks, such as synchronization, seem less vulnerable to such criticisms. Further, once a subject has stabilized in synchronization, examining the differences in response latencies with slightly more complex stimuli offers some hope of obtaining quantitative measures, in msec, of the magnitude of the illusions. If there are shifts in other aspects of the response distributions we may be able to develop better models of the temporal variation associated with the processing of more complex stimuli. In the introduction I suggested that this should be a goal of the cognitive temporal theorist. Synchronization may provide a means.

I find the present research exceedingly mechanistic and reductive. It is interesting to model the perception of identical stimuli in strictly mechanistic terms, and it is useful to know that the same mechanism is probably involv[illegible] over a fairly wide range of modalities and durations. But my biases are such that I regard this as a very useful baseline. Many different types of cues are involved in percepts of size and distance (see, eg., Gibson, 1950 and Gregory, 1966). I would be amazed if the same were not true for duration. I regard perception as an active, dynamic process, and percepts as the result of unconscious inferences drawn from as many sources of information as are available in the task.

Holway and Boring (1941) conducted a classic study of the perception of size in which they recorded observers' judgments under impoverished stimulus conditions (visual angle of the stimulus being the only available cue), and under various other more complex (and more naturalistic) conditions in which further information about stimulus size (information about its distance) was available. The research associated with quantal theory, including the present research, has provided a characterization of duration perception under impoverished stimulus conditions that Holway and Boring may not have imagined possible in the visual case. It is not a perfect characterization, as evidenced in the present data, for example, by the overly large kurtosis values, but I find it remarkable nevertheless. It is hardly unreasonable to seek still better characterizations of the mechanisms involved in the well-practiced processing of strictly empty intervals, but if I were continuing in the study of temporal perception I would instead search for ways to use what we know now as a springboard for examining how people deal with more complex stimulus configurations, as they do every day.

8. The complexities of the speeded discrimination data (Brewster,

1983; Kristofferson, 1983) have very recently led Kristofferson (1983) to state that we may have to abandon the idea of a single quantal "clock", and to suggest that there may be more than one q level operative in the nervous system at the same time.

APPENDIX 1

Summary statistics for each subject and each session.

The column headings are abbreviated. In case of confusion, they mean:

SESS: Session number

NUMBER TRIALS: Number of trials included (excluded in brackets) in analysis for that session

MEAN FP: Mean foreperiod duration

MEAN RL: Mean response latency

VARIANCE OF RL: Response latency variance (from P1)

VARIANCE OF RL+FP: Response latency variance (latency measured from warning stimulus)

VARIANCE OF FP: Foreperiod duration variance.

CORRELATION OF RL,FP: Correlation of response latency (from P1) and foreperiod duration

CORRELATION OF RL+FP,FP: Correlation of response latency (from WS) and foreperiod duration

ROOT B1 OF RL: Symmetry coefficient of response latency distribution (from P1)

ROOT B1 OF RL+FP: Symmetry coefficient of response latency distribution (from WS)

KURTOSIS RL : Kurtosis of response latency (from P1) distribution

KURTOSIS RL+FP: Kurtosis of response latency (from WS) distribution.

For a discussion of timing from WS rather than from P1, see Chapter 4.

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SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
1	300	900	2000	1928	24391	24266	101	-0.072	-0.007	-0.205	-0.208	2.401	2.426
2	300	900	2000	1934	23805	23996	86	0.037	0.096	-0.464	-0.462	2.597	2.605
3	300	900	2000	1984	17170	17255	94	-0.003	0.070	-0.510	-0.517	2.611	2.616
4	300	900	2000	1983	13648	13995	100	0.105	0.189	-0.396	-0.382	2.402	2.403
5	300	900	2000	1993	7484	7598	87	0.017	0.123	-0.369	-0.341	2.625	2.578
6	300	900	2000	1996	4811	4872	87	-0.020	0.113	-0.164	-0.169	3.239	3.203
7	300	900	2000	1994	4009	4142	95	0.031	0.182	0.037	-0.001	3.202	3.178
8	300	900	2000	1997	4243	4367	90	0.028	0.171	-0.011	0.005	2.650	2.559
9	300	900	2000	2005	5781	5756	119	-0.087	0.057	-0.483	-0.437	3.267	3.273
10	300	900	2000	1999	3936	4204	88	0.153	0.293	-0.123	-0.042	3.466	3.454
11	300	900	2000	2000	4082	4232	88	0.051	0.194	-0.325	-0.326	3.737	3.737
12	299 (1)	900	2000	1991	2978	3034	86	-0.030	0.138	0.180	0.203	2.816	2.821
13	300	900	2000	1996	3145	3301	93	0.059	0.225	-0.118	-0.074	3.198	3.151
14	300	900	2000	2000	2548	2615	79	-0.013	0.160	0.208	0.219	3.289	3.351
15	300	900	2000	1991	2466	2528	81	-0.021	0.158	-0.028	0.012	2.913	2.952
16	300	900	2000	1999	3502	3615	91	0.020	0.178	-0.672	-0.654	4.500	4.590
17	300	900	2000	1996	3356	3347	84	-0.087	0.071	-0.163	-0.155	3.080	3.187
18	299 (1)	900	2000	2003	3022	3122	101	-0.001	0.180	-0.124	-0.206	3.174	3.159
19	300	900	2000	1992	2852	2889	104	-0.062	0.128	0.217	0.229	2.929	3.048
20	299 (1)	900	2000	2000	3714	3711	81	-0.076	0.072	0.563	0.545	5.760	5.577
21	300	900	2000	1993	2738	2871	102	0.030	0.218	0.001	0.125	3.553	3.930
22	300	900	2000	1994	1601	1602	99	-0.123	0.126	-0.063	-0.118	3.098	3.301
23	300	900	2000	1997	2306	2372	78	-0.015	0.167	0.058	0.015	2.902	3.072
24	300	900	2000	1988	2580	2694	82	0.035	0.209	0.142	0.177	2.893	2.895
25	300	900	2000	1983	2072	2185	91	0.024	0.228	0.062	0.200	3.338	3.443
26	300	900	2000	1998	2323	2315	81	-0.102	0.084	0.120	0.123	3.204	3.070
27	300	900	2080	1993	1838	1949	91	0.023	0.239	0.140	0.064	3.710	3.537
28	300	900	2000	1990	2138	2289	98	0.058	0.263	0.302	0.301	3.025	2.972
29	300	900	2000	2003	1856	1873	87	-0.088	0.129	-0.010	-0.041	3.613	3.514
30	300	900	2000	1998	1820	1823	89	-0.106	0.115	0.104	0.067	3.511	3.436
31	300	900	2000	1997	1653	1715	83	-0.028	0.192	-0.177	-0.113	2.684	2.657
32	300	900	2000	1989	1571	1654	89	-0.008	0.225	0.113	0.177	3.386	3.415
33	300	900	2000	2001	1436	1591	89	0.092	0.324	0.056	0.081	3.078	2.962
34	300	900	2000	1991	1811	1816	79	-0.098	0.111	0.165	0.162	2.791	2.636
35	300	900	2000	1997	1633	1717	87	-0.003	0.222	0.109	0.086	2.767	2.763
36	300	900	2000	1995	1969	2096	93	0.039	0.249	0.263	0.219	3.157	2.976
37	300	900	2000	1995	1699	1787	75	0.018	0.223	-0.039	-0.096	2.773	2.832
38	300	900	2000	1997	1582	1693	89	0.028	0.257	0.136	0.140	3.067	3.054
39	300	900	2000	2001	1725	1699	88	-0.146	0.080	0.051	-0.070	2.885	2.828
40	300	900	2000	1990	1774	1861	88	-0.002	0.216	-0.102	-0.131	2.807	2.612
41	300	900	2000	1993	1746	1821	100	-0.029	0.205	0.297	0.284	4.173	3.957
42	300		2000	1994	2251								
43	300	900	2000	1995	1266	1301	90	-0.082	0.182	0.002	-0.071	3.370	3.470
44	299 (1)	900	2000	1998	1912	2024	87	0.031	0.238	0.319	0.297	3.070	2.912
45	300	900	2000	1990	2058	2114	88	-0.038	0.167	0.168	0.179	3.222	3.464
46	299 (1)	900	2000	1989	1739	1818	91	-0.015	0.209	0.199	0.252	3.343	3.233
47	299 (1)	900	2000	1996	1906	1914	94	-0.101	0.121	0.454	0.411	3.553	3.457
48	300	900	2000	1998	2055	2063	86	-0.093	0.111	0.450	0.423	4.009	4.107
49	300	900	2000	1999	1852	1946	103	-0.010	0.220	1.027	0.910	10.365	8.848
50	300	900	2000	1994	1234	1310	83	-0.012	0.241	-0.050	-0.019	3.284	3.192
51	300	900	2000	1995	1530	1595	84	-0.027	0.204	-0.078	-0.009	2.990	2.936
52	300	900	2000	1992	1349	1429	101	-0.028	0.238	0.064	0.062	3.567	3.348
53	300	900	1975	1972	1452	1493	88	-0.065	0.178	-0.232	-0.201	3.384	3.489
54	300	900	2000	1991	1341	1311	84	-0.170	0.081	0.336	0.344	3.789	3.696
55	300	900	1975	1967	1228	1322	116	-0.029	0.268	0.142	0.133	3.229	3.055
56	300	900	1950	1942	1022	1058	109	-0.109	0.213	0.539	0.476	3.640	3.442
57	300	900	1925	1916	1220	1290	95	-0.038	0.235	-0.111	-0.160	2.813	2.734
58	300	900	1925	1917	976	1033	88	-0.053	0.241	0.118	0.048	3.494	3.074
59	300	900	1900	1891	1189	1318	95	0.050	0.317	0.346	0.380	3.337	3.476
60	300	900	1900	1896	1084	1117	75	-0.074	0.186	-0.076	0.032	3.118	3.309

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SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
61	300	900	1900	1898	880	999	100	0.030	0.345	0.033	0.027	2.999	2.959
62	299 (1)	900	1900	1900	1044	1149	92	0.021	0.303	0.103	0.076	2.916	2.822
63	300	900	1900	1901	1011	1068	92	-0.058	0.237	-0.063	0.021	3.220	3.154
64	300	900	1875	1872	1124	1190	89	-0.036	0.239	-0.042	-0.001	3.162	3.160
65	300	900	1850	1842	924	957	91	-0.100	0.210	0.035	-0.048	3.314	3.312
66	300	900	1825	1823	959	999	94	-0.078	0.214	0.103	0.192	2.945	3.039
67	300	900	1800	1791	1070	1042	109	-0.201	0.120	0.075	0.132	2.779	2.651
68	300	900	1800	1798	896	949	82	-0.054	0.241	0.124	0.064	2.892	2.851
69	300	899	1800	1794	1165	1292	74	0.090	0.325	0.261	0.229	3.477	3.315
70	300	900	1800	1799	917	887	90	-0.210	0.104	0.157	0.087	3.513	3.627
71	300	900	1800	1798	892	963	87	-0.029	0.273	0.066	0.085	2.791	2.736
72	300	900	1775	1776	920	1045	88	0.066	0.352	-0.064	-0.039	2.823	2.866
73	300	900	1750	1746	873	896	86	-0.114	0.196	0.208	0.054	3.461	3.195
74	300	900	1725	1720	808	864	82	-0.049	0.260	0.038	0.130	3.076	3.304
75	300	900	1700	1701	915	993	83	-0.011	0.280	0.228	0.215	3.303	3.203
76	300	900	1700	1700	844	885	84	-0.081	0.229	0.045	-0.105	3.204	3.206
77	300	900	1700	1698	622	640	85	-0.147	0.220	-0.072	0.055	2.635	3.054
78	300	900	1700	1695	679	798	89	0.061	0.391	0.061	0.096	3.122	3.231
79	300	901	1700	1698	699	757	100	-0.080	0.287	0.209	0.153	2.813	2.579
80	300		1675	1672	895								
81	300		1650	1651	758								
82	300	900	1625	1627	663	702	86	-0.100	0.254	0.017	0.084	2.871	2.920
83	300	900	1600	1599	822	879	81	-0.048	0.258	0.051	0.137	2.734	2.606
84	299 (1)	900	1600	1602	825	913	84	0.006	0.310	0.328	0.230	2.991	2.961
85	300	900	1600	1607	850	946	91	0.009	0.319	0.311	0.290	3.498	3.359
86	300		1600	1599	842								
87	300	900	1600	1684	754	882	95	0.060	0.384	0.058	0.198	3.109	3.252
88	300	900	1575	1581	728	817	91	-0.002	0.331	-0.303	-0.181	3.340	3.275
89	300	900	1550	1549	820	855	97	-0.108	0.230	-0.273	-0.286	3.603	3.480
90	300	899	1525	1527	732	809	75	0.005	0.309	-0.150	-0.063	2.863	2.891
91	300	900	1500	1500	1015	1077	80	-0.032	0.242	0.087	0.006	3.256	3.214
92	300	900	1500	1494	793	822	93	-0.117	0.221	0.048	0.023	3.344	3.241
93	300	900	1500	1499	757	856	89	0.019	0.340	-0.056	0.194	2.885	2.827
94	300	900	1500	1502	716	836	100	0.039	0.381	-0.282	-0.143	3.384	3.193
95	300	900	1500	1501	709	753	85	-0.084	0.254	0.108	0.157	3.332	3.180
96	300	900	1475	1473	839	886	85	-0.071	0.241	-0.419	-0.419	5.307	5.087
97	299 (1)	900	1450	1454	710	860	86	0.129	0.433	0.090	0.088	3.156	2.921
98	300	900	1425	1425	672	753	92	-0.020	0.330	-0.158	0.040	3.080	3.275
99	300	900	1400	1402	550	605	94	-0.086	0.312	-0.128	0.021	3.001	3.240
100	300	900	1400	1399	646	724	81	-0.007	0.328	0.068	0.167	3.015	2.971
101	295 (5)	900	1400	1404	861	850	84	-0.176	0.138	0.359	0.428	4.272	3.949
102	300	900	1400	1400	799	921	99	0.040	0.365	-0.614	-0.358	5.401	5.546
103	300	900	1400	1405	892	944	101	-0.083	0.246	-0.001	0.065	3.217	3.383
104	300	900	1425	1429	828	922	94	-0.001	0.319	0.015	0.113	3.021	2.897
105	300	900	1425	1426	668	767	88	0.024	0.361	0.297	0.403	2.877	3.364
106	300	900	1425	1429	624	701	95	-0.037	0.333	-0.239	-0.258	2.869	2.919
107	300	900	1425	1430	825	905	95	-0.026	0.299	-0.444	-0.401	4.223	4.282
108	300	900	1425	1425	699	749	81	-0.063	0.267	0.376	0.345	4.442	3.909
109	300		1450	1450	644								
110	300	900	1450	1452	728	825	80	0.037	0.345	-0.040	0.018	3.778	3.513
111	300	900	1450	1455	617	703	89	-0.007	0.350	-0.326	-0.311	3.698	3.791
112	300	900	1450	1451	792	868	88	-0.023	0.296	0.134	0.196	3.180	3.179
113	300	900	1450	1448	624	680	107	-0.099	0.302	-0.107	0.071	2.824	2.822
114	300	900	1475	1473	731	818	100	-0.024	0.327	0.246	0.270	3.446	3.503
115	300	900	1475	1470	770	820	96	-0.083	0.261	-0.052	-0.127	3.049	3.018
116	299 (1)	900	1475	1474	697	745	94	-0.089	0.269	-0.221	-0.116	3.798	3.929
117	300	900	1475	1468	599	674	86	-0.024	0.335	0.007	0.175	3.022	3.156
118	299 (1)	900	1475	1473	700	775	91	-0.032	0.312	0.021	0.091	3.036	2.862
119	299 (1)	900	1500	1495	807	843	87	-0.096	0.228	0.557	0.528	9.720	8.233
120	300	900	1500	1494	687	734	92	-0.090	0.267	0.263	0.298	3.734	3.503

DG AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
121	295 (5)	900	1500	1499	567	653	95	-0.020	0.363	-0.120	-0.059	4.005	4.088
122	300	900	1500	1496	527	604	83	-0.013	0.358	-0.844	-0.481	7.263	6.067
123	300	900	1500	1499	505	639	97	0.085	0.465	0.409	0.557	3.643	3.967
124	300	900	1525	1522	614	682	94	-0.055	0.319	-0.161	-0.154	3.152	3.080
125	300	900	1525	1521	607	657	82	-0.072	0.283	0.227	0.238	2.800	2.997
126	300		1500	1498	612								
127	300		1500	1493	863								
128	300		1500	1499	506								
129	300		1500	1500	684								
130	300	900	1500	1506	628	712	99	-0.030	0.345	-0.433	-0.226	3.853	3.969
131	300	900	1500	1506	581	664	102	-0.040	0.354	-0.011	-0.061	2.689	2.653
132	300	900	1500	1504	453	514	89	-0.068	0.351	0.027	0.146	3.430	3.669
133	300	900	1500	1504	506	589	90	-0.016	0.376	-0.030	0.039	2.724	2.739
134	300	900	1500	1498	569	622	84	-0.071	0.300	0.170	0.139	3.413	3.109
135	300	900	1500	1500	524	634	97	0.029	0.418	0.026	0.194	2.659	3.011
136	300	900	1500	1500	538	630	88	0.010	0.382	-0.104	0.029	2.842	2.763
137	300	900	1500	1505	625	691	87	-0.047	0.310	0.104	0.215	3.835	3.949
138	300	900	1500	1502	411	484	91	-0.046	0.391	-0.032	0.131	3.085	3.096
139	300	900	1500	1502	455	524	88	-0.048	0.365	-0.241	-0.068	3.698	3.875
140	300	900	1500	1500	353	424	91	-0.058	0.411	-0.226	0.034	3.440	3.507
141	300	900	1500	1502	417	463	86	-0.105	0.331	0.070	0.071	3.006	2.762
142	300	900	1500	1501	446	530	108	-0.055	0.401	0.069	0.515	2.711	5.470
143	300	900	1500	1500	387	454	73	-0.016	0.385	-0.033	0.151	2.961	2.974
144	300	900	1500	1504	563	641	83	-0.012	0.349	0.214	0.348	4.287	4.264
145	300	900	1500	1498	371	459	89	-0.005	0.436	-0.027	-0.015	2.951	2.763
146	300	900	1500	1498	382	488	90	0.042	0.468	0.055	0.323	2.647	2.950
147	300	900	1500	1498	516	621	87	0.040	0.412	0.066	0.184	2.849	2.911
148	300	900	1500	1500	517	606	79	0.024	0.384	0.147	0.368	3.574	3.631
149	300	900	1500	1500	495	602	92	0.035	0.423	0.236	0.366	2.915	3.100
150	300	900	1500	1500	592	667	91	-0.034	0.337	-0.119	0.121	4.872	3.778
151	300	900	1500	1500	510	571	90	-0.068	0.333	0.363	0.315	3.397	3.363
152	300	900	1500	1499	552	630	79	-0.003	0.351	-0.363	-0.169	6.230	4.210
153	299 (1)	900	1500	1502	369	440	90	-0.053	0.403	0.056	0.050	2.741	2.690
154	300	900	1500	1501	377	471	108	-0.037	0.447	0.248	0.327	2.927	3.087
155	300	900	1500	1502	509	578	88	-0.043	0.349	-0.049	-0.097	3.912	3.796
156	300	900	1525	1531	463	559	92	0.009	0.414	0.105	0.455	3.246	4.353
157	300	900	1550	1551	405	488	81	0.003	0.412	0.230	0.276	3.673	3.451
158	300	900	1575	1571	387	502	119	-0.009	0.480	0.498	0.576	4.229	3.966
159	300	900	1600	1594	501	560	79	-0.049	0.328	-0.017	-0.030	3.069	2.927
160	300	900	1625	1621	403	461	84	-0.070	0.362	-0.053	0.055	2.829	2.849
161	300	900	1650	1645	409	494	78	0.019	0.414	0.356	0.340	3.152	2.959
162	300	900	1675	1673	432	532	96	0.010	0.434	-0.122	0.216	3.793	3.924
163	300	900	1700	1698	500	601	83	0.044	0.412	-0.015	0.185	3.411	3.291
164	298 (2)	900	1725	1724	636	731	91	0.010	0.361	0.350	0.705	3.736	4.916
165	300	901	1750	1751	452	532	97	-0.041	0.390	-0.107	-0.138	3.044	3.053
166	300	900	1750	1743	530	578	74	-0.068	0.293	0.258	0.295	3.057	3.178
167	300	900	1750	1749	364	448	74	0.032	0.435	0.114	0.210	3.335	3.205
168	300	900	1750	1750	369	397	84	-0.159	0.306	0.236	0.276	3.058	2.994
169	300	899	1750	1751	456	514	83	-0.063	0.342	-0.157	-0.084	3.508	3.442
170	300	900	1750	1747	600	644	92	-0.102	0.279	0.394	0.331	4.329	3.774
171	300	900	1750	1748	494	596	80	0.055	0.417	0.027	0.247	2.882	3.261
172	300	900	1750	1750	535	607	111	-0.078	0.354	-0.040	0.022	3.041	3.247
173	300	900	1750	1750	410	501	82	0.027	0.428	0.137	0.144	3.159	2.890
174	300	900	1750	1746	412	471	84	-0.067	0.359	0.169	0.255	3.040	3.030
175	300	900	1750	1745	558	679	98	0.048	0.424	0.011	0.298	3.270	3.611
176	300	900	1750	1752	622	703	91	-0.020	0.340	0.074	0.215	2.830	3.032
177	300	901	1750	1751	403	517	121	-0.016	0.470	-0.117	0.209	3.220	3.873
178	300	900	1750	1750	439	533	79	0.039	0.421	0.174	0.346	2.979	3.170
179	300	900	1750	1758	480	558	86	-0.019	0.375	-0.112	0.008	3.169	3.091
180	300	900	1750	1747	465	561	85	0.025	0.413	0.138	0.195	3.117	2.875

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
181	300	900	1750	1746	427	487	95	-0.088	0.360	0.320	0.203	3.579	3.889
182	299 (1)	900	1750	1747	403	481	90	-0.033	0.404	-0.188	0.020	3.034	3.076
183	299 (1)	900	1750	1748	377	500	94	0.075	0.499	-0.373	-0.188	6.993	5.788
184	300	900	1750	1750	413	485	92	-0.053	0.387	-0.089	-0.112	3.302	3.083
185	300	900	1750	1750	501	499	92	-0.220	0.209	-0.206	-0.225	2.569	2.665
186	300	900	1750	1751	436	513	84	-0.017	0.388	0.078	0.212	2.971	3.148
187	300	1000	1750	1750	656	653	73	-0.174	0.160	0.232	0.229	2.859	2.737
188	300	1001	1750	1751	566	609	101	-0.120	0.291	0.050	0.016	3.038	3.036
189	300	1000	1750	1748	794	835	81	-0.078	0.235	0.124	0.145	2.699	2.796
190	300	999	1750	1751	511	548	75	-0.099	0.275	0.220	0.267	2.947	2.983
191	297 (3)	1000	1750	1755	460	504	102	-0.132	0.323	-0.032	-0.039	3.115	2.923
192	300	1001	1750	1748	455	496	96	-0.132	0.314	-0.008	0.038	2.821	2.885
193	300	1000	1750	1750	445	534	110	-0.047	0.411	0.079	0.288	3.220	3.343
194	300	1000	1750	1750	459	504	87	-0.105	0.316	0.631	0.636	5.373	4.289
195	300	1000	1750	1752	492	578	83	0.008	0.386	-0.015	0.167	3.092	3.114
196	300	1000	1750	1751	474	531	83	-0.066	0.334	-0.056	0.178	2.722	2.981
197	300	999	1750	1752	470	550	65	0.044	0.383	-0.085	-0.035	2.734	2.843
198	300	1000	1750	1752	456	528	103	-0.070	0.376	-0.065	0.068	3.147	3.025
199	300	1000	1750	1752	389	458	88	-0.052	0.391	-0.031	0.058	3.025	3.119
200	300	1000	1750	1751	352	443	71	0.062	0.456	0.033	0.032	2.884	3.074
201	300	999	1750	1752	300	349	71	-0.077	0.380	-0.140	0.120	3.112	3.421
202	300	999	1750	1751	418	471	63	-0.031	0.337	0.013	0.006	2.811	2.855
203	300	1001	1750	1756	398	467	101	-0.077	0.393	0.074	0.104	2.635	2.817
204	300	1000	1750	1755	403	462	97	-0.095	0.368	-0.298	-0.208	3.188	3.265
205	300	1000	1750	1757	403	483	86	-0.015	0.407	0.010	-0.007	2.898	2.749
206	300	1000	1750	1752	486	515	81	-0.130	0.269	-0.166	-0.105	3.530	3.489
207	300	999	1750	1754	459	488	85	-0.141	0.281	-0.234	-0.048	3.259	3.484
208	300	999	1750	1750	421	446	75	-0.140	0.274	0.277	0.398	3.695	3.863
209	300	999	1750	1750	416	506	74	0.046	0.425	-0.003	0.029	3.215	3.160
210	300	1000	1750	1750	469	534	85	-0.049	0.353	-0.125	-0.047	2.670	2.784
211	300	1000	1750	1753	394	444	82	-0.092	0.344	-0.075	0.112	3.416	3.060
212	300	1000	1750	1751	502	523	84	-0.154	0.251	0.117	0.214	2.773	2.934
213	300	1000	1750	1751	499	625	94	0.076	0.455	0.222	0.300	2.883	2.749
214	300	1000	1750	1753	433	533	98	0.006	0.433	-0.025	0.292	3.018	3.548
215	300	1001	1750	1751	437	514	111	-0.078	0.393	-0.174	0.140	3.134	3.055
216	300	1000	1750	1753	401	458	107	-0.123	0.369	-0.098	0.198	2.728	3.522
217	300	1000	1750	1750	439	520	82	-0.005	0.393	-0.019	0.338	2.875	3.479
218	300	1000	1750	1749	381	472	78	0.037	0.440	0.082	0.241	2.724	3.249
219	300	1000	1750	1747	427	480	106	-0.126	0.352	-0.056	0.059	3.193	3.006
220	300	1001	1750	1745	636	733	106	-0.016	0.365	-0.038	0.111	3.363	3.258
221	300	999	1775	1779	486	565	80	-0.001	0.375	0.106	0.220	3.358	3.249
222	300	1000	1800	1801	450	466	87	-0.178	0.257	0.093	0.163	3.154	3.397
223	300	1000	1825	1825	506	536	88	-0.138	0.271	0.334	0.351	3.213	3.598
224	300	1000	1850	1845	511	567	89	-0.076	0.323	-0.310	-0.115	2.578	2.673
225	300	999	1875	1872	483	490	67	-0.166	0.204	0.249	0.156	3.010	3.099
226	300	999	1900	1899	633	684	64	-0.032	0.276	-0.131	0.036	3.613	3.847
227	300	1000	1925	1923	587	596	90	-0.178	0.212	0.254	0.152	3.281	3.189
228	300	1000	1950	1947	634	704	89	-0.040	0.317	-0.651	-0.518	5.767	5.923
229	300	1000	1975	1972	650	726	102	-0.050	0.327	0.062	0.122	3.749	3.631
230	300	1000	2000	1994	805	845	95	-0.098	0.239	-0.085	-0.013	2.993	3.172
231	300	1000	2000	1996	623	721	93	0.012	0.370	0.021	0.081	2.818	2.713
232	300	1000	2000	1999	513	541	75	-0.119	0.256	-0.008	0.035	2.719	2.771
233	300	1000	2000	1995	593	660	104	-0.075	0.326	0.373	0.450	3.746	3.504
234	300	1000	2000	1993	578	689	93	0.041	0.404	0.090	0.339	2.688	3.326
235	300	1001	2000	1999	579	696	97	0.041	0.412	0.195	0.373	2.955	3.294
236	300	999	2000	1991	665	751	78	0.016	0.338	0.133	0.190	3.130	3.062
237	300	1000	2000	2000	737	769	79	-0.097	0.224	0.352	0.515	3.823	3.811
238	300	1000	2000	2003	673	691	86	-0.142	0.212	-0.050	0.117	3.110	3.113
239	300	1001	2000	2006	641	774	135	-0.004	0.414	-0.056	0.153	2.978	3.008
240	300	1001	2000	2001	583	620	99	-0.129	0.274	-0.087	0.174	2.550	3.644

DG AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
241	300	1001	2000	2007	720	742	87	-0.130	0.215	0.549	0.516	4.152	3.622
242	300	999	2000	2000	626	649	75	-0.119	0.223	0.066	0.095	2.772	3.077
243	300	999	2000	1997	530	614	70	0.037	0.372	-0.236	-0.122	2.848	2.655
244	300	1000	2000	1999	508	593	84	0.002	0.378	0.039	0.059	3.145	2.781
245	300	1000	2000	1996	501	594	82	0.024	0.395	-0.120	0.021	3.022	2.656
246	300	1000	2000	2002	498	565	83	-0.041	0.345	-0.034	0.086	3.177	2.948
247	300	1000	2000	1997	514	628	82	0.079	0.432	0.101	0.222	3.084	2.965
248	300	1000	2000	1998	643	788	102	0.084	0.436	0.259	0.326	3.231	3.381
249	300	1001	2000	1996	595	700	107	-0.005	0.387	0.105	0.050	3.251	2.936
250	300	1001	2000	1998	516	593	114	-0.076	0.367	0.225	0.235	3.553	3.563
251	300	999	2000	1997	596	655	70	-0.027	0.301	0.031	0.190	3.118	3.212
252	300	1000	2000	1999	518	566	77	-0.072	0.300	-0.092	0.037	3.395	3.063
253	300	1000	2000	1995	605	670	96	-0.063	0.319	0.252	0.256	3.523	3.285
254	300	1000	2000	1997	560	617	73	-0.040	0.306	0.211	0.239	3.583	3.618
255	300	1001	2000	1997	614	752	118	0.037	0.429	0.009	0.123	2.964	3.041
256	300	1000	2000	1998	532	620	91	-0.005	0.378	-0.312	-0.256	3.485	3.302
257	300	1001	2000	2000	483	544	81	-0.049	0.339	-0.158	-0.197	3.000	3.072
258	300	1000	2000	1998	563	656	97	-0.008	0.377	0.077	0.182	2.698	2.988
259	300	1000	2000	1998	618	655	107	-0.136	0.271	-0.178	-0.160	3.093	3.038
260	300	1000	2000	1996	548	612	77	-0.028	0.327	-0.245	-0.200	3.087	3.241
261	300	1000	2000	1996	623	658	76	-0.095	0.248	0.139	0.099	2.898	2.928
262	300	999	2000	1991	628	678	67	-0.041	0.275	0.169	0.188	3.032	3.316
263	300	999	2000	1994	546	598	59	-0.021	0.295	-0.175	-0.015	2.831	3.395
264	300	999	2000	1999	615	664	75	-0.061	0.277	-0.028	0.004	2.604	2.421
265	300	1000	2000	1994	558	669	110	0.003	0.408	-0.112	-0.004	3.624	3.758
266	300	1000	2000	2005	743	763	87	-0.132	0.208	0.046	0.019	3.044	3.237
267	300	1000	2000	2002	685	702	75	-0.130	0.199	-0.070	-0.066	2.879	2.958
268	300	1000	2000	1996	452	546	88	0.016	0.416	-0.151	0.075	3.127	3.173
269	300	1000	2000	1997	486	535	94	-0.103	0.320	0.229	0.245	3.294	3.015
270	300	1000	2000	1996	699	690	84	-0.193	0.155	0.291	0.325	3.092	3.190
271	300	1000	2000	1998	526	555	93	-0.143	0.270	-0.283	-0.229	3.262	3.677
272	300	1000	2000	1999	500	559	73	-0.036	0.327	-0.168	0.159	3.050	3.516
273	300	1000	2000	2000	548	598	97	-0.102	0.305	-0.139	0.004	3.276	3.043
274	300	1001	2000	1996	627	736	134	-0.042	0.387	-0.208	-0.135	3.188	3.044
275	300	1000	2000	1994	694	708	78	-0.136	0.196	0.203	0.048	3.390	3.293
276	300	999	2000	1998	571	601	67	-0.095	0.242	-0.118	-0.039	2.758	2.645
277	300	999	2000	1997	637	722	73	0.026	0.343	-0.242	-0.117	3.232	3.579
278	299 (1)	1000	2000	1995	691	774	88	-0.012	0.326	0.114	0.114	2.632	2.611
279	300	1000	2000	1996	530	650	98	0.047	0.432	0.049	0.127	3.135	3.028
280	300	1000	2000	2000	508	620	81	0.077	0.432	0.169	0.320	3.033	2.924
281	300	1001	2000	1994	602	673	88	-0.038	0.326	0.029	0.124	2.925	2.865

GH AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
1	300	900	1500	1466	13697	13637	73	-0.066	0.007	-0.330	-0.315	3.334	3.298
2	299 (1)	900	1500	1451	8350	8437	99	-0.007	0.101	-0.215	-0.205	2.734	2.748
3	300	900	1500	1510	8494	8614	85	0.021	0.120	-0.041	-0.048	3.879	3.735
4	300	900	1500	1466	7352	7552	105	0.054	0.171	0.326	0.312	3.854	3.622
5	300	900	1500	1473	5149	5320	95	0.054	0.187	-0.067	-0.087	3.185	3.160
6	300	900	1500	1470	6287	6348	88	-0.018	0.100	-0.163	-0.165	2.723	2.722
7	300	900	1500	1477	4663	4710	93	-0.035	0.106	0.024	0.010	2.907	2.887
8	300	900	1500	1471	4193	4294	82	0.017	0.155	-0.180	-0.158	3.850	3.717
9	299 (1)	900	1500	1461	5459	5492	82	-0.037	0.086	-0.266	-0.276	2.759	2.728
10	300	900	1500	1483	3532	3553	84	-0.057	0.096	-0.030	-0.005	2.641	2.664
11	300	900	1500	1474	2945	3137	101	0.084	0.260	0.085	0.047	2.644	2.595
12	300	900	1500	1482	3208	3290	88	-0.006	0.158	-0.309	-0.369	3.069	3.011
13	300	900	1500	1484	2218	2380	95	0.072	0.270	0.030	0.114	2.907	2.922
14	300	900	1500	1490	2579	2711	90	0.044	0.225	0.146	0.190	3.151	3.189
15	300	900	1500	1495	3218	3306	91	-0.004	0.163	0.170	0.154	3.218	3.302
16	300	900	1500	1493	2212	2271	81	-0.026	0.163	0.210	0.210	3.069	3.156
17	300	900	1500	1483	2846	2918	87	-0.016	0.157	-0.132	-0.145	2.772	2.708
18	300	900	1500	1484	1863	2005	97	0.052	0.270	-0.098	-0.072	3.310	3.189
19	300	900	1500	1491	2599	2755	97	0.060	0.245	-0.167	-0.085	2.963	3.115
20	300	900	1500	1483	1856	1905	85	-0.046	0.166	0.492	0.546	3.075	3.356
21	300	900	1500	1488	1871	1916	93	-0.057	0.164	-0.102	-0.050	3.050	3.184
22	300	900	1500	1493	2636	2711	80	-0.005	0.167	0.095	0.050	2.906	2.771
23	300	900	1500	1481	1954	2004	83	-0.041	0.163	0.059	0.070	2.826	2.845
24	300	900	1500	1491	2107	2244	86	0.060	0.254	0.191	0.132	3.344	3.311
25	300	900	1500	1487	1873	1946	90	-0.021	0.195	0.163	0.094	3.273	3.005
26	300	900	1500	1484	1705	1770	78	-0.018	0.192	-0.170	-0.188	2.467	2.470
27	300	900	1500	1479	1854	1882	78	-0.065	0.139	0.274	0.325	3.426	3.386
28	299 (1)	900	1500	1482	1895	1984	79	0.013	0.212	0.166	0.148	3.003	2.971
29	300	900	1500	1485	1785	1891	108	-0.002	0.237	0.199	0.165	3.465	3.181
30	300	900	1500	1477	2420	2662	97	0.149	0.333	0.261	0.273	3.136	3.161
31	300	900	1500	1477	2135	2259	84	0.047	0.239	-0.032	-0.006	2.882	2.862
32	300	900	1500	1480	1790	1877	111	-0.027	0.217	-0.056	-0.004	2.963	2.962
33	300	900	1500	1478	2234	2340	93	0.015	0.214	-0.095	-0.036	3.024	2.926
34	300	900	1500	1481	1589	1710	79	0.059	0.272	-0.078	0.007	3.341	3.401
35	300	900	1500	1479	1718	1849	85	0.061	0.273	-0.051	0.022	3.587	3.508
36	300	900	1500	1486	1407	1529	81	0.060	0.288	-0.109	-0.022	3.239	3.349
37	300	900	1500	1484	1455	1545	86	0.006	0.241	-0.060	-0.029	3.195	3.018
38	300	900	1500	1483	1285	1347	83	-0.031	0.217	0.074	0.052	3.145	2.971
39	300	900	1500	1478	1517	1681	92	0.096	0.326	-0.017	0.008	3.605	3.651
40	300	900	1500	1484	1702	1800	96	0.004	0.234	0.200	0.186	2.970	3.002
41	300	900	1500	1485	1551	1690	92	0.062	0.292	-0.330	-0.274	3.786	3.554
42	299 (1)	900	1500	1487	1790	1868	81	-0.003	0.205	0.071	0.062	3.201	3.100
43	300	900	1500	1482	1922	2106	100	0.096	0.309	0.057	0.155	2.887	3.047
44	300	900	1500	1485	2268	2424	77	0.094	0.269	0.017	0.000	2.771	2.847
45	300		1500	1492	2149								
46	298 (2)	900	1500	1490	2265	2412	88	0.066	0.255	-0.064	-0.003	3.751	3.471
47	300	900	1500	1482	1736	1886	89	0.076	0.291	0.151	0.201	2.936	3.154
48	300	900	1500	1488	1088	1229	87	0.088	0.349	-0.108	0.097	2.938	3.330
49	300	900	1500	1491	1344	1499	89	0.096	0.334	0.227	0.177	3.027	2.983
50	300	900	1500	1486	1362	1488	84	0.062	0.297	0.208	0.245	3.298	3.238
51	300	900	1500	1495	1476	1556	86	-0.010	0.226	0.987	0.840	9.666	8.449
52	300	901	1500	1489	1374	1553	116	0.078	0.347	0.152	0.178	3.375	3.269
53	300	900	1500	1491	1120	1241	88	0.052	0.316	0.057	0.130	2.984	3.116
54	300	900	1500	1488	1316	1506	88	0.150	0.382	0.105	0.213	3.173	3.166
55	300	900	1500	1486	1418	1615	91	0.149	0.376	0.214	0.205	3.186	3.114
56	297 (3)	900	1500	1487	1368	1486	81	0.055	0.287	0.299	0.233	4.748	4.356
57	300	900	1500	1486	1262	1416	124	0.038	0.332	-0.461	-0.232	6.119	5.723
58	300	900	1500	1491	1335	1420	99	-0.020	0.245	0.088	0.100	2.919	2.822
59	300	900	1500	1488	1061	1118	82	-0.043	0.229	0.126	0.164	3.132	3.137
60	300	900	1500	1484	1196	1319	92	0.047	0.309	-0.296	-0.151	3.118	3.056

GH AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
61	300		1500	1487	1173								
62	300		1500	1490	3199								
63	300		1500	1489	1104								
64	300		1500	1484	1423								
65	300		1500	1481	1268								
66	300		1500	1485	1475								
67	300		1500	1485	1187								
68	300		1500	1495	1505								
69	300	900	1500	1494	1470	1586	101	0.019	0.271	0.265	0.286	3.065	3.095
70	300	900	1500	1484	1607	1783	96	0.102	0.328	-0.112	-0.038	3.456	3.662
71	300	900	1500	1488	1043	1077	87	-0.089	0.197	-0.172	-0.250	2.588	2.617
72	300	900	1500	1480	1712	1831	83	0.049	0.259	0.213	0.190	3.175	3.097
73	300	900	1500	1487	1084	1282	107	0.134	0.412	0.144	0.161	3.280	2.992
74	300	900	1500	1481	1483	1581	89	0.012	0.249	0.307	0.257	3.827	3.615
75	300	900	1500	1479	1572	1685	97	0.021	0.260	-0.128	-0.101	3.584	3.346
76	300	900	1500	1490	769	947	97	0.148	0.453	-0.148	0.050	3.087	3.245
77	300	901	1500	1486	960	1106	116	0.045	0.365	0.025	0.012	3.592	3.475
78	300	900	1500	1487	1101	1197	78	0.031	0.285	0.354	0.396	3.216	3.400
79	300	900	1500	1487	1398	1540	92	0.069	0.310	0.061	0.180	3.826	4.015
80	300	900	1500	1490	1042	1087	105	-0.090	0.222	-0.215	-0.208	2.693	2.646
81	300	900	1525	1512	871	978	88	0.035	0.333	-0.060	0.054	2.937	3.087
82	300	900	1550	1534	1062	1139	85	-0.014	0.260	-0.014	-0.015	2.943	3.104
83	300	900	1575	1558	1189	1270	83	-0.002	0.254	0.115	0.122	2.920	2.932
84	300	900	1600	1590	1233	1357	87	0.056	0.307	0.346	0.301	3.245	3.027
85	300	900	1600	1590	1565	1633	84	-0.022	0.205	0.089	0.127	2.779	2.949
86	300	900	1600	1589	922	973	98	-0.077	0.242	-0.067	-0.062	3.495	3.705
87	300	900	1600	1590	1187	1334	89	0.088	0.342	-0.157	-0.016	3.174	3.255
88	300	900	1600	1590	1163	1260	87	0.016	0.278	0.057	0.000	3.538	3.171
89	300	900	1625	1612	1188	1299	98	0.018	0.293	0.137	0.185	3.370	3.154
90	300	900	1650	1637	1198	1312	95	0.030	0.297	-0.253	-0.224	4.011	3.685
91	300	899	1675	1662	1429	1491	72	-0.016	0.204	-0.008	0.036	3.663	3.912
92	300	900	1700	1682	2042	2147	92	0.015	0.222	-0.008	-0.012	2.927	2.820
93	300	900	1700	1689	1562	1786	92	0.068	0.298	-0.223	-0.150	3.391	3.422
94	300	900	1700	1687	1388	1498	84	0.038	0.273	-0.279	-0.334	3.916	3.990
95	300	900	1700	1685	1763	1834	95	-0.030	0.198	0.290	0.179	3.139	2.853
96	300	900	1700	1684	2174	2326	91	0.069	0.265	0.396	0.456	4.224	4.201
97	300	900	1725	1709	1533	1608	88	-0.016	0.218	0.266	0.234	3.060	3.049
98	300	900	1750	1736	1694	1925	105	0.151	0.375	-0.013	0.052	3.295	3.381
99	300	900	1775	1758	2007	2207	83	0.145	0.331	0.151	0.163	3.070	2.963
100	300	900	1800	1784	1523	1628	100	0.007	0.255	-0.021	0.073	2.810	2.892
101	300	900	1800	1780	2265	2448	81	0.118	0.296	0.314	0.338	3.164	3.196
102	300	900	1800	1782	2192	2383	95	0.106	0.301	-0.455	-0.348	4.084	3.906
103	300	900	1800	1782	1476	1546	105	-0.044	0.217	0.259	0.133	2.803	2.716
104	300	900	1800	1779	2143	2276	111	0.022	0.242	-0.194	-0.137	3.395	3.433
105	300	900	1825	1803	2115	2169	82	-0.034	0.161	0.060	0.047	3.040	3.072
106	300	900	1850	1831	2086	2153	107	-0.043	0.180	0.115	0.145	4.046	3.788
107	300	900	1875	1850	1667	1719	89	-0.049	0.180	-0.002	0.010	2.855	3.071
108	300	900	1900	1873	1882	2027	97	0.056	0.273	-0.100	0.002	2.926	3.168
109	300	900	1900	1882	2241	2400	90	0.077	0.268	0.142	0.142	2.990	3.039
110	300	900	1900	1878	2661	2690	99	-0.069	0.124	-0.026	0.015	3.079	2.886
111	300	900	1900	1873	3247	3432	85	0.094	0.250	0.123	0.076	2.795	2.704
112	300	900	1900	1878	2574	2679	92	0.014	0.199	-0.027	-0.069	3.667	3.626
113	300	900	1900	1870	2120	2242	104	0.019	0.234	0.230	0.222	3.044	3.016
114	300	900	1925	1912	2381	2438	106	-0.048	0.161	0.038	0.063	2.567	2.480
115	300	900	1950	1932	2876	2949	94	-0.020	0.159	-0.256	-0.209	3.559	3.498
116	300	900	1975	1954	2764	2795	74	-0.047	0.116	0.057	0.086	3.282	3.122
117	300	900	2000	1990	3030	3163	90	0.040	0.208	0.073	0.156	3.482	3.521
118	300	900	2000	1978	3715	3948	81	0.139	0.278	-0.264	-0.255	3.300	3.344
119	300	900	2000	1978	2340	2466	99	0.028	0.228	0.081	0.089	2.969	3.108
120	300	900	2000	1977	3004	3075	86	-0.015	0.153	0.105	0.135	2.842	3.001

6H AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
121	300	900	2000	1982	3672	3801	101	0.023	0.186	0.096	0.059	3.050	2.996
122	300	900	2025	1995	2437	2563	103	0.023	0.223	0.381	0.339	3.634	3.351
123	300	900	2050	2030	3471	3661	90	0.089	0.243	-0.168	-0.148	3.137	3.100
124	300	900	2075	2048	3111	3289	96	0.075	0.244	0.216	0.218	2.595	2.571
125	300	900	2100	2082	3072	3307	89	0.140	0.299	-0.031	-0.045	2.893	2.921
126	300	900	2100	2063	2839	2995	87	0.070	0.238	0.278	0.278	3.238	3.202
127	300	900	2100	2068	3525	3708	81	0.096	0.241	-0.193	-0.177	3.568	3.686
128	300	900	2100	2076	3497	3769	95	0.155	0.307	-0.126	-0.104	2.941	2.937
129	300	900	2100	2074	3369	5534	82	0.063	0.184	-0.149	-0.165	3.008	3.030
130	300	900	2075	2045	2550	2699	89	0.063	0.243	-0.154	-0.044	3.990	3.809
131	298 (2)	900	2050	2029	2551	2703	88	0.067	0.246	-0.003	0.042	3.103	2.963
132	300	900	2025	2002	3809	4041	99	0.107	0.261	-0.386	-0.328	3.426	3.535
133	300	900	2000	1964	2996	3286	112	0.154	0.331	-0.017	0.034	2.755	2.797
134	300	900	2000	1971	2359	2472	81	0.037	0.217	-0.420	-0.408	4.122	4.203
135	300	900	2000	1971	2623	2765	98	0.043	0.231	-0.006	0.028	2.822	2.808
136	300	900	2000	1966	2589	2691	80	0.023	0.195	0.282	0.313	3.041	3.179
137	300	900	2000	1977	1772	1827	78	-0.031	0.177	-0.060	-0.013	2.888	2.864
138	300	900	2000	1977	2304	2447	96	0.050	0.246	0.238	0.290	3.171	3.411
139	300	900	2000	1972	2313	2433	85	0.040	0.226	0.197	0.200	2.885	2.947
140	300	1000	2000	1974	2905	3094	91	0.095	0.264	0.032	0.025	2.741	2.766
141	299 (1)	999	2000	1991	2208	2270	69	-0.010	0.165	0.045	0.051	2.810	2.778
142	300	1000	2000	1982	1855	2020	75	0.121	0.308	0.028	0.047	3.085	3.159
143	300	1000	2000	1979	1890	2056	100	0.076	0.293	0.189	0.201	3.013	2.937
144	300	1000	2000	1970	1754	1868	74	0.055	0.252	0.234	0.255	3.935	3.890
145	300	1001	2000	1972	3163	3314	85	0.063	0.222	-0.071	-0.004	2.778	2.755
146	300	999	2000	1982	1676	1742	90	-0.031	0.196	-0.299	-0.258	3.594	3.338
147	300	1000	2000	1981	1301	1503	83	0.182	0.404	0.252	0.374	3.300	3.494
148	300	1000	2000	1981	1266	1362	91	0.009	0.266	0.271	0.206	3.311	3.249
149	300	1000	2000	1982	1964	2013	83	-0.042	0.162	0.062	0.046	3.495	3.662
150	300	1001	2000	1977	1472	1621	85	0.090	0.315	0.253	0.221	3.318	3.267
151	300	1000	2000	1988	1492	1682	106	0.106	0.351	0.253	0.285	2.890	2.818
152	300	999	2000	1983	1555	1615	69	-0.013	0.194	0.066	0.199	2.677	2.875
153	300	1001	2000	1979	2118	2188	122	-0.051	0.186	-0.128	-0.141	2.712	2.727
154	300	999	2000	1981	1627	1749	98	0.030	0.266	0.245	0.247	2.709	2.686
155	300	1001	2000	1989	2759	2952	119	0.065	0.263	-0.532	-0.449	4.123	3.703
156	300	1000	2000	1984	2199	2334	69	0.085	0.255	0.014	0.017	3.031	3.109
157	300	999	2000	1990	1459	1546	75	0.018	0.238	-0.003	-0.037	3.172	3.191
158	300	1000	2000	1986	1523	1612	95	-0.008	0.235	-0.129	-0.091	3.103	3.152
159	300	999	2000	1980	1638	1746	67	0.062	0.256	0.072	0.072	2.841	2.828
160	300	999	2000	1965	3073	3217	65	0.087	0.228	0.047	0.054	3.177	3.122
161	300	1000	2000	1982	1558	1624	78	-0.016	0.203	0.113	0.092	3.147	3.198
162	300	999	2000	1986	1529	1655	69	0.086	0.288	0.196	0.243	2.891	3.117
163	300	1000	2000	1980	1654	1737	102	-0.024	0.219	0.252	0.177	3.431	3.310
164	300	999	2000	1971	1812	1885	68	0.006	0.196	-0.129	-0.129	3.109	3.046
165	300		2000	1976	1549								
166	300	1001	2000	1978	1169	1300	107	0.035	0.319	0.217	0.294	3.765	3.626
167	300	1000	2000	1979	1516	1608	79	0.019	0.240	0.090	0.079	3.336	3.318
168	300	1000	2000	1982	1442	1491	86	-0.053	0.188	-0.051	-0.117	2.838	2.910
169	300	1001	2000	1977	1460	1627	92	0.103	0.335	0.094	0.167	2.966	3.243
170	300	999	2000	1982	1442	1523	82	-0.002	0.230	0.201	0.238	3.200	3.040
171	300	1001	2000	1975	1877	2078	93	0.129	0.334	0.288	0.255	3.267	3.276
172	300	1000	2000	1984	1575	1740	95	0.089	0.319	0.246	0.187	3.036	2.789
173	300	1000	2000	1995	2787	2926	75	0.070	0.228	-0.034	0.041	3.102	3.258
174	300	1001	2000	1978	2658	2789	114	0.016	0.217	0.111	0.147	2.663	2.575
175	300	999	2000	1977	1991	2085	59	0.051	0.218	0.153	0.186	3.418	3.547
176	300	999	2000	1985	1769	1804	70	-0.049	0.148	-0.010	-0.018	2.942	2.959
177	300	999	2000	1976	1922	2014	63	0.043	0.218	-0.339	-0.232	4.482	4.246
178	300	1000	2000	1973	2235	2414	94	0.093	0.287	-0.078	-0.106	3.137	3.007
179	300	1000	2000	1985	1493	1643	105	0.057	0.307	0.297	0.317	2.623	2.648
180	300	1001	2000	1981	1612	1695	107	-0.029	0.223	0.176	0.184	2.966	2.984

GH AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
181	300	1000	2000	1985	1406	1521	79	0.055	0.281	0.177	0.249	3.076	2.843
182	300	1001	2000	1983	1428	1523	72	0.036	0.253	0.019	0.036	2.877	3.032
183	300	998	2000	1979	1437	1534	61	0.062	0.259	0.098	0.082	2.916	3.024
184	300	1001	1975	1955	1379	1472	99	-0.007	0.253	0.290	0.332	3.515	3.528
185	300	1001	1950	1928	3350	3415	107	-0.035	0.142	0.047	0.040	3.186	3.318
186	300	1000	1925	1915	1471	1547	98	-0.029	0.223	0.060	0.191	2.907	3.190
187	300	1000	1900	1886	1334	1442	85	0.033	0.275	0.045	0.023	3.884	3.607
188	300	1000	1875	1864	1611	1674	84	-0.029	0.196	0.007	0.130	3.217	3.145
189	300	999	1850	1833	1295	1386	84	0.011	0.257	0.237	0.380	4.010	4.084
190	300	999	1825	1803	1400	1447	78	-0.046	0.186	0.236	0.267	3.304	3.093
191	300	1000	1800	1788	1586	1654	119	-0.059	0.211	0.003	0.099	3.123	2.996
192	300	1000	1775	1762	1295	1390	79	0.026	0.264	-0.238	-0.153	3.472	3.278
193	300	1000	1750	1739	1147	1246	87	0.019	0.283	0.325	0.386	3.079	3.085
194	300	1001	1750	1743	1649	1752	134	-0.033	0.244	-0.181	-0.099	2.808	2.817
195	300	999	1750	1743	1071	1150	78	0.002	0.262	-0.123	-0.094	3.603	3.484
196	300	1000	1750	1737	1031	1118	93	-0.011	0.278	0.253	0.284	2.916	3.004
197	300	1000	1750	1741	981	1032	69	-0.035	0.224	-0.085	-0.108	3.031	3.209
198	300	999	1750	1733	1108	1227	76	0.074	0.319	-0.038	0.026	2.924	3.164
199	300	1000	1750	1738	832	1013	95	0.152	0.444	0.212	0.351	2.840	3.082
200	300	1000	1750	1738	1261	1353	91	0.001	0.260	0.053	0.065	3.269	3.271
201	300	999	1750	1730	1095	1148	80	-0.044	0.220	0.113	0.157	3.239	3.442
202	300	1000	1750	1740	983	1076	98	-0.008	0.295	0.138	0.131	2.851	2.872
203	300	999	1750	1735	1282	1325	80	-0.057	0.189	-0.051	-0.002	3.009	3.180
204	300	1000	1750	1740	1234	1276	95	-0.076	0.198	0.135	0.173	3.004	3.231
205	300	1000	1750	1741	1071	1247	96	0.124	0.393	0.018	0.164	3.223	3.411
206	300	999	1750	1739	1194	1252	66	-0.016	0.215	0.201	0.195	3.526	3.466
207	300	1000	1750	1746	1211	1314	95	0.011	0.279	1.201	1.188	8.749	8.082
208	300	1000	1750	1739	828	957	96	0.059	0.372	0.022	0.089	2.505	2.575
209	300	1001	1750	1742	1083	1124	97	-0.087	0.208	0.208	0.105	3.285	3.134
210	300	1000	1750	1743	860	949	91	-0.003	0.307	-0.022	0.042	3.125	3.354
211	300	1001	1750	1743	1001	1139	100	0.060	0.353	0.186	0.260	3.140	3.206
212	300	1000	1750	1741	1104	1249	104	0.061	0.346	-0.279	-0.215	3.004	3.021
213	300	1000	1750	1742	928	965	71	-0.065	0.207	0.066	0.066	2.797	2.834
214	300	1000	1750	1744	979	1057	87	-0.015	0.272	-0.085	0.060	2.923	3.044
215	300	1000	1750	1741	912	991	93	-0.024	0.284	0.005	0.136	2.750	3.059
216	300	999	1750	1738	863	905	63	-0.045	0.221	-0.010	0.054	2.709	2.729
217	300	1000	1750	1739	1207	1292	86	-0.001	0.257	0.057	0.050	3.198	3.406
218	300	1000	1750	1744	1090	1156	90	-0.038	0.242	-0.124	-0.150	3.160	3.213
219	300	1000	1750	1736	1458	1585	94	0.046	0.287	0.019	0.039	3.040	2.945
220	300	1000	1750	1737	860	919	89	-0.055	0.258	0.292	0.246	4.747	4.019
221	300	1000	1750	1737	1068	1211	96	0.073	0.350	0.293	0.337	3.302	3.255
222	300	1000	1750	1743	1161	1190	95	-0.100	0.184	0.484	0.416	4.147	3.787
223	300	1000	1750	1743	981	1105	105	0.029	0.335	-0.094	-0.042	3.289	3.301
224	300	1000	1750	1747	825	902	89	-0.021	0.293	0.048	-0.081	2.525	2.506
225	300	1000	1750	1736	969	1020	87	-0.062	0.232	0.111	0.150	2.995	3.166
226	300	1000	1750	1745	836	855	88	-0.128	0.194	0.243	0.240	3.069	3.173
227	300	999	1750	1744	747	848	95	0.011	0.345	-0.052	0.199	3.962	3.932
228	300	1000	1750	1741	1149	1193	89	-0.072	0.203	0.282	0.327	3.263	3.493
229	300	1000	1750	1740	1093	1185	96	-0.007	0.278	-0.011	-0.107	3.918	3.559
230	300	999	1750	1740	998	1092	91	0.006	0.294	0.116	0.185	3.005	3.084
231	300	999	1750	1741	962	1054	92	0.000	0.296	-0.181	-0.088	3.166	3.353
232	300	1000	1750	1737	879	1082	114	0.142	0.452	0.002	0.381	3.396	3.946
233	300	1000	1750	1742	954	1043	83	0.011	0.292	0.089	0.096	2.793	3.046
234	300	1000	1750	1742	865	956	95	-0.007	0.308	0.037	0.194	3.228	3.704
235	300	1000	1750	1736	1002	1114	92	0.035	0.320	0.183	0.251	2.887	2.979
236	300	1000	1750	1742	1288	1397	93	0.023	0.280	0.302	0.340	3.008	3.194
237	300	1000	1750	1742	847	924	82	-0.008	0.289	-0.058	-0.046	2.603	2.511
238	300	1000	1750	1739	938	1001	111	-0.073	0.261	-0.004	0.040	3.120	3.255
239	300	1000	1750	1741	1110	1170	83	-0.039	0.229	-0.004	0.076	2.910	2.859
240	300	1000	1750	1739	1090	1180	87	0.003	0.275	0.041	0.055	3.337	3.369

GH AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
241	300	1000	1750	1746	1040	1164	93	0.051	0.331	0.209	0.296	3.036	2.966
242	300	1000	1750	1739	1092	1139	93	-0.072	0.216	-0.113	-0.011	3.005	3.303
243	300	1000	1750	1743	781	887	86	0.039	0.347	-0.004	0.239	3.044	3.100
244	300	1000	1750	1741	1033	1129	110	-0.021	0.293	0.251	0.282	3.185	3.119
245	300	1000	1750	1747	1167	1219	102	-0.072	0.219	-0.115	0.067	3.400	3.472
246	300	1000	1750	1739	1220	1327	89	0.026	0.285	0.222	0.303	3.125	3.334
247	300	1001	1750	1737	1716	1813	120	-0.026	0.232	-0.191	-0.096	2.670	2.699
248	300	1001	1750	1751	931	1131	135	0.092	0.429	0.104	0.066	2.961	2.729
249	300	1000	1750	1750	938	1116	94	0.142	0.420	-0.097	-0.022	2.974	2.930
250	300	1000	1750	1751	940	1038	79	0.033	0.308	0.309	0.151	2.931	2.758
251	300	1000	1750	1752	1015	1078	67	-0.007	0.242	-0.095	-0.046	3.105	3.235
252	300	1000	1750	1751	1161	1321	85	0.120	0.366	0.159	0.178	2.994	2.967
253	300	1000	1750	1745	958	1014	79	-0.042	0.239	-0.087	-0.003	3.168	3.166
254	300	1000	1750	1751	1168	1228	71	-0.019	0.222	-0.069	-0.027	3.519	3.268
255	300	999	1750	1744	949	981	69	-0.072	0.194	0.237	0.149	3.273	3.158
256	300	1000	1750	1751	1431	1620	97	0.123	0.361	-0.014	0.113	3.614	3.419
257	300	1001	1750	1744	1203	1333	118	0.016	0.313	-0.059	0.114	2.955	3.382
258	300	999	1750	1745	762	852	86	0.007	0.325	-0.247	0.093	3.419	3.878
259	300	1000	1750	1744	728	841	105	0.013	0.367	0.249	0.239	3.268	3.208
260	300	1000	1750	1742	804	871	71	-0.009	0.277	-0.087	-0.021	3.157	3.299
261	300	1000	1750	1749	902	1062	84	0.139	0.409	0.102	0.241	3.223	3.255
262	300	999	1750	1744	726	809	92	-0.015	0.322	-0.117	0.013	3.252	2.897
263	300	1000	1725	1727	1085	1124	77	-0.065	0.198	0.208	0.267	3.382	3.134
264	300	1001	1700	1699	796	893	103	-0.010	0.331	-0.045	0.039	2.834	3.248
265	300	1001	1675	1671	768	878	98	0.023	0.355	-0.043	-0.046	3.182	3.163
266	300	1001	1650	1641	1283	1408	118	0.009	0.298	0.000	0.219	2.921	3.048
267	300	1000	1625	1627	1035	1149	86	0.048	0.318	0.168	0.201	2.856	3.118
268	300	1001	1600	1596	1771	1767	101	-0.125	0.115	-1.031	-0.971	7.113	6.821
269	300	1000	1575	1557	1902	2040	89	0.060	0.267	-0.190	-0.125	2.597	2.783
270	300	1000	1550	1546	921	1019	89	0.017	0.311	-0.196	-0.082	2.938	2.986
271	300	1002	1525	1521	1036	1097	118	-0.082	0.249	0.089	-0.003	3.058	2.980
272	300	1000	1500	1494	990	1034	89	-0.076	0.219	-0.015	0.029	3.056	3.186
273	300	999	1500	1497	794	856	84	-0.041	0.273	0.224	0.321	3.075	3.434
274	300		1500	1498	1275								
275	300	999	1500	1490	884	964	69	0.022	0.289	-0.014	0.129	2.932	3.273
276	300	1000	1500	1493	880	962	81	0.001	0.292	0.149	0.112	2.977	2.880
277	300	1000	1500	1493	822	954	97	0.064	0.377	0.099	0.187	3.141	3.110
278	300	1000	1500	1496	665	836	118	0.095	0.461	0.217	0.477	3.164	3.865
279	300	1001	1500	1493	819	944	109	0.026	0.364	0.189	0.333	3.453	3.540
280	300	1000	1500	1491	868	949	84	-0.005	0.292	0.012	0.309	3.643	3.524
281	300	1000	1500	1494	736	829	83	0.021	0.336	0.084	0.096	3.495	3.034
282	300	1000	1500	1499	665	750	88	-0.005	0.337	0.179	0.203	3.561	3.541
283	300	999	1500	1495	841	931	71	0.039	0.313	-0.242	-0.132	4.866	4.159
284	300	1001	1500	1501	1282	1405	105	0.025	0.297	-0.067	-0.097	3.604	3.523
285	300	1000	1500	1496	628	737	79	0.066	0.388	0.179	0.316	2.955	3.071
286	300	1001	1500	1494	1162	1303	137	0.005	0.329	0.084	0.326	3.436	3.904
287	300	1000	1500	1493	986	1101	94	0.034	0.325	0.027	0.125	2.969	3.039
288	300	1000	1500	1497	653	769	92	0.048	0.390	0.240	0.509	3.255	4.559
289	300	1000	1500	1495	689	768	87	-0.015	0.322	0.031	0.087	2.731	2.911
290	300	1000	1500	1492	734	763	79	-0.103	0.220	-0.083	0.050	3.401	3.322
291	300	1001	1500	1495	651	763	85	0.059	0.387	-0.185	-0.131	3.227	3.073
292	300	1000	1500	1491	687	792	76	0.063	0.369	0.008	0.226	2.806	3.390
293	300	1000	1500	1477	2314	2474	92	0.074	0.264	0.209	0.214	3.508	3.548
294	300	1000	1500	1488	3211	3200	98	-0.097	0.077	0.134	0.102	3.420	3.209
295	300	1000	1500	1488	1494	1691	91	0.145	0.368	0.169	0.272	3.191	3.356
296	300	1001	1500	1493	685	843	118	0.071	0.438	-0.132	0.197	4.692	4.949
297	300	999	1500	1486	984	1092	87	0.035	0.316	-0.137	-0.038	3.063	3.178
298	300	1000	1500	1494	547	618	96	-0.055	0.343	0.109	0.191	3.555	3.309
299	300	1000	1500	1491	839	929	79	0.023	0.313	-0.618	-0.575	5.150	4.784
300	300	1001	1500	1491	623	735	91	0.046	0.394	0.104	0.181	3.001	3.287

GH AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
301	300	1000	1500	1491	691	780	77	0.026	0.339	0.204	0.262	3.185	2.959
302	300	1000	1500	1491	673	707	69	-0.082	0.233	-0.070	0.008	3.118	2.873

RW AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF			CORRELATION OF		ROOT B1 OF		KURTOSIS (B2)	
					RL	RL+FP	FP	RL,FP	RL+FP,FP	RL	RL+FP	RL	RL+FP
1	300 (3)	900	150	159	1004	1084	90	-0.017	0.272	-0.734	-0.584	10.993	9.752
2	299 (1)	900	150	162	315	393	109	-0.082	0.452	0.108	0.501	3.796	5.133
3	300	900	150	160	246	319	81	-0.029	0.479	0.006	0.156	3.950	3.449
4	300	900	150	156	629	715	86	-0.001	0.346	-1.635	-1.491	10.761	9.816
5	297 (4)	900	150	154	1047	1102	84	-0.049	0.228	0.410	0.319	11.057	9.012
6	300	900	150	152	225	287	87	-0.088	0.471	-0.397	0.136	3.366	4.351
7	300	900	150	152	218	260	81	-0.146	0.425	-0.163	0.144	3.354	3.165
8	300	900	150	153	202	255	84	-0.121	0.466	-0.249	0.115	2.983	3.110
9	300	900	150	158	183	230	87	-0.159	0.474	-0.429	-0.116	4.677	3.534
10	300	900	150	155	195	272	79	-0.009	0.533	-0.031	0.198	3.768	3.236
11	300	900	150	155	258	297	85	-0.154	0.390	-0.256	-0.079	3.952	3.837
12	300	900	150	154	177	240	87	-0.095	0.520	-0.321	0.333	4.119	4.536
13	300	900	150	152	173	298	106	0.072	0.650	0.861	2.350	6.258	18.940
14	300	900	150	155	179	245	87	-0.082	0.525	-0.327	-0.123	3.904	3.732
15	300	900	150	149	169	248	99	-0.074	0.569	0.423	0.912	3.604	5.847
16	300 (1)	900	150	154	285	331	76	-0.102	0.384	-0.025	0.147	4.472	4.141
17	300 (1)	900	150	152	247	339	88	0.015	0.522	-1.136	-0.109	12.130	6.669
18	300 (2)	900	150	152	191	280	84	0.021	0.565	-0.077	0.252	3.407	3.851
19	300	900	150	148	162	259	84	0.056	0.614	-0.432	0.107	4.564	3.845
20	300	900	150	155	171	242	84	-0.056	0.543	-0.195	0.092	3.140	2.978
21	300 (1)	900	150	153	185	303	94	0.095	0.630	-0.241	0.378	3.868	4.158
22	300	900	150	151	171	243	89	-0.070	0.548	-0.249	0.207	3.274	3.393
23	300	900	150	148	323	369	98	-0.146	0.379	-0.573	-0.176	6.923	4.828
24	300	900	150	155	190	278	89	-0.007	0.561	-0.060	0.320	2.957	3.095
25	300	900	150	158	152	225	84	-0.044	0.574	-0.230	0.276	2.905	3.506
26	300	900	150	150	170	242	89	-0.069	0.548	-0.573	-0.056	5.725	4.641
27	300 (1)	900	150	149	183	237	90	-0.141	0.492	-0.486	-0.081	4.605	3.152
28	300 (1)	900	150	154	206	289	81	0.011	0.538	-1.494	-0.399	13.316	7.637
29	300		150	155	171								
30	300	900	150	155	141	248	91	0.072	0.659	-0.099	0.860	3.183	6.057
31	300 (1)	900	150	152	182	241	91	-0.126	0.506	-0.157	0.111	3.049	3.208
32	300 (1)	900	150	150	187	279	101	-0.034	0.574	0.071	0.748	3.726	4.516
33	300 (1)	900	150	155	155	243	91	-0.015	0.601	-0.158	0.307	3.804	3.609
34	300	900	150	157	152	275	105	0.069	0.670	-0.251	0.427	3.899	4.294
35	300	900	150	160	277	370	73	0.066	0.502	-1.004	-0.614	7.305	5.486
36	300	900	150	157	180	281	101	0.002	0.601	-0.184	0.486	4.128	4.594
37	300 (1)	900	150	156	152	242	89	0.004	0.610	-0.056	0.380	3.190	3.469
38	300	900	150	156	155	228	88	-0.066	0.569	-0.278	0.478	3.058	4.251
39	300 (1)	900	150	151	142	259	86	0.141	0.680	-0.072	0.596	3.934	4.220
40	300 (1)	900	150	153	149	231	98	-0.069	0.598	-0.042	0.356	3.463	3.748
41	300		150	151	222								
42	300		150	158	240								
43	300		150	152	176								
44	300		150	153	145								
45	300		150	152	168								
46	301	900	150	155	296	392	95	0.004	0.496	-2.210	-0.648	19.181	8.016
47	300	900	150	162	183	283	101	-0.003	0.596	-0.335	0.864	4.271	5.301
48	300	900	150	159	175	260	81	0.019	0.573	-0.471	0.116	3.769	3.643
49	300	900	150	147	172	276	91	0.055	0.617	-0.051	0.734	2.744	5.048
50	300	900	150	152	145	242	99	-0.004	0.635	-0.089	0.645	3.175	4.675
51	300	900	150	151	143	249	83	0.103	0.657	-0.447	-0.046	3.465	3.349
52	300 (1)	900	150	145	220	303	101	-0.060	0.526	-0.400	0.205	3.659	3.612
53	300	900	150	159	160	264	86	0.079	0.632	-0.618	0.291	5.048	4.030
54	300 (1)	900	150	149	139	227	79	0.044	0.623	0.228	0.432	3.043	3.318
55	300	900	150	154	141	224	86	-0.016	0.607	-0.030	0.395	3.518	3.551
56	300	900	150	148	276	375	112	-0.036	0.516	-0.938	-0.302	7.314	6.842
57	300 (1)	900	150	155	185	301	83	0.135	0.631	-0.317	0.294	3.030	3.490
58	300	900	150	155	171	305	106	0.106	0.668	-0.797	0.566	5.411	6.110
59	300	900	150	153	137	257	95	0.107	0.686	0.086	0.588	2.872	3.781
60	300	900	150	153	185	265	90	-0.040	0.550	-0.343	0.144	3.262	3.327

RW AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
61	300 (1)	900	155	156	129	242	94	0.086	0.686	-0.207	0.620	2.876	4.504
62	300	900	160	163	178	297	94	0.095	0.637	-0.200	0.543	3.168	4.036
63	300	901	165	167	167	296	100	0.114	0.666	0.063	0.538	3.046	3.477
64	300	900	170	175	166	288	101	0.085	0.655	0.189	0.561	2.807	3.993
65	300 (2)	900	175	176	166	288	101	0.083	0.655	0.091	0.671	3.510	3.856
66	300	900	175	177	176	286	83	0.113	0.627	0.065	0.561	2.977	3.440
67	300 (1)	900	175	171	128	250	105	0.073	0.701	-0.127	0.946	2.880	4.687
68	300	900	175	176	174	334	111	0.176	0.704	0.409	1.583	5.207	11.824
69	300	900	175	182	171	283	88	0.096	0.632	0.292	0.491	4.719	3.689
70	300 (1)	900	180	185	173	322	98	0.200	0.697	0.069	0.552	3.107	3.644
71	300 (1)	900	185	184	185	306	99	0.078	0.631	0.187	0.836	3.275	4.965
72	300	900	190	194	160	285	99	0.104	0.668	0.511	0.761	4.281	4.314
73	300 (1)	900	195	196	202	312	80	0.116	0.600	0.276	0.598	3.241	3.426
74	300	900	200	201	289	402	90	0.071	0.533	1.073	0.889	7.755	4.735
75	300	900	200	203	165	292	98	0.118	0.667	0.003	0.462	2.811	3.264
76	300	900	200	202	213	341	102	0.087	0.616	0.218	0.683	2.935	3.672
77	300	899	200	198	227	347	75	0.173	0.606	0.214	0.676	3.518	3.736
78	300	900	200	199	306	421	86	0.088	0.528	0.292	0.325	3.314	3.285
79	300		205	210	250								
80	300	900	210	210	281	397	89	0.087	0.547	0.207	0.597	2.803	3.736
81	300	900	200	203	286	417	98	0.101	0.568	0.542	0.561	3.507	3.198
82	300	900	200	206	165	263	76	0.100	0.616	0.323	0.665	2.757	3.471
83	300 (1)	900	200	206	268	410	82	0.200	0.610	0.294	0.555	3.816	4.226
84	300 (2)	900	200	201	177	267	83	0.028	0.581	0.288	0.661	4.230	4.308
85	300	900	195	192	226	352	89	0.128	0.606	1.083	1.112	8.987	7.484
86	300 (1)	900	190	191	191	299	106	0.008	0.601	0.209	0.642	3.590	5.085
87	300	900	185	186	154	279	104	0.085	0.672	0.149	0.618	3.093	4.493
88	300	900	180	180	190	298	89	0.072	0.604	-0.038	0.349	3.124	3.027
89	300	900	175	175	129	235	89	0.077	0.674	-0.111	0.735	3.306	5.239
90	300	900	170	172	160	291	96	0.140	0.679	-0.057	0.489	2.986	3.317
91	300 (1)	901	165	166	174	310	107	0.106	0.667	-0.319	0.361	3.329	3.435
92	300	900	160	160	132	214	88	-0.027	0.620	-0.102	0.583	2.952	4.193
93	300	900	155	156	155	259	95	0.034	0.633	-0.445	0.321	3.428	4.001
94	300	900	150	149	181	261	102	-0.079	0.560	-0.871	0.144	6.120	3.507
95	300 (1)	900	145	140	196	273	87	-0.039	0.531	-0.116	0.235	3.014	3.292
96	300 (1)	900	140	138	206	279	80	-0.028	0.512	-0.292	0.212	3.583	3.399
97	300	900	135	138	239	281	100	-0.187	0.423	-0.505	0.279	5.856	4.242
98	300	900	130	132	136	236	100	0.000	0.651	-0.321	0.353	3.196	3.862
99	300 (1)	900	125	128	201	222	91	-0.258	0.397	-0.396	0.051	4.925	5.229
100	301	900	120	116	354	338	98	-0.306	0.225	-1.182	-1.037	7.532	7.666
101	300	900	115	120	221	216	86	-0.331	0.297	-1.694	-0.469	11.015	4.685
102	300	900	110	111	318	314	87	-0.273	0.250	-1.036	-0.627	4.893	4.720
103	302	900	105	108	328	333	84	-0.235	0.268	-1.846	-1.096	11.432	6.966
104	300	900	100	95	474	465	83	-0.232	0.188	-0.613	-0.365	3.428	3.525
105	300	900	100	102	492	494	89	-0.209	0.217	-0.974	-0.761	4.293	4.061
106	301	900	105	106	338	315	115	-0.350	0.242	-1.274	-0.778	6.365	4.941
107	301	900	110	115	314	327	85	-0.221	0.293	-0.974	-1.155	7.315	8.169
108	301	900	115	119	279	292	97	-0.254	0.327	-1.523	-0.751	10.182	6.762
109	300	900	120	124	188	217	90	-0.235	0.425	-0.845	-0.215	4.916	4.486
110	299 (1)	900	125	133	209	251	89	-0.172	0.438	-0.869	-0.668	5.237	5.180
111	300	900	130	133	188	220	94	-0.235	0.436	-0.398	-0.117	3.657	3.933
112	300	900	135	137	158	229	115	-0.164	0.573	-0.320	0.164	3.745	3.380
113	300	900	140	137	217	294	94	-0.056	0.516	-0.356	0.459	3.732	4.118
114	300	900	145	150	155	300	100	0.181	0.708	-0.206	1.138	3.059	8.458
115	300	900	150	151	149	215	90	-0.103	0.562	-0.119	0.530	2.981	3.569
116	300 (2)	900	150	151	141	210	89	-0.092	0.576	-0.365	0.047	3.195	2.984
117	300	900	150	151	136	219	82	0.005	0.615	-0.117	0.537	3.032	4.218
118	300	900	150	149	154	237	94	-0.044	0.595	-0.408	0.141	3.103	3.536
119	300	900	150	147	154	211	81	-0.109	0.527	-0.473	-0.200	5.210	4.588
120	300	900	145	142	172	264	96	-0.020	0.589	-0.353	0.376	3.568	3.895

RW AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
121	300	900	140	140	199	285	97	-0.040	0.550	-1.187	-0.596	7.468	6.126
122	300	900	135	134	203	254	88	-0.135	0.466	-0.191	0.260	5.838	3.501
123	300 (3)	900	130	129	194	201	88	-0.308	0.360	-0.890	-0.134	5.140	2.933
124	300	900	125	124	176	207	79	-0.206	0.430	-0.562	-0.047	4.343	3.870
125	300	900	120	122	213	253	100	-0.207	0.439	-1.183	-0.049	5.640	4.078
126	301	900	115	108	441	406	80	-0.305	0.126	-1.015	-0.819	4.828	5.108
127	300	901	110	111	252	197	97	-0.486	0.151	-1.165	-0.238	6.373	3.135
128	300	900	105	101	306	294	83	-0.298	0.229	-1.486	-0.666	7.122	4.340
129	300	900	100	108	279	234	90	-0.426	0.156	-0.877	-0.458	4.037	3.723
130	300	900	95	97	532	494	80	-0.286	0.106	-0.562	-0.415	3.154	2.830
131	301	900	90	96	505	431	90	-0.386	0.038	-0.931	-0.588	4.171	3.199
132	301	900	95	93	589	573	96	-0.235	0.172	-0.975	-0.791	4.445	4.437
133	302	900	100	98	570	503	89	-0.347	0.050	-0.804	-0.469	4.019	3.754
134	300	900	100	97	410	378	88	-0.314	0.155	-0.610	-0.129	3.806	2.819
135	300	900	100	95	472	409	92	-0.372	0.075	-0.801	-0.507	4.970	3.362
136	300	900	100	103	327	328	90	-0.257	0.266	-0.467	-0.056	3.608	3.159
137	301	900	100	99	351	320	87	-0.338	0.168	-0.983	-0.779	5.160	4.552
138	300	900	100	104	442	419	85	-0.279	0.164	-0.455	-0.283	3.492	3.160
139	301	900	100	103	414	372	89	-0.343	0.128	-1.042	-0.968	5.040	5.417
140	302	899	100	100	453	417	97	-0.317	0.151	-1.105	-0.797	5.455	4.812
141	300	900	100	103	453	441	99	-0.264	0.207	-0.921	-0.756	4.556	4.422
142	299 (1)	900	100	102	404	358	93	-0.358	0.130	-0.641	-0.462	3.864	3.225
143	300	900	100	91	614	527	105	-0.378	0.038	-0.604	-0.523	3.123	3.156
144	300	900	100	105	393	392	91	-0.244	0.238	-0.663	-0.464	3.645	3.447
145	302	900	100	98	437	426	81	-0.244	0.189	-0.753	-0.554	4.380	3.863
146	301	901	100	97	445	382	105	-0.388	0.106	-0.775	-0.358	4.417	3.914
147	301	900	100	102	350	319	92	-0.345	0.176	-0.749	-0.619	5.624	5.708
148	300	900	100	102	269	227	96	-0.427	0.184	-0.757	-0.163	4.206	3.181
149	300	900	100	103	320	285	87	-0.366	0.166	-0.893	-0.609	3.614	3.421
150	300	900	100	101	385	334	91	-0.380	0.116	-0.663	-0.459	4.002	3.818
151	300	900	100	105	299	294	107	-0.313	0.288	-1.073	-0.334	6.369	4.549
152	300	900	100	103	262	277	79	-0.222	0.317	-0.626	-0.173	3.251	3.617
153	301	900	100	103	300	292	89	-0.299	0.250	-0.975	-0.928	5.872	6.451
154	300	900	100	101	315	261	94	-0.429	0.129	-0.803	-0.222	5.565	4.164
155	301	900	100	101	331	317	103	-0.318	0.245	-0.834	-0.469	5.126	4.098
156	300	900	100	105	334	328	88	-0.273	0.241	-0.776	-0.448	4.114	3.672
157	300	900	100	101	367	318	91	-0.381	0.125	-0.962	-0.495	4.157	3.119
158	300	900	100	101	460	377	88	-0.424	0.014	-0.639	-0.303	3.646	2.631
159	300	900	100	100	326	313	114	-0.331	0.265	-0.860	-0.183	4.250	3.604
160	301	900	100	100	466	392	83	-0.398	0.025	-0.667	-0.326	3.718	2.858
161	300	1000	100	97	507	464	81	-0.305	0.099	-0.967	-0.788	4.255	3.895
162	300	999	100	106	324	341	67	-0.170	0.277	-0.606	-0.500	6.003	5.307
163	300	1000	100	100	381	385	97	-0.242	0.261	-0.988	-0.696	4.372	3.714
164	300	1000	100	101	287	288	73	-0.249	0.256	-0.711	-0.403	3.520	3.321
165	300	1000	100	106	260	222	103	-0.430	0.217	-1.229	-0.647	5.974	4.446
166	300	1001	100	100	339	339	117	-0.295	0.294	-1.082	-0.928	4.518	4.744
167	300	1001	100	100	292	277	97	-0.334	0.248	-0.832	-0.427	3.947	4.130
168	300	1000	100	103	275	268	80	-0.293	0.249	-1.152	-0.331	6.196	4.671
169	300	999	100	101	258	239	74	-0.335	0.208	-1.085	-0.501	6.627	3.688
170	300	1000	100	104	319	352	97	-0.183	0.350	-1.100	-0.877	4.652	4.473
171	300	1000	100	103	300	275	83	-0.342	0.193	-1.033	-0.763	4.702	4.337
172	301	1001	100	102	498	434	150	-0.391	0.169	-1.344	-0.755	5.473	3.988
173	300	1000	100	103	275	268	85	-0.298	0.260	-0.942	-0.558	4.240	3.928
174	300	1000	100	103	346	332	75	-0.276	0.194	-1.037	-0.814	5.529	4.806
175	300	1001	100	104	260	197	122	-0.521	0.187	-1.459	-0.617	6.461	4.261
176	300	1000	100	102	281	279	73	-0.263	0.248	-1.174	-0.677	6.232	4.575
177	300	1000	100	104	227	241	84	-0.253	0.345	-0.614	-0.134	3.911	3.691
178	300	1001	100	103	217	244	110	-0.266	0.420	-0.767	-0.399	4.291	3.905
179	300	1000	100	107	258	245	73	-0.313	0.227	-1.240	-0.760	5.110	4.341
180	300	1000	100	108	287	283	94	-0.298	0.277	-1.016	-0.692	5.731	4.750

RW AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
181	300	1001	100	105	215	225	96	-0.300	0.361	-1.281	-0.172	7.713	3.763
182	300	1000	100	105	246	233	100	-0.361	0.284	-0.878	-0.443	5.337	3.441
183	300	999	100	99	249	210	90	-0.431	0.187	-0.561	-0.391	3.293	3.087
184	300	1000	100	98	318	318	90	-0.267	0.266	-0.899	-0.516	4.478	3.845
185	300	1000	100	101	287	264	88	-0.349	0.214	-1.154	-0.663	5.688	3.815
186	300	1001	100	106	161	210	121	-0.255	0.536	-0.826	-0.155	4.918	4.302
187	300	1000	100	104	173	186	63	-0.239	0.352	-0.930	-0.585	4.811	4.181
188	300	1000	100	101	224	227	105	-0.335	0.348	-0.862	-0.526	4.805	4.680
189	300	1000	100	100	347	371	84	-0.174	0.307	-0.919	-0.747	4.386	3.914
190	300	1000	100	105	286	309	88	-0.206	0.336	-1.436	-1.072	7.288	6.947
191	300	999	100	104	207	237	73	-0.173	0.393	-1.062	-0.650	6.092	5.503
192	300	1000	100	101	288	307	95	-0.229	0.334	-0.894	-0.608	4.499	4.117
193	300	1000	100	106	249	262	69	-0.211	0.306	-0.819	-0.614	4.982	3.891
194	300	1000	100	101	345	337	79	-0.265	0.217	-0.935	-0.430	4.843	3.371
195	300	1000	100	102	255	251	84	-0.302	0.274	-1.212	-0.574	6.786	4.176
196	300	999	100	103	256	248	64	-0.283	0.220	-0.678	-0.465	3.536	3.493
197	300	1000	100	104	248	200	91	-0.464	0.158	-0.986	-0.311	4.856	3.353
198	300	1001	100	103	309	273	125	-0.410	0.240	-1.275	-0.596	5.647	4.172
199	300	1000	100	103	302	301	92	-0.281	0.273	-0.930	-0.569	4.624	4.757
200	300	1001	100	107	225	218	97	-0.352	0.308	-1.037	-0.466	4.392	3.704
201	300	999	100	107	250	253	68	-0.250	0.271	-1.473	-0.987	8.221	6.839
202	300	1001	100	104	209	211	108	-0.353	0.365	-0.936	-0.189	5.202	4.650
203	300	1000	100	107	196	231	79	-0.179	0.421	-0.830	-0.500	4.268	4.181
204	300	999	100	101	324	298	95	-0.344	0.208	-0.982	-0.385	4.994	3.764
205	300	1000	100	103	226	230	84	-0.291	0.316	-0.817	-0.312	4.322	3.733
206	300	1000	100	103	200	223	85	-0.239	0.392	-0.814	-0.225	4.927	3.323
207	300	1000	100	109	240	251	80	-0.250	0.319	-0.929	-0.339	5.472	4.128
208	300	1001	100	105	211	264	85	-0.117	0.462	-0.746	-0.349	4.327	3.540
209	300	1001	100	101	334	313	111	-0.342	0.242	-1.437	-0.969	6.502	5.331
210	300	1001	100	105	293	320	81	-0.175	0.336	-0.916	-0.686	4.583	4.502
211	300	1000	95	98	263	253	86	-0.319	0.257	-0.744	-0.590	3.364	3.572
212	300	1001	95	99	281	232	103	-0.447	0.173	-1.293	-0.389	6.473	3.332
213	300	1000	95	101	278	256	98	-0.365	0.238	-1.108	-0.833	4.409	4.481
214	300	1001	95	98	281	273	105	-0.329	0.286	-1.049	-0.420	4.722	4.025
215	300	1000	95	99	415	369	114	-0.368	0.165	-0.879	-0.306	4.285	3.141
216	300	1000	95	97	278	260	106	-0.361	0.265	-0.929	-0.498	4.174	4.051
217	300	1001	95	96	371	307	124	-0.438	0.153	-1.100	-0.668	4.650	3.801
218	300	999	95	100	344	307	74	-0.346	0.125	-1.122	-0.941	4.614	4.430
219	300	1000	95	97	299	262	106	-0.401	0.208	-0.678	-0.436	3.491	3.265
220	300	999	95	102	200	227	67	-0.174	0.381	-0.773	-0.478	4.433	3.593
221	300	1000	95	99	320	307	97	-0.312	0.245	-0.959	-0.312	4.905	4.092
222	300	999	95	100	266	248	87	-0.347	0.234	-1.679	-0.586	10.068	4.511
223	300	1000	95	95	325	277	95	-0.408	0.143	-1.007	-0.349	5.123	3.286
224	300	1001	95	101	358	293	114	-0.443	0.135	-1.224	-0.524	5.488	3.819
225	300	1000	95	93	544	487	101	-0.336	0.101	-0.594	-0.375	3.212	3.100
226	300	1001	90	91	418	341	97	-0.433	0.055	-0.566	-0.350	2.736	2.831
227	300	1000	90	92	404	387	88	-0.279	0.192	-0.810	-0.653	3.476	3.567
228	301	1000	90	92	541	505	71	-0.271	0.094	-1.051	-1.087	4.546	5.265
229	300	1000	90	91	332	305	98	-0.348	0.204	-1.013	-0.514	5.011	4.199
230	300	999	90	92	390	341	69	-0.361	0.065	-1.149	-1.033	4.548	4.646
231	300	1000	90	94	379	331	94	-0.376	0.130	-0.655	-0.290	3.421	3.276
232	300	1000	90	93	309	299	76	-0.281	0.219	-0.925	-0.673	4.084	3.840
233	300	1000	90	95	358	368	93	-0.227	0.280	-0.936	-0.585	4.718	4.078
234	300	1000	90	89	302	243	98	-0.458	0.124	-0.925	-0.563	4.279	3.854
235	301	1000	90	89	368	327	112	-0.377	0.185	-1.446	-1.164	6.773	7.115
236	300	1000	90	89	366	302	101	-0.430	0.104	-1.041	-0.484	5.448	3.260
237	300	1000	90	92	318	292	95	-0.347	0.207	-0.712	-0.668	3.861	3.947
238	300	1000	90	95	279	257	85	-0.349	0.212	-1.019	-0.804	4.376	4.442
239	300	1001	90	93	324	241	119	-0.515	0.105	-1.157	-0.238	5.677	3.171
240	300	1001	90	91	394	349	109	-0.372	0.165	-0.903	-0.118	4.099	3.826

RW AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
241	300	1001	85	82	430	431	78	-0.211	0.214	-0.707	-0.458	3.488	2.975
242	300	1000	85	86	425	379	89	-0.347	0.116	-0.733	-0.778	3.407	4.349
243	300	1000	85	86	483	417	109	-0.382	0.100	-0.781	-0.562	3.127	2.875
244	300	1001	85	89	381	374	86	-0.258	0.219	-0.835	-0.722	3.746	3.784
245	300	1000	85	86	371	355	89	-0.287	0.206	-0.620	-0.443	3.239	3.413
246	303	1001	85	87	531	514	129	-0.279	0.217	-0.998	-1.067	4.858	6.161
247	300	1000	85	88	377	322	101	-0.400	0.127	-0.585	-0.481	3.235	3.243
248	300	1000	85	85	387	363	97	-0.312	0.195	-0.586	-0.340	3.178	3.108
249	300	1000	85	87	433	373	92	-0.381	0.087	-0.960	-0.799	3.752	3.460
250	300	1001	85	83	509	373	112	-0.520	-0.060	-0.742	-0.442	3.376	3.090
251	300	998	85	87	446	456	66	-0.166	0.216	-0.630	-0.336	3.532	3.855
252	300	1000	85	89	461	386	92	-0.405	0.045	-0.469	-0.334	2.930	2.554
253	301	1000	85	87	488	455	75	-0.282	0.113	-1.034	-0.806	4.799	4.433
254	300	1001	85	85	410	377	97	-0.326	0.168	-0.695	-0.591	3.204	3.208
255	300	999	85	91	394	350	84	-0.354	0.114	-0.870	-0.637	3.501	3.598
256	300	999	85	88	404	369	78	-0.318	0.127	-0.813	-0.692	3.785	3.775
257	300	1000	85	90	349	315	85	-0.345	0.157	-0.694	-0.543	3.767	3.337
258	300	1001	85	85	360	329	95	-0.340	0.182	-0.822	-0.675	3.793	3.749
259	304	1000	85	84	561	454	103	-0.437	-0.011	-1.879	-1.643	10.301	9.927
260	300	999	85	85	370	353	70	-0.269	0.169	-0.557	-0.561	3.562	3.908
261	300	1000	90	93	327	303	80	-0.320	0.180	-0.638	-0.445	3.162	2.907
262	300	1000	100	100	266	247	71	-0.327	0.198	-0.924	-0.642	4.606	3.864
263	300	1000	110	110	174	171	89	-0.368	0.349	-1.048	-0.274	5.456	4.813
264	300	1001	120	122	127	160	114	-0.335	0.544	-0.625	0.174	3.966	4.821
265	300	1000	130	134	200	242	84	-0.161	0.443	-1.172	-0.279	8.634	4.907
266	300	1000	140	140	148	242	92	0.009	0.623	-0.231	0.405	3.860	4.491
267	300	1001	150	150	126	242	104	0.053	0.694	-0.081	0.635	2.997	3.870
268	300	1001	150	152	129	243	106	0.033	0.686	-0.110	0.680	3.906	4.202
269	300	1000	150	152	148	230	96	-0.059	0.600	0.352	0.581	5.251	4.323
270	300	998	150	152	131	199	69	-0.004	0.585	0.301	0.612	6.651	5.002
271	300	1001	150	152	144	296	116	0.138	0.723	-0.165	0.861	3.526	6.280
272	300	1001	-150	155	162	292	114	0.062	0.670	-0.202	0.544	2.828	4.390
273	300	1000	150	155	123	269	122	0.097	0.739	0.006	1.459	3.039	9.011
274	300	1000	160	163	123	242	94	0.114	0.705	-0.130	0.498	3.148	3.827
275	300	1000	170	172	144	267	94	0.125	0.686	0.071	0.563	2.685	3.882
276	300	1000	180	185	142	261	94	0.110	0.680	0.255	0.683	3.276	4.044
277	300	1000	190	190	131	236	94	0.048	0.668	-0.046	0.625	2.897	4.044
278	300	1000	200	201	157	259	97	0.017	0.626	0.241	0.476	3.251	3.282
279	300	1000	200	200	188	299	95	0.060	0.611	0.220	0.305	3.229	3.182
280	300	1000	200	194	154	254	80	0.087	0.631	0.152	0.648	3.232	3.335
281	300	1000	200	201	209	353	102	0.147	0.650	0.222	0.556	2.858	3.379
282	300	999	200	201	173	299	76	0.213	0.668	0.210	0.639	2.742	3.927
283	300	1000	200	196	218	343	107	0.059	0.605	0.133	0.450	3.004	3.544
284	300	999	210	207	270	367	83	0.047	0.514	0.159	0.632	2.754	4.471
285	300		220	223	288								
286	300	1000	230	225	351	482	74	0.174	0.542	0.202	0.299	2.779	3.004
287	300	1001	240	235	330	459	94	0.101	0.537	0.174	0.292	3.113	3.023
288	300	1000	250	246	485	592	85	0.054	0.427	0.104	0.243	2.907	3.036
289	300	1000	250	250	373	448	74	0.001	0.408	0.241	0.454	2.992	3.549
290	300	1000	250	245	319	442	103	0.056	0.531	0.261	0.283	2.811	2.775
291	300	1001	250	241	325	436	97	0.038	0.505	0.067	-0.008	3.352	3.037
292	300	1000	250	251	318	469	95	0.162	0.583	0.104	0.309	2.782	2.869
293	300	1000	260	258	374	488	91	0.060	0.485	0.286	0.294	2.784	2.579
294	300	999	270	273	386	515	79	0.144	0.517	0.209	0.427	2.663	2.872
295	300	1001	280	281	486	655	97	0.164	0.527	0.251	0.297	3.892	3.819
296	300	1000	290	290	539	718	95	0.185	0.524	0.382	0.588	2.931	3.042
297	300	1001	300	295	416	526	97	0.030	0.457	0.299	0.396	3.459	3.128
298	300	1000	300	290	530	692	95	0.149	0.501	-0.198	0.222	3.511	3.855
299	300	999	300	292	583	672	79	0.022	0.364	0.443	0.409	3.635	3.382
300	300	1000	300	296	481	629	92	0.133	0.499	0.261	0.451	3.472	3.756

RW AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
301	300	999	300	301	473	639	80	0.223	0.545	0.134	0.243	3.089	3.203
302	300	1000	300	296	427	574	96	0.125	0.517	0.038	0.248	2.869	2.947
303	300	999	300	295	465	558	67	0.075	0.414	0.126	0.338	3.547	3.657
304	300	1001	300	287	499	623	100	0.053	0.449	-0.047	0.365	3.070	4.115
305	300	999	300	290	511	582	64	0.019	0.350	0.443	0.302	3.653	3.191
306	300	1001	300	282	912	1083	135	0.052	0.400	0.179	0.256	3.131	3.053
307	300	1000	300	297	559	747	88	0.224	0.537	0.138	0.464	2.843	3.342
308	300	999	300	297	495	590	79	0.042	0.404	0.061	0.056	3.582	3.246
309	300	1000	300	294	408	532	88	0.096	0.490	0.015	0.199	2.705	3.110
310	300		300	300	595								
311	300	1000	300	303	476	609	88	0.109	0.476	-0.058	0.297	2.681	3.456
312	300	1000	300	297	388	547	90	0.185	0.561	0.001	0.549	3.278	3.895
313	300	999	300	299	386	500	63	0.164	0.500	-0.058	0.092	3.003	3.074
314	300	1000	300	298	456	604	88	0.148	0.510	-0.349	0.189	4.285	4.905
315	300	1000	300	303	339	481	93	0.138	0.557	0.424	0.748	2.848	3.804
316	300	1000	300	300	389	550	114	0.110	0.548	0.076	0.629	2.765	4.038
317	300	1000	300	301	341	483	87	0.161	0.560	-0.116	0.296	3.159	3.646
318	300	1000	300	298	416	548	87	0.119	0.502	0.046	0.338	2.950	3.300
319	300	1000	300	302	476	608	99	0.075	0.471	-0.142	0.183	2.916	3.698
320	300	1001	300	284	297	499	101	0.291	0.675	0.720	1.046	5.371	6.129
321	300	1000	300	288	285	382	80	0.058	0.508	0.198	0.413	3.476	3.938
322	300	1000	300	295	411	524	94	0.047	0.466	-0.160	-0.023	2.584	2.819
323	300	1000	300	298	270	389	92	0.084	0.557	-0.085	0.192	2.815	3.233
324	300	1000	300	293	351	448	94	0.005	0.463	0.049	0.016	3.021	2.921
325	300	1000	300	293	357	466	89	0.055	0.485	-0.062	0.062	2.606	2.849
326	300	1000	300	296	290	406	92	0.074	0.538	-0.228	0.053	3.763	3.573
327	300	1000	300	295	281	388	93	0.045	0.527	-0.255	0.087	4.045	3.920
328	300	1001	300	290	276	462	119	0.183	0.649	-0.179	0.439	3.099	4.454
329	300	1000	300	296	371	473	80	0.064	0.468	-0.275	-0.066	3.203	3.072
330	300	999	300	296	365	475	79	0.092	0.488	-0.093	0.022	3.499	3.252
331	300	1000	300	295	324	425	80	0.064	0.489	-0.067	0.092	2.858	2.861
332	300	999	300	307	287	366	92	-0.042	0.465	-0.031	0.240	2.995	3.180
333	300	1000	300	303	290	406	81	0.113	0.542	-0.208	0.050	2.972	3.251
334	300	1000	300	298	317	484	99	0.190	0.607	0.051	0.654	3.220	4.528
335	300	1000	300	303	299	391	81	0.035	0.486	0.078	0.439	3.205	3.773
336	300	1000	300	295	248	403	104	0.158	0.633	0.139	0.573	3.160	3.965
337	300	1000	300	292	283	360	69	0.026	0.461	0.134	0.386	3.344	3.455
338	300	1000	300	290	330	496	104	0.168	0.595	0.180	0.582	3.618	3.624
339	300	999	300	293	267	396	80	0.167	0.586	0.109	0.718	3.072	5.043
340	300	1000	300	295	265	346	75	0.021	0.485	0.181	0.488	3.703	4.017
341	300	1001	300	295	333	518	135	0.118	0.605	0.248	0.575	3.583	3.757
342	300	1000	300	292	323	483	104	0.150	0.588	0.239	0.936	4.224	5.852
343	300	999	300	288	576	703	69	0.148	0.447	0.349	0.521	3.636	4.440
344	300	1000	300	296	435	585	108	0.097	0.513	0.493	0.569	6.691	4.996
345	300	1000	300	294	490	560	69	0.003	0.354	-0.503	-0.415	5.387	4.653
346	300	1001	300	298	312	491	113	0.175	0.619	-0.114	0.540	3.310	4.696
347	300	1000	300	290	342	416	86	-0.037	0.422	0.139	0.259	3.038	3.018
348	300	1001	300	294	308	428	103	0.047	0.532	0.337	0.671	3.151	4.190
349	300	1000	300	297	349	476	105	0.058	0.520	0.860	1.187	6.373	8.812
350	300	1000	300	293	329	418	76	0.040	0.463	0.326	0.442	3.255	3.022
351	300	1000	300	297	367	502	105	0.074	0.521	0.037	0.365	3.543	3.684
352	300	1000	300	295	336	443	100	0.022	0.493	0.100	0.262	2.755	3.071
353	300	999	300	294	290	381	78	0.046	0.492	-0.270	0.183	2.770	3.325
354	300	1000	300	290	359	483	98	0.071	0.511	0.297	0.517	3.907	4.411
355	300	1000	300	301	310	444	100	0.097	0.556	0.085	0.963	3.240	6.839
356	300	1001	300	290	366	453	83	0.013	0.439	0.072	0.226	2.997	2.865
357	300	1000	300	295	248	363	89	0.087	0.567	0.311	0.401	4.296	3.348
358	300	1000	300	302	339	455	81	0.106	0.513	0.068	0.457	3.069	4.306
359	300	1000	300	295	253	325	79	-0.023	0.473	0.427	0.447	3.483	3.236
360	300	999	300	295	275	402	86	0.131	0.572	0.140	0.490	3.142	3.804

RW AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
361	300	1000	300	295	254	364	97	0.038	0.549	0.382	0.577	2.859	3.408
362	300	1000	300	299	286	408	108	0.039	0.548	0.279	0.527	2.604	3.[illegible]
363	300	1000	300	294	239	313	76	-0.009	0.486	0.095	0.163	3.011	2.980
364	300	1000	300	295	224	368	96	0.166	0.639	0.283	0.588	2.969	3.346
365	300	1000	300	305	254	371	103	0.046	0.564	0.168	0.706	3.262	5.498
366	300	1000	300	298	236	358	99	0.074	0.586	0.101	0.507	2.914	3.782
367	300	1000	300	305	252	377	100	0.080	0.580	-0.012	0.776	2.598	5.230
368	300	999	310	309	233	326	78	0.056	0.536	0.298	0.497	3.336	3.620
369	300	1000	320	316	215	356	100	0.137	0.637	0.044	0.809	3.246	5.351
370	300	999	330	329	254	326	74	-0.010	0.469	0.169	0.478	2.794	3.856
371	300	1000	340	337	274	388	86	0.093	0.547	0.154	0.396	3.238	3.404
372	300	1000	350	346	340	437	79	0.052	0.472	-0.277	-0.082	3.376	3.591
373	300	1000	350	350	285	387	90	0.036	0.513	0.148	0.587	3.733	4.559
374	300	1000	350	347	255	373	95	0.075	0.567	0.092	0.674	2.608	4.929
375	300	1000	350	351	252	379	107	0.062	0.582	-0.185	0.291	2.830	3.659
376	300	1000	350	348	316	366	73	-0.078	0.376	0.152	0.318	2.697	2.875
377	300	999	340	337	317	412	69	0.086	0.485	-0.061	0.298	3.396	3.701
378	300	1000	330	326	220	296	97	-0.073	0.511	-0.231	0.254	2.819	3.194
379	300	1000	320	320	309	389	84	-0.012	0.454	0.242	0.399	3.080	3.231
380	300	1000	310	307	224	341	105	0.039	0.586	0.353	0.678	3.518	4.437
381	300	1000	300	295	179	270	85	0.024	0.580	0.170	0.544	3.420	4.193
382	300	1000	300	299	294	400	98	0.025	0.515	0.133	0.153	2.953	2.594
383	300	1000	300	302	205	304	89	0.039	0.573	0.204	0.455	3.200	3.465
384	300	1000	300	297	169	287	103	0.060	0.645	0.073	0.973	2.682	5.945
385	300	1000	300	301	228	337	73	0.138	0.578	0.045	0.536	3.408	4.606
386	300	1000	300	297	170	267	86	0.046	0.604	0.148	0.245	2.646	2.741
387	300	999	300	303	189	274	71	0.059	0.558	-0.062	0.365	3.368	3.624
388	300	1000	300	301	245	348	81	0.050	0.531	0.062	0.253	3.133	3.548
389	300	1000	300	297	200	323	90	0.119	0.623	0.146	0.583	2.961	3.449
390	300	1000	300	298	221	329	100	0.025	0.571	-0.034	0.515	2.897	4.180

JB AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
1	300	900	200	206	1401	1454	80	-0.040	0.195	1.264	1.096	7.163	6.354
2	300	900	200	201	1177	1300	86	0.058	0.312	0.295	0.285	5.583	4.973
3	300	900	200	201	849	975	105	0.035	0.361	0.839	0.666	6.246	5.004
4	300	900	200	205	874	990	84	0.058	0.346	0.857	0.884	4.933	4.659
5	299 (1)	900	200	209	810	908	88	0.018	0.329	0.567	0.572	4.200	4.078
6	300	900	200	195	618	695	97	-0.040	0.336	-0.042	0.111	10.966	8.455
7	300	900	200	203	641	732	94	-0.005	0.354	0.212	0.258	4.792	4.916
8	299 (1)	900	200	196	494	590	91	0.011	0.404	-0.052	0.013	3.195	2.950
9	300	900	200	206	680	763	73	0.022	0.331	0.615	0.601	4.868	4.693
10	300	900	200	192	424	468	85	-0.107	0.323	-0.072	0.192	3.155	2.933
11	300	900	200	196	545	635	94	-0.008	0.376	0.334	0.391	4.403	3.884
12	300	900	200	202	390	471	80	0.004	0.417	-0.066	0.025	3.793	3.514
13	300	900	200	203	410	516	95	0.030	0.455	0.106	0.363	3.956	3.806
14	300	900	200	204	418	532	107	0.016	0.463	-0.023	0.253	2.739	3.067
15	300	900	200	202	554	606	84	-0.075	0.302	-0.449	0.025	4.908	3.393
16	300	900	200	207	504	633	91	0.087	0.458	0.211	0.401	3.431	3.539
17	300 (1)	900	200	208	466	549	95	-0.029	0.390	0.032	0.139	2.976	2.981
18	300	900	200	203	476	566	86	0.008	0.397	0.285	0.526	3.285	3.887
19	300	900	200	200	563	618	80	-0.058	0.305	-0.015	0.188	3.594	3.305
20	300	899	200	196	603	677	74	-0.001	0.329	-0.134	-0.182	4.401	4.310
21	300	900	200	201	326	448	98	0.066	0.525	-0.068	0.263	3.994	3.813
22	300	900	200	200	572	718	98	0.102	0.461	-0.337	-0.027	3.405	3.509
23	300	900	200	203	518	605	81	0.017	0.381	-0.029	0.380	4.325	4.046
24	300	900	200	205	466	529	74	-0.031	0.346	-0.008	0.062	4.128	3.814
25	300	900	200	197	379	464	95	-0.024	0.429	0.343	0.484	3.941	4.568
26	300 (1)	900	200	198	481	511	100	-0.160	0.287	0.120	0.170	2.843	2.709
27	300	901	200	198	424	519	98	-0.008	0.428	-0.020	-0.006	4.223	4.047
28	300		200	196	710								
29	300	900	200	201	419	551	100	0.079	0.495	0.374	0.530	3.720	3.693
30	300	900	200	202	451	590	97	0.101	0.494	0.588	0.703	4.865	4.484
31	300	900	200	193	523	577	79	-0.061	0.312	-0.164	0.019	3.650	3.768
32	300	900	200	203	380	482	95	0.020	0.462	0.374	0.629	4.359	4.368
33	300	900	200	205	446	566	103	0.038	0.461	0.232	0.343	3.813	3.514
34	300	900	200	194	379	469	83	0.018	0.438	0.129	0.311	2.772	3.137
35	300	900	200	210	354	441	98	-0.029	0.444	0.313	0.096	3.294	2.960
36	300		200	202	439								
37	300		200	205	552								
38	300		200	209	513								
39	300		200	195	345								
40	300	900	200	201	371	461	90	0.001	0.444	0.233	0.307	3.688	3.580
41	300		200	204	377								
42	300	900	200	195	364	418	99	-0.118	0.377	-0.198	0.098	3.446	3.528
43	300	900	200	200	546	593	88	-0.093	0.295	-0.035	-0.141	4.012	3.556
44	300	900	200	192	499	588	89	0.001	0.390	-0.410	-0.153	4.924	4.601
45	300	900	200	201	523	616	99	-0.014	0.389	-0.397	-0.252	4.325	3.790
46	300	900	200	199	449	529	77	0.007	0.389	-0.051	-0.042	3.990	3.441
47	300	900	200	175	758	804	91	-0.087	0.252	-0.581	-0.442	4.341	4.072
48	300	900	200	201	356	396	85	-0.131	0.339	-0.146	-0.119	2.792	2.810
49	300	900	200	199	379	460	84	-0.008	0.420	0.031	0.228	3.356	3.373
50	300 (1)	899	200	200	297	368	62	0.032	0.438	0.242	0.425	3.530	3.693
51	300	900	200	200	469	561	110	-0.040	0.407	0.029	0.309	3.404	3.473
52	300	900	200	201	339	398	89	-0.086	0.395	0.306	0.554	3.489	3.867
53	300	900	200	194	398	550	97	0.142	0.540	-0.098	0.575	4.076	5.642
54	300	900	200	198	399	473	88	-0.036	0.397	0.192	0.265	2.836	2.594
55	300	900	200	198	442	490	84	-0.094	0.326	-0.123	0.089	3.958	3.835
56	301	900	195	188	545	620	91	-0.035	0.351	-1.542	-0.998	13.050	9.878
57	300	900	190	185	479	594	97	0.042	0.443	-0.108	0.282	3.456	4.280
58	300	900	185	179	369	416	75	-0.083	0.345	-0.554	-0.242	3.928	3.230
59	300	900	180	175	301	342	83	-0.134	0.368	-0.100	0.053	4.497	4.188
60	300 (1)	900	175	172	371	423	78	-0.079	0.356	0.639	0.718	7.380	8.050

JB AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
61	300	900	175	168	344	415	82	-0.032	0.415	-0.176	0.346	5.683	6.032
62	299 (1)	900	175	180	378	436	93	-0.094	0.375	-0.458	-0.017	5.226	4.097
63	300	900	175	174	318	384	104	-0.104	0.425	0.177	0.425	4.279	4.761
64	300	900	175	175	296	386	89	0.004	0.484	0.507	0.640	6.627	6.077
65	300	900	170	169	375	413	88	-0.138	0.331	-1.006	-0.694	6.227	4.810
66	300	900	165	159	374	467	76	0.049	0.448	-0.751	-0.405	4.223	4.124
67	299 (1)	900	160	165	359	471	95	0.047	0.489	0.190	0.831	3.661	5.213
68	300	900	155	157	431	476	102	-0.137	0.333	-0.724	-0.067	4.733	4.953
69	300	901	150	152	442	461	113	-0.211	0.289	-0.355	-0.086	3.839	3.586
70	300	900	150	153	438	457	92	-0.181	0.272	-0.722	-0.540	4.204	3.761
71	300	900	150	154	301	383	78	0.015	0.464	-0.211	0.318	4.513	5.584
72	300	900	150	148	551	669	88	0.066	0.424	-0.310	-0.087	3.091	3.140
73	300	900	150	148	431	465	101	-0.162	0.311	-0.588	-0.409	4.235	3.717
74	301	900	150	150	546	565	101	-0.175	0.250	-0.821	-0.106	7.089	6.798
75	300	900	150	166	379	421	95	-0.138	0.344	-0.459	-0.033	3.909	5.621
76	300	900	150	152	373	385	92	-0.216	0.276	-0.135	0.039	3.528	3.276
77	300 (2)	900	150	152	282	295	84	-0.229	0.308	-0.457	-0.078	3.700	3.346
78	301	900	150	147	389	438	84	-0.098	0.347	-1.762	-0.979	11.709	8.569
79	300	900	145	143	315	360	100	-0.152	0.383	-0.147	0.192	2.843	3.056
80	300	900	140	138	405	425	84	-0.174	0.274	-0.603	-0.109	7.032	5.606
81	300		135	135	348								
82	300	900	130	137	315	346	96	-0.188	0.348	-0.367	0.018	3.524	3.436
83	300	900	125	129	448	476	84	-0.146	0.279	-0.068	0.094	4.006	3.860
84	300		120	124	347								
85	300		115	122	408								
86	300		110	118	384								
87	300		105	112	564								
88	300	900	100	108	486	448	91	-0.306	0.132	-0.782	-0.686	4.712	4.580
89	302	900	95	99	732	747	79	-0.132	0.194	-0.819	-0.590	4.416	4.047
90	302	900	90	99	651	634	90	-0.222	0.153	-0.975	-1.028	4.901	5.536
91	300		90	103	778								
92	300		95	105	559								
93	300	900	100	104	614	630	74	-0.135	0.208	-0.499	-0.446	4.376	4.377
94	301	900	100	109	536	537	100	-0.213	0.219	-1.038	-0.759	6.390	5.897
95	300	901	100	106	534	634	98	0.004	0.397	-0.428	-0.198	2.915	3.045
96	301	900	100	100	663	620	84	-0.268	0.090	-0.865	-0.834	4.302	4.680
97	300	900	100	96	603	611	89	-0.175	0.208	-0.421	-0.435	3.188	3.342
98	299 (2)	900	100	104	566	512	86	-0.316	0.078	-0.321	0.106	6.655	4.949
99	300	900	100	103	513	510	92	-0.220	0.204	-0.512	-0.394	3.210	3.340
100	300	1000	100	101	459	476	91	-0.182	0.260	-0.904	-0.360	5.838	5.374
101	300 (2)	1000	100	108	860	856	84	-0.164	0.150	-0.990	-0.746	8.321	8.523
102	301	1000	100	95	974	948	67	-0.181	0.082	-0.967	-0.867	4.151	4.053
103	301	999	100	107	644	641	64	-0.164	0.152	-0.528	-0.526	4.417	4.737
104	302	1000	100	101	774	761	91	-0.195	0.149	-0.917	-0.608	5.111	4.217
105	301	999	100	110	470	467	67	-0.196	0.181	-1.096	-0.920	6.493	5.761
106	301	1000	100	109	517	576	89	-0.069	0.327	-0.979	-0.538	7.420	5.311
107	304	999	100	103	705	737	85	-0.109	0.233	-1.734	-1.479	8.594	8.283
108	301	1000	100	107	499	488	88	-0.235	0.188	-0.888	-0.466	5.289	3.367
109	300	1001	100	101	450	476	99	-0.173	0.288	-0.563	0.285	5.654	8.944
110	301	1000	100	104	440	490	72	-0.062	0.324	-1.384	-0.823	7.232	5.765
111	301	1000	100	106	489	558	81	-0.029	0.353	-1.894	-1.274	8.749	6.806
112	300	1000	100	107	411	429	85	-0.177	0.271	-0.821	-0.573	4.981	3.956
113	300	1001	100	105	463	437	95	-0.289	0.169	-1.495	-0.633	7.050	4.569
114	300	999	100	111	289	347	75	-0.060	0.410	-0.867	-0.326	5.738	5.038
115	300	1000	100	114	324	362	90	-0.153	0.355	-1.033	-0.227	5.834	4.702
116	300	1000	100	109	351	378	90	-0.176	0.318	-1.062	-0.715	6.618	5.493
117	300	1000	100	107	335	380	76	-0.096	0.358	-1.021	-0.977	5.074	5.263
118	300	1000	100	105	328	394	112	-0.120	0.423	-1.058	-0.334	5.479	3.707
119	300	1000	100	109	358	392	77	-0.132	0.319	-1.633	-0.954	9.266	6.653
120	300	1000	100	111	243	281	83	-0.155	0.399	-0.959	-0.347	7.882	4.927

JB AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
121	300	1000	100	110	289	362	102	-0.085	0.456	-0.959	-0.182	5.812	4.655
122	301	1000	100	107	404	426	77	-0.153	0.275	-1.055	-0.853	6.610	6.098
123	300	1001	100	108	340	410	121	-0.125	0.430	-0.690	0.270	5.028	7.265
124	300	1001	100	103	428	441	96	-0.205	0.265	-1.042	-0.816	5.801	6.182
125	300	1000	100	107	408	434	79	-0.146	0.285	-1.285	-0.636	6.291	4.718
126	300 (2)	1000	100	112	273	353	89	-0.032	0.475	-0.620	0.177	5.871	5.527
127	300	1000	100	104	378	422	71	-0.082	0.333	-1.260	-0.873	6.865	5.248
128	300	1000	100	111	321	381	99	-0.110	0.409	-0.891	-0.573	7.039	5.380
129	300	1000	100	109	349	370	88	-0.190	0.303	-1.428	-0.913	7.601	5.929
130	300	999	100	104	312	357	75	-0.097	0.367	-1.190	-0.810	6.279	6.068
131	300	1000	100	106	240	295	78	-0.081	0.441	-0.590	-0.356	4.491	4.385
132	300	1000	100	108	287	320	96	-0.192	0.367	-0.959	-0.463	5.553	4.972
133	300	999	100	107	273	295	70	-0.171	0.322	-0.831	-0.516	5.596	4.769
134	300	1000	100	104	382	426	88	-0.121	0.341	-0.937	-0.409	6.707	6.104
135	300	1000	100	107	294	328	97	-0.186	0.367	-1.015	-0.290	6.292	4.968
136	300	1000	95	97	454	543	120	-0.065	0.410	-1.230	-0.464	5.985	5.197
137	301	1000	95	102	472	429	102	-0.331	0.139	-1.533	-0.922	7.065	4.953
138	300	999	95	104	396	432	71	-0.106	0.305	-0.594	-0.324	4.772	4.357
139	300	999	95	99	352	368	72	-0.173	0.271	-0.761	-0.454	4.749	4.713
140	300	1001	95	98	360	385	97	-0.193	0.316	-0.700	-0.203	5.686	5.342
141	300	1001	95	101	391	409	106	-0.214	0.298	-1.035	-0.365	6.642	4.747
142	300	1000	95	107	325	332	74	-0.218	0.257	-1.233	-0.632	6.190	4.172
143	300	1000	95	98	418	425	78	-0.195	0.236	-1.190	-0.624	5.274	4.385
144	301	999	95	95	612	567	89	-0.285	0.099	-1.278	-0.807	5.565	4.995
145	300	1000	95	107	309	379	86	-0.049	0.432	-0.708	-0.347	4.325	3.759
146	300	999	100	110	340	365	76	-0.160	0.301	-0.199	-0.057	4.782	4.090
147	300	1001	120	128	216	285	101	-0.110	0.500	-0.232	0.106	3.272	3.755
148	300	999	110	118	362	419	78	-0.060	0.374	-0.352	0.080	4.107	4.403
149	300	1001	120	123	275	339	89	-0.082	0.438	-0.378	0.058	3.427	3.667
150	300	1000	130	137	160	233	91	-0.072	0.564	-0.634	0.153	3.508	3.843
151	300	1000	140	144	161	272	100	0.045	0.641	-0.085	0.579	3.556	4.577
152	300	1001	150	155	144	212	97	-0.124	0.575	-0.069	0.315	4.291	3.360
153	300	1000	150	155	159	275	97	0.077	0.653	-0.537	0.510	5.712	5.197
154	300	1000	150	154	144	226	88	-0.028	0.601	0.236	0.354	3.473	3.133
155	300	1000	150	152	146	222	74	0.008	0.584	-0.240	0.260	3.902	3.652
156	300	999	150	157	126	181	67	-0.064	0.553	-0.188	0.341	3.567	3.554
157	300	1000	160	162	151	261	98	0.046	0.649	-0.300	0.430	3.487	3.477
158	300	1000	170	175	176	266	89	0.005	0.582	-0.057	0.393	3.344	4.086
159	300	1000	180	180	161	216	95	-0.160	0.524	-0.006	0.439	3.644	3.523
160	300	1000	190	196	138	226	85	0.017	0.625	-0.046	0.155	3.276	3.494
161	300	1000	200	204	177	251	84	-0.042	0.545	0.169	0.451	2.907	3.217
162	300	1002	200	201	113	241	128	-0.001	0.730	-0.144	0.886	3.020	4.957
163	300	999	200	205	125	194	83	-0.070	0.598	0.059	0.502	2.642	3.687
164	300	1001	200	206	158	249	105	-0.053	0.606	0.130	0.421	2.390	3.216
165	300	999	200	202	183	283	90	0.037	0.594	0.434	0.836	3.710	4.315
166	300	1000	210	213	119	241	114	0.033	0.712	0.317	0.739	3.589	4.081
167	300	1000	220	218	198	289	89	0.009	0.562	0.771	0.835	6.361	4.906
168	300	999	230	239	247	269	63	-0.165	0.326	0.139	0.235	2.872	3.062
169	300	1000	240	242	219	308	86	0.012	0.537	0.275	0.521	3.384	3.469
170	300		250	259	289								
171	300	1000	250	251	239	314	87	-0.041	0.490	0.428	0.460	3.841	4.061
172	300		250	253	268								
173	300	1000	250	253	290	382	84	0.028	0.492	0.533	0.670	4.206	3.780
174	300		250	251	196								
175	300	1001	260	268	216	286	101	-0.104	0.504	-0.107	0.109	2.923	3.371
176	300	1000	270	272	254	299	92	-0.154	0.414	-0.117	0.186	2.870	2.905
177	300	1000	280	282	310	349	85	-0.140	0.360	0.002	0.082	2.628	2.594
178	300	1000	290	292	290	390	93	0.020	0.505	-0.005	0.376	2.747	3.344
179	300	1000	300	300	317	429	99	0.037	0.513	0.085	0.169	2.945	2.975
180	300	1000	250	254	207	264	75	-0.074	0.467	0.265	0.192	3.375	2.920

JB AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
181	300	1001	300	307	365	475	119	-0.024	0.480	0.315	0.489	4.084	4.559
182	300	999	300	304	373	458	81	0.011	0.429	0.649	0.755	4.585	4.370
183	300	1000	300	300	287	340	81	-0.089	0.405	0.079	0.196	2.748	3.357
184	300	1000	300	307	290	329	69	-0.105	0.360	0.038	0.045	3.215	3.246
185	300	1001	300	307	295	349	101	-0.135	0.413	0.021	0.169	3.119	3.278
186	300	1000	300	305	236	320	92	-0.029	0.512	-0.124	0.097	2.865	3.399
187	300	1000	300	305	328	399	81	-0.030	0.423	-0.324	-0.207	3.733	3.636
188	300	999	300	303	237	299	79	-0.061	0.460	0.028	0.195	2.746	3.002
189	300	1000	300	302	296	381	94	-0.026	0.473	0.087	0.250	3.272	3.261
190	308	1001	300	303	250	334	104	-0.054	0.503	0.387	0.401	4.409	3.638
191	300	1000	300	301	229	287	80	-0.083	0.453	0.087	0.490	2.981	3.336
192	300	1001	300	304	285	397	135	-0.060	0.533	-0.102	0.320	2.962	3.652
193	300	1000	300	301	258	312	81	-0.094	0.423	-0.029	0.080	2.746	2.993
194	300	1000	300	301	254	347	81	0.043	0.518	0.090	0.421	2.768	3.801
195	300	1000	300	302	205	296	108	-0.055	0.558	0.149	0.517	3.229	3.740
196	300	1000	300	305	278	333	68	-0.048	0.408	-0.219	-0.039	2.891	2.739
197	300	1001	300	305	194	277	113	-0.102	0.553	0.205	0.308	2.847	3.158
198	300	1001	300	298	337	409	101	-0.079	0.426	-0.064	0.029	2.788	2.801
199	300	1000	300	299	332	429	97	-0.001	0.475	-0.051	0.063	4.822	4.062
200	300	1000	300	302	217	285	71	-0.013	0.489	-0.204	0.123	3.059	3.170
201	300	1000	300	300	216	299	84	-0.002	0.528	-0.114	0.114	3.149	3.300
202	300	1000	300	309	216	314	103	-0.014	0.560	-0.126	0.198	3.408	3.438
203	300	1000	300	303	230	302	104	-0.104	0.497	0.190	0.683	3.507	4.446
204	300	1001	300	305	214	287	113	-0.128	0.517	0.032	0.190	2.731	2.764
205	300	1000	300	306	251	309	79	-0.075	0.439	0.042	0.046	2.777	2.635
206	300	999	300	302	233	319	79	0.027	0.521	-0.037	0.165	2.949	3.155
207	300	1000	300	303	214	287	79	-0.025	0.503	-0.191	0.103	3.255	3.718
208	300	999	300	304	176	235	79	-0.084	0.507	-0.022	0.317	3.801	3.201
209	300	1000	300	298	215	257	75	-0.130	0.421	0.026	0.064	3.236	3.134
210	300	1000	300	303	227	268	64	-0.097	0.399	-0.270	0.160	2.978	2.723
211	300	1000	300	305	208	272	73	-0.038	0.486	0.147	0.317	2.901	3.250
212	300	999	300	302	185	277	80	0.049	0.578	-0.092	0.518	2.613	4.238
213	300	999	300	303	247	317	69	0.004	0.470	-0.245	-0.021	3.040	3.292
214	300	1000	300	308	191	260	97	-0.106	0.522	-0.125	0.308	2.927	3.858
215	300	1000	300	301	214	290	108	-0.106	0.520	0.126	0.259	3.061	3.035
216	300	1000	300	303	176	237	73	-0.055	0.509	-0.079	0.104	2.920	2.871
217	300	1000	300	307	177	230	73	-0.091	0.485	-0.395	0.141	3.623	3.846
218	300	999	300	306	189	247	69	-0.046	0.488	0.458	0.674	4.068	4.452
219	300	1000	300	305	239	267	81	-0.189	0.372	-0.050	0.132	3.953	3.283
220	300	1000	300	305	208	313	95	0.033	0.579	-0.064	0.411	2.852	3.778
221	300	1000	300	305	208	321	107	0.018	0.593	-0.079	0.602	2.854	4.074
222	300	1000	300	305	166	215	73	-0.113	0.486	0.095	0.360	3.321	3.309
223	300	1001	300	306	193	312	111	0.027	0.618	0.357	0.901	3.418	5.268
224	300	999	300	305	220	284	80	-0.060	0.477	-0.185	0.350	3.781	4.491
225	300	1001	300	307	266	351	83	0.008	0.491	0.047	0.372	2.803	3.335
226	300	999	300	304	169	247	92	-0.055	0.564	0.068	0.344	2.956	3.155
227	300	1001	300	306	208	296	113	-0.083	0.549	0.355	0.433	3.065	3.090
228	300	1000	300	304	162	241	96	-0.068	0.574	0.094	0.107	2.694	2.614
229	300	1001	300	302	244	353	103	0.017	0.556	0.113	0.679	3.122	5.622
230	300	1000	300	306	225	299	79	-0.020	0.498	0.242	0.302	2.890	3.053
231	300	1000	300	305	213	305	105	-0.045	0.550	0.099	0.424	3.606	3.793
232	300	1000	300	304	202	273	70	0.003	0.511	0.166	0.274	3.528	2.921
233	300	999	300	305	163	225	80	-0.078	0.530	0.046	0.655	4.002	5.128
234	300	999	300	302	231	312	69	0.047	0.511	0.172	0.266	3.144	2.970
235	300	1000	300	303	232	284	80	-0.102	0.439	-0.580	-0.519	4.943	4.807
236	300	1000	300	303	182	245	83	-0.079	0.512	-0.076	0.388	3.252	4.117
237	300	999	300	302	204	266	70	-0.030	0.485	-0.328	0.071	4.431	4.695
238	300	1000	300	302	126	199	76	-0.013	0.608	-0.009	0.396	2.882	3.419
239	300	999	300	306	174	241	74	-0.032	0.529	0.047	0.181	3.405	3.083
240	300	1000	300	301	176	230	85	-0.129	0.497	-0.505	-0.085	4.534	4.969

JB AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
241	300	1000	300	303	181	252	71	0.002	0.533	-0.008	0.044	3.460	3.293
242	300	1001	300	301	180	266	117	-0.108	0.573	-0.033	0.402	2.992	3.822
243	300	1000	300	300	167	248	72	0.045	0.574	-0.031	0.394	2.843	3.912
244	300	1000	310	318	182	243	88	-0.106	0.509	-0.207	-0.031	3.114	3.195
245	300	1000	320	323	195	259	84	-0.079	0.502	-0.274	-0.143	4.385	3.649
246	300	1001	330	335	203	274	101	-0.105	0.517	-0.211	-0.119	3.723	3.250
247	300	1000	340	348	175	250	80	-0.023	0.547	-0.188	0.191	2.949	2.652
248	300	999	350	357	238	354	92	0.081	0.576	-0.324	0.090	3.616	3.287
249	300	1000	350	349	211	280	93	-0.086	0.502	-0.104	0.159	2.443	2.868
250	300	999	350	353	180	261	91	-0.039	0.559	0.105	0.524	3.386	3.963
251	300	999	350	357	210	283	83	-0.041	0.508	-0.198	0.186	2.959	2.877
252	300	1000	350	355	212	317	85	0.074	0.580	0.103	0.702	3.508	4.979
253	300	1000	340	348	222	296	83	-0.031	0.503	-0.119	0.091	2.813	2.827
254	300	999	330	329	239	352	97	0.052	0.568	0.345	0.837	3.416	4.945
255	300	1000	320	322	179	284	106	-0.002	0.609	0.107	0.833	3.041	4.822
256	299 (1)	1001	310	312	226	345	135	-0.045	0.590	-0.121	0.913	2.976	6.517
257	300	1000	300	301	221	269	90	-0.149	0.442	-0.432	-0.311	3.948	3.772
258	300	1000	300	302	184	246	83	-0.087	0.506	0.186	0.216	2.929	3.240
259	300	1000	300	305	195	231	81	-0.177	0.429	-0.083	0.594	5.286	7.292

KC AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF			CORRELATION OF		ROOT B1 OF		KURTOSIS (B2)	
					RL	RL+FP	FP	RL,FP	RL+FP,FP	RL	RL+FP	RL	RL+FP
1	305 (2)	900	150	160	3408	3402	74	-0.080	0.067	0.515	0.466	9.313	9.134
2	315	900	150	142	4837	4930	102	-0.006	0.138	0.234	0.156	5.716	5.588
3	305 (2)	900	150	186	4549	4532	94	-0.085	0.059	-0.145	-0.118	4.354	4.229
4	302 (1)	900	150	155	3127	3144	82	-0.065	0.097	-0.306	-0.342	4.172	4.171
5	307	900	150	160	2593	2610	84	-0.072	0.108	-0.932	-0.829	4.746	4.459
6	304	900	150	147	2258	2196	94	-0.169	0.035	-0.303	-0.253	4.867	4.657
7	300 (2)	900	150	178	2323	2295	83	-0.126	0.063	-0.590	-0.540	4.055	3.735
8	307	900	150	140	2924	2965	86	-0.045	0.126	-0.490	-0.483	3.924	3.949
9	303	900	150	142	2045	1994	81	-0.163	0.037	-0.511	-0.373	4.004	3.400
10	298 (2)	900	200	201	2481	2521	86	-0.058	0.135	1.038	1.160	9.419	9.384
11	301	900	200	198	2146	2317	93	0.089	0.285	0.044	0.041	5.052	4.899
12	300	900	200	195	1044	1132	86	0.002	0.278	0.194	0.428	4.126	4.198
13	300	900	200	189	1048	1115	88	-0.035	0.247	0.300	0.318	4.933	4.921
14	300	900	200	202	1075	1195	111	0.012	0.316	0.335	0.568	3.050	3.655
15	300	900	200	190	1289	1382	106	-0.017	0.260	0.074	0.210	3.188	3.635
16	300	900	200	199	1437	1499	93	-0.042	0.208	0.497	0.483	4.015	3.673
17	300	901	200	192	1293	1316	106	-0.112	0.173	0.681	0.719	4.336	4.224
18	299 (1)	900	200	203	1120	1185	83	-0.030	0.236	0.113	0.059	3.379	3.364
19	300	900	200	207	786	863	81	-0.008	0.298	-0.281	-0.374	5.704	5.478
20	300	900	200	204	1057	1121	95	-0.048	0.244	-0.058	-0.105	4.762	4.682
21	301 (1)	900	200	203	892	945	81	-0.052	0.243	-0.837	-0.831	8.561	8.304
22	300	900	200	196	771	835	92	-0.053	0.281	0.035	0.095	3.337	3.180
23	300	900	200	197	1061	1110	98	-0.076	0.222	0.407	0.459	3.764	3.655
24	300	900	200	197	969	1049	86	-0.011	0.275	0.178	0.182	4.409	4.201
25	300	901	200	190	943	1050	123	-0.023	0.321	0.668	0.670	5.853	5.012
26	300	900	200	190	955	1039	90	-0.009	0.285	0.482	0.465	7.089	6.843
27	300	900	200	195	911	1035	92	0.054	0.349	0.582	0.710	3.875	5.168
28	300	900	200	192	785	858	93	-0.038	0.294	-0.113	-0.172	4.582	4.039
29	300	901	200	192	821	895	120	-0.073	0.297	0.386	0.550	3.765	4.193
30	300	900	200	202	597	644	82	-0.080	0.280	0.015	-0.018	4.643	4.353
31	300		200	196	732								
32	300		200	198	1144								
33	301	900	200	189	937	1052	92	0.040	0.333	-0.547	-0.266	6.918	6.494
34	299 (1)	900	200	196	1055	1056	74	-0.132	0.133	0.180	0.121	5.052	5.120
35	300	900	200	196	1055	1069	93	-0.126	0.169	-0.126	-0.033	2.754	2.766
36	300	900	200	190	729	788	97	-0.072	0.282	-0.288	0.111	6.850	4.615
37	300	900	200	207	706	777	96	-0.048	0.305	0.581	0.486	3.745	3.484
38	300	900	200	193	867	907	99	-0.099	0.233	0.313	0.270	4.461	3.951
39	301 (1)	900	200	209	915	1018	84	0.032	0.318	-1.335	-0.946	11.614	9.534
40	300 (1)	900	200	204	958	950	90	-0.166	0.141	1.143	1.201	8.517	8.299
41	300	900	200	200	602	705	115	-0.023	0.382	0.228	0.321	4.268	3.589
42	300 (1)	900	200	197	529	609	93	-0.028	0.365	0.155	0.318	3.398	3.581
43	300	900	200	198	374	434	88	-0.076	0.380	-0.022	-0.033	3.316	2.972
44	300	900	200	189	523	553	84	-0.128	0.265	-0.103	-0.071	3.029	3.176
45	300	899	200	189	539	610	75	-0.010	0.340	-0.562	-0.460	7.908	6.898
46	300	900	200	196	563	672	98	0.022	0.403	0.286	0.158	4.964	3.738
47	299 (1)	900	200	183	791	868	112	-0.059	0.303	-0.361	-0.118	3.772	3.938
48	300		200	201	499								
49	300		200	200	891								
50	300	899	200	194	616	676	80	-0.045	0.301	0.082	0.115	4.428	3.779
51	300	900	200	189	733	759	91	-0.127	0.222	-0.678	-0.420	7.162	6.252
52	300 (1)	901	200	195	562	623	102	-0.087	0.323	0.571	0.619	3.837	4.441
53	300	900	200	184	609	687	100	-0.044	0.339	1.058	1.080	8.146	7.013
54	300 (1)	900	200	187	535	578	104	-0.128	0.300	-0.334	-0.262	7.922	7.077
55	300		200	192	591								
56	300	900	200	190	956	1011	98	-0.071	0.243	0.715	0.708	5.617	5.329
57	300	900	200	196	560	628	101	-0.069	0.335	0.132	0.025	4.391	4.179
58	300	900	200	199	734	799	91	-0.052	0.288	-1.072	-0.750	11.108	9.956
59	299 (1)	900	200	183	1115	1154	83	-0.073	0.197	-0.305	-0.194	5.274	5.558
60	300	900	200	186	722	835	86	0.056	0.372	0.386	0.461	3.725	4.143

KC AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
61	300	900	200	196	509	593	103	-0.040	0.379	0.429	0.638	4.247	4.694
62	300 (1)	900	200	200	500	585	102	-0.036	0.383	0.353	0.487	4.663	4.309
63	301	900	200	188	877	943	99	-0.057	0.269	-0.107	0.100	8.953	7.143
64	302	900	200	186	1105	1199	91	0.004	0.280	-1.164	-1.108	8.331	8.272
65	300	900	200	200	663	751	98	-0.020	0.342	0.175	0.421	4.319	4.789
66	299 (2)	901	200	210	877	909	100	-0.115	0.219	-1.677	-0.963	12.935	7.775
67	300		200	236	911								
68	300		200	200	702								
69	300		200	205	613								
70	300		200	195	1204								
71	300		200	178	683								
72	300		200	187	869								
73	300		200	218	800								
74	300	900	200	232	576	625	87	-0.084	0.292	0.355	0.512	3.293	3.869
75	300		200	211	1073								
76	298 (3)	900	200	220	1029	1062	84	-0.087	0.195	-0.488	-0.542	9.616	9.501

KF AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
1	298 (2)	900	200	198	1637	1690	81	-0.039	0.181	1.350	1.335	7.024	7.050
2	297 (3)	900	200	188	1564	1669	89	0.022	0.252	1.203	1.053	10.080	8.902
3	300	900	200	194	1056	1148	80	0.022	0.285	-0.010	0.006	4.372	4.062
4	301	900	200	197	1090	1198	92	0.027	0.302	-0.053	-0.115	9.076	8.058
5	300	900	200	195	714	758	81	-0.077	0.253	0.312	0.298	4.579	4.256
6	299 (2)	900	200	201	619	683	76	-0.026	0.309	1.043	0.776	8.625	6.345
7	300	900	200	201	460	573	109	0.007	0.443	0.248	0.269	3.441	3.196
8	300	900	200	196	344	436	78	0.044	0.461	0.539	0.613	3.407	4.142
9	300	900	200	195	408	507	88	0.029	0.442	0.807	0.726	6.641	5.698
10	300	900	200	197	294	348	82	-0.090	0.404	0.117	0.211	3.280	3.016
11	300	899	200	192	333	402	74	-0.016	0.414	0.272	0.309	3.233	3.284
12	300	900	200	199	375	431	89	-0.093	0.369	0.235	0.239	3.642	3.182
13	300	900	200	204	286	342	88	-0.101	0.416	0.759	0.617	5.403	4.166
14	300	900	200	197	425	538	85	0.074	0.463	0.098	0.183	3.197	3.287
15	300	900	200	200	348	468	112	0.022	0.508	-0.449	0.160	6.139	5.560
16	300	900	200	201	704	753	79	-0.065	0.262	1.004	0.810	4.807	4.058
17	300	900	200	194	706	774	96	-0.053	0.300	1.033	0.841	7.559	6.745
18	300	900	200	203	335	412	93	-0.047	0.434	0.467	0.470	3.323	3.115
19	300 (1)	900	200	198	514	618	91	0.033	0.413	0.506	0.458	3.430	3.058
20	300	900	200	192	580	715	85	0.115	0.447	0.054	0.163	4.213	3.868
21	300	900	200	200	333	394	92	-0.088	0.401	1.433	1.137	12.249	8.518
22	300	900	200	196	287	403	115	0.003	0.537	-0.227	0.132	4.257	3.943
23	300	900	200	198	475	561	95	-0.020	0.393	0.369	0.239	3.539	2.909
24	300 (1)	900	200	195	438	491	82	-0.078	0.335	0.389	0.461	3.046	2.892
25	300	900	200	198	426	574	105	0.101	0.515	0.379	0.666	4.168	4.564
26	300 (1)	900	200	204	389	496	117	-0.025	0.465	0.018	0.346	3.626	4.194
27	300 (1)	900	200	203	307	400	92	0.001	0.481	0.215	0.277	4.871	4.708
28	300	901	200	198	299	408	112	-0.008	0.517	0.463	0.505	5.428	4.543
29	300	900	200	201	262	341	88	-0.029	0.483	-0.249	0.263	2.846	3.690
30	300	900	200	197	224	297	106	-0.107	0.504	0.324	0.428	4.134	3.514
31	300 (1)	900	200	200	261	341	101	-0.064	0.488	0.153	0.334	3.826	3.569
32	300	900	200	198	319	419	101	-0.001	0.490	0.207	0.532	2.905	3.394
33	300	900	200	202	273	357	86	-0.006	0.485	0.881	0.756	5.175	4.103
34	300	900	200	197	267	338	84	-0.043	0.460	0.168	0.285	3.317	2.854
35	300	900	200	201	232	311	89	-0.033	0.505	-0.137	0.093	3.720	3.190
36	300	900	200	199	216	276	76	-0.064	0.468	0.411	0.303	5.045	4.442
37	300	900	200	203	302	382	99	-0.056	0.460	0.082	0.295	3.769	3.706
38	300	900	200	202	185	274	87	0.008	0.569	0.272	0.543	3.374	3.520
39	300	900	200	199	233	334	106	-0.015	0.550	0.432	0.518	4.641	4.219
40	300 (1)	900	200	197	276	343	79	-0.041	0.444	0.012	0.208	3.580	3.256
41	300	900	200	200	156	252	87	0.038	0.616	-0.169	0.330	3.054	3.122
42	300	900	200	204	320	386	87	-0.063	0.417	1.622	1.143	12.387	7.709
43	300	900	200	200	245	365	90	0.101	0.578	-0.071	0.394	3.799	4.001
44	300	901	200	197	233	371	123	0.044	0.611	0.163	0.964	4.151	5.456
45	300		200	203	181								
46	300	900	200	199	512	608	81	0.038	0.400	-0.207	0.097	3.200	3.530
47	300	900	200	201	261	388	114	0.037	0.572	-0.290	0.373	3.714	5.284
48	300	900	200	203	315	392	103	-0.070	0.449	-0.372	0.034	3.500	3.828
49	300	900	200	203	311	348	84	-0.145	0.354	-0.792	-0.420	4.829	4.241
50	300	900	200	205	275	363	106	-0.052	0.494	0.407	0.450	4.035	3.702
51	300 (1)	900	195	197	168	277	95	0.057	0.628	-0.210	0.368	4.157	4.388
52	300	900	190	189	193	280	89	-0.008	0.557	-0.040	0.370	2.823	3.643
53	300	900	185	186	152	247	91	0.016	0.620	-0.096	0.376	3.260	3.523
54	300	900	180	179	226	335	92	0.057	0.572	0.434	0.942	6.214	6.066
55	300	900	175	174	211	272	89	-0.103	0.482	-0.096	0.161	3.012	3.019
56	300	900	175	174	275	375	83	0.057	0.519	-0.400	0.180	4.270	3.872
57	300 (1)	900	175	179	251	330	81	-0.005	0.492	0.126	0.192	2.865	3.022
58	300 (2)	900	175	178	187	299	93	0.074	0.615	-0.005	0.364	3.094	3.567
59	300 (1)	900	175	179	124	206	96	-0.065	0.632	0.060	0.512	3.691	4.208
60	300	900	170	172	249	377	93	0.114	0.589	-0.155	0.292	4.018	3.820

KF AUDITORY

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
61	300	900	165	167	286	341	81	-0.087	0.408	-0.120	-0.013	3.051	2.986
62	300	900	160	162	170	248	88	-0.042	0.560	-0.128	0.270	3.024	2.819
63	300	900	155	158	166	257	89	0.008	0.596	-0.185	0.277	3.114	4.066
64	300 (1)	900	150	157	194	264	103	-0.116	0.525	-0.455	0.461	4.740	4.279
65	300	900	150	153	228	296	100	-0.106	0.488	-0.324	0.135	3.070	3.285
66	300 (1)	900	150	153	170	247	96	-0.072	0.564	-0.325	0.130	3.586	3.721
67	300	900	150	153	187	263	87	-0.045	0.537	-0.206	0.033	3.701	3.457
68	300	900	150	152	203	277	87	-0.050	0.518	-0.614	-0.046	4.535	3.111
69	300	900	150	152	199	279	92	-0.044	0.537	-1.028	-0.120	6.968	8.107
70	300	900	150	156	201	269	96	-0.102	0.511	1.580	1.171	14.763	8.635
71	300	900	150	154	158	221	82	-0.084	0.538	-0.332	0.242	4.467	4.091
72	300	900	150	154	259	339	100	-0.063	0.489	-0.319	0.110	3.899	3.872
73	300	900	150	152	194	280	98	-0.044	0.556	-0.799	0.298	6.130	4.020
74	300	900	150	147	300	346	87	-0.128	0.382	0.020	0.264	4.675	3.888
75	300	900	145	149	199	264	85	-0.075	0.502	0.008	0.001	4.421	3.563
76	300	900	140	145	160	270	113	-0.009	0.639	-0.429	0.695	4.753	7.523
77	300 (1)	900	135	134	133	221	96	-0.037	0.631	-0.175	0.653	3.172	5.921
78	300	900	130	132	251	291	80	-0.143	0.393	-0.323	-0.083	3.204	2.811
79	301	900	125	128	303	334	81	-0.158	0.341	-1.351	-0.929	10.683	9.869
80	300	900	120	130	380	430	108	-0.144	0.367	0.147	0.421	9.592	7.428
81	303	900	115	116	1319	1280	90	-0.188	0.073	0.644	0.643	9.983	9.129
82	300	900	110	117	386	414	89	-0.164	0.304	-0.732	-0.421	3.756	3.705

DK VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
1	300		300	248	4990								
2	300	900	300	301	3190	3215	112	-0.072	0.114	1.666	1.548	10.738	9.872
3	298 (2)	900	300	309	3458	3599	82	0.055	0.205	1.660	1.641	9.310	9.633
4	300	900	300	295	2113	2235	76	0.057	0.239	0.589	0.669	5.652	5.944
5	300		300	305	5008								
6	300	900	300	290	2259	2259	87	-0.098	0.099	0.640	0.726	6.143	6.383
7	300	999	300	297	2083	2155	73	-0.001	0.183	0.028	0.003	6.157	6.011
8	300	999	300	304	1655	1739	102	-0.022	0.221	0.232	0.201	3.940	3.822
9	300	999	300	287	2029	2086	89	-0.038	0.170	0.056	0.211	5.600	4.713
10	300	999	300	309	1550	1547	71	-0.111	0.102	-0.435	-0.387	4.284	4.268
11	299 (1)	1000	300	289	1303	1445	99	0.059	0.319	0.191	0.240	3.881	3.670
12	300	999	300	297	1905	1968	65	-0.003	0.179	0.196	0.201	4.989	4.924
13	300	1000	300	291	1270	1345	103	-0.038	0.239	0.530	0.515	4.822	4.621
14	300	1000	300	290	1542	1704	104	0.073	0.316	0.075	0.109	3.627	3.267
15	300	1000	300	297	1436	1546	79	0.046	0.270	0.229	0.244	3.199	3.102
16	300	1000	300	289	1291	1382	90	0.002	0.258	0.383	0.480	3.142	3.315
17	300	1000	300	297	1032	1119	94	-0.011	0.279	0.431	0.279	3.317	3.167
18	300	1000	300	302	890	929	90	-0.091	0.222	-0.024	0.092	3.272	2.907
19	300	999	300	305	939	1054	90	0.043	0.333	0.323	0.295	3.117	2.891
20	300	1000	300	297	846	965	90	0.051	0.354	0.136	0.276	3.469	3.180
21	300	1000	300	303	749	831	110	-0.048	0.318	0.522	0.700	5.152	4.908
22	300	1000	300	301	786	857	112	-0.068	0.295	1.562	1.320	11.447	8.771
23	300	1001	300	304	713	793	121	-0.069	0.325	0.277	0.347	3.162	3.273
24	299 (1)	1000	300	294	712	763	64	-0.031	0.260	0.282	0.295	3.864	3.440
25	300	1000	300	295	822	898	81	-0.008	0.291	0.244	0.270	2.726	2.618
26	300	1000	300	298	822	927	105	-0.001	0.336	0.121	0.276	2.899	3.599
27	300	1001	300	299	747	836	110	-0.038	0.327	0.634	0.538	3.790	3.248
28	300	1000	300	301	814	905	94	-0.006	0.317	0.317	0.451	3.603	3.807
29	300	1000	300	306	631	685	94	-0.083	0.290	-0.068	0.113	2.597	2.878
30	300	1000	300	299	774	823	85	-0.069	0.255	-0.089	-0.100	3.493	3.132
31	300	1001	300	302	735	864	101	0.051	0.389	-0.249	-0.203	2.931	3.010
32	300	999	300	302	833	840	66	-0.124	0.156	0.054	-0.012	3.092	3.329
33	300	1000	300	313	1056	1104	79	-0.056	0.214	-0.160	-0.141	3.523	3.805
34	300	1000	300	304	644	696	73	-0.049	0.278	-0.198	-0.115	2.461	2.429
35	300	1001	300	298	516	604	115	-0.057	0.384	-0.154	-0.201	2.819	2.759
36	300	1000	300	305	761	840	99	-0.037	0.308	-0.104	-0.026	2.957	2.850
37	300	1000	300	293	744	818	83	-0.018	0.301	-0.185	-0.074	2.878	3.045
38	299 (1)	1001	300	291	616	626	106	-0.189	0.225	0.539	0.500	3.955	3.434
39	300	1000	300	294	674	765	103	-0.023	0.346	0.217	0.214	3.034	3.177
40	300	1000	300	296	554	614	80	-0.048	0.315	-0.005	0.027	3.081	2.770
41	300	1000	300	303	530	631	92	0.018	0.399	-0.027	0.067	3.008	2.901
42	300	999	300	305	549	650	69	0.080	0.400	0.287	0.300	3.508	3.603
43	300	1000	300	297	698	814	81	0.074	0.383	0.355	0.349	3.317	3.105
44	300	1000	300	300	732	791	75	-0.034	0.275	0.113	-0.004	2.837	2.596
45	300	1000	300	303	896	1057	102	0.098	0.401	0.116	0.282	2.404	2.644
46	300	1001	300	306	907	1049	99	0.072	0.374	0.122	0.254	2.756	2.996
47	300	1000	300	304	554	579	70	-0.114	0.236	-0.072	0.013	2.632	2.770
48	300	999	300	304	777	839	74	-0.026	0.273	0.152	0.235	2.787	2.966
49	300	1000	300	299	672	717	106	-0.114	0.274	0.200	0.204	2.776	2.727
50	300	1000	300	301	646	718	75	-0.007	0.316	-0.092	-0.031	2.938	2.908
51	300	1001	305	303	781	878	151	-0.078	0.340	0.042	0.092	2.630	2.608
52	300	1001	305	308	815	910	97	-0.005	0.323	-0.040	0.175	2.803	3.399
53	300	1000	305	309	1149	1258	96	0.020	0.296	0.096	0.068	2.835	2.720
54	300	1000	305	303	547	636	93	-0.009	0.374	0.223	0.330	2.955	2.795
55	300	1000	305	296	431	502	84	-0.034	0.377	0.233	0.232	3.200	3.355
56	300	1001	305	301	515	597	111	-0.059	0.376	-0.051	0.128	3.801	3.793
57	300	1000	305	306	478	509	91	-0.144	0.284	-0.062	-0.084	2.810	2.743
58	300	1000	305	304	599	711	110	0.003	0.397	0.187	0.306	3.347	4.044
59	300	998	305	308	575	601	57	-0.086	0.225	-0.010	0.224	2.734	3.073
60	300	1000	305	303	510	563	74	-0.054	0.310	0.059	0.228	3.309	3.022

DK VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
61	300	1000	310	311	573	646	93	-0.045	0.337	0.021	0.311	3.144	4.002
62	300	1000	310	310	496	561	86	-0.051	0.344	0.213	0.269	2.746	3.136
63	300	1000	310	312	638	704	102	-0.070	0.314	0.252	0.436	2.808	3.157
64	300	999	310	315	518	591	69	0.012	0.353	-0.067	-0.128	3.148	3.085
65	300	1001	310	310	446	547	114	-0.029	0.430	0.085	0.245	2.787	2.954
66	300	1000	315	319	423	497	92	-0.046	0.387	0.285	0.239	3.305	3.050
67	300	1001	315	316	529	652	110	0.026	0.435	-0.321	0.075	3.474	3.963
68	300	1001	315	320	469	523	131	-0.156	0.354	-0.448	-0.309	3.456	3.656
69	300	1000	315	315	498	555	88	-0.073	0.328	-0.373	-0.258	4.671	4.463
70	300	1000	315	312	450	499	75	-0.073	0.320	-0.114	0.037	2.817	2.789
71	300	999	320	316	576	647	71	-0.002	0.330	0.030	0.117	3.074	3.060
72	300	1001	320	315	448	521	100	-0.062	0.380	0.013	0.145	3.065	2.982
73	300	1000	320	318	400	426	70	-0.131	0.279	-0.016	0.145	3.355	3.095
74	300	1001	320	320	444	512	109	-0.093	0.375	0.120	0.208	3.649	3.373
75	300	1000	320	314	384	431	79	-0.089	0.342	0.087	0.099	3.072	3.105
76	300	1002	320	320	286	393	123	-0.044	0.522	0.148	0.454	2.973	3.881
77	300	999	320	316	428	513	77	0.023	0.407	-0.409	0.050	3.733	3.491
78	300	1000	320	321	410	482	85	-0.034	0.388	0.073	0.233	2.916	3.293
79	300	1000	320	322	389	454	102	-0.094	0.388	0.134	0.259	3.130	3.002
80	300	1000	320	322	425	535	115	-0.012	0.454	-0.090	0.060	3.440	3.592
81	300	1000	320	323	387	518	98	0.084	0.507	0.012	0.498	2.910	4.136
82	300	1000	320	320	628	762	82	0.115	0.432	0.425	0.321	4.206	3.589
83	300	1000	320	321	547	691	91	0.117	0.468	0.163	0.461	2.976	3.510
84	300	1001	320	321	399	557	133	0.054	0.534	-0.298	0.263	3.419	3.995
85	300	1000	320	320	384	475	86	0.014	0.438	-0.010	0.158	2.727	2.943
86	300	1000	320	319	304	404	95	0.013	0.497	0.137	0.399	2.959	3.504
87	300	1001	320	318	305	456	123	0.073	0.578	0.308	0.532	3.138	3.425
88	300	1001	320	321	391	553	119	0.099	0.547	-0.106	0.336	2.973	3.284
89	300	1000	320	316	335	399	102	-0.103	0.412	-0.555	-0.182	5.212	4.656
90	300	1000	320	324	348	433	79	0.018	0.443	-0.085	0.266	4.624	3.773
91	300	999	325	323	332	418	64	0.073	0.458	0.032	0.064	3.113	2.992
92	300	1000	325	322	270	332	99	-0.114	0.443	0.184	0.233	3.097	3.406
93	300	1002	325	324	284	457	135	0.098	0.621	-0.078	0.716	3.306	4.876
94	300	1001	325	322	436	493	104	-0.111	0.356	-0.092	0.014	2.953	2.696
95	300	1001	325	324	348	413	109	-0.113	0.409	-0.008	0.282	3.887	3.689
96	300	999	325	326	415	436	85	-0.172	0.275	-0.254	-0.157	3.623	3.761
97	300	1000	325	325	327	456	87	0.124	0.541	0.158	0.571	3.597	4.598
98	300	1000	325	323	314	416	91	0.034	0.497	0.042	0.193	3.234	3.464
99	300	1000	325	322	312	377	97	-0.091	0.425	-0.485	-0.167	3.927	3.607
100	300	1000	325	325	333	426	74	0.061	0.471	0.023	0.310	3.519	3.540
101	300	1000	330	331	391	510	116	0.009	0.484	0.246	0.509	3.355	3.646
102	300	1000	335	337	401	474	105	-0.075	0.401	0.156	0.394	3.806	4.146
103	300	1000	340	339	472	558	86	0.000	0.392	-0.287	-0.046	3.287	3.575
104	300	1001	345	341	420	508	98	-0.025	0.417	0.029	0.287	2.813	3.071
105	300	1000	350	351	289	377	103	-0.044	0.485	0.357	0.331	4.264	3.118
106	300	1000	355	351	272	314	83	-0.138	0.385	0.206	0.191	3.452	3.322
107	299 (1)	999	360	355	356	390	83	-0.143	0.325	0.079	0.023	3.048	2.809
108	300	1000	365	358	318	426	110	-0.004	0.505	0.118	0.529	3.315	4.892
109	300	1000	370	369	419	532	102	0.029	0.463	0.125	0.400	2.734	2.966
110	300	1000	375	371	277	342	77	-0.040	0.439	0.519	0.462	4.106	3.684
111	300	1000	380	376	523	616	86	0.018	0.390	0.061	0.146	2.866	3.073
112	300	1000	385	385	407	476	87	-0.045	0.385	0.100	0.231	2.670	2.666
113	299 (1)	1000	390	384	357	431	78	-0.010	0.415	-0.007	0.240	2.726	2.790
114	300	1000	395	393	394	489	81	0.038	0.441	-0.002	0.066	3.234	3.232
115	300	999	400	399	429	468	71	-0.090	0.303	-0.297	-0.200	3.274	2.816
116	300	1000	400	393	422	568	93	0.131	0.518	0.409	0.420	7.223	5.038
117	300	999	400	408	477	536	73	-0.038	0.332	0.136	0.179	2.793	2.912
118	300	1000	400	399	370	466	87	0.027	0.456	-0.027	0.088	2.574	3.092
119	300	1000	400	400	454	547	79	0.040	0.415	0.215	0.239	2.830	2.759
120	300	999	400	401	344	416	65	0.025	0.417	0.063	0.166	2.934	3.450

DK VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
121	300	1001	400	399	381	478	101	-0.010	0.451	-0.040	-0.087	3.031	2.967
122	300	1001	400	397	427	506	79	0.000	0.396	-0.059	0.150	4.414	3.894
123	300	1000	400	399	396	500	89	0.039	0.457	0.368	0.553	3.922	4.116
124	300	1000	400	396	352	426	82	-0.024	0.416	-0.068	0.255	2.837	3.462
125	300	1000	405	405	473	532	87	-0.071	0.339	0.135	0.221	3.063	3.129
126	300	1000	410	407	448	477	97	-0.163	0.294	0.016	0.080	3.122	3.348
127	300	1000	415	412	514	639	123	0.004	0.442	0.048	0.349	3.626	3.818
128	300	999	420	420	536	617	69	0.033	0.366	0.135	0.195	2.972	2.899
129	300	1000	425	422	597	680	76	0.015	0.349	0.083	0.152	3.502	3.517
130	300	999	430	428	442	552	88	0.057	0.449	0.050	0.252	2.711	3.160
131	300	1000	435	437	511	583	98	-0.058	0.356	-0.003	0.142	3.159	3.320
132	300	1000	440	439	446	488	106	-0.147	0.325	0.255	0.215	3.029	3.099
133	300	1000	445	450	690	718	68	-0.091	0.218	-0.036	0.049	2.776	2.829
134	300	1001	450	452	715	821	105	0.002	0.360	-0.185	-0.010	3.531	3.558
135	300	1000	455	459	482	596	88	0.063	0.441	-0.315	0.088	4.360	3.134
136	300	999	460	463	705	796	74	0.038	0.340	-0.249	0.035	4.367	3.908
137	300	1000	465	466	493	578	87	-0.004	0.383	0.148	0.360	3.071	3.520
138	300	999	470	466	478	558	83	-0.007	0.378	-0.090	0.059	3.183	3.072
139	300	1000	475	469	593	703	107	0.006	0.395	0.018	0.146	2.919	2.852
140	300	1000	480	479	495	582	92	-0.013	0.385	-0.089	-0.039	3.055	3.217
141	300	1000	485	484	579	649	99	-0.060	0.334	-0.044	-0.080	2.818	2.815
142	300	1000	490	485	629	745	97	0.039	0.397	0.264	0.310	3.402	3.564
143	300	1000	495	495	748	909	84	0.153	0.442	-0.067	0.033	2.973	2.874
144	300	999	500	501	528	581	85	-0.078	0.310	-0.068	0.006	3.360	3.208
145	300	1000	500	496	517	576	72	-0.033	0.321	0.047	0.172	3.044	3.146
146	300	1000	500	504	622	653	89	-0.122	0.249	0.029	-0.003	2.775	2.645
147	300	1001	500	496	582	687	119	-0.026	0.392	-0.024	0.162	3.153	3.726
148	300	1000	500	502	592	677	75	0.026	0.357	0.114	0.174	3.268	3.039
149	300	1000	500	501	549	636	102	-0.033	0.370	-0.600	-0.204	5.067	4.698
150	300	1000	500	502	541	598	82	-0.060	0.314	-0.064	0.034	2.743	2.350
151	300	999	500	498	638	714	89	-0.027	0.328	0.188	0.281	3.415	3.342
152	300	999	500	503	767	771	74	-0.146	0.164	0.539	0.404	3.446	3.148
153	300	1000	500	505	656	718	84	-0.046	0.298	-0.061	0.021	2.829	2.825
154	300	1000	500	501	757	804	74	-0.057	0.248	-0.101	-0.122	3.594	3.609
155	300	1000	500	506	500	599	91	0.018	0.407	0.102	0.185	3.201	3.025
156	300	1000	500	499	493	541	75	-0.070	0.304	0.212	0.232	3.749	3.541
157	300	1001	500	507	524	592	113	-0.094	0.349	0.171	0.070	3.417	3.194
158	300	1001	500	506	519	601	110	-0.058	0.373	0.096	0.265	3.303	4.058
159	300	1001	500	500	603	651	128	-0.143	0.306	0.028	0.188	2.773	3.412
160	300	1000	500	502	544	605	98	-0.080	0.327	-0.112	0.065	3.247	3.026
161	300	1000	500	503	454	544	88	0.006	0.408	0.033	0.230	2.872	3.147
162	300	999	500	501	558	637	80	-0.003	0.352	0.230	0.323	3.614	3.810
163	299 (1)	1000	500	502	456	527	84	-0.036	0.367	0.214	0.150	3.947	3.626
164	300	1000	500	502	523	572	85	-0.085	0.305	0.080	0.225	3.750	3.350
165	300	1000	500	503	399	465	98	-0.080	0.384	-0.224	-0.016	3.092	2.911
166	300	1000	500	501	491	555	90	-0.061	0.346	-0.020	0.014	3.050	3.069
167	300	1000	500	501	538	645	107	0.001	0.408	-0.181	0.034	3.495	3.713
168	300	1001	500	499	455	518	114	-0.111	0.365	0.144	0.271	3.375	3.554
169	300	1000	500	499	520	651	87	0.101	0.457	0.094	0.386	3.575	3.558
170	300	1000	500	501	537	627	103	-0.028	0.381	-0.113	0.066	3.156	3.164
171	300	1000	500	502	591	609	89	-0.156	0.229	-0.063	-0.092	3.014	3.055
172	300	1000	500	502	536	623	101	-0.031	0.374	0.146	0.113	3.506	3.213
173	300	1000	495	498	466	552	98	-0.030	0.394	0.065	0.067	3.284	3.206
174	300	999	495	497	424	479	77	-0.061	0.343	0.008	0.125	2.871	2.934
175	300	1001	495	497	432	505	87	-0.035	0.382	-0.127	-0.109	2.868	2.655
176	300	1000	495	500	509	582	98	-0.057	0.358	0.032	-0.017	3.050	3.147
177	300	1000	495	502	454	564	104	0.014	0.441	-0.189	-0.084	2.809	2.828
178	300	1000	495	498	519	590	85	-0.031	0.350	0.169	0.305	2.984	3.307
179	300	1000	490	492	387	444	98	-0.107	0.370	0.092	0.098	3.027	2.636
180	300	1000	490	491	424	478	103	-0.118	0.353	0.032	0.119	2.753	2.784

DK VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
181	300	999	490	487	421	472	79	-0.077	0.337	0.136	0.126	2.995	2.888
182	300	1000	490	491	417	473	87	-0.082	0.352	-0.009	-0.035	2.768	2.753
183	300	1000	485	481	369	409	84	-0.126	0.334	-0.150	0.080	2.681	2.829
184	300	1000	485	484	389	454	91	-0.071	0.383	-0.030	0.077	3.175	3.251
185	300	1000	485	483	374	471	105	-0.020	0.454	0.162	0.382	2.785	3.323
186	300	1000	485	482	401	531	136	-0.013	0.494	-0.184	1.702	3.224	15.528
187	300	1000	485	487	407	482	97	-0.053	0.399	0.158	0.077	3.369	3.123
188	300	999	485	487	343	460	92	0.071	0.509	0.060	0.410	3.127	4.363
189	300	999	480	482	359	398	67	-0.094	0.323	0.046	0.174	2.800	3.283
190	300	1001	480	483	301	408	128	-0.053	0.514	-0.014	0.572	2.976	4.013
191	300	1000	480	481	478	558	93	-0.031	0.381	0.091	0.157	2.871	3.062
192	300	1000	480	482	458	507	96	-0.112	0.329	0.086	0.187	3.029	2.916
193	300	1000	475	477	442	540	107	-0.021	0.426	0.190	0.217	3.015	2.919
194	299 (1)	1000	475	475	360	460	89	0.030	0.467	-0.099	-0.026	3.435	2.819
195	300	1000	475	471	334	430	89	0.022	0.473	0.110	0.204	3.260	3.100
196	300	1000	475	479	315	420	96	0.026	0.500	-0.162	0.239	2.962	3.036
197	300	1000	475	479	430	462	98	-0.161	0.304	-0.087	0.098	3.009	3.151
198	300	1000	475	473	381	436	88	-0.089	0.365	0.219	0.397	2.820	3.848
199	300	1000	470	473	426	539	105	0.019	0.458	-0.122	0.029	3.205	3.797
200	300	999	470	470	353	435	95	-0.035	0.435	0.013	0.627	2.785	4.897
201	300	1000	470	470	336	395	98	-0.109	0.397	0.264	0.331	3.639	3.009
202	300	999	470	471	316	377	63	-0.008	0.402	-0.039	0.204	3.022	3.168
203	0		470	0	0								
204	300	1000	470	470	315	393	89	-0.032	0.447	0.204	0.317	3.121	3.034
205	300	1000	465	465	273	350	93	-0.050	0.472	-0.342	-0.147	3.473	3.614
206	300	1000	465	469	316	394	98	-0.056	0.447	-0.082	0.352	2.836	3.225
207	300	1000	465	467	282	365	89	-0.021	0.476	0.041	0.286	2.849	3.475
208	300	1000	465	466	285	340	88	-0.102	0.414	0.010	0.103	2.938	2.807
209	300	1000	465	467	249	353	89	0.051	0.545	-0.170	0.010	3.439	3.308
210	299 (1)	1000	460	462	310	398	97	-0.025	0.471	0.526	0.558	4.859	4.071
211	300	1000	460	462	283	342	88	-0.090	0.425	0.018	0.149	3.098	3.167
212	300	1000	460	462	349	420	89	-0.051	0.414	0.082	0.131	3.375	3.913
213	300	1000	460	463	293	374	89	-0.025	0.467	-0.083	0.004	2.862	2.846
214	300	1000	460	464	358	420	96	-0.092	0.392	0.056	0.161	3.605	3.571
215	300	1000	460	459	274	338	88	-0.076	0.442	0.039	0.167	2.715	2.975
216	300	1000	460	462	240	298	83	-0.089	0.449	0.031	0.288	3.755	3.735
217	300	999	455	455	315	415	95	0.013	0.490	0.025	0.542	3.484	4.411
218	300	1000	455	458	224	299	114	-0.121	0.514	0.022	0.579	2.909	4.551
219	300	1000	455	461	430	550	87	0.085	0.473	0.121	0.318	3.627	3.746
220	300	1000	455	459	281	366	96	-0.033	0.483	0.042	0.336	3.416	3.517
221	300	1000	455	458	365	395	90	-0.165	0.318	-0.061	0.172	3.322	2.782
222	300	1000	455	455	301	374	81	-0.027	0.441	0.025	0.012	2.509	2.484
223	300	1000	450	452	320	426	89	0.051	0.501	0.034	0.106	2.764	2.895
224	300	1000	450	456	382	440	98	-0.102	0.376	-0.313	-0.077	3.756	3.624
225	300	1000	450	452	260	373	89	0.081	0.556	0.022	0.340	3.361	3.385
226	300	1000	450	451	279	350	88	-0.053	0.454	0.089	0.219	2.992	3.007
227	300	1000	450	452	342	422	83	-0.009	0.434	0.158	0.233	3.396	3.339
228	300	1000	445	448	263	343	89	-0.030	0.484	0.078	0.274	2.801	3.967
229	300	1000	445	450	223	314	88	0.014	0.540	-0.086	0.232	2.935	2.935
230	300	1000	445	449	308	367	88	-0.089	0.409	0.255	0.414	3.115	3.102
231	300	999	445	450	289	390	95	0.017	0.508	0.437	0.866	3.884	5.247
232	300	1001	445	447	241	289	97	-0.161	0.431	-0.137	0.031	3.334	3.325
233	300	1000	440	445	290	381	114	-0.062	0.493	0.159	0.429	3.167	3.406
234	300	1000	440	437	322	378	102	-0.126	0.403	0.243	0.532	3.416	3.897
235	300	1000	440	439	259	328	89	-0.067	0.462	0.071	0.134	3.271	3.084
236	300	1000	440	443	257	352	92	0.011	0.520	0.338	0.524	3.908	4.627
237	300	1000	440	442	266	369	93	0.030	0.528	0.038	0.218	3.347	3.099
238	300	1001	435	434	275	327	96	-0.135	0.418	-0.003	0.300	3.566	3.978
239	300	1000	435	433	256	368	94	0.058	0.553	0.015	0.262	2.662	3.015
240	300	1000	435	436	191	278	89	-0.009	0.558	0.087	0.358	2.653	3.081

DK VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
241	300	1000	435	437	269	338	92	-0.074	0.456	0.038	0.212	2.819	3.217
242	300	999	435	433	316	406	92	-0.006	0.472	-0.082	0.212	2.796	3.101
243	300		435	436	263								
244	300	1000	430	431	253	318	92	-0.090	0.459	-0.105	-0.051	2.990	3.024
245	300	1000	430	428	303	374	80	-0.028	0.438	0.147	0.180	3.319	3.077
246	300	1000	430	432	288	346	79	-0.072	0.413	0.154	0.282	3.117	3.273
247	300	1000	430	431	268	366	102	-0.014	0.516	0.011	0.427	3.330	3.704
248	300	1000	425	427	298	396	89	0.025	0.496	0.283	0.589	3.053	3.625
249	300	999	425	424	293	369	84	-0.025	0.454	0.339	0.504	3.339	3.722
250	300	1000	425	418	220	305	93	-0.026	0.529	0.045	0.335	2.992	3.179
251	300	1000	425	425	282	383	86	0.045	0.514	0.189	0.513	3.029	3.383
252	300	1000	425	425	250	345	94	0.004	0.524	0.038	0.417	3.160	3.603
253	300	1000	420	423	270	384	89	0.080	0.549	0.037	0.173	2.703	3.033
254	300	999	420	417	246	307	84	-0.078	0.452	0.073	0.072	3.408	3.002
255	300	1000	420	426	250	348	114	-0.049	0.532	-0.183	0.413	4.392	4.128
256	300	1000	420	417	271	362	94	-0.011	0.500	0.183	0.382	3.007	3.191
257	300	1000	420	423	308	375	87	-0.062	0.426	-0.187	0.045	2.770	3.034
258	300	1000	415	418	221	294	99	-0.086	0.506	-0.101	0.069	2.775	2.696
259	300	1001	415	415	256	344	96	-0.024	0.508	0.188	0.325	3.306	3.487
260	300	1000	415	417	288	343	86	-0.098	0.412	0.199	0.138	3.035	2.916
261	300	1000	415	410	262	343	93	-0.038	0.488	0.187	0.511	3.275	3.502
262	300	1000	415	418	217	312	92	0.011	0.553	0.129	0.392	3.141	3.124
263	300	1001	410	412	230	320	119	-0.090	0.535	0.083	0.347	2.801	3.257
264	300	1000	410	410	194	289	79	0.065	0.576	0.128	0.660	4.256	4.773
265	300	999	410	412	224	277	79	-0.101	0.445	-0.079	-0.010	3.133	3.101
266	300	1001	410	412	219	358	135	0.012	0.624	0.156	0.795	3.083	4.612
267	300	1000	410	413	235	329	86	0.027	0.536	0.001	0.170	3.141	3.289
268	300	1000	405	407	282	348	80	-0.047	0.438	-0.314	-0.012	3.047	3.414
269	300	1000	405	408	287	334	79	-0.109	0.386	0.192	0.200	3.385	3.379
270	300	1000	405	404	251	340	90	-0.002	0.512	-0.011	0.371	2.904	4.351
271	300	1000	405	405	228	299	81	-0.035	0.490	-0.035	0.220	3.329	3.501
272	300	1000	405	404	252	398	108	0.118	0.614	0.119	0.455	3.404	4.193
273	300	1000	400	399	206	279	71	0.006	0.510	0.251	0.351	3.356	3.341
274	300	1000	400	400	181	222	69	-0.124	0.446	-0.003	0.154	2.919	3.134
275	300	1000	400	402	195	310	86	0.113	0.617	0.026	1.281	3.841	11.640
276	300	1000	400	402	259	338	80	-0.004	0.484	0.146	0.395	3.084	3.088
277	300	999	400	399	253	342	79	0.035	0.512	0.118	0.435	3.147	2.990
278	300	1000	395	396	233	327	90	0.017	0.537	-0.019	0.118	3.180	3.310
279	300	1000	395	398	236	308	71	0.003	0.483	0.741	0.601	4.999	4.214
280	300	1000	395	393	193	277	87	-0.013	0.550	-0.035	0.547	2.964	3.847
281	300	1000	395	398	180	277	86	0.046	0.595	-0.062	0.811	3.234	7.073
282	300	1001	395	397	217	336	111	0.022	0.593	-0.012	0.623	2.981	4.763
283	300	1000	390	392	214	281	64	0.014	0.489	0.148	0.294	3.301	3.420
284	300	1001	390	396	261	366	96	0.028	0.536	-0.160	0.376	3.240	3.925
285	300	1000	390	395	191	310	110	0.029	0.619	0.290	0.812	3.463	4.979
286	300	999	390	395	282	367	79	0.018	0.481	0.156	0.246	3.750	3.852
287	300	1001	390	389	182	313	135	-0.013	0.647	0.029	0.424	3.302	3.299
288	300	1000	385	384	183	274	94	-0.013	0.575	0.043	0.313	3.008	3.115
289	300	1000	385	383	193	279	93	-0.028	0.555	0.178	0.424	3.324	4.099
290	299 (1)	1000	385	381	171	252	92	-0.042	0.570	-0.039	0.339	2.816	3.188
291	300	1000	385	389	184	276	93	-0.004	0.577	0.081	0.344	3.273	3.491
292	300	1001	385	389	149	259	96	0.058	0.653	-0.180	0.506	3.167	4.496
293	300	1000	380	385	219	367	110	0.120	0.641	-0.139	0.293	3.581	3.420
294	300	1001	380	383	228	342	101	0.043	0.579	-0.287	0.215	2.900	3.317
295	300	1000	380	377	243	335	92	-0.001	0.524	0.060	0.252	3.120	3.207
296	300	1000	380	378	227	320	87	0.022	0.540	-0.048	0.239	2.839	3.009
297	300	999	380	384	226	328	84	0.069	0.562	-0.050	0.200	2.753	3.315
298	300	1000	375	375	190	264	92	-0.067	0.532	0.103	0.054	3.669	3.425
299	300	999	375	377	170	266	92	0.018	0.603	-0.128	0.402	2.833	3.049
300	300	1000	375	379	184	334	110	0.141	0.679	-0.169	1.005	2.904	6.123

DK VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
301	300	1000	375	372	451	558	88	0.048	0.440	1.083	0.817	8.065	5.455
302	300	999	375	374	168	249	79	0.010	0.572	-0.055	0.530	3.188	3.651
303	300	1000	375	373	164	223	90	-0.129	0.523	0.114	0.215	2.656	3.318
304	300	1000	370	371	193	243	87	-0.146	0.469	-0.172	0.044	3.220	3.381
305	300	1000	370	370	208	306	86	0.041	0.565	0.032	0.580	4.145	4.638
306	300	1001	370	372	168	266	111	-0.050	0.607	-0.180	0.573	3.127	4.638
307	300	1001	370	370	205	331	113	0.041	0.617	-0.045	0.595	3.626	4.825
308	300	1080	370	370	180	269	87	0.007	0.575	-0.072	0.097	3.168	3.012
309	300	1000	365	363	232	323	86	0.015	0.529	0.018	0.562	3.270	4.564
310	300	1000	365	362	161	249	84	0.015	0.593	-0.004	0.346	2.956	3.290
311	300	1000	365	362	234	298	108	-0.138	0.480	-0.312	0.055	3.854	3.662
312	300	1000	365	365	211	286	95	-0.071	0.515	-0.152	0.120	2.816	3.257
313	300	999	365	366	209	277	69	-0.004	0.495	0.143	0.400	2.814	3.228
314	300	1000	360	360	216	317	103	-0.005	0.564	-0.099	0.373	3.209	3.859
315	300	1000	360	362	202	271	79	-0.041	0.505	-0.212	-0.058	2.565	2.830
316	300	1000	360	364	163	259	90	0.027	0.609	-0.190	0.348	3.479	3.905
317	300	1000	360	362	201	268	108	-0.137	0.515	-0.271	0.228	4.173	3.932
318	300	1000	360	362	195	279	96	-0.044	0.548	-0.051	0.368	3.309	3.825
319	300	1000	355	355	190	243	64	-0.045	0.472	-0.127	0.070	2.803	2.958
320	300	1000	355	357	188	287	108	-0.035	0.586	-0.274	0.189	3.502	3.679
321	300	999	355	358	211	271	80	-0.079	0.475	0.126	0.530	3.442	4.207
322	300	1000	355	354	206	276	87	-0.062	0.508	-0.250	0.066	2.708	2.911
323	300	1000	355	352	203	270	87	-0.075	0.503	-0.010	0.245	2.979	3.935
324	300	1001	350	350	193	270	111	-0.118	0.542	0.057	0.383	2.845	3.753
325	300	1000	350	352	226	302	104	-0.093	0.508	0.186	0.425	3.278	3.259
326	300	1001	350	352	164	262	119	-0.076	0.615	0.108	0.484	3.055	3.797
327	300	1000	350	351	229	279	80	-0.111	0.434	-0.004	0.156	3.133	3.135
328	300		350	346	153								
329	300	1001	345	346	180	243	111	-0.170	0.530	-0.023	0.449	2.789	3.995
330	300	1000	345	348	215	328	104	0.027	0.587	-0.343	0.268	3.474	4.471
331	300	1000	345	346	166	203	64	-0.128	0.445	-0.074	0.161	2.925	3.130
332	300	1001	345	348	152	270	113	0.016	0.660	-0.456	0.237	4.260	3.918
333	300	1000	345	346	174	271	97	-0.003	0.597	-0.232	0.166	3.328	3.326
334	300	1000	340	340	176	222	84	-0.153	0.478	0.027	0.354	2.853	3.881
335	300	1001	340	339	175	277	111	-0.033	0.607	-0.026	0.431	3.305	3.787
336	300	1000	340	338	211	273	103	-0.138	0.492	0.013	0.290	2.938	3.579
337	300	1000	340	339	252	302	79	-0.104	0.418	-0.102	-0.002	2.761	3.007
338	300	1000	340	349	154	212	64	-0.028	0.525	0.026	0.098	2.980	3.132
339	300	1001	335	339	235	334	113	-0.045	0.545	-0.077	0.302	2.833	3.691
340	300	999	335	340	210	249	80	-0.159	0.420	-0.279	0.160	3.334	4.696
341	300	1000	335	338	191	276	103	-0.066	0.555	-0.736	-0.155	5.832	5.448
342	300	1000	335	335	210	311	107	-0.022	0.569	0.066	0.414	2.806	3.782
343	300	1000	335	334	142	203	81	-0.091	0.554	0.029	0.577	3.402	3.724
344	300	1000	330	330	179	209	71	-0.185	0.414	-0.344	-0.171	3.322	3.275
345	300	999	330	334	192	236	74	-0.129	0.446	-0.120	-0.224	2.538	2.906
346	300	1000	330	329	220	279	86	-0.098	0.467	-0.247	-0.095	3.097	3.201
347	300	1000	330	332	173	246	90	-0.067	0.549	0.132	0.415	2.939	3.521
348	300	999	330	330	181	266	92	-0.027	0.565	-0.004	0.461	3.322	3.746
349	300	1000	325	322	187	261	89	-0.060	0.534	-0.203	-0.009	3.418	3.651
350	300	1001	325	327	185	273	113	-0.086	0.573	0.013	0.327	3.481	3.298
351	300	1000	325	322	184	239	96	-0.156	0.496	0.224	0.412	3.160	3.362
352	300	1000	325	322	174	247	84	-0.043	0.546	0.113	0.425	3.047	3.838
353	300	1000	325	327	228	341	103	0.033	0.575	0.069	0.543	2.567	3.612
354	300	1000	320	323	206	234	79	-0.202	0.394	0.335	0.245	3.864	3.127
355	300	1000	320	325	173	254	105	-0.090	0.570	-0.309	0.124	3.135	3.544
356	300	1000	320	324	165	242	81	-0.015	0.566	0.245	0.836	3.028	4.905
357	300	1001	320	322	189	268	103	-0.088	0.548	-0.008	0.267	3.266	3.290
358	300	1000	320	322	235	327	97	-0.017	0.531	-0.310	0.238	3.873	4.624
359	300	1000	315	317	194	281	84	0.014	0.558	-0.062	0.161	2.714	2.893
360	300	1000	315	316	183	253	73	-0.013	0.527	-0.022	0.317	2.688	3.661

DK VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
361	300	1000	315	319	203	285	76	0.024	0.537	-0.031	0.071	2.813	2.940
362	300	1000	315	318	161	227	79	-0.060	0.540	0.048	0.359	3.118	3.255
363	300	1000	315	317	205	310	105	-0.002	0.581	-0.148	0.076	3.031	3.071
364	300	1000	310	311	198	255	81	-0.093	0.481	0.053	0.235	3.277	3.677
365	300	1000	310	311	229	291	71	-0.037	0.463	0.460	0.497	3.475	3.235
366	300	1000	310	308	196	243	89	-0.158	0.464	-0.053	0.056	2.883	3.231
367	300	1000	310	312	175	249	97	-0.088	0.551	0.144	0.274	3.241	3.714
368	300	1000	305	307	170	220	84	-0.143	0.492	0.183	0.369	2.823	3.323
369	300	1000	305	303	170	228	76	-0.080	0.510	0.028	0.205	3.402	3.241
370	300	1000	305	305	194	232	103	-0.228	0.457	0.019	0.181	2.753	3.231
371	300	1000	305	309	115	160	81	-0.186	0.552	-0.243	0.189	2.818	3.078
372	300	1000	305	304	188	238	71	-0.093	0.465	0.218	0.322	2.648	3.105
373	300	1001	300	298	148	213	113	-0.184	0.575	-0.218	0.328	3.338	4.066
374	300	1000	300	303	164	223	96	-0.147	0.528	-0.154	0.249	2.997	3.014
375	300	1000	300	301	173	257	105	-0.080	0.575	-0.105	0.316	2.882	3.637
376	300	1000	300	305	179	243	95	-0.118	0.524	-0.066	0.382	2.629	3.431
377	300	1000	300	302	197	266	76	-0.027	0.512	0.203	0.281	3.707	3.181
378	300	1000	300	301	221	307	103	-0.057	0.530	0.025	0.155	4.096	4.075
379	300	1000	300	297	164	229	81	-0.069	0.536	0.128	0.570	3.024	4.130
380	300	1000	300	301	161	226	100	-0.140	0.546	0.183	1.050	3.198	8.569
381	300	1000	300	298	164	212	100	-0.204	0.509	-0.063	0.391	3.026	3.393
382	300	1001	300	303	179	241	83	-0.082	0.514	-0.118	0.223	3.090	3.268
383	300	1000	300	301	170	234	86	-0.092	0.526	-0.033	0.352	2.696	3.744
384	300	1000	300	307	208	282	88	-0.047	0.516	-0.261	0.216	3.868	3.155
385	300	1000	300	301	176	250	84	-0.037	0.547	0.078	0.218	3.547	2.863
386	300	1000	300	302	174	234	81	-0.089	0.511	-0.091	0.226	3.053	3.315
387	300	1000	300	303	176	241	98	-0.123	0.531	-0.091	0.293	3.125	3.455
388	300	1001	295	294	147	180	83	-0.224	0.474	-0.107	-0.107	2.685	2.778
389	300	1000	290	291	162	231	89	-0.082	0.552	0.112	0.693	3.215	4.258
390	300	999	285	286	145	191	74	-0.137	0.505	0.012	0.147	3.359	3.082
391	300	1000	280	279	115	155	79	-0.208	0.537	0.125	0.300	3.411	3.328
392	300	1000	275	277	140	202	90	-0.126	0.563	-0.008	0.458	2.617	3.599
393	300	1000	275	278	146	216	79	-0.042	0.572	-0.255	0.108	3.655	4.079
394	300	1000	275	276	197	285	90	-0.007	0.556	-0.346	0.077	3.829	3.693
395	0		275	0	0								
396	300	1000	275	279	138	208	83	-0.058	0.583	-0.325	0.019	3.736	3.767
397	300	1000	275	280	165	211	88	-0.172	0.492	-0.065	0.183	2.789	3.343
398	300	1000	280	284	191	246	84	-0.111	0.485	-0.076	0.174	3.560	3.536
399	300	1000	285	282	174	273	103	-0.013	0.603	-0.108	0.909	3.002	6.432
400	300	1001	290	290	150	200	100	-0.206	0.531	-0.078	0.418	3.252	4.748
401	300	1000	295	296	168	213	99	-0.211	0.495	0.327	0.336	2.940	3.156
402	300	1001	300	298	133	211	109	-0.125	0.617	-0.134	0.440	3.249	3.171
403	300	1001	300	304	132	197	106	-0.175	0.591	-0.123	0.323	3.180	3.463
404	300	999	300	301	137	219	94	-0.050	0.615	0.112	0.738	2.859	5.366
405	300	999	300	304	144	232	86	0.011	0.618	0.184	1.033	2.604	7.827
406	300	1000	300	300	134	177	89	-0.213	0.524	0.068	0.351	2.990	2.927
407	300	1000	300	297	132	180	83	-0.167	0.535	0.112	0.623	3.298	4.665
408	300	1000	300	299	165	228	88	-0.103	0.532	0.026	0.568	2.905	3.764
409	300	1000	300	304	148	228	85	-0.025	0.592	-0.095	0.274	3.303	3.133
410	300	1000	300	300	158	280	103	0.075	0.662	0.104	0.734	3.257	4.743
411	300	1000	300	300	177	241	80	-0.066	0.521	-0.080	0.050	2.673	2.893
412	300	1000	305	303	164	220	73	-0.074	0.511	-0.154	0.287	3.052	3.507
413	300	999	305	306	178	227	71	-0.098	0.472	-0.062	0.210	3.740	3.353
414	300	999	305	309	169	251	69	0.061	0.575	0.032	0.287	2.972	3.005
415	300	1000	305	306	185	279	89	0.022	0.582	-0.098	0.303	3.762	4.299
416	300	1000	305	306	177	226	80	-0.131	0.480	-0.199	0.103	3.020	3.024
417	300	1000	305	305	205	230	84	-0.224	0.391	-0.310	-0.172	3.403	3.209
418	300	1000	305	306	197	276	85	-0.025	0.535	0.001	0.421	2.786	3.425
419	300	1000	305	306	160	186	86	-0.254	0.443	0.094	0.218	3.278	2.771
420	300	999	305	307	158	200	71	-0.134	0.477	0.062	0.436	2.980	3.904

DK VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
421	300	1000	305	307	136	204	76	-0.040	0.578	-0.377	0.218	4.089	3.700
422	300	1000	310	313	128	178	71	-0.108	0.539	-0.110	0.134	3.273	3.094
423	300	1000	310	313	150	221	76	-0.022	0.568	-0.119	0.194	2.967	3.028
424	300	1001	310	311	176	277	115	-0.048	0.607	-0.187	0.643	3.549	4.014
425	300	1000	310	307	157	204	72	-0.113	0.493	0.191	0.170	3.318	2.933
426	300	1001	310	313	128	214	98	-0.053	0.635	0.113	0.609	2.733	4.566
427	300	1000	310	312	143	263	100	0.085	0.678	0.017	0.801	3.033	5.898
428	300	999	310	313	157	192	78	-0.196	0.461	-0.067	0.329	2.757	3.312
429	300	1000	310	313	121	191	80	-0.050	0.607	-0.071	0.367	2.423	3.338
430	300	1001	310	312	177	249	118	-0.160	0.555	-0.175	0.412	3.202	4.370
431	300	1000	310	306	128	182	95	-0.183	0.568	0.141	0.424	2.861	3.570
432	300	1000	315	318	167	249	86	-0.017	0.573	-0.244	0.112	3.247	3.328
433	300	999	315	319	132	227	97	-0.006	0.649	-0.214	0.493	2.730	3.585
434	300	1000	315	318	130	173	90	-0.218	0.534	0.191	0.418	3.301	3.048
435	300	1000	315	313	130	199	76	-0.032	0.591	-0.088	0.228	3.849	3.022
436	300	1001	315	318	142	261	116	0.011	0.676	0.088	1.036	3.174	6.014
437	300	1000	315	316	166	231	72	-0.028	0.533	0.800	1.008	9.081	8.633
438	300	1001	315	317	157	270	106	0.024	0.646	0.206	0.965	3.132	5.868
439	300	1001	315	314	135	231	98	-0.006	0.646	-0.060	0.770	3.209	4.799
440	300	1001	315	309	146	238	101	-0.034	0.625	-0.069	0.493	2.819	3.688
441	300	1000	315	313	121	193	99	-0.121	0.621	-0.273	0.599	2.950	4.995
442	300	999	320	320	136	224	78	0.048	0.628	-0.217	0.376	2.738	3.450
443	300	1000	320	325	131	217	76	0.052	0.631	0.015	0.360	2.910	3.269
444	300	1000	320	324	127	171	68	-0.126	0.519	0.405	0.359	3.043	2.577
445	300	999	320	322	132	213	83	-0.013	0.616	0.085	0.676	2.622	4.025
446	300	1000	320	319	157	253	81	0.062	0.617	0.283	0.572	3.228	3.800
447	300	1000	320	318	154	249	90	0.018	0.617	-0.131	0.633	2.984	4.374
448	300	1000	320	323	140	202	71	-0.044	0.556	-0.178	0.176	2.405	3.025
449	300	1000	320	321	167	251	84	-0.001	0.579	0.166	0.461	3.427	3.795
450	300	1001	320	327	255	298	90	-0.154	0.407	-0.238	0.113	3.308	3.183
451	300	1000	320	318	180	244	100	-0.133	0.525	0.244	0.617	3.020	4.476
452	300	999	325	324	205	290	78	0.028	0.543	-0.120	0.212	3.122	3.324
453	300	999	325	323	163	217	78	-0.107	0.507	0.285	0.475	3.594	3.755
454	300	1001	325	323	171	235	83	-0.079	0.526	-0.050	0.073	3.209	3.102
455	300	1000	325	324	209	280	89	-0.068	0.505	-0.135	0.182	3.372	3.286
456	300	1000	325	328	196	256	86	-0.098	0.493	-0.243	0.033	3.332	3.328
457	300	999	325	328	173	220	92	-0.178	0.488	0.096	0.474	3.374	4.016
458	300	1000	325	326	213	286	83	-0.035	0.507	-0.035	0.423	3.152	5.135
459	300	1000	325	323	186	246	71	-0.053	0.494	-0.132	0.197	3.299	4.085
460	300	1000	325	327	167	217	98	-0.186	0.507	-0.286	0.246	3.198	3.632
461	300	1000	325	329	236	331	100	-0.017	0.536	-0.077	0.371	3.252	4.215
462	300	1000	330	330	161	231	86	-0.067	0.552	0.213	0.337	3.312	2.994
463	300	1000	330	333	197	276	79	-0.004	0.533	-0.211	0.129	3.091	3.375
464	300	999	330	331	174	238	71	-0.028	0.520	0.053	0.381	3.162	3.945
465	300	1000	330	333	214	281	76	-0.038	0.487	0.156	0.438	3.021	3.498
466	300	999	330	331	213	254	84	-0.161	0.427	-0.159	-0.018	3.235	3.131
467	300	1000	340	340	270	349	85	-0.017	0.479	-0.345	0.095	3.448	3.193
468	300	999	340	343	212	281	108	-0.131	0.507	0.129	0.404	3.248	3.582
469	299 (1)	999	340	340	175	237	68	-0.029	0.511	0.052	0.570	3.076	5.309
470	300	1000	340	340	194	270	80	-0.017	0.530	0.201	0.352	3.487	3.362
471	300	1000	340	343	170	199	75	-0.201	0.429	-0.086	0.084	3.218	3.329
472	300	999	350	350	154	219	97	-0.131	0.556	0.023	0.522	4.231	4.307
473	300	999	350	349	153	234	75	0.026	0.588	-0.207	0.304	2.722	3.475
474	300	1000	350	348	250	336	80	0.021	0.507	0.126	0.276	3.209	3.456
475	300	999	350	351	165	212	73	-0.117	0.483	-0.113	0.285	3.919	3.271
476	300	1000	350	350	168	232	119	-0.194	0.552	0.176	0.597	3.487	3.692
477	300	1001	360	359	174	249	109	-0.122	0.559	0.218	0.623	3.795	4.664
478	300	1000	360	356	176	271	96	-0.004	0.591	0.314	0.639	3.099	3.754
479	300	1000	360	357	181	245	92	-0.109	0.520	0.155	0.196	2.885	2.987
480	300	999	360	360	154	247	108	-0.056	0.617	0.166	1.012	3.104	7.365

DK VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
481	300	1000	360	359	130	204	87	-0.059	0.606	0.103	0.543	3.133	3.868
482	300	1000	370	370	176	202	75	-0.215	0.411	-0.194	0.121	2.666	2.947
483	300	1000	370	371	161	233	88	-0.068	0.558	-0.013	0.107	2.950	3.259
484	300	1000	370	372	166	218	83	-0.132	0.501	0.182	0.377	2.964	3.641
485	300	999	370	368	168	268	85	0.062	0.612	0.180	0.720	3.799	4.497
486	300	999	370	374	164	242	94	-0.064	0.571	0.223	0.792	3.080	5.225
487	300	1000	380	382	179	240	80	-0.079	0.510	0.181	0.760	3.522	5.022
488	300	1001	380	383	190	291	118	-0.060	0.589	0.200	0.387	3.331	3.310
489	300	1000	380	381	194	271	95	-0.066	0.535	0.111	0.349	3.191	3.154
490	300	1000	380	379	155	220	86	-0.087	0.551	-0.413	-0.024	3.446	3.056
491	300	1000	380	382	147	238	84	0.034	0.620	0.047	0.241	3.086	3.113
492	299 (1)	1000	390	387	214	283	86	-0.062	0.497	0.392	0.592	3.271	3.642
493	300	1000	390	389	205	273	73	-0.017	0.501	0.269	0.267	2.757	3.080
494	300	1000	390	388	160	266	105	0.004	0.630	0.001	0.682	2.937	5.243
495	300	1000	390	394	185	242	81	-0.096	0.495	-0.142	0.044	2.928	3.115
496	300	1000	390	391	161	208	90	-0.178	0.502	0.042	0.435	3.128	3.283
497	300	1001	400	400	248	321	116	-0.127	0.490	0.054	0.386	3.203	4.245
498	300	999	400	399	200	276	86	-0.043	0.523	0.217	0.322	3.511	3.613
499	300	1000	400	398	180	228	83	-0.139	0.478	-0.065	0.265	2.750	3.286
500	300	1000	400	399	214	285	88	-0.061	0.502	0.360	0.373	3.753	3.223
501	300	1000	400	398	175	258	103	-0.074	0.570	0.309	0.616	3.243	3.938
502	300	1000	400	400	180	217	81	-0.182	0.444	-0.057	0.167	2.998	2.725
503	300	1000	400	398	194	251	75	-0.077	0.481	-0.120	-0.040	2.930	3.103
504	300	1000	400	401	187	263	95	-0.067	0.542	0.111	0.300	2.736	3.105
505	300	1000	400	398	203	273	86	-0.057	0.511	0.086	0.257	3.040	3.546
506	300	1000	400	396	224	296	87	-0.054	0.496	-0.038	0.200	3.324	3.140
507	300	999	400	397	182	269	80	0.032	0.571	0.144	0.546	3.123	4.027
508	300	1000	400	400	204	245	82	-0.158	0.434	0.159	0.347	3.147	3.588
509	300	1000	400	402	163	200	78	-0.180	0.462	0.198	-0.012	3.005	2.561
510	300	1000	400	400	205	258	85	-0.121	0.467	-0.104	0.309	3.089	3.876
511	300	1000	400	402	188	277	101	-0.046	0.566	0.026	0.229	2.675	3.418
512	300	1000	400	398	191	273	83	-0.006	0.547	0.088	0.234	3.973	3.684
513	300	1000	400	400	220	268	82	-0.126	0.439	0.158	0.195	2.778	2.815
514	300	1000	400	397	200	297	104	-0.022	0.572	0.021	0.235	2.857	3.131
515	300	1001	400	398	218	323	135	-0.089	0.573	0.180	0.544	2.722	4.047
516	300	999	400	400	162	249	88	-0.001	0.593	0.009	0.274	3.086	3.242
517	300	999	400	399	176	210	74	-0.175	0.432	-0.142	0.115	3.261	3.122
518	300	999	400	402	211	260	72	-0.097	0.440	0.047	0.152	3.080	3.045
519	300	1000	400	403	175	252	88	-0.042	0.556	-0.051	0.292	2.665	3.579
520	300	1001	400	403	200	260	106	-0.155	0.501	0.085	0.407	3.974	3.552
521	300	1001	400	402	183	257	135	-0.195	0.560	0.378	0.590	4.078	4.496
522	300	999	400	402	219	285	88	-0.080	0.485	0.091	0.475	2.977	3.808
523	300	999	400	400	199	272	75	-0.008	0.519	0.182	0.334	2.914	3.223
524	300	1000	400	404	204	269	72	-0.024	0.494	0.043	-0.042	3.559	3.359
525	300	1001	400	400	210	322	106	0.018	0.589	0.820	1.403	5.568	8.965
526	300	1000	400	402	177	248	99	-0.106	0.543	0.019	0.303	3.240	3.333
527	300	999	400	401	167	206	78	-0.171	0.462	0.003	0.075	2.886	3.265
528	300	999	400	399	178	227	73	-0.104	0.474	-0.054	0.180	2.670	2.769
529	300	1000	400	400	171	227	119	-0.221	0.533	0.056	0.235	3.172	3.132
530	300	1000	400	405	173	266	104	-0.042	0.593	0.200	0.413	2.740	3.058
531	300	999	400	400	168	237	80	-0.047	0.540	-0.074	0.243	2.707	3.253
532	300	1000	400	399	158	216	85	-0.117	0.528	-0.119	0.109	3.045	3.403
533	300	1000	400	402	157	227	103	-0.129	0.566	-0.221	0.336	2.954	3.323
534	300	1001	400	400	158	225	122	-0.197	0.571	0.117	0.857	3.588	4.623
535	300	1001	400	401	194	266	105	-0.115	0.529	-0.019	0.363	2.589	4.448
536	300	1000	400	403	180	219	81	-0.174	0.450	0.239	0.338	2.834	2.942
537	300	1000	400	401	173	265	94	-0.010	0.589	0.221	0.793	2.940	5.025
538	300	1000	400	403	183	265	156	-0.219	0.585	0.093	1.137	3.340	8.108
539	300	1000	400	403	162	254	107	-0.053	0.606	0.057	0.551	3.275	3.707
540	300	1001	400	398	194	277	109	-0.087	0.553	0.241	0.400	3.317	3.500

DK VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
541	300	1000	400	399	184	252	96	-0.105	0.528	-0.019	0.236	2.566	2.906
542	300	1000	400	401	187	230	82	-0.158	0.455	0.152	0.119	3.181	3.198
543	300	1000	400	403	163	213	78	-0.121	0.499	-0.032	0.292	2.579	3.244
544	300	1001	400	400	194	276	105	-0.081	0.550	0.053	0.507	2.504	3.694
545	300	1001	400	401	161	227	109	-0.159	0.557	0.084	0.218	3.027	2.998
546	300	1000	400	401	183	236	68	-0.065	0.477	0.047	0.124	2.596	2.714
547	300	999	410	410	205	249	83	-0.148	0.444	0.052	0.328	2.668	3.044
548	300	999	410	410	192	260	108	-0.140	0.525	0.376	0.754	3.686	5.016
549	300	1000	410	411	149	203	69	-0.078	0.518	-0.037	0.347	3.068	3.267
550	300	1000	410	410	174	233	95	-0.139	0.517	-0.109	0.354	2.891	3.733
551	300	1000	410	412	176	250	86	-0.047	0.546	-0.060	0.389	2.996	3.310
552	300	999	420	418	219	255	69	-0.138	0.393	0.219	0.319	2.895	2.735
553	300	1000	420	420	189	238	81	-0.128	0.470	0.159	0.258	3.280	3.236
554	300	1000	420	419	200	225	76	-0.207	0.388	-0.146	-0.090	3.009	3.023
555	300	1000	420	420	181	227	71	-0.110	0.459	-0.175	-0.217	2.771	2.838
556	300	1001	420	424	148	248	98	0.009	0.635	0.113	0.524	2.792	3.817
557	300	1001	430	429	199	254	101	-0.163	0.487	-0.085	0.051	3.281	3.253
558	300	1000	430	425	227	283	101	-0.149	0.463	-0.126	0.004	3.027	2.690
559	300	1000	430	429	304	344	83	-0.135	0.365	-0.118	0.121	3.083	3.259
560	300	1000	430	433	193	257	98	-0.124	0.509	0.239	0.438	3.040	3.406
561	300	1000	430	426	194	264	81	-0.043	0.517	0.002	0.283	3.056	3.248
562	300	1000	440	435	264	322	75	-0.064	0.426	-0.040	0.011	3.111	3.124
563	300	999	440	439	208	305	91	0.023	0.564	-0.262	0.398	3.011	4.122
564	300	1001	440	439	182	274	103	-0.042	0.579	0.109	0.219	2.849	2.853
565	300	1001	440	443	179	259	87	-0.027	0.556	-0.117	0.130	2.999	3.399
566	300	1000	440	439	200	279	76	0.013	0.533	0.234	0.359	3.178	3.180
567	300	1000	450	452	188	253	69	-0.016	0.508	-0.125	-0.040	2.715	2.804
568	300	1000	450	453	238	337	106	-0.022	0.542	0.003	0.495	3.307	4.427
569	300	1000	450	451	225	260	74	-0.149	0.395	0.015	0.144	2.704	3.300
570	300	1000	450	451	155	219	83	-0.081	0.547	-0.053	0.325	3.323	3.766
571	300	999	450	453	238	297	78	-0.073	0.448	-0.029	0.170	2.769	3.226
572	300	1000	460	462	210	261	75	-0.100	0.448	0.111	0.085	2.541	2.589
573	300	999	460	464	209	246	90	-0.195	0.426	-0.038	-0.026	2.809	2.784
574	300	1001	460	463	218	282	103	-0.131	0.489	-0.020	0.203	2.889	3.115
575	300	1001	460	462	248	290	87	-0.152	0.406	-0.113	0.106	2.674	2.663
576	300	1000	460	462	218	283	78	-0.052	0.480	0.098	0.092	2.735	3.042
577	300	1000	470	469	246	314	120	-0.152	0.485	-0.117	0.352	2.733	3.994
578	300	1001	470	469	209	274	73	-0.031	0.488	0.020	0.330	2.992	3.621
579	300	1000	470	468	245	327	87	-0.019	0.499	0.153	0.314	3.189	3.130
580	300	1001	470	473	180	267	103	-0.060	0.572	-0.014	0.366	3.198	3.638
581	300	1001	470	473	185	229	87	-0.170	0.462	-0.004	0.042	3.331	3.166
582	300	999	480	474	182	248	97	-0.117	0.525	0.111	0.193	2.831	2.950
583	300	1000	480	478	211	288	103	-0.088	0.524	-0.006	0.753	2.879	4.680
584	300		480	482	204								
585	300	1000	480	484	207	264	90	-0.119	0.478	-0.182	0.368	2.897	3.745
586	300	999	480	478	202	261	74	-0.861	0.478	-0.082	0.233	3.212	3.262
587	300	1000	490	490	220	315	80	0.057	0.550	-0.076	0.409	3.435	3.539
588	300	1000	490	490	205	251	68	-0,091	0.437	-0.085	0.131	3.238	3.311
589	300	999	490	492	229	262	83	-0.180	0.396	-0.004	0.395	3.280	3.233
590	300	1000	490	493	174	206	78	-0.198	0.434	-0.363	-0.031	3.139	2.804
591	300	1000	490	493	249	320	120	-0.143	0.487	-0.036	0.273	2.810	3.841
592	300	1000	500	496	243	324	87	-0.019	0.501	0.277	0.482	3.297	3.750
593	300	1000	500	494	178	237	80	-0,089	0.506	0.026	0.625	3.210	4.589
594	300	1000	500	497	195	277	80	0.007	0.545	-0.024	0.399	3.291	4.030
595	300	1000	500	498	186	224	76	-0.159	0.438	0.269	0.186	3.100	3.032
596	300	1000	500	503	248	305	69	-0.047	0.433	0.090	0.117	3.068	2.900
597	300	1000	500	498	195	239	84	-0.155	0.454	0.033	0.141	2.804	3.202
598	300	1000	500	498	199	304	117	-0.040	0.588	-0.182	0.548	3.536	5.192
599	300	1000	500	501	199	233	91	-0.210	0.430	-0.051	0.104	3.357	3.011
600	300	1000	500	500	215	270	87	-0.120	0.462	0.340	0.301	3.179	3.005

DK VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH ~~INT~~	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
601	300	1000	500	501	204	249	80	-0.136	0.443	-0.187	-0.026	2.904	2.517
602	300	1000	500	499	230	266	76	-0.153	0.392	0.037	0.014	3.188	2.884
603	300	1000	500	500	230	282	94	-0.143	0.448	0.157	0.081	2.967	2.694
604	300	1000	500	500	210	327	106	0.040	0.600	0.024	0.601	3.677	5.537
605	300	1001	500	504	195	296	128	-0.087	0.588	-0.254	0.136	3.470	3.360
606	300	1000	500	504	273	299	89	-0.200	0.354	0.080	-0.014	3.762	3.236
607	300	1000	500	500	187	254	87	-0.079	0.517	-0.086	0.282	2.797	3.381
608	300	1000	500	500	226	294	80	-0.046	0.483	0.276	0.314	3.215	3.475
609	300	1000	500	505	248	295	84	-0.127	0.417	0.070	0.278	3.073	3.009
610	300	1000	500	503	153	231	117	-0.147	0.592	0.048	0.848	2.920	5.134
611	300	1000	500	503	179	242	96	-0.128	0.520	-0.027	0.169	2.954	2.911
612	300	1000	500	502	202	303	94	0.026	0.578	0.160	0.475	2.624	3.205
613	300	1000	500	501	210	279	119	-0.161	0.515	0.367	0.651	3.646	4.487
614	300	1000	500	500	147	207	85	-0.113	0.547	0.166	0.578	3.125	3.953
615	300	1000	500	500	208	358	156	-0.017	0.647	0.594	1.879	5.320	11.606
616	300	1000	500	504	212	279	107	-0.131	0.504	-0.171	0.263	2.903	3.407
617	300	1000	500	501	187	272	104	-0.067	0.564	0.078	0.372	2.760	3.349
618	300	999	500	501	184	255	80	-0.035	0.529	-0.099	0.596	3.033	4.486
619	300	1000	500	500	196	263	85	-0.069	0.509	0.030	0.270	2.647	2.667
620	300	1000	500	503	219	273	101	-0.155	0.469	0.326	0.342	3.038	3.124
621	300	1000	500	500	236	327	83	0.027	0.527	0.006	0.385	3.075	3.776
622	300	1001	500	497	247	357	122	-0.034	0.556	0.064	0.273	3.634	4.343
623	300	999	500	503	180	247	108	-0.147	0.536	-0.142	0.429	2.964	3.910
624	300	1000	500	503	198	224	69	-0.186	0.381	-0.099	0.006	2.611	2.880
625	300	1000	500	505	159	222	96	-0.135	0.544	0.182	0.157	3.092	2.951
626	300	1000	500	501	158	221	94	-0.127	0.546	0.102	0.407	3.176	3.309
627	300	1000	500	510	159	245	106	-0.076	0.596	0.138	0.346	2.892	3.176
628	300	1000	500	503	208	272	74	-0.040	0.486	-0.093	0.064	3.920	3.657
629	300	1000	500	499	165	242	80	-0.012	0.564	0.188	0.357	3.186	3.475
630	300	1001	500	498	160	216	91	-0.145	0.524	0.152	0.326	3.057	3.411
631	300	1001	500	504	199	296	128	-0.098	0.578	0.204	0.334	3.618	3.444
632	300	1000	500	506	195	250	83	-0.109	0.480	-0.382	0.154	3.446	3.309
633	300	1000	500	502	162	230	93	-0.103	0.550	-0.039	0.383	3.128	4.067
634	300	1000	500	500	166	278	105	0.027	0.636	0.185	0.904	2.932	5.867
635	300	1000	500	505	170	221	91	-0.161	0.501	0.086	0.287	4.343	4.944
636	300	1000	500	502	158	204	95	-0.199	0.507	0.287	0.596	3.979	4.146
637	300	1001	500	503	197	261	106	-0.145	0.511	0.225	0.366	2.963	3.241
638	300	1001	500	500	179	280	122	-0.070	0.604	0.026	0.523	3.434	4.212
639	300	1000	500	501	164	234	93	-0.091	0.555	0.118	0.531	2.983	3.661
640	300	1000	500	503	160	217	71	-0.065	0.516	0.332	0.643	2.913	3.983
641	299 (1)	1001	500	509	168	266	97	0.002	0.606	-0.094	0.322	2.769	3.580
642	300	999	500	500	174	246	85	-0.051	0.544	-0.231	0.028	4.037	4.053
643	300	999	500	508	165	208	81	-0.167	0.475	0.286	0.479	3.831	3.680
644	300	1001	500	501	178	242	128	-0.215	0.544	-0.086	0.497	3.069	3.884
645	300	1000	500	502	174	262	83	0.020	0.579	0.149	0.280	2.703	3.020
646	300	999	500	501	183	227	78	-0.145	0.457	0.142	0.131	3.062	2.896
647	299 (1)	1001	500	501	160	267	85	0.092	0.637	0.113	0.363	3.094	3.382
648	300	999	500	499	191	239	72	-0.101	0.459	-0.059	0.003	3.583	3.076
649	300	999	500	501	152	208	65	-0.047	0.520	-0.043	0.202	2.999	3.649
650	300	1000	500	503	165	234	76	-0.033	0.544	-0.235	0.285	3.260	3.932
651	300	1000	500	506	200	257	85	-0.109	0.480	0.000	0.416	2.853	3.810
652	300	1000	500	502	156	223	80	-0.059	0.549	-0.097	0.265	2.831	3.525
653	300	1001	500	501	197	259	91	-0.108	0.498	0.176	0.333	3.220	2.893
654	300	1000	500	501	163	225	83	-0.090	0.530	0.095	0.616	3.353	4.269
655	300	999	500	501	160	209	78	-0.130	0.497	-0.185	-0.082	3.340	3.341
656	300	1000	500	506	149	189	80	-0.181	0.488	0.179	0.161	3.855	3.231
657	300	1001	500	500	202	269	86	-0.073	0.503	-0.412	-0.039	4.876	3.671
658	300	1000	500	502	164	250	98	-0.045	0.588	-0.143	0.206	2.939	3.118
659	300	1000	500	499	133	190	81	-0.113	0.557	-0.072	0.216	3.097	2.990
660	300	1001	500	500	137	192	87	-0.147	0.548	0.222	0.277	3.458	2.877

DK VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
661	300	999	500	500	143	170	67	-0.206	0.438	-0.088	0.193	2.454	3.179
662	300	1000	500	501	177	253	89	-0.052	0.549	0.018	0.275	2.865	3.299
663	300	1001	500	505	185	282	138	-0.130	0.596	0.064	0.811	2.701	7.175
664	300	1000	500	501	163	229	80	-0.059	0.540	0.181	0.453	2.986	3.454
665	300	1001	500	507	175	238	86	-0.096	0.520	-0.221	0.055	3.162	3.597
666	300	1001	500	501	170	238	121	-0.186	0.557	0.160	0.269	3.300	3.237
667	300	1000	500	502	169	213	92	-0.192	0.487	-0.014	0.124	3.466	3.770
668	300	1000	500	502	173	255	96	-0.053	0.570	0.003	0.648	3.062	4.662
669	300	1000	500	502	137	226	104	-0.064	0.629	0.090	0.608	2.870	3.931
670	300	1000	500	502	170	278	106	0.007	0.624	0.194	0.844	2.986	5.084
671	300	1000	500	500	174	238	81	-0.073	0.522	-0.158	0.019	2.803	2.934
672	300	1000	500	506	150	239	98	-0.038	0.610	0.036	0.445	3.818	3.526
673	300	1001	500	502	142	220	106	-0.112	0.605	-0.060	0.229	2.873	3.028
674	300	1001	500	504	145	242	122	-0.096	0.635	-0.071	0.796	2.756	4.643
675	300	999	500	504	168	209	71	-0.136	0.459	0.055	0.393	3.105	3.370
676	300	1000	500	504	168	220	83	-0.132	0.498	0.048	0.105	3.131	2.906
677	300	1000	500	501	162	205	76	-0.150	0.474	-0.232	0.119	3.466	4.128
678	300	1000	500	504	136	197	96	-0.153	0.570	-0.153	0.522	3.160	4.261
679	300	1001	500	500	163	227	91	-0.112	0.539	-0.016	0.406	3.788	4.304
680	300	1001	500	498	169	257	128	-0.139	0.594	0.254	0.454	3.220	3.363
681	300	1001	500	503	167	263	120	-0.083	0.608	0.122	0.321	3.543	3.718
682	300	1000	500	507	199	231	92	-0.222	0.426	-0.177	0.179	3.075	3.669
683	300	1000	500	502	171	193	93	-0.282	0.431	0.272	0.378	3.853	2.994
684	300	1000	500	499	160	225	71	-0.030	0.537	0.319	0.532	3.285	3.122
685	300	1000	500	504	155	219	83	-0.084	0.544	0.215	0.462	2.850	3.445
686	300	1000	500	504	193	236	91	-0.180	0.457	0.111	0.068	3.196	2.827
687	300	1000	500	502	188	266	96	-0.065	0.545	-0.041	0.226	3.090	3.482
688	300	1000	500	502	136	182	76	-0.148	0.519	0.006	0.469	3.006	3.524
689	300	1000	500	502	144	197	65	-0.062	0.520	-0.077	0.285	2.847	4.153
690	300	1000	500	502	137	191	80	-0.126	0.542	-0.297	0.192	4.081	3.039
691	300	1000	500	502	173	240	76	-0.041	0.529	-0.083	0.258	4.900	4.110

IS VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
1	298 (2)	900	300	290	6480	6554	83	-0.006	0.106	1.528	1.576	5.939	6.362
2	300	900	300	311	2544	2760	95	0.123	0.304	1.060	1.087	5.030	4.853
3	300	900	300	288	1830	1910	74	0.009	0.205	0.841	0.748	3.848	3.612
4	300		300	296	1003								
5	300	900	300	292	969	1067	82	0.028	0.304	0.602	0.500	4.329	4.385
6	300		300	283	1398								
7	300	900	300	295	859	931	99	-0.046	0.281	-0.180	-0.271	4.067	3.815
8	300	901	300	303	757	844	120	-0.055	0.325	0.122	0.135	3.837	3.486
9	300	1000	300	308	899	1003	85	0.034	0.324	0.730	0.708	6.067	5.552
10	300	1000	300	282	661	722	93	-0.065	0.298	0.527	0.360	3.556	3.176
11	300	1000	300	288	590	601	82	-0.161	0.210	0.246	0.118	4.173	3.622
12	300	1000	300	288	846	925	72	0.013	0.292	0.110	0.036	5.355	5.218
13	300	1000	300	300	467	525	79	-0.056	0.336	0.051	0.015	3.388	2.825
14	300	999	300	303	615	673	78	-0.047	0.296	0.218	0.321	3.376	3.326
15	300	1001	300	293	572	638	115	-0.095	0.336	0.217	0.392	3.288	4.202
16	300	1000	300	300	710	794	80	0.009	0.325	0.308	0.263	4.772	4.560
17	300	1000	300	305	489	589	91	0.021	0.413	0.057	0.315	3.117	3.330
18	300	1000	300	299	423	481	71	-0.037	0.350	0.684	0.687	5.153	4.962
19	300	1000	300	295	390	470	80	0.000	0.413	0.376	0.231	3.955	3.392
20	300	999	300	294	521	606	72	0.032	0.375	-0.036	0.103	3.004	3.184
21	300	1000	300	298	378	416	71	-0.099	0.318	0.077	0.358	3.231	3.461
22	300	1000	300	298	627	730	90	0.027	0.376	0.309	0.556	4.017	4.300
23	300	1000	300	295	658	727	76	-0.016	0.308	-0.185	0.107	4.712	4.467
24	300	1001	300	293	494	566	98	-0.059	0.360	0.000	0.032	3.323	3.180
25	300	1000	300	281	801	898	105	-0.013	0.330	0.243	0.393	4.298	3.838
26	300	999	300	293	420	530	92	0.047	0.457	0.088	0.341	3.090	3.365
27	300	1000	300	289	702	834	94	0.075	0.404	0.369	0.411	4.142	4.053
28	300	1000	300	278	868	962	91	0.006	0.313	0.725	0.820	6.093	5.792
29	300	1000	300	286	519	605	93	-0.017	0.377	0.284	0.395	5.272	4.639
30	299 (1)	1000	300	296	462	507	105	-0.137	0.326	0.323	0.358	3.374	3.079
31	300	999	300	297	365	460	78	0.050	0.457	0.054	0.309	4.484	4.108
32	300	999	300	283	506	575	70	-0.004	0.346	0.686	0.591	5.993	5.059
33	300	1000	300	291	415	534	91	0.071	0.476	0.596	0.652	6.104	5.089
34	300	1000	300	293	308	354	80	-0.108	0.374	0.160	0.200	2.893	2.925
35	300	1000	300	287	337	425	97	-0.026	0.455	0.117	0.390	3.174	3.089
36	300	1000	300	288	338	427	104	-0.039	0.458	0.052	0.322	4.893	3.852
37	300	1000	300	295	405	491	75	0.030	0.419	0.404	0.452	3.808	3.905
38	300	1000	300	294	353	447	91	0.006	0.458	0.461	0.492	3.212	3.366
39	300	1001	300	290	350	455	131	-0.062	0.483	0.137	0.246	3.819	3.486
40	300	1000	300	286	513	603	79	0.027	0.387	0.436	0.502	4.016	3.447
41	300	999	300	293	364	452	89	0.000	0.443	0.489	0.419	4.333	3.925
42	300	1000	300	293	496	579	100	-0.039	0.379	0.694	0.614	4.645	3.846
43	300	1000	300	288	370	454	74	0.030	0.430	-0.095	0.127	4.115	3.467
44	300	1000	300	292	384	449	85	-0.055	0.383	0.318	0.380	4.310	3.897
45	300	999	300	297	336	400	67	-0.009	0.400	0.136	0.243	3.021	3.104
46	300	999	300	287	438	479	68	-0.078	0.302	-0.464	0.098	11.688	7.601
47	300	1000	300	293	297	366	81	-0.039	0.434	0.004	0.019	3.143	2.955
48	300	1000	300	288	458	517	85	-0.066	0.344	0.111	0.249	3.826	4.027
49	300	1000	300	297	248	341	104	-0.034	0.523	-0.107	0.142	3.058	3.886
50	300	1000	300	297	228	319	94	-0.008	0.536	-0.187	0.216	3.020	2.982
51	300	999	300	301	335	409	78	-0.013	0.426	-0.142	0.191	3.151	3.264
52	300	1000	300	293	188	299	104	0.025	0.610	0.208	0.581	2.914	3.291
53	300	1000	300	291	208	303	87	0.034	0.563	0.269	0.985	3.890	5.617
54	300	1000	300	289	286	421	103	0.093	0.572	-0.199	0.266	2.991	3.537
55	300	1000	300	294	290	386	101	-0.014	0.499	0.120	0.367	3.161	3.281
56	300	1000	300	288	312	435	75	0.158	0.549	-0.071	0.092	3.112	2.974
57	300	1000	300	296	361	445	86	-0.007	0.435	-0.149	0.188	3.283	3.348
58	300	1000	300	296	259	407	108	0.120	0.611	-0.169	0.435	2.977	3.666
59	300	1000	300	295	416	488	81	-0.025	0.383	0.622	0.514	7.970	5.809
60	300	1000	300	289	295	427	90	0.130	0.567	0.165	0.498	5.227	4.669

IS VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
61	300	1001	300	294	425	584	119	0.088	0.526	0.017	0.346	3.132	3.535
62	300	1000	300	278	409	474	91	-0.067	0.376	0.031	0.001	4.022	4.254
63	300	999	300	294	398	442	69	-0.074	0.326	0.559	0.443	3.805	3.231
64	300	1000	300	290	458	492	68	-0.095	0.280	0.037	0.052	3.266	3.120
65	300	1000	300	291	376	465	90	-0.003	0.436	0.210	0.212	4.001	3.917
66	300	1000	300	294	378	467	109	-0.050	0.439	0.034	0.166	3.700	3.392
67	300	1000	300	284	351	471	104	0.042	0.507	0.337	0.755	3.921	4.755
68	300	1000	300	291	333	416	78	0.015	0.446	-0.065	0.046	3.181	2.998
69	300	1000	300	291	302	354	76	-0.079	0.390	-0.019	0.073	3.860	3.973
70	300	999	300	293	361	515	96	0.155	0.562	-0.041	0.307	3.961	3.593
71	300	1001	305	298	380	488	97	0.030	0.472	0.384	0.645	3.188	4.254
72	300	1000	305	295	341	398	73	-0.049	0.383	0.417	0.351	5.448	4.109
73	299 (1)	1001	305	296	296	411	100	0.043	0.529	0.288	0.296	2.866	2.709
74	300	1001	305	300	317	399	99	-0.050	0.455	-0.211	0.128	2.922	3.131
75	300	1000	305	311	396	487	101	-0.025	0.433	-0.070	0.220	3.618	3.889
76	300	1000	310	301	304	372	90	-0.066	0.431	-0.427	-0.151	3.643	3.246
77	300	1000	310	302	383	486	102	0.002	0.461	-0.318	-0.069	3.301	3.292
78	300	999	310	306	254	287	69	-0.141	0.360	0.063	0.071	4.045	3.931
79	300	1000	310	306	433	542	111	-0.004	0.448	0.394	0.555	4.290	3.872
80	300	1000	310	298	322	392	110	-0.107	0.434	-0.372	0.179	3.778	3.414
81	300	1001	315	316	386	501	114	0.003	0.480	-0.109	0.210	2.568	3.167
82	300	1000	315	320	494	583	97	-0.019	0.390	0.131	0.328	3.010	3.333
83	300	1000	315	308	422	495	100	-0.068	0.388	0.013	0.264	2.779	3.337
84	300	1000	315	317	431	499	78	-0.026	0.370	0.195	0.416	3.695	3.822
85	300	1000	315	314	411	524	88	0.067	0.469	-0.106	0.207	2.861	3.363
86	300	1001	315	308	258	344	104	-0.054	0.502	0.627	0.626	3.772	3.486
87	300	1000	315	302	355	446	78	0.036	0.451	0.163	0.167	3.360	2.863
88	300	1000	315	317	353	411	91	-0.091	0.385	0.333	0.537	3.144	4.065
89	300	1000	315	306	288	376	97	-0.028	0.485	0.452	0.556	3.075	3.199
90	300	1000	315	311	400	498	87	0.030	0.445	0.707	0.697	6.063	5.548
91	300	1000	320	318	424	560	91	0.114	0.503	0.281	0.350	3.339	3.136
92	300	1000	320	318	233	311	96	-0.059	0.504	0.181	0.460	3.583	3.412
93	300	1001	320	319	386	501	116	-0.003	0.478	0.164	0.409	3.267	3.348
94	300	1001	320	313	289	360	112	-0.113	0.456	0.383	0.405	3.945	3.751
95	300	1000	320	311	334	411	93	-0.046	0.433	0.259	0.368	3.231	3.286
96	300	1000	325	320	431	527	89	0.018	0.427	0.489	0.554	3.623	3.146
97	300	1000	325	312	513	650	85	0.124	0.472	0.322	0.532	3.164	3.640
98	300	1000	325	314	299	384	89	-0.011	0.471	-0.013	0.404	3.194	3.457
99	300	1000	325	316	257	318	85	-0.084	0.443	-0.127	0.164	3.300	4.033
100	300	1000	325	319	335	440	96	0.025	0.489	0.389	0.552	4.160	3.755
101	300	1001	325	321	300	372	85	-0.041	0.441	-0.156	-0.138	3.999	3.992
102	300	1000	325	324	234	307	85	-0.043	0.488	-0.092	0.139	2.742	2.894
103	300	999	325	329	364	464	63	0.121	0.476	0.029	0.169	2.751	2.648
104	300	1001	325	335	339	435	109	-0.034	0.471	0.306	0.491	3.566	3.492
105	300	1000	325	330	300	383	90	-0.021	0.465	0.119	0.243	3.221	3.298
106	300	1001	330	337	177	264	89	-0.007	0.575	0.335	0.443	3.695	3.212
107	300	1000	340	344	290	367	99	-0.067	0.460	0.110	0.387	3.477	3.549
108	300	1000	335	326	210	312	119	-0.054	0.574	0.155	0.606	3.060	4.232
109	300	1000	345	332	288	378	87	0.012	0.489	0.140	0.345	3.012	3.595
110	300	1000	350	347	289	382	83	0.030	0.493	-0.153	0.001	3.073	3.037
111	300	999	355	348	218	318	92	0.030	0.563	0.301	0.511	3.796	3.780
112	300	1000	360	365	247	389	105	0.115	0.611	0.135	0.530	4.084	3.913
113	300	1000	365	371	356	483	77	0.152	0.529	0.115	0.256	2.815	2.837
114	300	999	370	371	237	325	80	0.031	0.521	0.224	0.446	3.285	3.764
115	300	1000	375	370	274	356	82	-0.002	0.480	0.337	0.217	3.805	3.165
116	300	1000	380	371	435	532	92	0.014	0.428	0.264	0.300	3.143	2.955
117	300	1000	385	370	343	427	81	0.008	0.443	-0.074	0.140	2.871	3.054
118	300	1001	390	386	273	377	103	0.004	0.526	0.360	0.448	4.770	3.951
119	300	999	395	391	382	453	69	0.006	0.396	0.262	0.448	3.742	4.423
120	299 (1)	999	400	391	468	537	80	-0.027	0.360	0.028	0.212	3.314	3.434

IS VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
121	300	1000	400	397	483	557	80	-0.016	0.365	0.077	0.202	2.590	2.951
122	300	1000	400	392	393	492	91	0.022	0.449	0.433	0.570	2.973	3.624
123	300	1000	400	381	771	811	90	-0.095	0.241	0.866	0.766	5.342	4.593
124	300	1000	400	392	359	418	77	-0.057	0.377	0.582	0.558	4.126	4.282
125	300	1001	400	384	543	648	97	0.017	0.403	1.020	0.717	7.582	5.481
126	300	999	400	387	489	569	77	0.008	0.375	-0.025	0.043	3.479	3.335
127	300	1000	400	391	429	485	98	-0.103	0.353	0.341	0.514	4.074	4.835
128	300	1000	400	402	395	519	107	0.043	0.491	0.531	0.638	3.226	3.451
129	300	1000	400	397	374	437	81	-0.052	0.382	0.478	0.509	3.866	3.763
130	300	1001	400	390	384	477	105	-0.030	0.442	-0.009	0.198	3.935	3.464
131	300	1001	400	393	466	608	95	0.109	0.492	0.123	0.522	2.963	3.498
132	300	1000	400	393	305	390	85	-0.001	0.466	-0.115	-0.075	3.134	2.706
133	300	999	400	399	450	521	59	0.035	0.370	-0.014	0.079	3.149	3.542
134	300	999	400	410	352	431	69	0.034	0.430	-0.139	-0.003	3.343	2.877
135	300	1001	400	391	329	488	124	0.086	0.576	0.418	0.781	3.331	4.494
136	300	1000	400	401	342	455	100	0.036	0.500	0.150	0.437	2.995	3.701
137	300	1000	400	393	418	525	80	0.076	0.458	0.231	0.541	3.388	3.743
138	300	1001	400	395	331	484	116	0.096	0.568	0.139	0.495	2.807	3.167
139	300	1000	400	408	358	539	105	0.197	0.601	0.350	0.762	2.841	3.694
140	300	1001	405	407	315	457	114	0.075	0.561	0.201	0.528	2.881	3.206
141	300		410	410	524								
142	300	1000	415	419	531	616	88	-0.006	0.372	0.493	0.473	5.623	4.578
143	300	1000	420	416	445	531	98	-0.028	0.404	0.330	0.450	3.367	3.258
144	300	1000	425	421	398	487	81	0.024	0.429	-0.390	-0.254	4.519	4.101
145	300	1000	430	421	445	533	73	0.041	0.407	0.385	0.427	3.535	3.492
146	300	1000	435	429	490	606	84	0.080	0.444	0.142	0.235	3.512	3.170
147	300	1000	440	434	627	716	84	0.013	0.354	-0.106	-0.175	4.293	3.641
148	300	1000	445	434	432	538	85	0.055	0.447	0.639	0.414	5.604	4.609
149	300	1000	450	446	383	473	67	0.073	0.442	0.233	0.246	3.013	2.919
150	300	1000	455	452	630	734	104	-0.001	0.376	0.351	0.353	3.317	3.040
151	300	1001	460	458	370	513	94	0.131	0.539	0.315	0.449	3.145	3.083
152	300	1000	465	464	506	600	109	-0.033	0.396	0.566	0.532	4.719	4.400
153	300	1000	470	466	531	637	91	0.035	0.410	-0.060	-0.013	3.675	3.258
154	300	1001	475	473	489	607	95	0.052	0.444	0.082	0.324	2.935	3.144
155	300	1000	480	476	423	527	86	0.046	0.446	0.026	0.032	2.773	2.973
156	300	1001	485	483	495	612	111	0.014	0.438	0.185	0.275	2.912	3.097
157	300	999	490	490	452	551	67	0.089	0.430	-0.311	-0.127	3.237	3.291
158	300	1001	495	489	433	515	97	-0.036	0.400	0.550	0.585	4.364	4.196
159	300	1000	500	494	505	637	99	0.075	0.460	0.236	0.281	3.982	3.617
160	300	999	500	497	363	403	65	-0.083	0.322	-0.026	-0.006	3.291	3.531
161	300	1000	500	491	432	518	106	-0.046	0.411	0.525	0.498	3.690	3.332
162	300	1001	500	493	566	685	94	0.055	0.420	-0.041	0.036	3.372	3.413
163	300	1000	500	505	498	585	88	-0.002	0.386	-0.219	-0.057	3.321	2.902
164	300	999	500	501	614	719	80	0.057	0.387	-0.001	0.138	2.906	3.000
165	300	1000	500	494	423	480	73	-0.045	0.348	0.230	0.334	3.462	3.609
166	300	1000	500	500	454	572	79	0.103	0.464	0.013	0.096	3.271	3.183
167	300	1001	500	497	541	689	133	0.027	0.464	0.716	0.751	5.843	5.638
168	300	999	500	503	439	511	72	-0.002	0.374	0.074	0.190	2.882	3.345
169	300	1001	500	499	431	507	98	-0.053	0.390	0.331	0.597	4.018	4.929
170	300	1000	500	498	535	639	95	0.020	0.403	0.004	0.222	3.001	3.137
171	300	999	500	495	464	512	80	-0.082	0.316	0.054	0.108	2.793	2.788
172	300	1000	500	500	337	473	96	0.111	0.544	0.107	0.250	3.170	3.860
173	300	1000	500	493	365	462	98	-0.005	0.457	0.079	0.168	2.924	3.099
174	300	1000	495	483	713	856	95	0.094	0.419	0.417	0.503	3.219	3.293
175	300	1000	495	489	451	533	96	-0.034	0.394	0.268	0.261	3.700	3.373
176	300	1000	495	493	588	745	103	0.110	0.470	0.567	0.637	4.158	4.258
177	300	1000	495	500	373	437	95	-0.081	0.392	-0.040	0.018	2.918	3.074
178	300	1000	495	496	440	589	96	0.129	0.515	0.049	0.435	3.123	3.748
179	300	1000	490	490	427	494	98	-0.076	0.375	0.043	0.369	3.231	3.542
180	300	1000	490	492	319	426	101	0.016	0.501	-0.171	0.274	2.859	3.236

IS VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
181	300	999	490	490	262	354	80	0.042	0.511	-0.059	0.345	2.707	3.363
182	300	1000	490	491	476	553	104	-0.060	0.377	-0.105	-0.172	3.251	3.063
183	300	1000	490	482	364	400	91	-0.152	0.333	-0.018	0.060	2.798	2.797
184	300	999	485	481	288	357	79	-0.034	0.440	0.448	0.553	3.355	3.551
185	300		485	487	399								
186	300		485	472	520								
187	300	1001	485	485	430	542	98	0.034	0.455	0.409	0.474	4.288	4.303
188	300	1000	485	476	584	701	95	0.046	0.410	0.909	0.765	7.702	5.925
189	300	999	485	485	465	578	80	0.086	0.448	-0.021	0.108	3.081	3.203
190	300	1000	485	486	419	489	91	-0.054	0.382	-0.114	0.121	3.160	3.091
191	300	999	485	485	277	353	67	0.035	0.466	-0.028	0.357	3.212	3.640
192	300	1001	485	491	309	409	100	-0.001	0.494	0.058	0.328	3.077	2.842
193	300	1000	485	488	328	403	87	-0.035	0.433	0.068	0.088	2.827	2.874
194	300	1000	485	484	257	354	95	0.007	0.524	0.223	0.354	2.843	3.115
195	300	999	485	488	461	532	79	-0.020	0.367	-0.186	-0.009	3.206	3.097
196	295 (5)	999	485	484	441	516	66	0.026	0.382	-1.186	-0.987	9.945	8.476
197	300	1000	485	481	297	370	89	-0.050	0.445	0.177	0.521	3.358	3.461
198	300	1000	485	480	303	440	97	0.117	0.566	0.144	0.349	2.816	2.945
199	300	1001	485	480	353	474	89	0.088	0.510	0.003	0.294	2.592	2.968
200	300	1000	485	487	324	445	85	0.109	0.530	0.055	0.262	2.992	3.043
201	300	1000	485	482	335	435	80	0.062	0.482	-0.390	-0.025	3.152	3.176
202	300		485	482	279								
203	300	1000	480	476	224	343	102	0.055	0.590	-0.210	0.240	3.015	3.771
204	300		480	481	294								
205	300	1000	480	483	336	411	82	-0.018	0.430	0.223	0.150	3.171	2.886
206	300	1000	480	482	275	353	87	-0.028	0.473	0.106	0.219	2.651	2.870
207	300	1000	480	482	361	451	95	-0.013	0.447	-0.200	-0.038	3.297	3.058
208	300	999	480	475	268	321	91	-0.121	0.421	0.231	0.652	3.773	4.881
209	300	1000	480	476	254	348	88	0.021	0.520	-0.178	-0.038	3.437	3.257
210	300	999	480	475	275	352	63	0.054	0.471	0.136	0.291	3.439	3.088
211	300	999	480	477	292	379	91	-0.012	0.480	0.079	0.366	3.307	3.853
212	300	1000	480	481	273	386	86	0.085	0.545	0.153	0.308	3.169	3.147
213	300	1000	475	466	206	303	82	0.059	0.570	0.125	0.382	3.203	3.518
214	300	999	475	467	181	299	95	0.089	0.632	-0.067	1.021	2.652	5.661
215	300	1000	475	475	265	349	88	-0.013	0.490	-0.273	-0.063	3.280	3.680
216	300	1000	475	471	233	340	93	0.045	0.562	0.342	0.607	3.263	3.784
217	300	999	475	473	342	439	95	0.006	0.470	0.206	0.626	3.088	5.550
218	300	1000	475	464	234	313	81	-0.004	0.504	0.082	0.216	2.642	2.909
219	300	1000	475	470	203	312	114	-0.018	0.591	0.028	0.368	2.989	3.992
220	300	1000	475	472	244	294	89	-0.131	0.431	0.218	0.322	3.123	3.420
221	300	1000	475	480	271	363	82	0.032	0.504	-0.328	0.024	2.824	3.320
222	300	1000	475	481	250	318	81	-0.045	0.465	-0.064	0.025	3.298	2.979
223	300	1000	470	472	192	245	87	-0.132	0.480	-0.199	-0.100	2.837	3.123
224	300	1000	470	476	369	511	87	0.150	0.541	-0.146	0.130	3.068	3.314
225	300	999	470	478	293	365	63	0.032	0.445	-0.021	0.127	3.033	3.478
226	300	1000	470	467	174	280	105	0.003	0.615	0.153	0.651	3.241	4.487
227	300	1000	470	464	158	239	86	-0.020	0.584	0.110	0.545	3.314	4.079
228	300	1000	470	465	149	226	81	-0.017	0.583	0.209	0.489	3.457	3.585
229	300	1000	470	465	156	291	105	0.116	0.686	0.344	0.926	3.139	4.722
230	300	1000	470	473	264	370	102	0.011	0.534	0.046	0.352	2.760	3.205
231	300	1000	470	465	252	309	85	-0.096	0.439	-0.021	0.230	3.045	3.514
232	300	999	470	478	249	338	84	0.019	0.513	-0.557	-0.084	3.918	4.437
233	300	1000	465	470	199	303	93	0.040	0.586	0.035	0.467	3.413	3.100
234	300	1000	465	474	275	379	94	0.031	0.523	-0.411	-0.179	3.583	3.483
235	300	1000	465	460	226	332	87	0.065	0.567	0.274	0.401	2.931	3.181
236	300	999	465	469	210	288	83	-0.020	0.521	0.135	0.439	2.774	3.523
237	300	999	465	465	301	409	93	0.046	0.516	0.264	0.552	2.907	3.300
238	300	1001	465	469	204	305	101	0.000	0.576	-0.272	0.205	2.967	3.679
239	300	1000	465	469	160	261	92	0.035	0.622	-0.026	0.523	2.964	4.106
240	300	1000	465	466	257	381	102	0.069	0.574	-0.087	0.375	3.065	3.862

IS VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
241	300	1000	465	467	344	454	92	0.052	0.496	-0.027	0.187	3.065	3.134
242	300	1000	465	467	216	283	85	-0.066	0.489	-0.261	0.095	3.345	3.329
243	300	1000	460	466	225	299	93	-0.064	0.502	-0.277	0.083	3.067	3.110
244	300	1000	460	466	217	270	82	-0.108	0.454	-0.325	-0.069	3.466	3.831
245	300	1000	460	464	333	436	96	0.022	0.487	-0.350	-0.023	3.158	2.879
246	300	1001	460	467	226	329	119	-0.049	0.561	-0.026	0.617	2.804	4.089
247	300	1000	460	457	221	326	93	0.043	0.569	-0.097	0.148	3.276	3.294
248	300	1000	455	456	277	359	110	-0.079	0.485	0.143	0.638	3.205	3.916
249	300	1000	455	468	253	363	96	0.045	0.551	-0.135	0.235	3.269	3.455
250	300	1000	455	450	232	344	110	0.007	0.572	-0.211	0.285	2.816	3.581
251	300	1001	455	451	212	326	101	0.047	0.594	0.052	0.407	3.117	3.385
252	300	1001	455	460	230	413	132	0.145	0.674	0.157	0.581	3.369	3.295
253	300	1000	450	448	249	341	81	0.039	0.519	-0.145	0.318	2.971	3.354
254	300	1001	450	445	210	308	112	-0.043	0.567	0.279	0.638	4.338	4.026
255	300	1000	450	445	223	350	104	0.076	0.607	-0.058	0.639	3.812	4.922
256	300	1000	450	445	195	283	80	0.034	0.559	0.178	0.548	2.788	3.467
257	300	1001	450	448	160	304	135	0.032	0.690	-0.405	0.398	3.680	3.656
258	300	1000	445	438	256	363	99	0.023	0.543	1.512	1.242	12.983	7.852
259	300	1000	445	443	200	298	86	0.044	0.574	0.084	0.526	2.547	3.891
260	300	1001	445	432	192	287	120	-0.081	0.579	0.326	0.545	4.241	4.270
261	300	1000	445	439	223	299	80	-0.017	0.502	0.220	0.423	3.391	3.674
262	300	1000	445	445	205	281	79	-0.015	0.518	0.063	0.522	3.440	3.642
263	300	1000	440	431	354	414	88	-0.081	0.387	-0.141	0.129	3.693	3.870
264	300	1000	440	436	252	369	108	0.028	0.564	0.223	0.693	2.899	4.788
265	300	1000	440	431	204	294	87	0.013	0.555	0.012	0.442	2.849	3.107
266	300	1000	440	430	201	307	102	0.014	0.588	-0.059	0.325	2.789	3.159
267	300	1000	440	436	173	262	89	-0.001	0.582	-0.038	0.407	2.899	3.529
268	300	999	435	433	192	277	84	0.004	0.553	-0.126	0.368	2.955	3.837
269	300	1000	435	435	215	298	94	-0.038	0.528	-0.041	0.166	2.592	3.007
270	300	1000	435	433	178	263	102	-0.063	0.571	0.102	0.362	2.911	3.372
271	300	1000	435	433	185	255	89	-0.071	0.530	0.001	0.473	2.930	3.307
272	300	1000	435	437	158	264	85	0.094	0.639	0.117	0.553	2.691	3.459
273	300	1000	430	427	149	262	99	0.058	0.658	-0.011	0.982	3.040	7.221
274	300	1000	430	431	154	244	93	-0.014	0.606	-0.176	0.203	2.827	3.143
275	300	1000	430	428	178	292	92	0.088	0.629	0.215	0.521	3.094	3.455
276	300	1001	430	431	181	320	119	0.070	0.662	-0.004	0.543	2.723	3.039
277	300	1001	430	430	226	381	120	0.105	0.642	0.328	1.171	3.354	7.198
278	300	1000	425	434	191	292	108	-0.023	0.589	-0.083	0.229	2.876	[illegible].246
279	300	1000	425	424	288	371	71	0.041	0.474	-0.274	0.021	3.389	3.379
280	300	1000	425	423	208	253	64	-0.085	0.426	-0.091	0.043	3.064	2.842
281	300	1001	425	429	164	264	111	-0.042	0.616	-0.115	0.180	2.522	2.933
282	300	1000	425	425	162	237	95	-0.079	0.568	-0.176	0.436	2.916	3.673
283	300	1000	420	417	126	195	104	-0.154	0.607	-0.007	0.392	2.892	3.500
284	300	1000	420	413	147	211	64	-0.002	0.551	-0.213	0.219	3.887	3.233
285	300	1001	420	420	167	301	113	0.074	0.669	0.090	0.455	3.247	3.321
286	300	1000	420	420	181	263	96	-0.052	0.560	-0.198	0.258	3.025	3.324
287	300	1001	420	417	173	271	104	-0.022	0.601	-0.055	0.478	2.689	4.087
288	300	1000	415	415	172	286	97	0.066	0.634	0.161	0.554	3.305	4.495
289	300	1000	415	410	151	218	84	-0.077	0.557	0.209	0.763	2.689	3.825
290	299 (1)	1001	415	410	196	297	111	-0.033	0.584	0.356	0.682	3.125	3.729
291	300	1000	415	410	166	221	73	-0.080	0.506	0.251	0.197	3.257	2.596
292	300	1000	415	413	215	283	79	-0.042	0.493	0.167	0.172	2.954	2.850
293	300	1000	410	401	140	238	105	-0.030	0.642	-0.425	0.212	3.740	4.320
294	300	1000	410	408	170	236	80	-0.057	0.532	0.244	0.214	4.040	3.565
295	300	999	410	407	155	244	81	0.038	0.605	0.148	0.636	3.399	4.425
296	300	1000	410	411	137	217	81	-0.004	0.606	-0.049	0.120	3.928	3.232
297	300	1000	410	407	154	271	88	0.123	0.663	0.362	0.792	2.900	4.621
298	300	1000	405	407	137	227	69	0.106	0.634	-0.009	0.631	3.082	4.607
299	300	1000	405	405	140	230	86	0.017	0.626	-0.045	0.552	2.734	4.689
300	300	1001	405	405	165	285	111	0.032	0.649	-0.215	0.471	3.068	4.019

IS VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
301	300	1000	405	413	174	241	64	0.009	0.525	-0.210	0.062	2.846	2.512
302	300	1001	405	409	156	279	113	0.038	0.665	-0.036	0.190	2.973	2.800
303	300	1001	400	399	145	251	113	-0.029	0.649	-0.269	0.393	2.937	3.486
304	300	1000	400	400	130	220	95	-0.022	0.642	-0.011	0.563	2.643	3.851
305	300	1001	400	402	163	271	103	0.020	0.632	0.209	0.648	3.129	3.717
306	300	1000	400	397	144	232	97	-0.040	0.615	0.078	0.752	2.976	5.268
307	300	1000	400	397	167	233	73	-0.033	0.533	0.041	0.260	2.975	3.004
308	300	1000	395	393	163	234	76	-0.026	0.550	0.221	0.532	3.077	3.651
309	300	1000	395	397	169	270	71	0.135	0.621	0.249	0.752	2.957	4.589
310	300	1000	395	395	136	215	86	-0.035	0.685	0.037	1.305	3.649	8.271
311	300	1001	395	399	133	247	112	0.011	0.680	-0.028	0.728	3.320	4.480
312	300	1001	395	397	144	267	119	0.014	0.679	0.099	0.998	3.291	4.822
313	300	1000	390	389	132	204	80	-0.040	0.595	-0.083	0.433	2.990	3.214
314	300	1000	390	387	157	245	80	0.036	0.600	-0.158	0.211	3.211	3.526
315	300	1000	390	389	165	275	90	0.084	0.636	0.095	0.649	2.715	3.768
316	300	1000	390	388	126	194	81	-0.062	0.596	-0.202	0.273	2.757	2.937
317	300	1001	390	387	188	322	135	-0.004	0.645	-0.057	0.507	3.095	3.642
318	300	1000	385	387	102	188	81	0.032	0.678	0.074	0.770	2.843	4.523
319	300	1000	385	386	168	264	108	-0.044	0.604	0.236	0.499	4.536	4.206
320	300	1000	385	383	157	220	71	-0.038	0.536	-0.126	0.137	3.211	3.296
321	300	1000	385	384	158	223	64	0.005	0.540	0.067	0.408	2.835	3.685
322	300	1000	385	387	124	224	89	0.051	0.669	-0.022	0.535	3.068	4.088
323	300	999	380	383	114	195	81	0.000	0.645	-0.074	0.384	2.871	3.696
324	300	1001	380	374	104	203	135	-0.153	0.706	0.060	0.675	3.098	3.366
325	300	1000	380	382	122	206	81	0.021	0.641	0.343	0.483	3.307	3.015
326	300	1000	380	385	107	226	108	0.054	0.728	-0.263	0.626	3.224	4.038
327	300	1000	380	383	187	254	71	-0.014	0.516	-0.067	0.209	2.784	3.118
328	300	1000	375	385	176	274	95	0.008	0.597	-0.092	0.199	3.690	3.384
329	300	1000	375	380	325	400	104	-0.081	0.438	-0.507	-0.298	3.963	3.965
330	300	1000	375	380	115	202	96	-0.041	0.656	-0.131	0.372	3.698	3.974
331	300	1001	375	381	119	231	103	0.036	0.695	0.002	0.699	3.409	3.886
332	300	1000	375	374	116	189	84	-0.054	0.624	-0.076	0.518	3.154	4.400
333	300	1000	375	374	120	228	95	0.058	0.689	0.015	0.747	2.848	4.611
334	300	1000	370	365	190	264	107	-0.116	0.538	-0.429	0.214	4.433	3.477
335	300	1000	370	371	129	206	81	-0.022	0.610	0.093	0.523	3.173	3.957
336	300	1000	370	369	133	232	95	0.015	0.652	-0.101	0.495	2:795	4.124
337	300	999	370	369	176	274	80	0.072	0.600	0.246	0.505	3.883	3.920
338	300	1000	370	369	181	260	76	0.011	0.551	0.014	0.351	2.515	3.095
339	300	1000	365	366	157	238	103	-0.087	0.587	-0.119	0.369	3.243	5.022
340	300	1000	365	360	189	244	79	-0.100	0.483	-0.213	0.015	2.781	2.897
341	300	1000	365	364	143	274	105	0.107	0.697	-0.129	0.758	2.745	4.387
342	300	999	365	366	159	207	74	-0.120	0.494	-0.108	0.138	3.134	3.117
343	300	1000	365	364	200	247	105	-0.201	0.472	0.090	0.414	3.429	3.742
344	300	1000	360	364	112	172	71	-0.063	0.593	0.002	0.429	2.716	3.285
345	300	1000	360	358	150	215	100	-0.140	0.564	0.203	0.521	3.178	3.878
346	300	999	360	361	131	208	78	-0.006	0.608	-0.183	0.495	2.984	4.443
347	300	1000	360	355	144	227	98	-0.062	0.607	-0.005	0.448	3.805	3.736
348	300	1000	360	359	121	211	100	-0.044	0.655	0.187	0.881	3.059	5.442
349	300	1001	355	357	132	192	83	-0.109	0.566	-0.305	0.240	3.216	2.899
350	300	1000	355	355	188	228	89	-0.192	0.451	-0.164	0.017	2.988	2.756
351	300	1000	355	363	183	250	71	-0.018	0.520	-0.010	0.309	3.366	3.418
352	300	1000	355	364	177	254	100	-0.086	0.554	0.079	0.406	2.812	3.692
353	300	1000	355	361	183	273	100	-0.037	0.575	-0.176	0.316	2.921	3.914
354	300	999	355	351	248	333	74	0.039	0.507	0.322	0.530	3.235	3.671
355	300	1000	355	354	235	329	90	0.016	0.536	0.001	0.511	2.557	3.450
356	300	1001	355	352	135	220	116	-0.126	0.628	0.139	0.442	3.341	3.192
357	300	999	355	360	132	247	86	0.132	0.688	0.007	0.550	3.244	3.539
358	300	1001	355	355	164	266	83	0.081	0.622	-0.356	0.383	3.680	4.593
359	300	1000	355	357	148	222	90	-0.071	0.579	0.080	0.503	3.335	3.425
360	300	1001	355	363	171	286	106	0.034	0.635	-0.132	0.424	2.995	3.629

IS VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
361	300	1000	350	354	196	232	68	-0.137	0.413	-0.053	0.002	3.043	2.801
362	300	1000	350	355	185	291	103	0.011	0.605	-0.310	0.810	3.346	7.203
363	300	1001	350	353	187	283	106	-0.035	0.583	-0.420	0.067	3.773	4.283
364	300	1001	350	351	159	278	135	-0.053	0.656	-0.082	0.707	3.368	5.482
365	300	1000	350	350	169	247	97	-0.073	0.566	-0.050	0.570	3.310	4.138
366	300	1000	345	352	278	328	90	-0.126	0.407	-0.015	0.182	3.019	2.941
367	300	1000	345	341	233	296	94	-0.106	0.470	0.117	0.357	4.727	3.916
368	300	999	345	345	212	257	88	-0.158	0.441	-0.226	0.131	3.171	3.356
369	300	1001	345	338	141	223	118	-0.140	0.617	-0.099	0.388	3.309	4.126
370	300	1000	345	342	105	188	87	-0.025	0.664	0.084	0.641	3.082	3.968
371	300	999	340	335	145	196	72	-0.102	0.520	-0.048	0.466	4.336	3.221
372	300	1001	340	342	130	213	108	-0.107	0.629	0.136	0.347	2.852	2.943
373	300	999	340	336	150	283	108	0.099	0.690	0.408	1.761	3.271	10.486
374	300	999	340	338	108	203	82	0.070	0.687	-0.175	0.572	3.252	4.167
375	300	1000	340	341	132	193	75	-0.071	0.566	-0.277	0.698	4.850	4.647
376	300	1000	335	334	199	265	88	-0.082	0.505	0.174	0.618	3.577	4.877
377	300	999	335	346	131	211	72	0.040	0.616	0.168	0.585	4.351	4.185
378	300	1000	335	337	127	201	88	-0.067	0.609	-0.009	0.197	3.183	3.239
379	300	1000	335	342	138	227	82	0.036	0.629	-0.059	0.869	3.384	5.243
380	300	1000	335	341	152	293	103	0.147	0.701	0.061	0.880	2.520	5.306
381	300	1000	330	337	164	239	97	-0.088	0.563	-0.032	0.361	2.918	3.318
382	300	1000	330	323	143	195	94	-0.180	0.541	-0.141	0.270	3.941	4.019
383	300	1000	330	328	161	225	91	-0.112	0.543	0.301	0.389	3.531	3.340
384	300	999	330	332	201	261	75	-0.060	0.483	0.063	0.228	3.140	3.670
385	300	1000	330	335	203	280	96	-0.066	0.529	0.013	0.333	3.537	3.544
386	300	1000	325	329	160	189	83	-0.234	0.447	0.063	0.002	3.416	3.075
387	300	1000	325	321	237	289	104	-0.167	0.450	0.160	0.466	3.014	3.479
388	300	1001	325	324	152	290	122	0.061	0.692	-0.009	0.548	3.270	3.836
389	300	1001	325	329	188	298	105	0.017	0.607	0.157	1.052	3.148	6.241
390	300	1000	325	326	148	257	94	0.058	0.651	0.048	1.176	4.809	8.640
391	300	1000	320	321	148	211	89	-0.112	0.556	-0.059	0.261	3.031	3.032
392	300	1000	320	318	198	252	95	-0.148	0.483	0.118	0.622	4.292	4.968
393	300	1000	320	314	89	171	80	0.015	0.693	0.162	0.524	2.993	3.624
394	300	1000	320	316	95	140	85	-0.224	0.596	0.209	1.073	3.502	7.367
395	300	1000	320	319	117	274	156	0.006	0.757	-0.271	2.112	3.008	15.217
396	300	1000	315	315	133	305	155	0.061	0.752	0.172	2.341	3.707	17.542
397	300	1000	315	320	157	237	87	-0.031	0.582	-0.179	0.250	3.642	3.135
398	300	1000	315	312	123	207	82	0.009	0.637	0.189	0.571	2.885	4.088
399	300	1000	315	314	191	249	103	-0.163	0.501	-0.125	0.708	3.178	5.572
400	300	1000	315	315	175	249	80	-0.028	0.544	-0.363	0.162	4.229	3.582
401	300	1000	310	318	192	265	87	-0.051	0.528	-0.287	0.397	4.812	5.059
402	300	1001	310	316	185	324	101	0.138	0.663	0.028	0.770	3.201	4.966
403	300	1000	310	304	140	220	76	0.020	0.603	0.347	0.803	4.458	5.804
404	300	999	310	307	154	226	74	-0.007	0.566	-0.591	-0.004	6.839	[illegible]
405	300	1000	310	300	117	232	80	0.179	0.714	0.299	0.834	3.422	3.912
406	300	1000	305	300	148	221	87	-0.066	0.576	0.033	0.548	2.919	3.962
407	300	1000	305	306	148	321	156	0.058	0.736	0.204	1.515	2.795	8.436
408	300	1000	305	302	139	260	108	0.055	0.684	0.281	0.731	2.718	3.722
409	300	1000	305	302	139	271	96	0.155	0.706	0.131	0.636	3.188	3.545
410	300	1000	305	293	129	226	83	0.071	0.659	-0.206	0.798	3.017	4.145
411	300	1000	300	302	174	234	80	-0.083	0.512	-0.064	0.481	3.101	3.436
412	300	1000	300	297	116	186	84	-0.068	0.617	0.405	0.634	4.939	3.848
413	300	1000	300	296	113	182	78	-0.047	0.618	-0.285	0.672	3.171	6.201
414	300	1000	300	289	186	286	120	-0.067	0.595	-0.087	0.613	3.678	5.551
415	300	1000	300	294	106	179	82	-0.048	0.641	-0.024	0.471	3.007	3.703
416	300	1000	295	294	114	191	78	-0.007	0.636	0.207	0.755	3.415	4.653
417	300	1000	290	290	99	178	85	-0.032	0.666	-0.128	0.396	2.977	3.582
418	300	1000	285	283	98	193	101	-0.030	0.702	-0.250	0.914	3.276	5.519
419	300	1000	280	284	141	231	90	0.003	0.626	-0.178	0.326	3.610	3.384
420	300	1000	275	277	158	275	105	0.047	0.652	-0.009	0.729	3.521	4.037

IS VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
421	300	999	275	275	153	238	80	0.021	0.597	-0.204	0.346	3.429	3.476
422	300	1001	275	275	147	237	106	-0.064	0.619	-0.175	0.225	3.869	3.452
423	300	999	275	270	135	230	94	0.003	0.642	-0.135	0.635	2.912	4.951
424	300	999	275	272	100	170	91	-0.109	0.648	-0.402	0.807	3.827	4.064
425	300	1000	275	273	124	203	79	0.003	0.626	-0.223	0.514	3.174	4.189
426	300	1001	280	278	133	232	119	-0.077	0.656	-0.173	0.744	3.743	3.983
427	300	1000	285	283	105	199	87	0.033	0.685	-0.029	0.671	2.728	3.766
428	300	1000	290	288	122	196	75	-0.008	0.614	0.042	0.817	3.193	4.296
429	300	1000	295	286	118	209	84	0.036	0.662	0.041	0.373	3.286	3.278
430	300	1000	300	288	109	170	76	-0.084	0.601	0.192	0.421	3.304	3.285
431	300	1000	300	293	94	181	84	0.017	0.693	-0.085	0.812	3.580	4.207
432	300	1000	300	301	107	205	117	-0.088	0.693	0.115	1.292	2.867	7.539
433	300	1000	300	294	90	170	87	-0.041	0.687	-0.037	0.839	2.974	4.793
434	300	1000	300	295	86	157	80	-0.055	0.673	0.169	0.774	3.261	4.867
435	300	1000	300	297	99	174	76	-0.003	0.658	-0.332	0.593	3.519	4.282
436	300	1000	305	310	146	251	96	0.035	0.646	-0.262	0.527	3.194	3.856
437	300	1001	305	306	147	252	91	0.063	0.648	0.157	0.608	2.997	3.844
438	300	1001	305	299	117	266	128	0.082	0.749	0.102	0.862	3.277	4.164
439	300	1000	305	305	101	205	93	0.058	0.714	0.030	0.691	2.814	3.864
440	300	1000	305	309	89	163	97	-0.123	0.679	0.120	0.710	3.027	4.462
441	300	1000	305	310	93	189	95	0.005	0.713	-0.010	0.587	3.288	3.795
442	300	1000	310	310	141	239	84	0.069	0.644	0.347	0.654	3.496	3.707
443	300	1000	310	307	103	205	91	0.057	0.707	0.235	0.897	3.435	4.798
444	300	1001	310	302	107	204	89	0.042	0.690	0.648	1.031	4.435	4.922
445	300	1001	310	307	112	263	138	0.048	0.758	-0.014	2.597	3.326	23.356
446	300	1000	310	304	103	182	97	-0.090	0.662	0.017	1.275	2.724	8.609
447	300	1000	310	305	138	235	89	0.037	0.644	0.028	0.468	3.087	3.554
448	300	1000	315	314	159	300	89	0.216	0.702	0.253	0.881	3.095	4.344
449	300	1000	315	305	176	281	87	0.070	0.613	0.283	0.487	3.538	3.162
450	300	999	315	307	119	193	72	0.012	0.622	-0.021	0.527	3.386	4.059
451	300	1000	315	308	157	248	88	0.017	0.607	0.062	0.559	4.452	4.437
452	300	1001	315	310	106	217	106	0.028	0.717	0.315	0.940	3.475	4.931
453	300	1000	315	314	89	168	87	-0.047	0.686	0.017	0.861	3.187	5.645
454	300	999	320	321	92	147	73	-0.107	0.619	0.012	0.316	3.179	2.991
455	300	1001	320	319	123	247	106	0.081	0.712	-0.096	0.603	3.640	3.881
456	300	999	320	323	89	181	94	-0.011	0.713	-0.343	0.704	3.555	5.359
457	300	999	320	323	103	199	91	0.025	0.695	0.059	0.776	2.775	4.660
458	300	1000	320	316	138	233	90	0.021	0.639	0.002	0.614	2.988	4.502
459	300	1001	320	316	128	246	139	-0.079	0.695	0.908	1.949	5.860	14.570
460	300	1001	325	319	103	191	72	0.090	0.681	0.257	0.559	3.612	3.440
461	300	1000	325	322	151	247	76	0.093	0.628	0.133	0.563	4.029	3.923
462	300	1000	325	316	138	216	69	0.045	0.602	0.355	0.698	3.070	4.078
463	300	1000	325	327	175	251	80	-0.020	0.549	0.013	0.110	3.747	3.477
464	300	1000	325	321	209	315	91	0.057	0.583	0.143	0.317	2.970	3.004
465	300	1000	325	323	80	186	105	0.005	0.755	0.086	1.005	2.709	4.825
466	300	999	325	320	101	181	81	-0.003	0.666	-0.257	0.714	3.790	4.936
467	300	999	325	317	103	157	76	-0.125	0.594	-0.171	0.426	3.272	3.820
468	300	1001	325	320	124	195	73	-0.009	0.604	-0.895	-0.202	7.752	5.855
469	300	1000	325	322	178	247	80	-0.044	0.531	-0.166	0.182	3.294	3.354
470	300	1000	330	319	144	209	80	-0.072	0.560	-0.266	0.068	3.392	2.988
471	300	1000	330	327	127	206	76	0.016	0.620	0.185	0.678	3.558	3.798
472	300	1000	330	326	126	217	78	0.061	0.648	0.053	0.974	3.343	5.769
473	300	1000	330	325	99	198	83	0.088	0.709	0.003	0.776	3.195	5.060
474	300	1000	330	324	115	205	91	-0.006	0.661	0.283	0.552	3.467	3.543
475	300	1000	340	338	128	220	94	-0.011	0.647	-0.118	0.674	3.355	4.836
476	300	1000	340	342	149	221	73	-0.005	0.571	-0.059	0.276	3.331	3.677
477	300	1000	340	336	138	184	67	-0.112	0.507	-0.393	-0.037	3.311	3.361
478	300	1001	340	337	169	310	104	0.139	0.682	0.068	0.846	3.069	5.304
479	300	1000	340	334	124	240	91	0.120	0.701	-0.071	0.431	2.890	2.924
480	300	1000	350	344	140	259	95	0.106	0.683	0.271	0.859	3.722	4.282

IS VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
481	300	1000	350	347	147	217	78	-0.039	0.570	0.234	0.481	3.024	3.451
482	300	1000	350	351	143	250	91	0.072	0.657	0.228	0.628	2.604	4.053
483	300	999	350	345	105	196	81	0.058	0.683	0.151	1.068	3.298	5.050
484	300	999	350	358	120	194	71	0.020	0.620	-0.188	0.185	2.915	3.825
485	300	999	360	362	134	186	66	-0.075	0.533	0.121	0.340	2.955	3.388
486	300	999	360	360	129	225	76	0.098	0.656	0.094	0.369	2.744	2.996
487	300	1000	360	354	134	204	76	-0.028	0.588	-0.107	0.270	3.240	3.467
488	300	1000	360	359	127	213	94	-0.040	0.635	0.173	0.558	2.899	3.735
489	300	1000	360	362	134	218	88	-0.018	0.622	0.284	0.363	3.497	3.130
490	300	1000	370	362	139	237	95	0.012	0.642	-0.055	0.593	3.721	4.095
491	300	1000	370	372	181	287	80	0.109	0.614	0.229	0.477	3.505	3.547
492	300	1001	370	372	202	314	103	0.032	0.598	0.218	0.415	2.831	3.218
493	300	999	370	367	161	232	72	-0.004	0.554	-0.009	0.507	3.257	4.037
494	300	999	370	368	111	198	66	0.118	0.667	0.120	0.280	3.168	3.080
495	300	999	380	369	109	182	76	-0.020	0.632	0.354	0.598	4.1[illegible]0	3.562
496	300	1000	380	376	136	254	118	0.002	0.682	0.241	0.703	3.092	4.223
497	300	1000	380	373	148	237	92	-0.017	0.611	0.223	0.522	3.604	3.079
498	300	1000	380	375	133	228	98	-0.010	0.647	0.230	0.634	3.226	3.806
499	300	1000	380	379	124	202	91	-0.063	0.622	0.040	0.270	3.197	3.451
500	300	1001	390	387	104	189	120	-0.156	0.680	0.162	0.587	3.003	3.652
501	300	1001	390	391	143	268	106	0.078	0.687	-0.007	0.452	2.594	3.532
502	300	1001	390	378	110	214	122	-0.077	0.700	0.130	0.795	3.354	4.256
503	300	1000	390	389	185	285	93	0.024	0.592	0.006	0.326	3.044	3.294
504	299 (1)	1000	390	390	142	229	101	-0.058	0.619	0.267	0.541	3.526	3.406
505	300	1000	400	396	111	203	93	-0.007	0.672	0.265	0.677	3.771	4.212
506	300	1000	400	403	104	176	98	-0.128	0.646	0.156	0.565	3.221	3.785
507	300	1000	400	388	141	196	90	-0.152	0.547	0.086	0.601	3.930	3.726
508	300	999	400	394	129	210	86	-0.019	0.623	0.310	0.565	3.907	3.740
509	300	1000	400	390	119	213	98	-0.019	0.664	0.325	1.227	3.509	6.752
510	300	1000	400	388	88	168	88	-0.043	0.693	-0.222	0.491	3.074	4.016
511	300	1001	400	401	126	207	105	-0.103	0.633	0.181	0.332	3.033	3.066
512	300	999	400	399	194	273	77	0.006	0.538	0.155	0.401	3.227	3.611
513	300	1001	400	392	115	231	121	-0.023	0.708	0.276	0.680	2.784	3.479
514	300	1000	400	387	113	188	92	-0.085	0.634	0.001	0.554	3.081	4.265
515	300	1000	400	395	100	197	93	0.017	0.701	-0.049	0.890	3.078	5.066
516	300	1000	400	399	115	179	66	-0.009	0.599	0.003	0.414	2.877	3.669
517	300	1000	400	391	102	202	77	0.133	0.710	0.013	0.520	3.835	4.153
518	300	1001	400	390	138	224	73	0.065	0.621	-0.115	0.539	2.954	4.291
519	300	1000	400	399	140	239	87	0.057	0.646	0.117	0.640	3.072	3.575
520	300	1000	400	387	114	189	69	0.031	0.629	-0.293	0.225	3.301	3.611
521	300	1000	400	391	102	188	84	0.009	0.677	0.358	0.788	4.108	3.805
522	300	1000	400	395	105	199	117	-0.102	0.693	0.104	0.773	3.458	4.570
523	300	1000	400	396	146	221	87	-0.053	0.585	0.261	0.458	3.341	3.477
524	300	1000	400	391	139	245	79	0.128	0.666	0.235	0.831	3.131	4.381
525	300	1000	400	389	102	194	94	-0.011	0.689	-0.110	0.442	2.954	3.183
526	300	1000	410	409	122	252	106	0.106	0.722	0.332	1.555	3.729	9.728
527	300	1000	410	407	128	216	98	-0.043	0.640	0.221	0.432	4.637	4.193
528	300	1001	410	400	118	233	122	-0.026	0.704	-0.019	0.891	2.865	5.575
529	300	1001	410	403	205	308	121	-0.058	0.580	0.020	0.404	3.089	3.360
530	300	1000	410	405	122	188	84	-0.086	0.599	0.180	0.744	2.983	4.156
531	300	1000	420	423	148	249	117	-0.062	0.639	0.211	1.202	3.267	7.303
532	300	1000	420	419	225	324	94	0.016	0.552	0.483	0.721	5.185	4.803
533	300	999	420	418	131	197	71	-0.026	0.577	-0.176	0.275	2.974	3.656
534	300	1000	420	416	124	208	83	0.004	0.634	0.394	0.597	4.037	3.845
535	300	1000	420	421	111	186	90	-0.073	0.637	0.065	0.670	3.336	4.838
536	300	1000	430	427	94	179	96	-0.060	0.688	0.023	0.567	2.743	3.728
537	300	1000	430	426	114	198	76	0.039	0.651	-0.041	0.515	3.142	3.534
538	300	1000	430	425	174	238	65	-0.006	0.516	0.202	0.306	3.037	3.154
539	300	1000	430	428	129	212	66	0.094	0.631	0.312	0.595	3.615	3.476
540	300	1000	430	429	139	216	76	0.003	0.597	0.077	0.190	3.060	3.314

LL VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
1	300	1001	300	303	1704	1807	117	-0.015	0.239	0.560	0.653	4.778	4.813
2	300	1000	300	308	908	995	83	0.008	0.296	0.263	0.260	3.295	3.196
3	300	1000	300	303	687	734	103	-0.106	0.273	-0.008	0.176	3.537	3.154
4	300	1000	300	305	531	614	92	-0.022	0.367	0.410	0.208	4.730	3.643
5	300	1000	300	296	456	554	97	0.003	0.421	0.271	0.503	3.475	4.340
6	300	1000	300	303	391	475	80	0.010	0.421	0.456	0.527	3.644	3.428
7	300	1000	300	298	359	402	75	-0.098	0.338	0.216	0.043	2.841	2.553
8	300	1000	300	301	342	428	96	-0.027	0.450	0.381	0.573	3.223	3.765
9	300	1000	300	306	389	428	83	-0.122	0.324	0.143	0.233	2.912	3.212
10	300	999	300	302	401	456	78	-0.066	0.351	0.105	0.133	3.813	3.665
11	300	999	300	304	361	420	69	-0.031	0.377	0.292	0.308	3.193	3.169
12	300	1000	300	300	375	460	98	-0.034	0.430	0.446	0.323	3.391	3.038
13	300	1000	300	309	491	538	72	-0.065	0.304	0.407	0.342	3.055	3.068
14	300	999	300	299	331	429	87	0.033	0.479	0.260	0.528	3.134	3.435
15	300	1000	300	298	519	645	91	0.078	0.446	0.387	0.374	3.196	3.194
16	300	1001	300	298	317	442	119	0.017	0.533	0.113	0.580	2.813	3.699
17	300	1001	300	300	302	454	110	0.116	0.587	0.333	0.977	3.353	6.176
18	300	1000	300	298	584	646	99	-0.078	0.317	0.410	0.389	3.384	3.134
19	300	1001	300	307	384	506	112	0.024	0.491	-0.084	0.156	3.374	3.179
20	300	1000	300	300	342	407	110	-0.114	0.414	0.306	0.327	3.243	3.439
21	300	1000	300	296	403	476	112	-0.092	0.400	0.220	0.250	3.189	3.083
22	300	999	300	301	378	462	91	-0.019	0.427	0.276	0.437	3.143	3.289
23	300	999	300	303	379	446	78	-0.034	0.387	0.170	0.194	2.669	2.833
24	300	999	300	302	287	372	68	0.064	0.482	-0.143	0.005	3.571	3.661
25	300	1000	300	302	386	419	80	-0.133	0.309	0.145	0.082	3.473	3.054
26	300	1001	300	303	292	372	109	-0.084	0.468	0.464	0.344	3.699	3.342
27	300	1001	300	307	616	693	103	-0.052	0.336	0.586	0.462	4.706	3.755
28	300	1000	300	307	647	727	80	0.001	0.333	0.270	0.285	3.247	3.183
29	300	1000	300	303	443	523	79	0.004	0.392	0.321	0.288	3.128	2.631
30	300	999	300	304	401	483	75	-0.019	0.412	0.160	0.233	3.290	3.318
31	300	1001	300	302	359	455	94	0.004	0.459	-0.046	0.074	3.318	3.261
32	300	1000	300	301	294	367	96	-0.067	0.452	0.368	0.565	4.184	4.503
33	300	1001	300	301	261	315	116	-0.180	0.444	0.231	0.424	2.890	3.031
34	300	1000	300	295	488	546	83	-0.062	0.332	0.464	0.637	3.508	4.496
35	300	1000	300	296	522	539	94	-0.174	0.246	0.057	0.033	2.696	2.643
36	300	999	300	301	387	464	81	-0.011	0.407	0.195	0.389	3.144	3.438
37	300	999	300	296	348	389	94	-0.149	0.352	0.015	0.013	3.195	3.054
38	300	1001	300	300	359	444	100	-0.040	0.440	0.162	0.458	3.057	3.362
39	300	1000	300	298	310	403	88	0.015	0.481	0.365	0.433	3.495	3.389
40	300	1000	300	300	381	455	87	-0.038	0.403	0.310	0.404	3.363	3.572
41	300	1001	300	301	285	338	90	-0.116	0.410	0.160	0.413	2.909	3.560
42	300	1001	300	296	509	566	104	-0.102	0.333	0.170	0.183	3.400	3.786
43	300	1001	300	303	369	443	116	-0.101	0.420	0.201	0.211	2.874	2.629
44	300	999	300	297	548	639	88	0.008	0.377	0.136	0.299	3.092	3.518
45	300	1000	300	300	358	452	98	-0.012	0.454	0.021	0.083	3.405	3.324
46	300	1000	300	299	370	432	74	-0.035	0.382	-0.128	-0.011	4.224	3.680
47	300	1000	300	304	372	478	83	0.065	0.474	-0.117	0.094	3.548	3.532
48	300	999	300	300	423	496	71	0.005	0.384	0.374	0.317	3.176	2.957
49	300	999	300	296	441	483	69	-0.076	0.306	-0.061	0.165	3.274	3.329
50	300	1001	300	303	377	453	101	-0.062	0.415	0.153	0.064	3.473	2.932
51	300	1000	305	305	373	440	78	-0.033	0.391	0.126	0.234	3.070	2.836
52	300	1000	305	306	372	442	83	-0.039	0.398	0.300	0.321	3.111	2.904
53	300	1000	305	307	424	509	85	0.000	0.409	-0.266	-0.119	3.730	3.994
54	300	1000	305	310	374	416	87	-0.125	0.338	0.207	0.188	3.045	3.027
55	300	1000	305	304	484	625	96	0.106	0.484	0.182	0.404	2.794	3.100
56	300	1001	305	304	457	559	86	0.040	0.429	0.134	0.014	3.344	3.047
57	300	999	305	313	454	523	79	-0.027	0.364	0.267	0.239	3.305	2.849
58	300	1001	305	304	567	644	101	-0.048	0.350	0.720	0.662	4.317	3.919
59	300	1000	305	300	540	627	89	-0.006	0.371	0.372	0.332	3.317	3.360
60	300	1000	305	311	447	482	87	-0.130	0.300	0.043	0.016	3.623	3.928

LL VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
61	300	1000	310	310	502	544	81	-0.098	0.293	0.569	0.512	3.755	3.742
62	300	1001	310	311	576	674	120	-0.043	0.383	0.362	0.359	3.536	3.598
63	300	1000	310	307	549	612	89	-0.059	0.326	0.357	0.626	3.544	3.775
64	300	1000	310	313	708	802	71	0.053	0.347	0.795	0.667	6.221	5.318
65	300	1000	310	310	578	646	90	-0.048	0.329	0.232	0.183	2.766	2.704
66	300	1001	310	315	788	831	86	-0.081	0.243	0.846	0.675	6.666	5.570
67	300	1001	310	308	577	703	113	0.025	0.424	0.277	0.343	3.424	3.560
68	300	1000	310	310	511	618	85	0.051	0.418	0.534	0.511	4.641	4.111
69	300	1001	310	311	388	479	93	-0.005	0.435	0.220	0.161	2.893	2.724
70	300	1000	310	319	563	656	85	0.020	0.378	0.190	0.150	3.702	3.657
71	300	999	315	312	433	476	88	-0.113	0.322	-0.127	0.028	3.008	3.165
72	300	1001	315	313	387	440	113	-0.142	0.372	0.638	0.609	4.827	3.957
73	300	999	315	320	468	506	87	-0.122	0.298	-0.124	-0.118	3.202	3.199
74	300	1001	315	323	380	482	98	0.011	0.460	0.184	0.204	3.559	3.383
75	300	1000	315	310	518	592	84	-0.026	0.354	0.164	0.199	3.196	3.057
76	300	1001	315	322	511	653	117	0.052	0.470	0.203	0.424	3.266	3.725
77	300	1000	315	320	467	581	96	0.042	0.445	0.260	0.389	3.129	3.266
78	300	1000	315	310	445	549	107	-0.007	0.436	0.284	0.360	3.329	3.310
79	300	1000	315	319	670	750	100	-0.038	0.329	-0.596	-0.177	8.758	6.939
80	300	999	315	314	472	539	73	-0.017	0.352	0.393	0.396	3.709	3.439
81	300	999	320	324	416	497	70	0.031	0.404	0.179	0.189	2.821	2.788
82	300	1000	320	324	369	471	96	0.016	0.465	0.093	0.196	2.855	3.048
83	300	1001	320	324	428	474	78	-0.089	0.321	0.530	0.533	4.341	4.219
84	300	1000	320	318	409	499	99	-0.024	0.424	0.450	0.340	4.176	3.535
85	300	1000	320	324	360	411	80	-0.085	0.361	0.025	0.077	2.584	2.856
86	300	999	320	322	406	474	82	-0.041	0.379	0.177	0.243	2.681	2.689
87	300	1000	320	300	1074	1276	119	0.116	0.412	1.193	1.587	6.393	8.709
88	300	999	320	324	312	370	67	-0.029	0.398	0.017	-0.030	2.796	2.785
89	300	1001	320	318	535	599	103	-0.084	0.336	0.337	0.274	3.742	3.421
90	300	1000	320	321	361	448	93	-0.016	0.442	-0.147	-0.023	3.254	3.256
91	300	-	325	335	369								
92	300	1000	325	319	1136	1165	75	-0.078	0.177	0.586	0.589	4.417	4.129
93	300	1000	325	328	339	442	79	0.073	0.487	0.137	0.471	2.947	3.679
94	300	1000	325	319	288	366	82	-0.015	0.460	-0.104	0.171	3.180	3.288
95	300	1001	325	321	391	516	117	0.018	0.493	0.238	0.296	2.830	3.041
96	300	1000	325	324	344	413	93	-0.065	0.415	0.059	0.246	3.169	3.307
97	300	1000	325	318	393	493	88	0.034	0.452	0.021	0.172	2.583	2.553
98	300	1000	325	329	457	560	89	0.035	0.430	0.135	0.261	3.431	3.516
99	300	1000	325	325	443	487	83	-0.101	0.315	0.084	0.093	2.934	3.122
100	300	1000	325	327	441	535	88	0.016	0.419	0.183	0.191	3.161	3.429
101	300	1000	330	330	494	562	90	-0.049	0.353	1.120	0.910	8.858	7.058
102	300	999	335	333	354	429	91	-0.045	0.421	0.018	0.269	3.008	3.471
103	300	1000	340	347	332	402	89	-0.056	0.420	0.335	0.350	3.429	3.220
104	300	1000	345	349	405	475	97	-0.069	0.389	0.317	0.524	3.373	4.027
105	300	1000	350	351	390	479	94	-0.014	0.430	0.189	0.455	2.958	3.279
106	300	1000	355	357	286	386	98	0.010	0.511	-0.010	0.410	2.795	3.409
107	300	1000	360	358	365	443	88	-0.028	0.420	0.247	0.320	4.684	4.199
108	300	1000	365	365	298	389	88	0.009	0.483	0.004	0.155	3.193	3.477
109	300	1000	370	374	315	404	81	0.025	0.470	-0.114	-0.014	4.007	3.833
110	300	1000	375	384	343	441	85	0.039	0.472	0.021	0.236	2.545	2.942
111	300	1000	380	385	442	599	94	0.154	0.529	0.467	0.616	4.201	4.228
112	300	1000	385	387	329	418	84	0.017	0.462	0.050	0.230	2.926	3.039
113	300	1001	390	400	482	620	101	0.084	0.478	0.174	0.342	2.774	3.256
114	300	1000	395	394	310	379	102	-0.093	0.435	0.135	0.307	2.910	3.594
115	300	1000	400	403	413	533	94	0.069	0.479	0.249	0.478	3.648	4.363
116	300	999	400	401	318	389	84	-0.015	0.451	0.151	0.233	2.472	2.355
117	300	1000	400	405	488	594	93	0.052	0.442	0.281	0.278	3.556	3.618
118	300	1000	400	399	246	300	82	-0.096	0.435	0.035	-0.127	3.153	2.800
119	300	999	400	403	269	344	81	-0.018	0.467	0.010	0.091	2.567	2.653
120	300	1000	400	402	477	592	87	0.066	0.443	0.344	0.368	3.858	3.352

LL VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
121	300	1000	400	401	366	430	80	-0.048	0.387	0.366	0.337	3.047	2.894
122	300	1000	400	401	304	435	105	0.071	0.551	-0.212	0.239	3.091	4.192
123	300	1000	400	397	377	491	100	0.036	0.482	0.229	0.457	2.832	4.611
124	300	1000	400	400	440	443	80	-0.206	0.219	0.198	0.151	3.625	3.329
125	300	1000	405	410	365	435	83	-0.039	0.402	0.167	0.278	3.067	2.820
126	300	999	410	416	366	441	93	-0.048	0.416	0.127	0.163	3.090	3.625
127	300	1000	415	426	335	423	93	-0.014	0.456	0.[illegible]	0.179	3.566	3.605
128	300	1000	420	426	399	483	80	0.013	0.418	0.191	0.132	3.507	3.357
129	300	1000	425	427	236	296	79	-0.069	0.455	0.349	0.293	2.697	2.661
130	300	1000	430	436	308	350	69	-0.093	0.358	0.085	0.314	2.982	3.301
131	300	1000	435	438	330	413	71	0.039	0.450	0.132	0.140	3.163	3.125
132	300	1000	440	455	448	582	107	0.063	0.484	0.308	0.291	3.771	3.417
133	300	999	445	449	389	463	79	-0.013	0.401	-0.028	-0.118	3.047	3.118
134	300	1000	450	458	318	421	95	0.022	0.495	0.380	0.432	3.670	3.328
135	300	1000	455	454	330	430	107	-0.018	0.483	0.098	0.304	2.586	3.051
136	300	1000	460	468	388	476	105	-0.041	0.432	0.197	0.880	5.307	4.063
137	300	1000	465	466	486	494	81	-0.182	0.224	0.418	0.335	3.607	3.419
138	300	1000	465	465	371	386	69	-0.168	0.258	0.179	0.132	3.035	3.076
139	300	1000	470	469	362	444	86	-0.011	0.431	0.067	0.085	3.493	3.267
140	300	1000	475	475	471	530	69	-0.030	0.333	0.247	0.186	3.924	3.600
141	300		480	484	378								
142	300	1000	485	487	435	544	96	0.032	0.448	-0.048	0.136	3.460	3.741
143	300	1000	490	493	460	544	76	0.020	0.393	0.224	0.182	3.323	3.234
144	300	1001	500	497	391	507	116	0.001	0.479	0.336	0.391	3.124	3.172
145	300	1001	500	506	412	527	103	0.028	0.468	0.228	0.404	3.260	3.615
146	300	999	500	500	378	438	80	-0.055	0.377	0.334	0.255	3.835	3.659
147	300	999	500	500	329	429	69	0.106	0.493	0.286	0.352	3.415	3.836
148	300	1000	500	500	470	525	95	-0.096	0.335	0.503	0.591	4.156	4.068
149	300	1000	500	499	507	639	107	0.053	0.456	0.206	0.450	2.938	3.325
150	300	1000	500	514	550	589	85	-0.105	0.278	0.796	0.641	5.343	4.668
151	300	1000	500	503	448	531	71	0.031	0.396	0.370	0.306	3.283	2.849
152	300	1001	500	501	464	550	111	-0.057	0.397	0.296	0.305	2.939	2.689
153	300	999	500	499	407	480	71	0.007	0.391	0.216	0.281	3.873	3.684
154	300	1000	500	499	414	461	64	-0.054	0.321	0.179	0.188	3.551	3.503
155	300	1001	500	501	420	479	103	-0.106	0.365	0.158	0.224	2.973	3.208
156	300	1000	500	497	403	463	79	-0.054	0.364	0.228	0.198	3.483	3.538
157	300	999	500	499	489	568	78	0.002	0.372	0.342	0.463	3.544	3.433
158	300	999	500	503	410	428	74	-0.161	0.260	0.261	0.377	2.921	3.155
159	300	1000	500	494	429	521	89	0.006	0.419	0.551	0.441	3.374	3.206
160	300	1000	500	499	489	610	105	0.036	0.446	0.529	0.798	4.075	4.992
161	300	1000	500	501	396	543	100	0.120	0.531	0.353	0.519	3.997	4.124
162	300	1000	500	508	512	559	85	-0.092	0.303	0.413	0.351	3.864	3.581
163	300	999	500	497	364	450	92	-0.018	0.436	0.241	0.407	2.702	3.052
164	300	1000	495	499	429	515	80	0.015	0.409	0.065	0.247	2.864	3.168
165	300	1000	495	495	343	414	89	-0.050	0.418	0.224	0.343	3.310	3.025
166	300	999	495	499	476	549	78	-0.012	0.366	0.168	0.143	4.042	3.662
167	300	1000	495	501	358	422	68	-0.010	0.391	0.240	0.363	3.446	3.979
168	300	1000	495	497	445	520	80	-0.015	0.379	0.599	0.813	4.309	4.811
169	300	1000	495	502	356	454	84	0.041	0.466	0.256	0.397	3.543	3.543
170	300	1000	490	491	291	374	104	-0.064	0.473	0.370	0.370	3.505	3.381
171	300	1000	490	489	313	390	103	-0.073	0.448	0.078	0.181	3.498	3.117
172	300	1000	490	493	398	482	105	-0.050	0.421	0.135	0.290	4.376	4.096
173	300	999	490	494	356	406	69	-0.063	0.354	0.350	0.108	3.896	3.481
174	300	1000	490	478	358	425	85	-0.052	0.399	0.477	0.268	4.079	3.164
175	300	1000	490	492	506	546	93	-0.123	0.295	0.449	0.339	5.719	4.460
176	300	1000	485	482	337	413	75	0.003	0.430	0.098	0.065	3.597	3.368
177	300	1000	485	487	385	469	88	-0.011	0.423	1.065	0.950	6.940	6.098
178	300	1000	485	481	238	309	76	-0.019	0.480	0.072	0.372	2.929	3.113
179	300	1001	485	485	282	366	115	-0.086	0.485	0.151	0.549	2.991	3.584
180	300	1000	485	482	310	376	76	-0.035	0.418	0.051	0.134	2.959	2.858

LL VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
181	300	1000	485	484	366	499	98	0.094	0.523	0.485	0.548	3.161	3.027
182	300	1000	480	477	489	561	79	-0.019	0.359	0.519	0.481	3.786	3.746
183	300	1000	480	479	360	457	100	-0.009	0.459	0.350	0.532	3.477	4.000
184	300	1001	480	477	229	320	108	-0.053	0.537	0.067	0.122	2.654	2.619
185	300	999	480	483	313	412	94	0.014	0.490	0.047	0.307	2.977	3.182
186	300	1000	480	483	370	450	87	-0.020	0.423	-0.049	0.610	2.953	4.884
187	300	1000	480	482	333	386	85	-0.095	0.381	-0.002	0.132	3.712	3.588
188	300	1000	475	480	287	374	69	0.064	0.486	0.426	0.462	3.932	3.554
189	300	1000	475	476	271	332	95	-0.104	0.440	0.288	0.480	2.980	3.515
190	300	1000	475	475	305	407	86	0.050	0.502	0.223	0.364	3.183	3.301
191	300	999	475	474	286	386	91	0.024	0.508	0.232	0.361	3.016	3.128
192	300	1000	475	475	274	403	103	0.075	0.568	0.167	0.545	3.593	4.736
193	300	1000	475	475	263	347	86	-0.004	0.493	0.299	0.356	3.243	3.129
194	300	1000	470	470	258	380	89	0.110	0.574	0.191	0.620	3.632	4.293
195	300	1000	465	469	405	447	85	-0.118	0.325	0.302	0.543	3.598	3.978
196	300	999	460	464	354	437	97	-0.039	0.436	0.163	0.299	4.083	3.665
197	300	1000	455	459	311	391	97	-0.047	0.454	0.216	0.251	3.258	3.441
198	300	1000	450	451	254	330	83	-0.025	0.480	0.050	0.100	2.880	2.954
199	300	1000	450	452	358	468	97	0.037	0.486	0.325	0.558	5.192	4.403
200	300	1001	450	456	357	483	98	0.074	0.514	0.389	0.662	3.221	3.649
201	300	1000	450	445	314	385	82	-0.035	0.429	0.311	0.506	3.181	3.604
202	300	1000	450	452	349	384	75	-0.124	0.324	0.173	0.011	3.537	3.159
203	300	1000	450	452	351	459	91	0.050	0.488	0.234	0.507	3.413	3.887
204	300	1001	450	457	335	451	138	-0.051	0.510	0.280	0.515	4.284	5.391
205	300	1000	445	441	310	424	98	0.047	0.520	0.516	0.728	3.914	4.025
206	300	999	440	439	337	393	73	-0.054	0.380	0.062	0.219	3.645	3.353
207	380	1000	435	441	359	464	89	0.066	0.481	0.623	0.388	5.328	4.020
208	300	1000	430	432	432	471	101	-0.147	0.322	0.095	0.111	2.907	2.950
209	300	999	425	415	359	443	85	-0.002	0.436	0.417	0.465	4.538	4.780
210	300	1000	420	420	409	487	93	-0.040	0.401	0.158	0.405	3.802	3.992
211	300	1000	415	419	297	400	90	0.038	0.508	0.546	0.555	4.073	3.473
212	300	1001	410	416	387	534	115	0.075	0.528	0.237	0.594	3.530	3.859
213	300	1001	405	403	323	412	122	-0.085	0.470	0.178	0.267	2.829	3.014
214	300	1000	400	404	276	325	94	-0.138	0.411	0.063	0.267	3.184	3.490
215	300	1000	400	397	289	367	91	-0.040	0.462	0.344	0.313	3.435	2.991
216	300	1000	400	405	362	436	80	-0.017	0.412	0.344	0.333	4.206	3.972
217	300	1000	400	410	359	468	84	0.070	0.485	0.423	0.597	3.793	3.593
218	300	999	400	401	279	336	67	-0.036	0.413	0.288	0.440	3.260	3.250
219	300	1000	400	399	238	303	75	-0.039	0.464	-0.002	0.260	3.007	3.365
220	300		400	397	307								
221	300	1000	400	398	299	358	80	-0.067	0.411	0.076	0.342	3.899	3.193
222	300	999	400	398	315	348	67	-0.115	0.329	0.240	0.350	2.954	3.551
223	300	1000	400	403	346	402	76	-0.061	0.379	0.484	0.393	3.595	3.489
224	300	999	395	397	348	366	64	-0.157	0.266	-0.003	-0.009	3.065	3.073
225	300	999	390	391	317	392	83	-0.027	0.437	0.127	0.217	2.950	3.175
226	300	1000	385	384	310	386	88	-0.037	0.444	0.132	0.262	3.025	2.871
227	300	1000	380	385	300	406	84	0.067	0.513	0.261	0.433	3.756	3.076
228	380	1000	375	376	304	385	117	-0.097	0.466	0.149	0.370	2.739	3.381
229	300	1000	370	374	325	428	91	0.033	0.490	0.554	0.684	4.705	4.783
230	300	1000	365	374	307	404	95	0.006	0.490	0.157	0.379	3.393	3.540
231	300	1000	360	365	308	402	85	0.027	0.484	0.117	0.404	3.307	3.431
232	300	1000	355	360	266	413	118	0.083	0.601	0.515	0.590	3.782	3.850
233	300	1000	350	355	252	345	74	0.071	0.524	-0.015	0.126	3.249	2.944
234	300	1001	350	354	210	340	138	-0.026	0.618	0.176	1.124	3.449	9.180
235	300	1000	350	356	265	351	91	-0.016	0.495	0.422	0.453	4.856	4.098
236	300	1000	350	351	212	329	87	0.110	0.603	-0.019	0.479	3.021	4.199
237	300	1000	350	355	320	402	76	0.018	0.450	0.575	0.998	4.029	4.867
238	300	1000	350	355	210	305	106	-0.036	0.559	0.384	0.688	3.534	4.254
239	300	1001	350	356	263	365	109	-0.018	0.530	0.290	0.612	3.774	4.620
240	300	1000	350	356	288	364	96	-0.059	0.460	0.193	0.247	3.071	2.989

LL VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
241	300	1000	350	360	213	255	83	-0.155	0.428	0.069	0.299	3.380	3.039
242	300	1001	350	352	189	304	105	0.038	0.616	-0.077	0.608	3.324	5.157
243	300	1000	345	344	254	341	98	-0.031	0.508	-0.018	0.294	2.913	3.769
244	300	1000	340	344	293	397	93	0.031	0.512	0.531	0.551	4.626	3.731
245	300	1000	335	337	229	315	80	0.021	0.522	-0.058	0.163	3.202	3.141
246	300	999	330	336	289	363	78	-0.014	0.452	-0.204	0.138	3.575	3.075
247	300	999	325	330	316	390	81	-0.021	0.436	0.062	0.267	3.421	3.669
248	300	1001	320	322	255	430	120	0.159	0.650	-0.019	0.446	3.148	3.562
249	300	1001	315	315	205	311	121	-0.049	0.584	-0.154	0.467	3.059	3.857
250	300	1000	310	314	273	339	92	-0.083	0.447	0.137	0.084	3.042	2.757
251	300	1000	305	302	281	394	76	0.127	0.547	0.413	0.334	3.219	2.824
252	300	1000	300	305	309	426	105	0.031	0.524	0.087	0.381	3.182	3.652
253	300	999	300	310	378	465	76	0.034	0.435	0.230	0.311	3.365	3.485
254	300	1000	300	306	303	406	118	-0.039	0.505	-0.153	0.197	3.522	4.226
255	300	1001	300	304	337	500	128	0.084	0.575	0.494	0.720	4.084	4.372
256	300	1000	300	309	440	570	105	0.057	0.480	0.564	0.649	5.000	4.492
257	300	1000	300	300	272	397	85	0.131	0.572	0.195	0.461	3.652	3.749
258	300	1000	300	303	332	400	75	-0.024	0.413	-0.186	0.108	2.548	2.963
259	300	999	300	300	376	435	90	-0.086	0.376	0.450	0.583	3.547	3.664
260	300	999	300	305	262	319	92	-0.114	0.433	-0.003	0.213	2.575	3.209
261	300	1000	300	304	251	343	92	-0.003	0.517	0.166	0.122	3.510	3.142

JS VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
1	300	999	300	308	2456	2474	78	-0.068	0.109	0.419	0.402	4.644	4.491
2	298 (2)	1000	300	306	1245	1338	116	-0.030	0.266	0.092	0.128	4.973	4.315
3	300	999	300	314	1086	1156	67	0.006	0.247	0.012	-0.092	3.250	3.286
4	300	1000	300	315	689	765	78	-0.005	0.315	0.173	0.604	4.156	5.894
5	300	1000	300	314	1090	1190	73	0.050	0.295	0.537	0.648	5.626	5.713
6	299 (1)	1000	300	288	1015	1071	70	-0.027	0.229	0.414	0.481	4.622	5.062
7	300	1000	300	285	926	1015	96	-0.012	0.296	0.301	0.258	4.046	3.703
8	299 (1)	1000	300	287	854	1010	103	0.090	0.402	0.468	0.811	4.702	6.590
9	300	1000	300	292	1550	1659	107	0.003	0.257	1.421	1.367	8.803	8.354
10	300	1000	300	285	900	944	96	-0.088	0.233	0.205	0.226	3.283	3.088
11	300	1000	300	292	861	900	85	-0.086	0.224	0.179	0.242	3.097	2.944
12	300	999	300	295	771	879	88	0.040	0.353	0.215	0.117	3.017	2.739
13	300	1000	300	308	899	973	95	-0.037	0.278	0.597	0.571	3.908	4.037
14	300	1000	300	296	1001	1037	96	-0.097	0.209	0.676	0.667	5.612	5.621
15	300	999	300	303	1210	1292	80	0.003	0.251	-0.546	-0.518	6.825	7.014
16	300	1000	300	304	666	737	95	-0.047	0.314	0.086	0.211	3.081	3.250
17	300	1000	300	293	750	882	81	0.103	0.398	0.408	0.619	3.454	4.137
18	300	1000	300	288	780	871	84	0.014	0.323	0.533	0.479	4.432	3.893
19	300	1000	300	300	552	627	106	-0.065	0.351	0.091	0.260	3.961	3.244
20	300	1000	300	294	579	640	94	-0.070	0.316	0.235	0.469	3.546	4.767
21	300	1000	300	294	588	636	83	-0.081	0.284	0.143	0.036	3.314	3.260
22	300	1000	300	295	527	553	97	-0.158	0.265	0.046	0.200	3.494	3.316
23	300	1000	300	296	559	620	84	-0.052	0.318	0.202	0.257	3.229	3.364
24	300	1000	300	307	806	862	74	-0.038	0.257	-0.046	-0.091	3.221	3.011
25	300	1000	300	300	659	710	100	-0.095	0.284	0.121	0.195	2.979	2.948
26	300	1001	300	296	581	712	126	0.009	0.430	0.037	0.455	2.711	4.363
27	300	1000	300	292	691	707	87	-0.144	0.208	0.102	0.062	3.502	3.500
28	300	1000	300	300	519	585	90	-0.057	0.339	0.366	0.276	3.709	3.642
29	300	1000	300	290	637	762	98	0.053	0.408	0.289	0.394	3.028	3.478
30	300	999	300	298	500	567	70	-0.008	0.343	0.227	0.349	4.140	4.157
31	300	1001	300	291	613	733	101	0.038	0.406	0.112	0.313	3.662	3.440
32	300	1001	300	294	433	523	121	-0.066	0.420	0.142	0.436	3.101	3.254
33	300	1000	300	287	558	651	89	0.009	0.379	0.453	0.527	3.819	3.784
34	300	1000	300	295	455	555	98	0.005	0.424	0.258	0.120	3.487	2.857
35	300	999	300	302	523	565	85	-0.104	0.289	0.445	0.459	3.716	3.519
36	300	1000	300	295	492	531	79	-0.100	0.289	-0.107	-0.207	2.980	2.822
37	300	1000	300	291	440	486	82	-0.095	0.319	-0.051	-0.032	3.007	3.024
38	300	999	300	291	572	642	76	-0.015	0.330	-0.130	-0.071	3.370	3.103
39	300	999	300	291	540	601	65	-0.011	0.319	0.161	0.220	4.010	3.803
40	300	1000	300	292	407	443	81	-0.123	0.309	0.208	0.238	3.175	3.135
41	300	998	300	297	460	511	69	-0.052	0.317	0.238	0.325	3.101	3.060
42	300	1000	300	294	754	789	100	-0.118	0.241	0.511	0.538	3.649	3.727
43	300	1000	300	297	656	751	96	-0.003	0.355	0.389	0.445	4.117	4.349
44	300	1002	300	288	630	716	120	-0.063	0.351	0.481	0.378	4.113	3.544
45	297 (3)	1000	300	296	591	636	77	-0.075	0.275	0.292	0.249	3.222	3.199
46	300	1000	300	298	388	441	88	-0.096	0.357	0.332	0.326	3.005	2.966
47	300	1000	300	300	494	519	89	-0.152	0.264	0.252	0.143	2.731	2.632
48	300	1000	300	296	635	663	84	-0.121	0.237	-0.136	-0.344	7.642	7.455
49	300	999	300	288	514	592	86	-0.021	0.362	0.533	0.469	3.568	3.595
50	300	1000	300	294	598	663	98	-0.067	0.320	0.102	0.252	2.885	3.768
51	300	1000	300	291	532	584	74	-0.056	0.303	-0.168	0.099	3.650	4.187
52	300	1000	300	291	581	661	81	-0.003	0.348	0.163	0.098	3.853	3.658
53	300	1001	300	292	483	527	101	-0.129	0.315	0.272	0.207	3.140	3.116
54	300	1000	300	294	554	585	79	-0.115	0.255	0.209	0.125	3.390	3.214
55	300	999	300	298	499	544	80	-0.088	0.299	0.194	0.304	3.172	3.354
56	300	999	305	300	641	669	77	-0.110	0.232	0.434	0.299	3.196	3.151
57	300	999	305	302	377	443	71	-0.014	0.387	0.099	0.180	3.325	3.421
58	300		305	300	509								
59	300	1001	305	303	462	523	102	-0.096	0.352	0.010	0.076	3.592	3.249
60	300	1000	305	301	472	514	85	-0.107	0.305	-0.070	-0.141	4.013	3.889

JS VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
61	300	1000	310	310	489	555	94	-0.065	0.350	0.298	0.298	2.892	2.820
62	300	1000	310	307	570	624	81	-0.062	0.300	-0.141	0.091	4.442	4.014
63	300	999	310	310	456	493.	72	-0.096	0.289	0.287	0.254	3.299	3.078
64	300	1000	310	309	360	416	95	-0.104	0.381	-0.052	0.211	2.910	2.964
65	300	1000	310	316	557	630	74	-0.002	0.340	0.299	0.416	3.326	3.864
66	300	1000	315	324	524	577	88	-0.082	0.312	0.307	0.285	3.444	3.316
67	300	1000	315	317	522	581	105	-0.099	0.331	0.290	0.374	3.059	3.072
68	300	1000	315	312	563	614	88	-0.082	0.300	0.172	0.098	3.605	3.304
69	300	1000	315	304	491	558	85	-0.045	0.349	0.499	0.442	3.931	3.764
70	300	1000	315	317	562	605	82	-0.093	0.279	-0.114	0.104	4.691	3.756
71	300	999	320	314	572	656	63	0.054	0.361	0.095	0.074	3.485	3.831
72	300	1000	320	317	509	569	105	-0.097	0.338	0.277	0.201	2.843	2.790
73	300	999	320	320	608	679	91	-0.042	0.327	0.522	0.525	3.475	3.450
74	300	1000	320	324	663	747	104	-0.039	0.337	0.116	0.201	3.327	3.501
75	300	1000	320	318	468	508	83	-0.110	0.298	-0.018	0.138	3.023	3.123

RW VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
391	300	1001	300	300	782	846	116	-0.087	0.287	0.787	0.903	5.578	5.367
392	300	1000	300	302	538	570	89	-0.129	0.270	-0.028	-0.015	3.248	2.884
393	300	1000	300	306	463	460	80	-0.215	0.202	0.086	0.471	3.422	4.411
394	300	1000	300	307	464	468	73	-0.186	0.209	-0.212	-0.109	3.177	3.194
395	300	1000	300	302	308	391	85	-0.007	0.459	0.062	0.155	3.024	3.045
396	300	1000	300	308	555	553	76	-0.189	0.181	0.451	0.329	4.093	3.973
397	300	999	300	302	354	377	84	-0.177	0.300	-0.081	-0.064	2.798	2.919
398	300	999	300	297	537	562	85	-0.140	0.252	0.285	0.159	3.708	3.840
399	300	1000	300	303	505	529	86	-0.149	0.257	0.013	0.117	3.274	3.115
400	300	1000	300	301	472	468	81	-0.219	0.197	-0.402	-0.202	3.819	4.199
401	300	1000	300	297	419	439	90	-0.180	0.277	-0.188	0.006	2.898	3.206
402	300	1000	300	296	440	476	83	-0.123	0.299	0.021	-0.021	3.346	3.148
403	300	1000	300	301	419	454	81	-0.125	0.302	0.065	0.027	3.159	2.973
404	300	1000	300	288	360	409	73	-0.072	0.354	-0.036	0.070	3.058	2.890
405	300	1000	300	299	371	415	102	-0.148	0.356	-0.098	-0.237	2.498	2.748
406	300	1000	300	304	483	532	81	-0.081	0.313	-0.200	-0.027	2.885	2.702
407	300	1000	300	300	371	382	90	-0.215	0.274	-0.094	-0.044	2.695	2.704
408	300	1001	300	301	511	485	106	-0.283	0.177	-0.111	-0.018	3.270	2.969
409	300	999	300	306	404	460	94	-0.096	0.362	0.023	0.167	3.396	3.361
410	300	999	300	300	396	436	91	-0.134	0.330	0.041	0.180	3.036	2.852
411	300	999	300	294	295	349	108	-0.152	0.418	0.019	0.452	3.173	4.447
412	300	1000	300	301	319	388	69	-0.002	0.421	-0.141	0.057	3.392	3.101
413	300	1000	300	291	400	415	87	-0.194	0.269	-0.137	-0.111	2.980	3.087
414	300	999	300	302	386	429	72	-0.086	0.329	0.033	0.212	3.179	2.961
415	300	1000	300	299	290	355	83	-0.059	0.431	0.257	0.475	3.198	3.489
416	300	1000	300	300	272	343	82	-0.035	0.458	0.328	0.485	3.227	3.652
417	300	1000	300	297	386	437	76	-0.071	0.351	1.045	0.792	7.805	6.477
418	300	1000	300	299	321	382	71	-0.033	0.400	0.391	0.436	3.310	2.897
419	300	1001	300	294	345	417	109	-0.096	0.424	0.153	0.505	2.948	3.665
420	300	1001	300	294	340	396	106	-0.132	0.396	0.035	0.138	3.179	3.142
421	300	999	300	300	357	386	71	-0.131	0.303	0.158	0.108	3.114	2.986
422	300	999	300	299	337	388	69	-0.058	0.368	0.274	0.379	2.955	3.252
423	300	1000	300	302	337	352	76	-0.189	0.279	0.210	0.179	2.778	2.616
424	300	1000	300	303	419	467	71	-0.088	0.326	0.555	0.762	4.793	5.410
425	300	1001	300	297	328	343	106	-0.244	0.318	0.120	0.298	3.006	3.175
426	300	1001	300	301	276	342	109	-0.123	0.454	0.066	0.239	2.861	3.086
427	300	999	300	306	301	348	78	-0.102	0.379	0.195	0.114	2.781	3.011
428	300	1000	300	303	350	379	89	-0.170	0.322	0.032	0.126	2.786	2.600
429	300	999	300	304	301	308	74	-0.228	0.267	-0.358	0.209	3.565	3.694
430	300	999	300	303	279	340	94	-0.101	0.434	0.133	0.205	3.023	3.327
431	300	999	300	292	259	312	91	-0.123	0.428	0.087	-0.006	3.320	2.963
432	300	1000	300	300	288	358	156	-0.201	0.479	0.013	0.609	3.447	5.013
433	300	1000	300	298	357	407	107	-0.146	0.376	-0.128	-0.229	2.972	3.064
434	300	999	300	299	291	302	85	-0.235	0.300	-0.337	-0.232	3.624	3.512
435	300	999	300	300	303	334	94	-0.186	0.353	-0.187	-0.115	3.250	3.056
436	300	1000	300	297	280	342	80	-0.061	0.429	0.280	0.377	3.060	3.329
437	300	1001	300	295	207	258	106	-0.185	0.476	-0.007	0.198	3.004	2.878
438	300	1000	300	299	325	381	68	-0.041	0.384	-0.025	0.199	3.795	3.509
439	300	1000	300	294	331	358	93	-0.190	0.328	0.241	-0.016	3.414	3.339
440	300	1000	300	296	264	336	87	-0.049	0.466	0.124	0.388	2.939	3.743
441	300	1000	305	307	375	453	83	-0.012	0.416	-0.026	0.190	3.425	3.796
442	300	1000	310	311	239	316	81	-0.013	0.495	0.209	0.326	2.854	3.036
443	300	999	315	316	314	337	71	-0.162	0.302	-0.058	0.282	3.362	3.389
444	300	999	320	318	284	337	69	-0.060	0.398	0.265	0.544	3.226	3.678
445	300	1000	325	332	305	364	76	-0.055	0.407	-0.122	-0.010	2.661	3.042
446	300	1000	330	332	293	345	71	-0.066	0.392	0.224	0.298	3.710	3.400
447	300	1000	335	340	355	404	85	-0.102	0.362	0.158	0.127	2.931	2.744
448	300	1000	340	347	324	403	80	-0.004	0.442	0.206	0.312	3.209	3.476
449	300	1000	345	347	310	354	69	-0.085	0.361	0.241	0.572	3.544	4.075
450	300	1000	350	358	280	326	104	-0.171	0.407	-0.018	0.141	2.946	3.018

RW VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	VARIANCE OF RL+FP	VARIANCE OF FP	CORRELATION OF RL,FP	CORRELATION OF RL+FP,FP	ROOT B1 OF RL	ROOT B1 OF RL+FP	KURTOSIS (B2) RL	KURTOSIS (B2) RL+FP
451	300	1000	350	353	216	291	103	-0.095	0.514	0.216	0.381	3.846	4.458
452	300	1000	350	355	335	371	90	-0.154	0.345	0.064	0.229	2.787	2.832
453	300	1000	350	344	382	433	94	-0.113	0.360	-0.188	-0.061	3.350	3.632
454	300	1000	350	348	299	407	87	0.063	0.517	0.074	0.623	3.291	4.765
455	300	999	350	347	230	274	73	-0.109	0.415	0.111	0.287	2.775	3.358
456	300	999	350	356	306	404	97	0.003	0.492	-0.168	0.262	2.806	4.020
457	300	1000	360	370	328	381	90	-0.106	0.387	0.638	0.974	5.952	7.424
458	300	1000	365	366	394	484	94	-0.012	0.430	0.281	0.333	3.453	3.294
459	300	999	370	379	348	399	72	-0.069	0.362	0.131	0.254	3.273	3.299
460	300	1000	375	372	372	420	76	-0.084	0.346	0.450	0.399	3.739	3.211
461	300	1000	380	386	428	519	85	0.014	0.418	0.506	0.636	4.341	3.748
462	300	1000	385	382	330	395	78	-0.039	0.409	0.071	0.084	3.546	3.350
463	300	999	390	395	326	397	90	-0.058	0.425	0.265	0.507	3.432	4.191
464	300	1001	395	400	544	660	103	0.027	0.420	0.312	0.405	3.598	3.875
465	300	1001	400	397	494	533	87	-0.116	0.291	1.246	0.958	10.094	8.049
466	300	999	400	399	476	515	67	-0.078	0.285	0.181	0.139	3.639	3.534
467	300	1001	400	404	485	595	89	0.052	0.433	0.085	0.111	3.162	2.625
468	300		400	407	477								
469	300	1000	400	404	557	611	87	-0.075	0.305	-0.126	-0.021	3.642	3.996
470	300	1000	400	407	447	496	76	-0.072	0.324	0.382	0.522	3.247	4.018
471	300	1001	400	406	310	435	156	-0.070	0.540	-0.009	0.874	3.940	8.772
472	300	1000	400	406	443	487	107	-0.145	0.330	0.304	0.557	2.776	3.419
473	300	1001	400	400	407	476	109	-0.093	0.392	0.609	0.466	4.242	3.372
474	300	1000	400	402	344	422	96	-0.050	0.431	0.450	0.766	3.582	4.942
475	300	1000	400	397	493	506	104	-0.203	0.254	0.491	0.421	3.327	3.173
476	300	999	400	396	442	510	80	-0.032	0.366	0.604	0.563	3.705	3.354
477	300	1000	400	395	408	464	119	-0.145	0.371	0.384	0.472	4.010	3.597
478	300	1000	400	392	332	397	85	-0.057	0.411	0.157	0.307	3.884	3.935
479	300	1000	400	395	449	535	85	0.002	0.401	0.487	0.491	4.078	3.800
480	300	1000	400	395	394	430	90	-0.142	0.322	0.295	0.416	3.056	3.572
481	300	1001	400	399	366	441	122	-0.112	0.424	0.051	0.235	3.070	3.366
482	300	1000	400	400	366	402	70	-0.108	0.316	0.190	-0.022	3.861	3.669
483	300	1001	400	396	403	455	106	-0.132	0.359	0.485	0.638	4.275	4.164
484	300	1000	400	397	430	554	100	0.056	0.474	0.098	0.306	2.986	3.433
485	300	999	390	392	412	525	78	0.094	0.470	0.047	0.274	3.103	2.869
486	300	1000	390	395	260	329	89	-0.067	0.461	0.012	0.152	2.746	2.726
487	300	1000	390	388	332	383	95	-0.124	0.382	0.344	0.301	3.737	3.639
488	300	1000	390	396	275	327	80	-0.094	0.408	0.018	0.125	2.655	2.790
489	300	1000	390	384	261	297	79	-0.150	0.376	0.022	0.077	3.861	4.219
490	300	1001	380	384	333	410	105	-0.073	0.439	-0.179	-0.028	3.246	3.632
491	300	1000	380	376	310	377	96	-0.085	0.428	-0.137	0.173	2.594	3.417
492	300	1000	380	372	316	375	81	-0.069	0.401	0.209	0.296	3.486	3.185
493	300	1000	380	384	282	363	95	-0.044	0.473	0.154	0.419	2.578	2.919
494	300	1000	380	381	318	337	84	-0.199	0.304	0.217	0.012	3.165	2.721
495	300	1000	370	377	379	421	78	-0.106	0.331	0.318	0.361	3.602	3.760
496	300	1000	370	370	292	360	120	-0.139	0.453	-0.156	0.148	2.865	3.697
497	300	1000	370	375	262	322	91	-0.103	0.439	0.032	0.269	3.417	3.626
498	300	1000	370	372	326	399	83	-0.029	0.430	-0.044	0.354	2.903	4.212
499	300	1000	370	376	327	414	82	0.016	0.459	0.041	0.159	2.742	2.927
500	300	1000	360	360	306	386	94	-0.042	0.457	-0.352	0.137	3.429	3.938
501	300	999	360	362	303	346	88	-0.135	0.377	-0.149	-0.068	2.749	3.044
502	300	1001	360	364	316	376	109	-0.131	0.418	-0.128	-0.047	2.707	2.672
503	300	999	360	367	345	412	85	-0.053	0.406	0.221	0.325	5.631	5.289
504	300	999	360	365	755	762	72	-0.138	0.170	-0.013	-0.120	3.217	3.269
505	300	999	350	356	204	253	66	-0.073	0.447	-0.148	-0.015	3.136	2.734
506	300	1000	350	355	300	323	74	-0.171	0.315	-0.008	0.172	2.943	2.729
507	300	999	350	353	348	349	73	-0.225	0.231	-0.094	-0.096	2.643	2.680
508	300	1000	350	357	232	286	82	-0.100	0.445	0.240	0.091	3.368	3.251
509	300	1000	350	352	263	304	78	-0.132	0.384	0.161	0.093	2.856	3.109
510	300	1001	340	342	267	266	118	-0.334	0.331	-0.019	0.089	2.797	2.985

RW VISUAL

SESS	NUMBER TRIALS	MEAN FP	SYNCH INT	MEAN RL	VARIANCE OF RL	RL+FP	FP	CORRELATION OF RL,FP	RL+FP,FP	ROOT B1 OF RL	RL+FP	KURTOSIS (B2) RL	RL+FP
511	300	1000	340	346	256	309	87	-0.116	0.425	-0.038	0.121	2.979	2.729
512	300	999	340	343	221	296	81	-0.022	0.504	0.087	0.381	3.284	3.741
513	300	1000	340	344	240	276	91	-0.187	0.401	0.117	0.167	2.935	3.161
514	300	1000	340	342	238	282	92	-0.162	0.423	0.198	0.503	3.636	3.487
515	300	1000	330	331	291	338	74	-0.094	0.381	0.045	0.393	3.565	4.060
516	300	1000	330	334	198	293	91	0.015	0.570	0.068	0.597	2.827	4.279
517	300	1000	330	329	261	287	95	-0.221	0.365	-0.218	0.249	3.064	3.554
518	300	1000	330	330	213	255	84	-0.155	0.430	0.117	0.299	2.840	2.979
519	300	1000	330	335	291	323	78	-0.153	0.347	0.278	0.343	3.388	3.462
520	300	1000	320	328	184	284	120	-0.069	0.595	0.009	1.009	3.306	6.890
521	300	1000	320	321	312	370	91	-0.097	0.406	-0.042	-0.018	2.971	3.025
522	300	1001	320	323	213	249	73	-0.146	0.405	-0.001	-0.097	2.850	3.237
523	300	1000	320	331	238	281	75	-0.122	0.406	-0.056	0.019	3.524	3.594
524	300	1000	320	323	212	252	76	-0.144	0.418	-0.048	0.192	2.979	3.213
525	300	1000	310	309	253	296	85	-0.146	0.401	-0.054	0.150	3.182	2.910
526	300	999	310	319	183	257	81	-0.028	0.538	-0.109	0.219	4.120	3.984
527	300	999	310	315	298	292	77	-0.272	0.239	-0.128	0.337	2.858	3.423
528	300	1000	310	317	190	254	91	-0.100	0.510	0.188	0.205	2.871	2.936
529	300	1001	310	314	264	317	119	-0.186	0.444	0.325	0.320	3.211	3.072
530	300	1000	300	304	234	279	91	-0.157	0.426	-0.133	0.145	3.174	3.344
531	300	1000	300	296	215	295	96	-0.057	0.521	-0.066	0.232	3.047	3.081
532	300	1000	300	298	236	265	76	-0.177	0.370	-0.052	0.244	2.674	3.140
533	300	1000	300	302	218	271	81	-0.106	0.452	0.006	0.135	3.151	3.316
534	300	1000	300	292	344	371	76	-0.151	0.307	0.144	0.117	3.396	3.346
535	300	1000	300	303	310	373	91	-0.082	0.419	-0.035	0.029	3.663	3.294
536	300	1000	300	302	245	284	74	-0.133	0.388	0.139	0.229	3.079	2.944
537	300	1000	300	301	260	288	80	-0.179	0.357	0.068	0.117	3.111	3.374
538	300	1000	300	299	261	295	85	-0.173	0.375	-0.223	-0.104	3.074	3.975
539	300	1000	300	305	247	298	118	-0.198	0.449	-0.311	-0.247	3.236	3.383
540	300	1000	300	300	270	288	92	-0.233	0.340	-0.024	0.046	3.562	3.323
541	300		300	300	305								
542	300	1001	300	300	258	308	106	-0.170	0.432	-0.034	0.112	3.201	3.081
543	300	1000	300	295	322	373	96	-0.129	0.387	-0.505	-0.117	4.408	3.671
544	300	1001	300	297	239	253	73	-0.223	0.319	-0.289	-0.127	3.938	3.589
545	300	1000	300	300	313	377	87	-0.071	0.415	0.178	0.237	3.138	3.234
546	300	1000	300	302	255	272	69	-0.195	0.315	0.194	0.050	3.891	3.776
547	300	1000	300	295	276	290	91	-0.243	0.323	0.319	0.334	4.437	4.377
548	300	1000	300	303	308	332	87	-0.193	0.327	0.142	0.035	3.409	3.088
549	300	1000	300	298	283	297	80	-0.219	0.305	0.260	0.236	3.992	3.012

Appendix 2

Distributional Information

(a) Notation and Basic Theorems

Let $f(x)$ be the density function of a random variable X and denote the expected value of a function, $g()$, of X by $E(g(X))$. By definition (eg. Freund, 1971)

$$E(g(X)) = \Sigma g(x) * f(x) \quad \text{if X is discrete}$$
$$= \int g(x) * f(x)dx \quad \text{if X is continuous.}$$

Let μ be the population mean. For discrete distributions, the second, third and fourth central moments about the mean are defined as:

$$\mu_2 = \Sigma(x-\mu)^2 * f(x) = V(X) \text{ (Variance)}$$
$$\mu_3 = \Sigma(x-\mu)^3 * f(x)$$
$$\mu_4 = \Sigma(x-\mu)^4 * f(x).$$

The definitions for continuous distributions are the same except for replacement of discrete summation by integration.

The population coefficients of symmetry, $\sqrt{\beta_1}$, and kurtosis, β_2 are defined as:

$$\sqrt{\beta_1} = \mu_3/V(X)^{3/2}$$
$$\beta_2 = \mu_4/V(X)^2.$$

Symmetrically distributed variables have $\sqrt{\beta_1} = 0$. Positively skewed distributions (such as the geometric, exponential and chi-square) have positive symmetry coefficients.

Distributions with thin tails (data points many standard deviations from the mean are extremely unlikely) have low kurtosis coefficients. As extreme values become more likely, the kurtosis increases.

From Johnson and Kotz (1970) and Hastings and Peacock (1974), we obtain the following information:

Distribution	Variance	Coefficient of Symmetry	Coefficient of Kurtosis	4th Central Moment
Triangular	$q^2/6$	0	2.4	$q^4/15$
Normal	σ^2	0	3.0	$3\sigma^4$
Logistic	b^2	0	4.2	$4.2b^4$
Geometric	r/p^2	$(2-p)/\sqrt{r}$	$9+p^2/r$	$9r^2/p^4 + r/p^2$ $(r=1-p)$

Let X and Y be two random variables and let x and y be observed values of X and Y respectively. The variable Z is called the sum, or convolution, of X and Y when observed values, z, are formed by taking $z = x+y$.

Most of the work below will involve convolutions of two or more of the four distributions above. The following two theorems will be useful:

Expectation of a Product (Freund, 1971, p. 179)

If X and Y are statistically independent then $E(X \cdot Y) = E(X) \cdot E(Y)$.

Covariance of a Linear Combination (Freund, 1971, Theorem 6.4, p. 196)

If $X_1, X_2, \ldots, X_n$ are random variables and $c_1, c_2, \ldots, c_n$ and $d_1, d_2, \ldots, d_n$ are constants and $Y_1 = \Sigma c_i X_i$ and $Y_2 = \Sigma d_i X_i$, then the covariance of Y_1 and Y_2, $COV(Y_1,Y_2)$, is given by:

$$COV(Y_1,Y_2) = \Sigma c_i d_i V(X_i) + \sum_{i<j}\sum (c_i d_j + c_j d_i) \cdot COV(X_i,X_j).$$

Finally, the geometric variable of interest in the present work is the foreperiod duration. On the PDP-8 geometric variates were generated with a mean of 10 msec (plus 890), in units of 1 msec. On the Apple, geometric variates were generated in 200 microsecond units, with p = .0208608. Converting to milliseconds, the foreperiod distributions of the present research had the following statistics:

	Mean	Variance	$\sqrt{\beta_1}$	β_2	μ_3	μ_4
Apple	9.5874	90	2.00011	9.00044	1707.78	72903.6
PDP-8	10.0000	90	2.00278	9.01111	1710.00	72990.0

I will use the Apple values below.

(b) <u>Symmetry and Kurtosis of the Sum of Independent Random Variables</u>

Let X and Y be independent random variables and let Z be their convolution, Z = X+Y. Let the means of X, Y and Z be denoted μ_x, μ_y and μ_z respectively. Since X and Y are independent, the variance $V(Z) = V(X) + V(Y)$. By definition, the <u>symmetry</u> coefficient is $\sqrt{\beta_1} = \mu_3/V(Z)^{3/2} = E[(Z-\mu_z)^3]/V(Z)^{3/2}$. Focusing on the numerator, we have

$$E[(Z-\mu_Z)^3] = E[(X+Y-\mu_x-\mu_y)^3]$$

$$= E[(X-\mu_x)^3] + 3E[(X-\mu_x)(Y-\mu_y)^2] + 3E[(X-\mu_x)^2(Y-\mu_y)]$$

$$+ E[(Y-\mu_y)^2]$$

Since X and Y are independent, so are $(X-\mu_x)$ and $(Y-\mu_y)^2$, as are $(X-\mu_x)^2$ and $(Y-\mu_y)$. And since $E[X-\mu_x] = E[Y-\mu_y] = 0$, we have

$$E[(X-\mu_x)(Y-\mu_y)^2] = E[X-\mu_x] \times E[(Y-\mu_y)^2] = 0, \text{ and}$$

$$E[(X-\mu_x)^2(Y-\mu_y)] = E[(X-\mu_x)^2] \times E[Y-\mu_y] = 0. \text{ Thus,}$$

$$E[(Z-\mu_Z)^3] = E[(X-\mu_x)^3] + E[(Y-\mu_y)^3], \text{ and}$$

$$\sqrt{\beta_1} = \{E[(X-\mu_x)^3] + E[Y-\mu_y)^3]\}/\{V(X)+V(Y)\}^{3/2}.$$

Substituting X+Y for Z and dropping terms that reduce to zero, for <u>kurtosis</u> we have:

$$\beta_2 = E[((X-\mu_x)+(Y-\mu_y))^4]/\{V(X)+V(Y)\}^2$$

$$= \{E[(X-\mu_x)^4] + E[(Y-\mu_y)^4] + 6E[(X-\mu_x)^2(Y-\mu_y)^2]\}/\{V(X)+V(Y)\}^2$$

$$= \{E[(X-\mu_x)^4] + E[(Y-\mu_y)^4] + 6V(X)V(Y)\}/\{V(X)+V(Y)\}^2.$$

(c) <u>The Sum of a Triangular and a Normal Variable</u>

Kristofferson (1976) proposed that efferent latency variability could be described as normal and that the synchronization latency distribution was the convolution of independent triangular and normal variables. Hopkins (1982) originally used the logistic as an approximation to the normal, though the logistic kurtosis is substantially larger than the normal's. From the equation above, the kurtosis coefficient of this distribution is

$$\beta_2 = \{2.4q^4/36 + 3\sigma^4 + q^2\sigma^2\}/\{q^2/6 + \sigma^2\}^2.$$

This has a minimum of 2.4 when the normal variance is zero and a maximum of 3 when the triangular variance is zero. It increases monotonically between these two extremes. (I have checked this by examining the higher derivatives of the function.)

The kurtosis coefficients of the present data were generally larger than 3. In all of the experiments, averages across 5 sessions of the kurtosis coefficients were almost always larger than 3. This distribution does not describe the present data.

(d) Convolution of a Triangular and a Logistic Variable

Hopkins (1982) derived the density and distribution functions of this convolution. Unfortunately, there were two copying errors in his final equations for the cumulative distribution function. The integrations involved were not easy, so a final corrected formula should be made available. I have checked the following expression with him (Hopkins, personal communication, November 1, 1982) and by simulation. Let Z be the convolution of the two variables and F(Z) be its cumulative distribution function. Then, in the notation of Hopkins (1982),

$F(z) = 1 + A + B + C$, where

$A = (k/w^2)\int \ln(1+\exp((a-z)/k)dz$

$B = (k/w^2)\int \ln(1+\exp((2w+a-z)/k)dz$, and

$C = (2k/w^2)\int \ln(1+\exp(w+a-z)/k)dz$.

Translating notations, $w = q$, the quantum size, a is the logistic mean, and $k = \sqrt{3}b/\pi$, where b is the logistic standard deviation. For evaluation of the integrals, see Hopkins (1982, p. 251).

The variance of this distribution is $b^2 + q^2/6$. It is symmetrical. From the formula above for the kurtosis of a sum of two variables, we obtain

$$\beta_2 = 2.4(q^4 + 63b^4 + 15q^2b^2)/(q^2 + 6b^2)^2.$$

For later reference, the fourth central moment can be obtained by multiplying the kurtosis by the square of the variance of the convolution. It is

$$\mu_4 = (q^4 + 63b^4 + 15q^2b^2)/15.$$

The kurtosis is between 2.4 (when the logistic variance is zero) and 4.2 (when the triangular variance is zero). Let V(T) be the triangular variance and V(L) be the logistic variance. The kurtosis of the convolution is a strictly monotonically increasing function of V(L)/(V(T)+V(L)). The kurtosis is independent of scale. That is, suppose that you multiply q and b by a non-zero constant, c. The variances V(T) and V(L) will each change by a factor of c^2. (If V(T) was the variance before multiplication, the new variance is c^2V(T).) The numerator and denominator of the expression for kurtosis both change by a factor of c^4 and this constant factor divides out. The kurtosis depends only on the relative values of V(L) and V(T). If V(L)/(V(L)+V(T)) is constant, so is the kurtosis, whatever the value of V(L).

In Chapter 3 I tabled (Table 3) some examples of the kurtosis of the logistic-plus-triangle convolution as a function of V(L)/(V(L)+V(T)) (which I called b^2/V there). The values were obtained by setting V(L) to an arbitrary constant (100, except when the ratio was 0), adjusting V(T) to obtain ratios of 0.1, 0.2, etc., and computing the kurtosis from the formula above. Since the kurtosis is independent of scale, any other values of V(L) would have yielded the same results.

In Chapter 6 I estimated logistic variances of Kristofferson's (1976) data from kurtosis coefficients and overall variances of the latency distributions. This was done iteratively. The kurtosis of the logistic-plus-triangle convolution is strictly monotonically increasing with V(L)/(V(L)+V(T)). By virtue of monotonicity, there is a one-to-one relationship between kurtosis and this variance ratio. I wrote a short computer program that tried different variance ratios until it found one that yielded a kurtosis value extremely close to the sample kurtosis. This yielded, then, an estimate of V(L)/(V(L)+V(T)). According to Hopkins' model, synchronization latency variance is V(L)+V(T), the variance of a logistic variable plus that of a triangular variable, so by multiplying the estimated ratio V(L)/(V(L)+V(T)) by the response latency variance (V(L)+V(T)), we obtain an estimate of V(L), the logistic variance.

The estimate of V(L) so obtained is a "method of moments" estimate. This is an old and intuitively reasonable procedure but there is no guarantee that it is unbiased and such estimates, when they involve high moments, are often quite variable. Hopkins (1982) provided kurtosis coefficients, sample variances, and minimum chi-square estimators of the logistic variances of some distributions. He provided me with a few further groups of estimates (personal communication). I compared his estimates with those obtained in the way outlined above. The two estimation procedures yielded different values for the logistic variance but there was no tendency for one to yield higher values than the other. Minimum chi-square estimation may (or, given the flatness of its parameter space, as discussed in Chapter 3, may not) yield lower variance estimates of the logistic variance but it appears that with samples of 1500 observations (5 sessions) the two estimation procedures will on average yield the same estimates. (The sample size is important because the bias of a consistent estimator diminishes as the sample size increases. The distributions chosen from Kristofferson (1976) all involved at least 5 sessions.)

(e) Timing From WS or From P1

First, suppose that the subject times from P1. Let random variable ZP1 be the interval between P1 onset and the completion of the response and suppose that ZP1 is distributed as the convolution of two independent random variables, one logistic, the other triangular. Let the duration of the interval between the offset of the warning stimulus (WS) and the onset of P1, i.e. the foreperiod duration, be represented by FP. FP is geometrically distributed with a known parameter. Because timing units were 1 msec on the PDP-8 and .2 msec on the Apple, the geometric parameter differed across computers, resulting in very small differences in the shape of the geometric distribution on each machine. In what follows I will use the Apple values since most sessions were run on the Apple.

The interval from WS offset to the completion of the response is the sum of two independent (*ex hypothesis*) random variables, ZP1 and FP.

$$V(ZP1 + FP) = V(ZP1) + V(FP) = q^2/6 + b^2 + 90.$$

From Section (b) of this appendix, the symmetry coefficient is

$$\sqrt{\beta_1} = (E[(ZP1-E[ZP1])^3] + E[(FP-E[FP])^3])/V(ZP1+FP)^{3/2}$$

where E[ZP1] and E[FP] are the respective means of ZP1 and FP. ZP1 is symmetrical so its third central moment is 0. The third central moment of FP, as tabled in Section (a) of this appendix, is approximately 1708. Thus

$$\sqrt{\beta_1} = 1708/V(ZP1 + FP)^{3/2}.$$

The kurtosis of the sum of ZP1 and FP can also be found using the general kurtosis formula of Section (b) and the kurtosis and 4th moment of the sum of a logistic and a triangle obtained in Section (d). The calculations are straightforward but longer than those for symmetry. The final result is

$$\beta_2 = \frac{(q^4+63b^4+15q^2b^2)/15 + 90(q^2+6b^2) + 72904}{(b^2+q^2/6)^2 + 180(b^2+q^2/6) + 8100}$$

This is an unwieldy result. It may be worth noting that I have checked it (and almost all of the others in this appendix) by simulation.

These are the statistics of the distribution of response latencies obtained if the subject times exclusively from P1, with logistic-plus-triangular variability, and if we measure the response latency from the offset of WS.

Now suppose that the subject times from WS offset instead of from P1 onset. Let ZWS represent his response latency, i.e. the interval from WS offset to completion of the response, and suppose that ZWS is distributed as the sum of a logistic and a triangular variable (independent), just as we supposed for ZP1. Finally, suppose that the subject's timing is uninfluenced by the foreperiod duration, i.e. that ZWS and FP are independent.

If we measure the response latency relative to P1 in this case, on each trial we are subtracting the foreperiod duration from ZWS to obtain the final latency estimate (re P1). That is, we are measuring ZWS - FP.

All of the theorems above refer to addition of random variables rather than to subtraction. It is easy enough to recast this in terms of addition. Define a new variable, MFP, such that MFP = -FP. For example, if the foreperiod on a given trial is 999 msec, the value of MFP for that trial is -999. Multiplication by -1 has no effect on variance or kurtosis. The variances of MFP and FP, and their kurtoses, are the same. The symmetry coefficients of FP and MFP are the same in absolute magnitude, but they differ in sign. The symmetry coefficient of FP is approximately 1708. The symmetry coefficient of MFP is -1708.

$$V(ZWS-FP) = V(ZWS+MFP) = b^2+q^2/6.$$

This formula is identical to that for V(ZP1+FP) but I do not mean to imply here that the logistic (b^2) and triangular ($q^2/6$) variances are identical when the subject times from P1 and when the subject times from WS. The values of q and b may differ in the two cases. Given the values of q and b, the <u>expressions</u> for computing V(ZWS-FP) and V(ZP1+FP) are the same.

The symmetry coefficient for ZWS-FP is $-1708/V(ZWS-FP)^{3/2}$, the same as that for ZP1+FP except for the reversal in sign.

The expressions for kurtosis of ZP1+FP and ZWS-FP are the same.

The formulas in this Section are the basis for most of the entries in Table 5 of Chapter 4, which described the shapes of latency distributions when timing was from WS or from P1 and latencies were measured relative to WS or P1. Tables 5 and 6 and other sections of Chapter 4 also made reference to correlations between FP and response latency under the two models above. These are dealt with in the next and final section of this appendix.

(f) <u>Response Latency and Foreperiod Correlations</u>

Suppose that the subject times from P1, and let ZP1 be defined as in the previous Section. ZP1 is triangular-plus-logistic and is assumed independent of FP, the foreperiod duration.

Let COV(X,Y) be the symbol for the covariance of two random variables, X and Y and denote their correlation by CORR(X,Y). Since ZP1 is independent of FP *ex hypothesis*,

COV(ZP1,FP) = CORR(ZP1,FP) = 0.

If we measure response latencies from WS offset rather than from P1 onset, and correlate these with foreperiod duration, we are computing the correlation between ZP1+FP and FP. Casting this in terms of Freund's theorem 6.4, presented in Section (a) of this appendix, let Y_1 = ZP1+FP and let Y_2 = FP. Then

$$\begin{aligned} COV(ZP1+FP,FP) &= COV(Y_1,Y_2) \\ &= 0 \times V(ZP1) + 1 \times V(FP) + COV(ZP1,FP) \\ &= V(FP) \end{aligned}$$

$$\begin{aligned} \text{Thus } CORR(ZP1+FP,FP) &= V(FP)/(V(ZP1+FP) \times V(FP))^{1/2} \\ &= (V(FP)/V(ZP1+FP))^{1/2}. \end{aligned}$$

Now, suppose instead that the subject times from WS rather than from P1, represent the subject's response latency (from WS offset to response completion) by ZWS, assumed to be the sum of a logistic and a triangular variate, independent of FP. _Ex hypothesis_ CORR(ZWS,FP)=0.

If we measure response latencies from P1 rather than from WS, we are measuring ZWS-FP and the correlation of these measured latencies with the foreperiod durations is CORR(ZWS-FP,FP). Freund's theorem 6.4 is again directly applicable, with the same result as above except for a reversal in sign:

$$\mathrm{CORR}(\mathrm{ZWS}-\mathrm{FP},\mathrm{FP}) \doteq (\mathrm{V}(\mathrm{FP})/\mathrm{V}(\mathrm{ZWS}-\mathrm{FP}))^{1/2}.$$