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THE EFFECT OF A 0.5 Hz ELECTROMAGNETIC FIELD ON LEARNING, MEMORY, AND EMOTION DURING AN OPERANT INHIBITORY TASK ON YOUNG AND OLD RATS

by

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Abstract

Exposure to an extremely low frequency (.01 Hz to 100 Hz) electromagnetic field has been shown to cause changes in instrumental and open field behaviour. These changes could be explained by alterations in emotional lability, memory, or learning processes. Different effects have been shown for animals exposed at different ages. These three possible explanations and the age effect were investigated by exposing two age groups of rats to a 0.5 Hz fluctuating and rotating magnetic field. Thirty young male (250 gm) rats and thirty old (retired breeder) rats, at 80% ad lib. weight were pre-trained for two sessions on separate days in an inhibitory (DRL 6 second) operant task (plus one day magazine training) and then exposed to either the magnetic field generated by rotating horseshoe magnets, or to a "sham" field using lead slugs in the place of the magnets. Except when testing operant responses, the animals were kept in the field condition. After 72 hours in the field away from the operant task, the animals were allowed five daily sessions until 100 reinforcements each day were earned. Measures were taken of the number of fecal boluses produced (an emotionality measure), the time taken to earn the reinforcements, and the response latencies while

working for reinforcement. If memory was affected, differences would show on early re-test days, and if learning was affected, differences would show on later re-test days.

In fact, differences between experimental and control groups on learning, memory, and emotional lability were in the predicted direction, but failed to reach stastical significance ($p>.05$). Some of the possible intervening variables that might account for this failure are discussed.

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INTRODUCTION

Electromagnetic Phenomena

The biological organism is an electrically active creature. All cells generate electric potentials, with a difference in charge across their cell walls due to ion concentration differences. The central nervous system in animals controls much of the body with signals transmitted by means of this electrochemistry. This is the quickest messenger system in the body, being almost instantaneous in comparison to the hormonal/cardiovascular system. Electric signals also generate magnetic fields, the strength of which can be approximated with the Maxwell equations (Konig, 1974). With shielding of ambient magnetic fields, the body's magnetic signals are measurable at a distance with a magnetoencephalogram, or MEG (Williamson & Kaufman, 1978). An active human brain generates electromagnetic signals in the 40 Hz range (beta activity), the relaxed human produces signals in the 8 to 12 Hz range (alpha rhythm), and the deep sleeping person shows electrical activity in the 4 Hz and lower frequency range (delta activity). Even lower frequencies are generated by glial cells of the nervous system. These signals are in the 0 (D.C.) to 1 Hz range.

Electric and magnetic phenomena in the environment are also numerous. The earth functions as a magnet and is surrounded by an electrically charged ionosphere. Movement of air currents in the atmosphere creates changes in the electric charge, normally about 130 V/m positive at ground level (Polk, 1974). These static electric charges can vary from 3000 V/m positive to about 1500 V/m negative. There is also a decrease in static charge with elevation (Polk, 1974).

The earth's normal magnetic field of 0.6 gauss ("gauss" and "oersted" are measures of magnetic field and flux density which are equivalent in air; for the purpose of this paper, they may be used interchangeably since the intensity differences in biological systems are very small) in temperate zones, also varies. Electromagnetic variation follows a diurnal cycle, lunar (28 day) cycle, annual cycle, as well as other regular cycles related to planetary movements, etc. It also varies irregularly in association with sunspot activity. North- South direction of the earth's field also reverses itself periodically (every 960 years).

Electromagnetic Variables

Charged Particles

The air contains thousands of ions in every cubic centimeter. These ions can be either positively charged or negatively charged. The proportions and concentrations of the smaller of these ions may affect our general health and psychological states (Soyka, 1974). Since the metabolism uses largely the ionic form of most minerals (e.g., sodium, potassium, calcium, etc.) and other body chemicals, a potential connection between air ions and physiology exists (Kreuger, 197?).

Electromagnetics

The electromagnetic spectrum ranges from pure D.C. (constant) fields, to fields which fluctuate at frequencies billions of cycles per second. Physicists break these frequencies down into band ranges as shown in Table 1. For the purposes of this paper, ELF will be defined as frequencies between 0 and 100 Hz.

TABLE 1

BAND	FREQUENCY RANGE
Extremely low frequency (ELF)	3 Hz to 30 Hz
Super low frequency (SLF)	30 Hz to 300 Hz
Ultra low frequency (ULF)	300 Hz to 3K Hz
Very low frequency (VLF)	3K Hz to 30K Hz
Low frequency (LF)	30K Hz to 300K Hz
Medium frequency (MF)	300K Hz to 3 MegaHertz
High frequency (HF)	3 MegaHz to 30 MegaHz
Very high frequency (VHF)	30 MegaHz to 300 MegaHz
Ultra high frequency (UHF)	300 MegaHz to 3 GigaHz
Super high frequency (SHF)	3 GigaHz to 30 GigaHz
Extremely high frequency (EHF)	30 GigaHz to 300 GigaHz

The waveform of radiation in these bands may take many shapes, such as sinusoidal, peaked, square wave, or irregular. These forms may be mixed and modulated at different frequencies. The modulation may be in amplitude, frequency, or pulsed.

Atmospherics consist of all frequencies of electromagnetic waves, but geophysical phenomena serve to attenuate some frequencies and accentuate others. Notably, electromagnetic phenomena in two ELF frequencies, about 10 Hz and about 0.5 Hz, follow distinct daily rhythms. The 10 Hz fields are associated with the waveguide characteristics of the ionosphere and ground and are called "Shumann resonance" waves (Konig, 1974). The 0.5 Hz waves have as yet no identified resonator, though this frequency would generate a wavelength about equal to the lunar distance. The relationship of lunar distance to 0.5 Hz fields will be discussed later.

The presence of regular magnetic or electric waves in the frequencies approximating many rhythms of biological phenomena at the molecular, cellular, organ, and organismic levels suggests the possibility of an interaction between the phenomena that could affect the organism (Persinger, 1974). Most organisms have a specific mechanism, the visual system, capable of direct response to a limited range of the electromagnetic spectrum called visible light (400-700 nM). Indirect response to electromagnetic phenomena is possible, such as warming from infrared and microwave, erythema from ultraviolet, and chromosomal changes from x- ray and higher frequency radiation. The physics of the mechanisms underlying these responses is well understood. However, response to the lower frequency electromagnetic phenomena, which is normally of much lower intensity, is not well understood. Although attentuation of ELF radiation is low (Taylor & Sao, 1970), and penetrability is high, it seems implausable a priori that an energy source in the mV/m range could significantly affect phenomena such as cell wall potentials in the KV/m range. However, a growing body of data suggests such effects do indeed occur though the mechanisms remain, for the most part, to be elucidated. Some of the effects of D.C. and ELF magnetics will now be considered. Of particular interest are those electromagnetic field frequencies associated with biological phenomena, especially those of the brain. Konig (1962, 1971) mentions the similarity between the ambient 10Hz magnetic waves and alpha EEG patterns, and between 3 to 5 Hz waves and delta wave EEG patterns. At the same time there is a marked similarity between the under 1 Hz magnetic waves and glial cell "D.C." potential fluctuations. Rowland (1968) has correlated this slow brain glial cell potential system with learning and storage of information. Hyden and Lange (1970) report that the amount of S100 protein in the brain increases in trained animals and is specifically correlated with learning. The S100 protein is mainly a glial cell protein, but also occurs in neurons (Hyden & McEwen, 1966). A link between glial proteins in cells active at frequencies below 100Hz suggests a possible link to the effects of electromagnetic fields of similar low frequencies.

Response to Magnetic Fields

Birds have been shown to use magnetic fields for navigation (Southern, 1974; Wiltschko & Wiltschko, 1975). In some animals, the response to the magnetic field took precedence over the positions of stars for direction control. This response demonstrates an immediate sensitivity to the earth's normal field. Reille (1968) showed increased heart rate in pigeons in response to a 5 second 0.15 gauss field acting as a conditioned stimulus for a 0.5 second shock. The effect was absent in 300 to 500 Hz fields, weak in a D.C. field, and stronger in 0.2 to 0.5 Hz fields. Wever (1974) found that circadian rhythms in humans living in a magnetically shielded room were disrupted. Synchrony between various body functions (kidney activity, temperature and waking/sleeping cycles, etc.) was affected. Light/dark cues alone could not keep these people entrained on a normal cycle. In rooms shielded for all but the magnetic field, desynchrony did not occur. An artificial continuous 10 Hz field prevented desynchrony, and entrainment to a periodically operating 10 Hz field was possible for on/off cycles from 23.5 to 26 hours. Wever's field was a D.C. field turned on and off 10 times per second, producing a square wave signal.

Bawin (1974) exposed cats to a VHF (147 MegaHertz) field amplitude modulated at various ELF (i.e., 1 - 25 Hz) frequencies. The cats exposed to 1 to 5 Hz modulations showed increased somnolence, while those exposed to 16 - 20 Hz modulations exhibited faster EEG and greater activity. The unmodulated field produced no effects, suggesting that the ELF component alone was responsible for the effect.

Atmospherics are electromagnetic waves caused by geophysical phenomena such as weather, season, and sunspot activity. Type I atmospherics are regular sine wave signals of about 9 Hz, and type II atmospherics are irregular sine wave-shaped signals of 3 to 5 Hz. Koniq (1960) tested human reaction times of thousands of subjects during the 1953 Munich transport exhibition while measuring type I and II atmospherics. Reaction times increased during type II signals and decreased during type I activity. Using artificially created fields of similar frequencies, the same results were found in the lab. These increased reaction times during periods of greater type I (3-5 Hz) activity are concurrent with the findings of Wilson (1974). He exposed humans to D.C. fields of 5 to 17 gauss, and to different pairs of frequencies between 2 and 12 Hz. No differences (from controls) were found in the D.C. field, but with each case "the higher frequency in each pairing producing slower reaction times". Hamer (1969) confirmed the inverse relationship between frequency and reaction time using electric fields as low as 0.002 V(rms) across plates 50 cm apart.

Physiological Effects

Dubrov (1974) noted a close relationship (no correlations calculated due to the nature of the data) between weight change or lethality from exposure to ionizing radiation and measures of the geomagnetic field such as declination, horizontal strength and change in the vertical component of the field strength. Taneyeva et al. (1974) found significantly extended lifespan and increased oxygen uptake during overheating and subcooling in crustaceans (artrenia salina) exposed to a 1050 Oe. magnetic field. They also found increased resistance to the lethal effects of arsenic (1.0% solution) and strychine (0.1% solution).

Persinger, Carrey, Lafreniere, and Mazzuchin (1978) obtained 38 tissue and consumptive measures of rats exposed to ELF (0.5 Hz) rotating magnetic fields (RMFs) and to different caging (pre-exposure, post weaning) conditions. These subjects had also been exposed for 3 days prenatally and for 3 days postnatally to either a 0.5 Hz rotating magnetic field or a "sham" field using the magnetic field generating apparatus without magnetics. Interestingly, the different caging conditions (plastic tubs with bedding vs. wire cages above bedding) produced significant differences on more measures than did the magnetic fields. However, serum tests showed significant differences in blood sodium chloride (not consistently in all experiments) and calcium changes in magnetic field exposed rats (as adults) compared to controls (sham group). Between the 10^{-8} T (Tesla, 1 Gamma= 10^{-5} Gauss= 10^{-9} Tesla) and 10^{-1} T groups, post hoc analysis showed a significant difference, indicating a dose relationship. For serum GOT (glutamate oxaloacetic transaminase) measures a strong interaction between postweaning caging conditions and field intensity was shown. Serum GOT levels over the 4 field intensities plotted for the 2 caging conditions were a mirror image of each other. Thus caging conditions produced the exact opposite effect for the field intensity in two caging conditions. A transaminase transfers an amino group from an amimo acid to a keto acid to form another (different) amino acid. Since amino acids form proteins, and protein formation is associated with learning, a potential mechanism for interference with learning or memory is suggested.

Greater differences were seen in animals exposed perinatally to the 0.5 Hz field (relative to the sham field controls). These measures were taken more than 190 days after the 6 day exposure. Alterations were seen in thymus weights, testicle weights, GOT, LDH (lactase dehydrogenase), and Urea nitrogen suggesting widespread metabolic effects of treatment. In previous experiments with rats maintained at 80% free feeding weights (Ossenkopp, Koltek, and Persinger, 1972), using a different strain of rats, 8 - 10 % increases in testicle weight were seen compared to 4% in this experiment. Thus greater and more numerous effects are seen in animals exposed perinatally than in animals exposed as adults. No perinatal exposure/adult exposure condition interactions were found.

Behavioural Effects

Aggression

Persinger (1974), after exposing rats for 300 days to 0.5 Hz magnetic fields, measured aggressive activity. All 23 instances of the presence of blood and loss of hair (called "aggressive attacks") seen during five daily feeding sessions were in the group of 8 exposed animals. The rats exposed to a "sham" field showed none of these attacks.

Open Field Activity

Normal rats placed into an open field area show initial fear reactions (covering, defecating) followed by exploratory behaviour. With further daily exposures to the open field, ambulation (exploratory behaviour) begins to decline as familiarity with the area develops. This response decrement with repeated exposure to novel stimuli is called habituation (reference) and is considered to be a rudimentary form of learning. Rats prenatally exposed to 0.5 Hz magnetic fields (Ossenkopp, 1972 and Persinger, 1969) showed greater defecation and less ambulatory behaviour at 21 to 25 days of age in each daily session in the open field than did the controls. The differences, in both studies, were greater for male rats than for females. Persinger (1974) found adult rats exposed to the 0.5 Hz magnetic field showed less habituation to an open field (decrease in ambulation over sessions) than controls, but the effect was seen only in males. The differences shown in the young rats were interpreted as the result of increased fear of the novel environment, whereas the effect of field exposure in the older animals could be seen as a failure to become familiar with the open field while repeatedly exploring it. Thus, in young animals ELF magnetic field exposure may primarily effect emotional response while the effect on mature animals may also be a learning decrement.

Persinger (1971) noticed that rats exposed perinatally to a 0.5 Hz magnetic field displayed more variance in open field ambulatory behaviour than controls. He tested this by correlating ambulation with many enviornmental factors that varied during or after the time of exposure. The largest (significant) correlation was with lunar distance. No significant correlations were found for control animals. Breeding animals for parturition at specific lunar distance, he found a significant ($t=7.66$, $p<.001$) correlation ($r=.877$) between median squares traversed and lunar distance at birth, in the exposed litters. Rats born closest to perigee showed less ambulation than controls or those born closer to apogee. This correlation demonstrates that the effect of exposure to magnetic fields may be dependent on other (subtle or unexpected) enviornmental influences.

Learning may be defined as a change in behaviour which results from experience. Memory could be defined as the retention of a learned response from one time to another as evidenced by the performance of that response. With each daily presentation of the task, both memory (since the last performance) and learning are important determinants of performance. With short (24 Hr.) periods between performances, memory is less affected by decay or interference than with longer (72 hour) periods. Some some biochemical changes in the brain associated with memory consolidation take place between 24 and 72 hours after learning (Geller and Jarvik, 1970). If memory consolidation were interfered with by the magnetic field, differences would be evident on first performance after the 72 hours away from a learning task. If learning were affected, effects would show up on all days as failure to improve (relative to controls) over the previous day and especially by the fifth day in the D.R.L. task (see p. 16 for a description of this procedure) beginning exposure to the field.

Laforge (unpublished, 1973) trained rats to press a lever for a water reinforcer, then exposed them for 45 minutes per day for 2 days to an 800 gauss field of 2 Hz or 0.2 Hz, or to a constant field. When re-tested, the 2 Hz and the 0.2 Hz exposed rats showed fewer lever presses. He suggests a decrement in learning, while Persinger, Ludwig, and Ossenkopp (1973) suggest that the increased (competing) activity as found by Persinger, Ossenkopp, and Glavin (1972) could account for the decrement in lever pressing.

In a free-operant avoidance situation (Sidman avoidance procedure) pre- and neonatally exposed adult rats showed fewer responses (than controls), but received the same number of shocks (Persinger & Foster, 1970). Because ELF exposed rats showed increased emotional behaviour in the open field experiments, the authors suggested the lower responding was due to "freezing" responses to the shock signal. This was tested (Persinger & Pear, 1972) with a conditioned suppression task (on adult rats exposed neonatally to the 0.5 Hz field). Initial responding showed more conditioned suppression in the C S (tone) - U C S (unavoidable shock) interval, but subsequent pairings resulted in similar suppression in controls. The experimental group showed less response bursting following the U C S (shock) than controls accounting for most of the differences in total responses between the groups. Similar behaviour patterns are seen in rats with hypothyroid like symptoms (e.g., Feuer & Broadhurst, 1962; Yeakel & Rhodes, 1941) and increased relative thyroid weights (and testicle weights) were found in the rats in the experiments discussed above (Ossenkopp, Koltek, and Persinger, 1972).

When testing learning behaviour under different schedules of reinforcement, most schedules produce typical response patterns mostly dependent on the reinforcement contingencies. These schedules are: fixed ratio, (F.R.) and variable ratio (V.R.), which reward a proportion of the responses, and fixed interval (F.I.) and variable interval (V.I.), whih reward as a function of time, and mixtures and combinations of these (Ferster & Skinner, 19). In a D.R.L.(differentially reinforced low reponse rate) task, availability of the reinforcer is withheld for a set time period from the previous response. For example, in a D.R.L. 6 second schedule, if the animal waits 6 seconds before responding, he is reinforced, but if he responds before 6 seconds he must wait another 6 seconds from the time of that response before the response reinforcement is available. The D.R.L. 6 second schedule is a difficult task for a rat to master. In the interval between responses (I.R.T.), the rat produces many response delaying behaviours which are not primarily reinforced and so are easily disrupted. Latris, Weiss, Clark, and Reynolds (1965) discuss the sensitivity of the D.R.L. schedule to several influences (stimulants, introduction of other schedules, and other factors). This author (unpublished honors thesis, 1974, cited by Persinger, 1974) trained adult rats briefly (two 30 minute sessions) on a D.R.L. 6 second or 4 second task, exposed them to a 0.5 Hz magnetic field for 72 hours and then retested them daily on the D.R.L. task for 5 days. Except during the D.R.L. tasks (30 minutes daily) and weighing and feeding (3 minutes daily) the rats were maintained in the magnetic field area. On initial return to the D.R.L. task, magnetic field exposed rats showed poorest performance (measured by the ratio of total responses / reinforcements earned). A control group placed away from the magnets in the same room showed an intermediate ability (field was too weak to be measured by the available equipment; i.e., less than 0.05 gauss) while a group exposed to a "sham" field (same equipment without the magnets) and their control group (in the same room away from the sham magnets) showed the best performance on the D.R.L. task. There were no significant differences between the latter two groups. Unfortunately, the design of the experiment was not balanced, and younger animals used in later experimental runs showed completely different response patterns, compared to controls, suggesting a definite age-dependent effect. The present study is an attempt to replicate and extend the findings outlined above.

Because of previous research showing differences in the effects from exposure to 0.5 Hz magnetic fields in adult male rats (thyroid, testicle weight) exposed perinatally compared to those exposed as adults seen in the experiments by Persinger, and the suggestion of an age-interaction effect seen in this author's research, it was decided to test for this interaction on a learning task in the present study.

A 0.5 Hz rotating magnetic field was chosen because of the large number of previous studies showing emotional, physiological, and behavioural effects with rats at different ages, and because of the regular occurence of natural (and artificial) fields in this frequency.

To test for disruption of memory consolidation as opposed to decreased learning, a period away from the learning task is neccessary. The 72 hour period was chosen to be certain to exceed the 48 hour latency of memory consolidation discussed by Geller and Jarvik (1970).

Fecal boluses produced during an aperant session represents the amount of emotional reponse in that interval. Fear, anger, frustration and other emotional reactions result in increased defecation. Therefore, fecal boluses should be counted.

METHOD

1. Subjects

Seventy two male Wistar albino rats were obtained from the University of British Columbia breeding colony. Half of these (36 rats) were obtained in one batch, and were retired breeding stock (age estimated to be 50 - 150 weeks). The other 36 animals were obtained in groups of 6 littermates at 21 days of age. These animals were maintained on ad-libitum feeding until the individuals in the group weighed 250 to 300 grams. Six older animals were then selected in a stratified sample (the heaviest animal from each of the six weight ranges) and placed on a weight-loss feeding schedule. Each animal was then weighed daily, until the end of the experiment, and fed a daily food ration (4 - 10 grams) during weight loss (except day 1 of the food deprivation schedule). Two days after the older animals were begun on this schedule, the younger rats were also placed on a similar deprivation schedule. The feeding schedule was designed to get each animal to 80% of the ad-libitum feeding weight at the same time. For the older rats, this was 80% of their weight at the beginning of the deprivation. For the younger animals, allowance was made for growth based on growth curves extrapolated for each animal and from previous normative data collected by this author. For example, one rat began deprivation at a weight of 286 grams, and 80% of this is 229 grams. After sixteen days, growth would normally be expected to change this animal's weight, without food deprivation, to 355 grams, and 80% of this is 284 grams. Thus the animal would weigh essentially the same as he did at the beginning, but would still be food deprived to a degree similar to the older rats. (See Appendix III for food deprivation figures.) All animals could then be trained with a food reward.

Prior to deprivation, all animals were housed in galvanized wire- bottomed cages. After the beginning of deprivation, animals were kept in plastic tubs (29 x 18 x 13 cm) with wire tops held in place with coil springs. Each of these plastic cages was surrounded by white cardboard barriers so that the animals could not see the magnetic field apparatus. Although the deprivation schedule was mild compared to that used in previous experiments, in 3 cases one of the old animals died, shortly after beginning, from apparent digestive tract disorders. When there were six survivors of each age group, 5 were chosen at random from these except when one animal showed an unusual inability to learn the instrumental task. All animals proved to be relatively slow to learn the bar press response compared to animals used in the author's previous research. Thus of 72 rats obtained, 60 were used in the experiment.

2. Apparatus

a. Magnetic Field Apparatus

A pair of horseshoe instruments magnets (Westinghouse USAF-6249A) were mounted horizontally on top of a table, with the pole surfaces facing 20 cm apart. These were turned by a single 60:1 reducing gear motor (Bodine model NSI-12R) mounted beneath the table. The magnets were turned in opposite directions by toothed belts, (see Fig. 1). The magnets turned at 30 r.p.m. with each pole alternately facing a like pole, then an opposite pole. This generated a horizontally rotating electromagnetic field (see Fig. 2), which turned and fluctuated at 0.5 Hz. A 10 foot board was mounted above the table between the magnets with supports at the end separate from the table, (Fig. 1). Thus, motor vibrations in the table were not transmitted to this board which was used to hold rat cages during the experimental phase of the research. The strength of the magnetic field

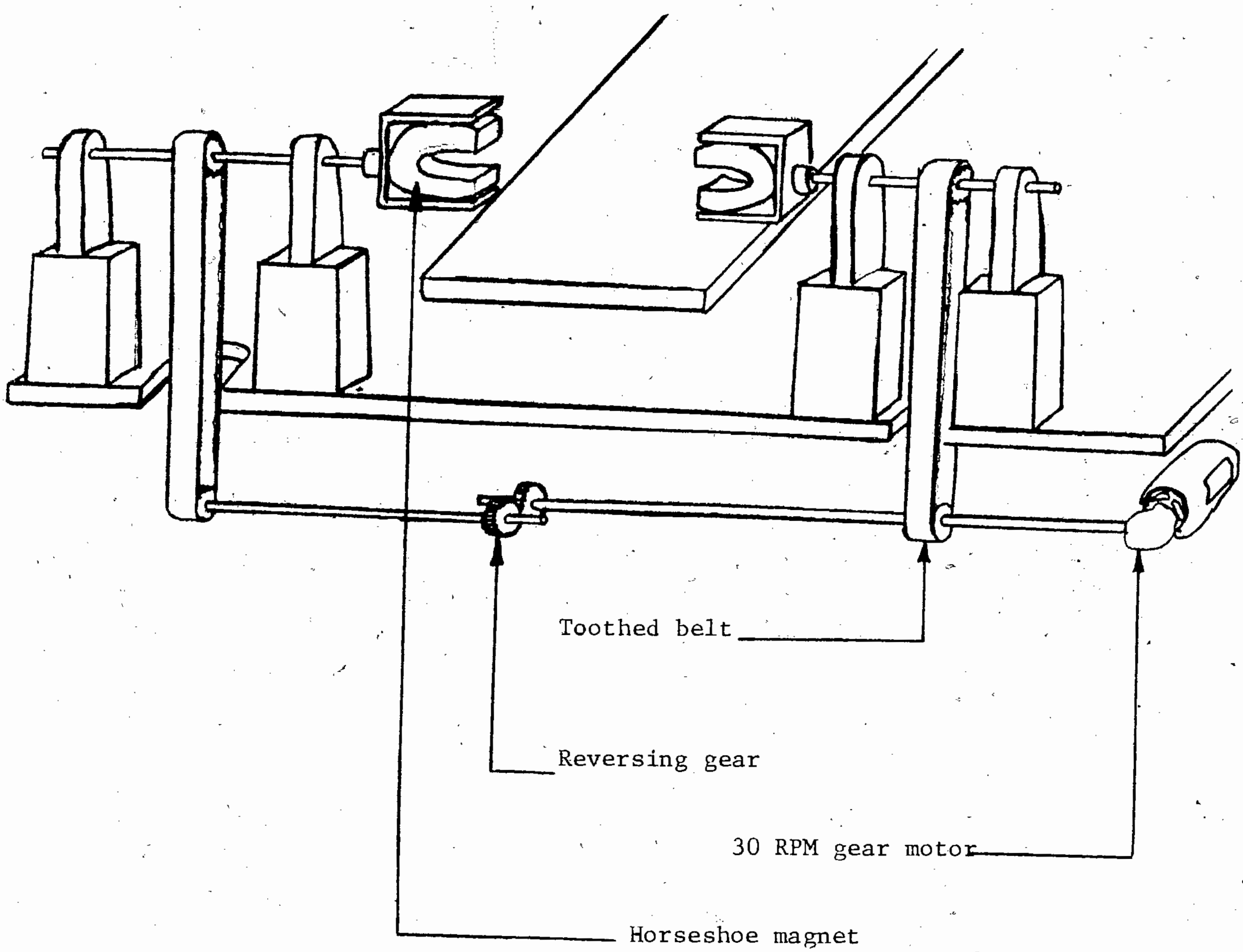

Figure 1 Magnetic field apparatus

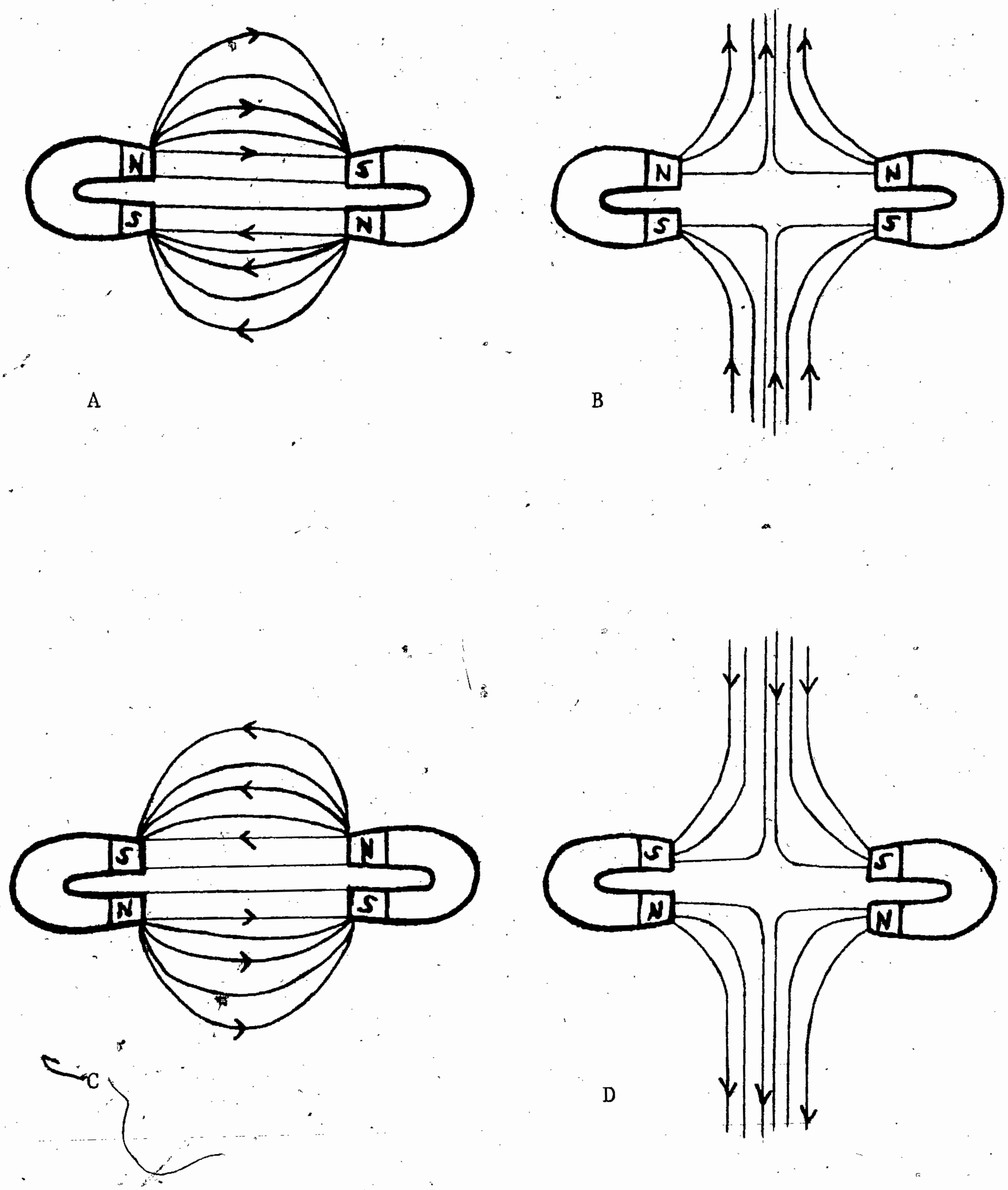

Figure 2 Magnet rotation produces rotating magnetic field

at the various distances ranged from 5.0 gauss (peak to peak) to 0.05 gauss.

b. Operant Control Apparatus

Automatic control equipment was programmed to deliver either a CRF (continuous reinforcement) or a D.R.L. (differentially reinforced low response rate) 6 second schedule of reinforcement for lever pressing in a standard Skinner Box. Reinforcers could also be delivered manually from a hand held switch for shaping the lever-press response. The operant chamber (Skinner box) was fitted with a non-recessed food delivery cup so that the rat could see the 0.25 gram food pellet when it was delivered as a reinforcer. Secondary reinforcement came from the sound of the food delivery solenoid. This 10 inch by 15 inch chamber was enclosed in a sound attenuating case which was fitted with a ventilation fan. From inside the chamber the sound of the operant control programming equipment could not be heard.

Automatic recording equipment produced a count of:

(a) total reinforcers delivered (animals were removed when 100 reinforcers were obtained),

(b) total responses occuring between 0 and 1 second after the previous response,

(c) between 1 and 2 seconds,

(d) between 2 and 3 seconds,

(e) between 3 and 4 seconds,

(f) between 4 and 5 seconds,

(g) between 5 and 6 seconds, and

(h) responses occurring more than 6 seconds after the last response,

(i) the grand total of all responses made, and

(j) the elapsed time needed to earn the 100 reinforcers.

A cumulative response chart recorder was also used to make a running record of response patterns throughout the interval each rat was in the chamber. This record was useful in detecting episodes of "response bursting" described earlier.

3. Experimental Design

Sixty rats were in the design, 30 young (250 - 300 gram) rats and 30 old (550 - 995 gram) rats. Half of each of these were exposed to the magnetic field apparatus with the magnets in place (the experimental group), the others were exposed to the same apparatus with the magnets replaced by lead slugs of the same weight (the control group). Ten animals (5 young, 5 old) were placed at five distances from the area between the magnets or lead slugs. These groups of 10 animals were exposed to the experimental (E) or control (C) conditions in this sequence: C, E, C, E, E, C. The experiment was repeated three times. Thus we have a factorial design: Ages = 2, by Treatments = 2 (experimental and control), by Closeness (field strength) = 5, with subjects (N = 3) within.

Data were collected for 2 successive days immediately prior to exposure to the magnetic field apparatus, and for five days during the exposure.

4. Procedure

When 12 rats had reached the 80% ad-lib. weight, they were shaped in the operant chamber for a lever-press response and were removed from the equipment when 100 reinforcers had been earned. They were replaced in the plastic cage, and the cage was returned to the colony area.

The rats were weighed and fed daily several hours after being in the operant chamber. On the following two days, the rats were exposed to the operant chamber on a D.R.L. 6 second schedule until they earned 100 reinforcers, and then returned to the colony area. Responses made during these two days would constitute a pre-exposure (to the magnetic field) level, and could be used as a covariate to control for the individual differences in the animals' response patterns.

Immediately after the second trial on the D.R.L. task, the animals were placed into the magnetic field apparatus. A distance from the magnets was selected so that the order that the animal was tested in the operant chamber was minimally correlated with the distance. The rats were left in the magnetic field equipment for 72 hours except for daily weighing (about 3 minutes). Then the animals were returned to the operant chamber for 5 more daily sessions on the D.R.L. task. Each session lasted until 100 reinforcers were earned. Fecal boluses were counted after each session. The rats were returned to their cages and to the magnetic field apparatus immediately after each session.

5. Analyses

A design with 2 treatment factors (control and experimental), 2 ages (young and old), and 5 magnetic field exposure levels, all crossed factors, with 3 subjects per cell (nested) was produced. Response totals for seven inter-response time intervals (0-1, 1-2, 2-3, 3-4, 4-5, 5-6, over 6 seconds), total time, and number of fecal boluses per session were the first measures. Typical inter-response latencies were calculated by the formula

$$\bar{x} = \frac{\sum_{i=1}^{7} R(\bar{t}_i)}{R\ total}$$

where R= number of responses in the interval, and $\bar{t}$ = middle of the time interval (i.e., in the interval 5-6 seconds, $\bar{t}$ = 5.5)

This formula was selected even though the t intervals were not equal ratio (i.e., 6+ interval included responses in an interval of more than one second while the other intervals were of one second). Since all responses longer than 6 seconds produced the same result, and very long IRT intervals were occasionally made which could give a false picture of the animal's ability to withold responding for the appropriate time. The formula gives a number closer to the median IRT than the mean IRT (which would be calculated by dividing the total responses by the time to earn the 100 reinforcers). The analysis called for is a multivariate analysis of covariance with responses on the first 2 days (pre- exposure) as predictors for the responses on the last 5 days, the last 2 days, and for days 3 and 4. These covariates are useful in reducing error due to individual differences in the rats which are present prior to exposure. BMD 12V computer stastical package was used in all the analyses.

RESULTS

Means

The complete set of means and deviations is shown in Appendix I. No significant differences were found in any of the analyses between the 5 distances, but significant differences were seen in some cases for other factors. Table 2 (a) shows cell means for each of the seven days of testing for the number of fecal boluses produced by the two age groups in the experimental and control condition. The F value (Table 3) for the treatment X age interaction using data for all 5 days is 0.8799 (non significant). Greater emotional response (more fecal boluses) is seen in the older experimental group after exposure, but the high values for this group prior to exposure eliminates any chance of finding this difference significant. The values of the covariates for days 1 and 2 are significant ($F = 2.33$ for day 1 and $F = 1.42$ for day 2) predictors of measures on later days. Separate analyses for the first 2 post-exposure days and for the last 2 post-exposure days did not change the significance (see Tables 3, 4, and 5).

TABLE 2

MEANS

Mean inter-response time latencies from the calculated formula.

DAY	EXPER. GP.		CONTROL GP.	
	OLD RATS	YOUNG RATS	OLD RATS	YOUNG RATS
1	3.755	3.639	3.881	3.789
2	4.395	4.601	4.368	4.570
3	4.750	4.975	4.642	4.836
4	4.534	4.901	4.697	4.602
5	4.860	5.013	5.004	4.838
6	4.754	5.060	5.158	5.025
7	4.973	5.201	5.036	4.951

Mean number of fecal boluses produced during each session

DAY	EXPER. GP.		CONTROL GP.	
	OLD RATS	YOUNG RATS	OLD RATS	YOUNG RATS
1	6.267	2.200	1.867	1.533
2	3.667	1.533	2.667	0.933
3	2.667	1.467	2.733	1.067
4	2.867	0.867	1.667	1.667
5	2.733	1.467	2.333	1.933
6	3.267	0.667	1.800	1.200
7	4.267	1.067	1.667	1.200

TABLE 3

SUMMARY OE F TABLE
FOR FECAL BOLUSES

DEPENDENT VARIABLES ARE THE MEASURES ON EACH OF THE 5 POST-EXPOSURE DAYS

COVARIATES ARE THE MEASURES TAKEN ON THE 2 PRE-EXPOSURE DAYS

SOURCE	APPROXIMATE F- STATISTIC	DEGREES OF FREEDOM	
TREATMENT	0.7296	5	34.00
AGE	0.9873	5	34.00
CLOSENESS	0.8632	20	113.72
TA	0.8799	5	34.00
TC	1.1146	20	113.72
AC	0.7451	20	113.72
TAC	0.5532	20	113.72
COVARIATE 1	2.3316	5	34.00
COVARIATE 3	1.4195	5	34.00
R (TAC)			

It is assumed that this table shows the effects of treatment (magnetic field or sham field exposure) age (old or young rats), and closeness to the field apparatus on emotion for the 5 post-exposure days. Note that there are no significant effects. The large differences in group means post-exposure is predicted by pre-exposure means.

TABLE 4

SUMMARY OF F TABLE
FOR FECAL BOLUSES

DEPENDENT VARIABLES ARE THE MEASURES ON
EACH OF THE FIRST 2 PRE-EXPOSURE DAYS

COVARIATES ARE THE MEASURES TAKEN
ON THE 2 PRE-EXPOSURE DAYS

SOURCE	APPROXIMATE F- STATISTIC	DEGREES OF FREEDOM	
TREATMENT	0.5715	2	37.00
AGE	0.7557	2	37.00
CLOSENESS	0.7692	8	74.00
TA	0.3504	2	37.00
TC	1.0579	8	74.00
AC	0.5846	8	74.00
TAC	0.2993	8	74.00
COVARIATE 1	4.7497	2	37.00
COVARIATE 3	2.5019	2	37.00
R (TAC)			

It is assumed that this table shows the effects of treatment (magnetic field or sham field exposure) age (old or young rats), and closeness to the field apparatus on emotion for the first 2 post-exposure days.
Note that there are no significant effects.
The large differences in group means post-exposure is predicted by pre-exposure means.

TABLE 5

SUMMARY OF F TABLE
FOR FECAL BOLUSES

DEPENDENT VARIABLES ARE THE MEASURES ON EACH OF THE LAST 2 POST-EXPOSURE DAYS

COVARIATES ARE THE MEASURES TAKEN ON THE 2 PRE-EXPOSURE DAYS

SOURCE	APPROXIMATE F- STATISTIC	DEGREES OF FREEDOM	
TREATMENT	0.3789	2	37.00
AGE	1.8191	2	37.00
CLOSENESS	0.9008	8	74.00
TA	1.0934	2	37.00
TC	0.5187	8	74.00
AC	0.7864	8	74.00
TAC	0.8277	8	74.00
COVARIATE 1	1.1265	2	37.00
COVARIATE 3	0.5090	2	37.00
R (TAC)			

It is assumed that this table shows the effects of treatment (magnetic field or sham field exposure) age (old or young rats), and closeness to the field apparatus on emotion for the first 2 post-exposure days.
Note that there are no significant effects.

TABLE 6

SUMMARY OF F TABLE
FOR INTER-RESPONSE TIME
LATENCY (calculated)

DEPENDENT VARIABLES ARE THE MEASURES ON
EACH OF THE 5 POST-EXPOSURE DAYS

COVARIATES ARE THE MEASURES TAKEN
ON EACH OF THE 2 PRE-EXPOSURE DAYS

SOURCE	APPROXIMATE F- STATISTIC	DEGREES OF FREEDOM		
TREATMENT	3.0876	5	34.00	p<.025
AGE	0.9348	5	34.00	
CLOSENESS	1.0085	20	113.72	
TA	2.3182	5	34.00	p<.10, n.s.
TC	0.8028	20	113.72	
AC	0.4105	20	113.72	
TAC	1.1716	20	113.72	
COVARIATE 2	0.2272	5	34.00	
COVARIATE 4	5.8808	5	34.00	
R (TAC)				

It is assumed that this table shows the effects of treatment (magnetic field or sham field exposure) age (old or young rats), and closeness to the field on learning and memory during the 5 post-exposure days of retesting of the task learned in the 2 pre-exposure days.

When the inter-response latency measures calculated from response frequency in each time interval were used as a measure, significant was found. Using days 1 and 2 as covariates and the 5 post exposure days as the dependent variables, significance was seen on the treatment variable (F = 3.0876, p less than .025) but not for treatment by age interaction (F = 2.3182, p less than .10); see Table 6. Separate analyses done using the data from the first 2 past exposure days and the last 2 post exposure days (Tables 7 and 8) found no significance for the treatment effect on days immediately after exposure (F = 0.4815) but significance for the T X A interaction (F = 5.0621, p less than .025). Using data from only the last 2 days gets a large F value for the treatment effect (F = 7.7632, p less than .005), and loss of significance for the T X A interaction (F = 2.1868, p less than .20).

In further testing of emotional response, the number of responses in the 0-1 second range, representing emotional response bursting to some degree, was used with the measure obtained by counting fecal boluses. This combination was used in a multivariate analysis and no significant effects were seen. For example, the T X A effect using the 2 variables on days 3 and 4 as dependent variables and days 1 and 2 as covariates, F = 1.1205 with 4 and 33 degrees of freedom. For the last 2 days, F = 0.9794. Using the cruder measure of average response latency obtained by dividing elapsed time in seconds by the total number of responses, we obtain significance patterns similar to those using the more complex formula for average inter-response latency, (compare Tables 9 and 10 to Tables 7 and 8).

TABLE 7

SUMMARY OF F TABLE
FOR INTER-RESPONSE TIME
LATENCY (calculated)

DEPENDENT VARIABLES ARE THE MEASURES ON
ON EACH OF THE FIRST 2 POST-EXPOSURE DAYS

COVARIATES ARE THE MEASURES TAKEN
ON EACH OF THE 2 PRE-EXPOSURE DAYS

SOURCE	APPROXIMATE F- STATISTIC	DEGREES OF FREEDOM		
TREATMENT	0.4815	2	37.00	
AGE	0.2672	2	37.00	
CLOSENESS	0.6429	8	74.00	
TA	5.0621	2	37.00	p<.05
TC	0.6993	8	74.00	
AC	0.3644	8	74.00	
TAC	1.8771	8	74.00	
COVARIATE 2	0.4755	2	37.00	
COVARIATE 4	9.1628	2	37.00	
R (TAC)				

TABLE 8

SUMMARY OF F TABLE
FOR INTER-RESPONSE TIME
LATENCY (calculated)

DEPENDENT VARIABLES ARE THE MEASURES ON
ON EACH OF THE LAST 2 POST-EXPOSURE DAYS

COVARIATES ARE THE MEASURES TAKEN
ON EACH OF THE 2 PRE-EXPOSURE DAYS

SOURCE	APPROXIMATE F- STATISTIC	DEGREES OF FREEDOM		
TREATMENT	7.7632	2	37.00	p<.005
AGE	0.1141	2	37.00	
CLOSENESS	1.0284	8	74.00	
TA	2.1868	2	37.00	n.s.
TC	1.2292	8	74.00	
AC	0.5337	8	74.00	
TAC	0.8298	8	74.00	
COVARIATE 2	0.1589	2	37.00	
COVARIATE 4	14.0576	2	37.00	
R (TAC)				

TABLE 9

SUMMARY OF F TABLE
FOR TIME TO EARN 100
REINFORCERS / TOTAL RESPONSES

DEPENDENT VARIABLES ARE THE MEASURES ON
ON EACH OF THE FIRST 2 POST-EXPOSURE DAYS

COVARIATES ARE THE MEASURES TAKEN
ON EACH OF THE 2 PRE-EXPOSURE DAYS

SOURCE	APPROXIMATE F- STATISTIC	DEGREES OF FREEDOM		
TREATMENT	1.2556	2	37.00	
AGE	0.1055	2	37.00	
CLOSENESS	0.4633	8	74.00	
TA	5.2488	2	37.00	p<.05
TC	1.1139	8	74.00	
AC	0.5701	8	74.00	
TAC	1.0712	8	74.00	
COVARIATE 2	1.0809	2	37.00	
COVARIATE 4	4.3542	2	37.00	
R (TAC)				

TABLE 10

SUMMARY OF F TABLE
FOR TOTAL TIME TO EARN 100
REINFORCERS / TOTAL RESPONSES

DEPENDENT VARIABLES ARE THE MEASURES ON
ON EACH OF THE LAST 2 POST-EXPOSURE DAYS

COVARIATES ARE THE MEASURES TAKEN
ON EACH OF THE 2 PRE-EXPOSURE DAYS

SOURCE	APPROXIMATE F- STATISTIC	DEGREES OF FREEDOM			
TREATMENT	4.9135	2	37.00	$p<.05$	
AGE	0.6597	2	37.00		
CLOSENESS	1.4129	8	74.00		
TA	3.3484	2	37.00	$p<.10$	n.s.
TC	1.5347	8	74.00		
AC	0.9438	8	74.00		
TAC	0.7300	8	74.00		
COVARIATE 2	1.9483	2	37.00		
COVARIATE 4	11.8808	2	37.00		
R (TAC)					

DISCUSSION

A major weakness in the analyses performed is the lack of utilization of data from each of the 5 days after exposure. Animals exposed repeatedly to the same situation would be expected to change their behaviour, over these exposures, in a systematic way. An example of this type of change is called a learning curve. The analyses did not study the shapes of these learning curves, but treated the data from all days or from the first 2 and the last 2 days after exposure to the field as independent data. Expectations were for a treatment effect which may be obscured by a treatment by age interaction. In the learning/memory measure of inter-response latency, the first 2 days in the D.R.L task after exposure showed a T X A interaction with no T main effect. These first days back to the task after 72 hours in the magnetic field measure retention of the learning which took place prior to exposure. The effect on the 2 age groups is the opposite; young animals generally had longer IRT's (relative to their controls) and the old animals had shorter IRT's. Longer IRT's signify better performance on the D.R.L schedule. This suggests that learning or memory may be interfered with in some way in the older rats, while young rats may have been facilitated in the ability to inhibit responding.

The last days show the result of 5 daily trials of learning. By then any effect on learning (if it exists) should be stronger than an effect on memory consolidation during the 72 hours in the 0.5 Hz field and away from the D.R.L. task. This effect was not demonstrated.

The effect of the magnetic field on the measures of emotion taken (the number of fecal boluses, responses with IRT's below 1 second) did not show significance. This finding is at odds with the author's previous research which indicated a strong effect on emotion, as measured by fecal bolus production. No explanation is offered for this result except that the data was in the predicted direction of a T X A interaction on the last 3 days but was not consistent enough to show stastical significance.

The effects which were recorded on response inhibition and emotion have several possible etiologies. Changes in hormone levels, especially testosterone, may affect general activity levels causing more competing responses such as grooming, looking for escape routes, etc., or could lead to changes in alertness or motivation, or in perception of time. bar-press response delaying behaviours or, more likely, bar-press response behaviour.

The effects seen are a result of acute exposure to very low levels of magnetic fields. Since the closeness of the magnets had no significant effect on any of the measures, it would appear that even short term, low dose exposures to this type of field can have effects which may be measurable with crude learning tasks such as D.R.L. responding. Whether the determinant of the effect is direct action on the brain (and which part of the brain) or the endrocrine system remains to be tested. The potential mechanisms for a weak magnetic field many orders below the electric fields measured across cell walls (in volts/m) and in the nervous system have not been discussed.

APPENDIX

Means and deviation scores for all cells of the design: T=1 is control group

T=2 is magnetic field exposure group

A=1 is old animals

A=2 is young animals

C=1 is closest to magnetic field apparatus

C=5 is farthest from mag. field apparatus

D=1 is day 1 (first pre-exposure day)

D=2 is day 2 (second pre-exposure day)

D=3 is day 3 (first post-exposure day)

D=7 is day 7 (last post-exposure day)

Measures are (in order):

fecal boluses

0-1 second responses

total responses

calculated response latency

total time/ total responses

MEAN 2.11667

CELL MEANS

T =	1	2
	1.73333	2.50000

A =	1	2
	2.89048	1.34286

C =	1	2	3	4	5
	2.09524	2.51190	2.10714	2.03571	1.83333

D =	1	2	3	4	5	6	
	2.96667	2.20000	1.98333	1.76667	2.11667	1.73333	2

	A =	1	2
T =	1	2.10476	1.36190
	2	3.67619	1.32381

	C =	1	2	3	4	5
T =	1	2.52381	2.07143	1.88095	0.69048	1.50000
	2	1.66667	2.95238	2.33333	3.38095	2.16667

	C =	1	2	3	4	5
A =	1	2.92857	2.92857	3.52381	2.61905	2.45238
	2	1.26190	2.09524	0.69048	1.45238	1.21428

	D =	1	2	3	4	5	6	
T =	1	1.70000	1.80000	1.90000	1.66667	2.13333	1.50000	1
	2	4.23333	2.60000	2.06667	1.86667	2.10000	1.96667	2

	D =	1	2	3	4	5	6	
A =	1	4.06667	3.16667	2.70000	2.26667	2.53333	2.53333	2
	2	1.86667	1.23333	1.26667	1.26667	1.70000	0.93333	1

	D =	1	2	3	4	5	6	
C =	1	2.00000	1.16667	2.25000	1.58333	2.41667	2.50000	2
	2	4.91667	2.50000	2.83333	1.91667	1.91667	1.16667	2
	3	1.33333	2.75000	1.50000	2.08333	2.00000	2.58333	2
	4	3.08333	2.66667	1.66667	1.66667	2.50000	1.41667	1
	5	3.50000	1.91667	1.66667	1.58333	1.75000	1.00000	1

T = 1

	C = 1	2	3	4	5
A = 1	3.38095	1.85714	2.61905	1.00000	1.66667
2	1.66667	2.28571	1.14286	0.38095	1.33333

T = 2

	C = 1	2	3	4	5
A = 1	2.47619	4.00000	4.42857	4.23809	3.23809
2	0.85714	1.90476	0.23810	2.52381	1.09524

T = 1

	D = 1	2	3	4	5	6	
A = 1	1.86667	2.66667	2.73333	1.66667	2.33333	1.80000	1
2	1.53333	0.93333	1.06667	1.66667	1.93333	1.20000	1

T = 2

	D = 1	2	3	4	5	6	
A = 1	6.26667	3.66667	2.66667	2.86667	2.73333	3.26667	4
2	2.20000	1.53333	1.46667	0.86667	1.46667	0.66667	1

T = 1

	D = 1	2	3	4	5	6	
C = 1	2.83333	1.66667	3.33333	2.00000	3.16667	2.50000	2
2	3.16667	2.50000	2.50000	2.83333	1.66667	0.83333	1
3	0.0	1.83333	1.83333	1.66667	2.66667	2.33333	2
4	0.83333	1.00000	0.83333	0.50000	0.83333	0.83333	0
5	1.66667	2.00000	1.00000	1.33333	2.33333	1.00000	1

T = 2

	D = 1	2	3	4	5	6	
C = 1	1.16667	0.66667	1.16667	1.16667	1.66667	2.50000	3
2	6.66667	2.50000	3.16667	1.00000	2.16667	1.50000	3
3	2.66667	3.66667	1.16667	2.50000	1.33333	2.83333	2
4	5.33333	4.33333	2.50000	2.83333	4.16667	2.00000	2
5	5.33333	1.83333	2.33333	1.83333	1.16667	1.00000	1

A = 1

C \ D	1	2	3	4	5	6	
C = 1	2.83333	2.33333	3.16667	1.66667	3.66667	3.66667	3
2	5.33333	4.16667	2.83333	2.50000	1.50000	1.00000	3
3	2.66667	4.50000	2.66667	3.33333	2.50000	4.50000	4
4	5.16667	2.50000	2.33333	1.66667	3.00000	2.00000	1
5	4.33333	2.33333	2.50000	2.16667	2.00000	1.50000	2

A = 2

C \ D	1	2	3	4	5	6	
C = 1	1.16667	0.0	1.33333	1.50000	1.16667	1.33333	2
2	4.50000	0.83333	2.83333	1.33333	2.33333	1.33333	1
3	0.0	1.00000	0.33333	0.83333	1.50000	0.66667	0
4	1.00000	2.83333	1.00000	1.66667	2.00000	0.83333	0
5	2.66667	1.50000	0.83333	1.00000	1.50000	0.50000	0

T = 1 A = 1

C \ D =	1	2	3	4	5	6	
1	3.33333	3.33333	5.00000	2.00000	4.66667	3.00000	2
2	3.66667	3.66667	2.00000	3.00000	0.66667	0.0	0
3	0.0	2.66667	3.00000	1.66667	3.00000	3.33333	4
4	0.66667	1.00000	1.66667	0.33333	1.66667	1.66667	0
5	1.66667	2.66667	2.00000	1.33333	1.66667	1.00000	1

T = 1 A = 2

C \ D =	1	2	3	4	5	6	
1	2.33333	0.0	1.66667	2.00000	1.66667	2.00000	2
2	2.66667	1.33333	3.00000	2.66667	2.66667	1.66667	2
3	0.0	1.00000	0.66667	1.66667	2.33333	1.33333	1
4	1.00000	1.00000	0.0	0.66667	0.0	0.0	0
5	1.66667	1.33333	0.0	1.33333	3.00000	1.00000	1

T = 2 A = 1

C \ D =	1	2	3	4	5	6	
1	2.33333	1.33333	1.33333	1.33333	2.66667	4.33333	4
2	7.00000	4.66667	3.66667	2.00000	2.33333	2.00000	6
3	5.33333	6.33333	2.33333	5.00000	2.00000	5.66667	4
4	9.66667	4.00000	3.00000	3.00000	4.33333	2.33333	3
5	7.00000	2.00000	3.00000	3.00000	2.33333	2.00000	3

T = 2 A = 2

C \ D =	1	2	3	4	5	6	
1	0.0	0.0	1.00000	1.00000	0.66667	0.66667	2
2	6.33333	0.33333	2.66667	0.0	2.00000	1.00000	1
3	0.0	1.00000	0.0	0.0	0.66667	0.0	0
4	1.00000	4.66667	2.00000	2.66667	4.00000	1.66667	1
5	3.66667	1.66667	1.66667	0.66667	0.0	0.0	0

CELL DEVIATIONS

X(T....) - X(.....)

T =	1	2
	-0.38333	0.38333

X(.A...) - X(.....)

A =	1	2
	0.77381	-0.77381

X(..C..) - X(.....)

C =	1	2	3	4	5
	-0.02143	0.39524	-0.00952	-0.08095	-0.28333

X(....D) - X(.....)

D =	1	2	3	4	5	6	
	0.85000	0.08333	-0.13333	-0.35000	0.0	-0.38333	-0

X(TA...) - X(.A...) - X(T....) + X(.....)

T =	A =	1	2
	1	-0.40238	0.40238
	2	0.40238	-0.40238

X(T.C..) - X(..C..) - X(T....) + X(.....)

T =	C =	1	2	3	4	5
	1	0.81190	-0.05714	0.15714	-0.96190	0.05000
	2	-0.81191	0.05714	-0.15714	0.96190	-0.05000

X(.AC..) - X(..C..) - X(.A...) + X(.....)

A =	C =	1	2	3	4	5
	1	0.05952	-0.35714	0.64286	-0.19048	-0.15476
	2	-0.05952	0.35714	-0.64286	0.19048	0.15476

X(T...D) - X(....D) - X(T....) + X(.....)

T	D = 1	2	3	4	5	6	
1	-0.88333	-0.01667	0.30000	0.28333	0.40000	0.15000	-0
2	0.88333	0.01667	-0.30000	-0.28333	-0.40000	-0.15000	0

X(.A..D) - X(....D) - X(.A...) + X(.....)

A	D = 1	2	3	4	5	6	
1	0.32619	0.19286	-0.05714	-0.27381	-0.35714	0.02619	0
2	-0.32619	-0.19286	0.05714	0.27381	0.35714	-0.02619	-0

X(..C.D) - X(....D) - X(..C..) + X(.....)

C	D = 1	2	3	4	5	6	
1	-0.94524	-1.01191	0.28810	-0.16191	0.32143	0.78810	0
2	1.55476	-0.09524	0.45476	-0.24524	-0.59524	-0.96191	-0
3	-1.62381	0.55952	-0.47381	0.32619	-0.10714	0.85952	0
4	0.19762	0.54762	-0.23571	-0.01905	0.46429	-0.23571	-0
5	0.81667	-0.00000	-0.03333	0.10000	-0.08333	-0.45000	-0

X(TAC..) - X(.AC..) - X(T.C..) - X(TA...) + X(..C..) +
+ X(T....) - X(.....)

T = 1

A	C = 1	2	3	4	5
1	0.42619	-0.22857	-0.27619	0.12857	-0.05000
2	-0.42619	0.22857	0.27619	-0.12857	0.05000

T = 2

A	C = 1	2	3	4	5
1	-0.42619	0.22857	0.27619	-0.12857	0.05000
2	0.42619	-0.22857	-0.27619	0.12857	-0.05000

T = 1

D =	1	2	3	4	5	6	
A = 1	-0.53095	0.30238	0.51905	-0.09762	0.18571	-0.09762	-0
2	0.53095	-0.30238	-0.51905	0.09762	-0.18572	0.09762	0

T = 2

D =	1	2	3	4	5	6	
A = 1	0.53095	-0.30238	-0.51905	0.09762	-0.18571	0.09762	0
2	-0.53095	0.30238	0.51905	-0.09762	0.18571	-0.09762	-0

X(T.C.D) - X(..C.D) - X(T...D) - X(T.C..) + X(....D) +
+ X(T....) - X(.....)

T = 1

D =	1	2	3	4	5	6	
C = 1	1.28809	0.08810	0.35476	-0.29524	-0.07857	-0.57857	-0
2	-0.42619	0.45714	-0.19286	1.07381	-0.20952	-0.04286	-0
3	-0.22381	-0.67381	0.25952	-0.47381	0.49286	-0.17381	0
4	-0.02143	-0.30476	0.21191	-0.10476	-0.72143	0.61191	0
5	-0.61667	0.43333	-0.63333	-0.20000	0.51667	0.18333	0

T = 2

D =	1	2	3	4	5	6	
C = 1	-1.28809	-0.08809	-0.35476	0.29524	0.07857	0.57857	0
2	0.42619	-0.45714	0.19286	-1.07381	0.20953	0.04286	0
3	0.22381	0.67381	-0.25952	0.47381	-0.49286	0.17381	-0
4	0.02143	0.30476	-0.21190	0.10476	0.72143	-0.61190	-0
5	0.61667	-0.43333	0.63333	0.20000	-0.51667	-0.18333	-0

X(.AC.D) - X(..C.D) - X(.A..D) - X(.AC..) + X(....D) +
+ X(.A...) - X(.....)

A = 1

D =	1	2	3	4	5	6	
C = 1	-0.32619	0.14048	0.14048	-0.47619	0.77381	0.30714	-0
2	-0.32619	1.05714	-0.35952	0.44048	-0.47619	-0.60952	0
3	-0.40952	0.14048	-0.19286	0.10714	-0.55952	0.47381	0
4	1.17381	-0.94286	0.14048	-0.30952	0.27381	-0.02619	-0
5	-0.11191	-0.39524	0.27143	0.23810	-0.01190	-0.14524	0

A = 2

D =	1	2	3	4	5	6	
C = 1	0.32619	-0.14048	-0.14048	0.47619	-0.77381	-0.30714	0
2	0.32619	-1.05714	0.35952	-0.44048	0.47619	0.60952	-0
3	0.40952	-0.14048	0.19286	-0.10714	0.55952	-0.47381	-0
4	-1.17381	0.94286	-0.14048	0.30952	-0.27381	0.02619	0
5	0.11191	0.39524	-0.27143	-0.23809	0.01190	0.14524	-0

X(TAC.D) - X(.AC.D) - X(T.C.D) - X(TA..D) - X(TAC..) +
+ X(.A..D) + X(T...D) + X(.AC..) + X(T.C..) + X(TA...) -
- X(..C..) - X(.A...) - X(T....) + X(.....)

T = 1 A = 1

C	D = 1	2	3	4	5	6	
C = 1	0.17381	0.17381	0.20714	-0.00952	0.04048	-0.59286	0
2	1.24524	-0.17143	-0.38809	0.31190	-0.13809	0.06190	-0
3	-0.12381	-0.54048	0.15953	-0.47381	0.32619	-0.14048	0
4	-1.44524	0.13809	-0.07857	0.20476	0.42143	0.62143	0
5	0.15000	0.40000	0.10000	-0.03333	-0.65000	0.05000	-0

T = 1 A = 2

C	D = 1	2	3	4	5	6	
C = 1	-0.17381	-0.17381	-0.20714	0.00952	-0.04047	0.59286	-0
2	-1.24524	0.17143	0.38809	-0.31191	0.13810	-0.06191	0
3	0.12381	0.54048	-0.15952	0.47381	-0.32619	0.14048	-0
4	1.44524	-0.13810	0.07857	-0.20476	-0.42143	-0.62143	-0
5	-0.15000	-0.40000	-0.10000	0.03333	0.65000	-0.05000	0

T = 2 A = 1

C	D = 1	2	3	4	5	6	
C = 1	-0.17381	-0.17381	-0.20714	0.00952	-0.04048	0.59286	-0
2	-1.24524	0.17143	0.38809	-0.31191	0.13809	-0.06191	0
3	0.12381	0.54048	-0.15952	0.47381	-0.32619	0.14048	-0
4	1.44524	-0.13810	0.07857	-0.20476	-0.42143	-0.62143	-0
5	-0.15000	-0.40000	-0.10000	0.03333	0.65000	-0.05000	0

T = 2 A = 2

C	D = 1	2	3	4	5	6	
C = 1	0.17381	0.17381	0.20714	-0.00953	0.04048	-0.59286	0
2	1.24524	-0.17143	-0.38810	0.31190	-0.13810	0.06190	-0
3	-0.12381	-0.54048	0.15952	-0.47381	0.32619	-0.14048	0
4	-1.44524	0.13809	-0.07857	0.20476	0.42143	0.62142	0
5	0.15000	0.40000	0.10000	-0.03334	-0.65000	0.05000	-0

DEPENDENT VARIABLE 2 (0-1 SEC RESP.)

MEAN 22.85951

CELL MEANS

T =	1	2
	25.00000	20.71904

A =	1	2
	30.93810	14.78095

C =	1	2	3	4	5
	14.79762	20.46428	28.36903	19.54761	31.11903

D =	1	2	3	4	5	6	
	43.88333	22.23332	18.00000	22.38333	18.20000	19.51666	16

	A =	1	2
T =	1	32.84761	17.15237
	2	29.02856	12.40952

	C =	1	2	3	4	5
T =	1	15.97619	16.54761	29.97618	18.80951	43.69048
	2	13.61905	24.38095	26.76190	20.28571	18.54761

	C =	1	2	3	4	5
A =	1	16.97618	28.90475	35.40475	23.40475	50.00000
	2	12.61905	12.02381	21.33333	15.69048	12.23809

	D =	1	2	3	4	5	6	
T =	1	39.06667	23.46666	22.59999	26.56667	21.66666	20.66666	20
	2	48.70000	21.00000	13.40000	18.20000	14.73333	16.36665	12

	D =	1	2	3	4	5	6	
A =	1	55.23332	31.46666	25.36666	30.39999	24.59999	26.03333	22
	2	32.53333	13.00000	10.03333	14.36667	11.80000	11.00000	10

	D =	1	2	3	4	5	6	
C =	1	34.16666	10.66667	11.83333	18.25000	10.58333	8.08333	10
	2	42.83333	24.00000	10.58333	16.41666	14.00000	16.08333	19
	3	51.08333	27.25000	21.66666	24.25000	22.41666	28.58333	23
	4	42.16666	21.75000	20.75000	20.41666	13.50000	10.41667	7
	5	49.16666	27.50000	25.16666	32.58333	30.50000	29.41666	23

T = 1

C =	1	2	3	4	5
A = 1	18.52380	21.76190	27.28571	20.28571	76.38095
2	13.42857	11.33333	32.66666	17.33333	11.00000

T = 2

C =	1	2	3	4	5
A = 1	15.42857	36.04761	43.52380	26.52380	23.61903
2	11.80952	12.71428	10.00000	14.04762	13.47619

T = 1

D =	1	2	3	4	5	6	
A = 1	49.53333	33.26666	31.73332	33.39999	28.20000	26.66666	27
2	28.59999	13.66667	13.46667	19.73332	15.13333	14.66667	14

T = 2

D =	1	2	3	4	5	6	
A = 1	60.93332	29.66666	20.20000	27.39999	21.00000	25.39999	18
2	36.46666	12.33333	6.60000	9.00000	8.46667	7.33333	6

T = 1

D =	1	2	3	4	5	6	
C = 1	23.50000	13.00000	14.66667	23.33333	12.00000	9.00000	16
2	29.66666	27.00000	12.83333	14.66667	11.16667	10.33333	10
3	51.16666	28.50000	25.50000	24.16666	23.16666	26.50000	30
4	42.50000	18.83333	19.16666	20.00000	11.66667	10.00000	9
5	48.50000	30.00000	40.83333	50.66666	50.33333	47.50000	38

T = 2

D =	1	2	3	4	5	6	
C = 1	44.83333	8.33333	9.00000	13.16667	9.16667	7.16667	3
2	56.00000	21.00000	8.33333	18.16666	16.83333	21.83333	28
3	51.00000	26.00000	17.83333	24.33333	21.66666	30.66666	15
4	41.83333	24.66666	22.33333	20.83333	15.33333	10.83333	6
5	49.83333	25.00000	9.50000	14.50000	10.66667	11.33333	9

A = 1

C	D = 1	2	3	4	5	6	
1	41.66666	14.33333	12.16667	21.33333	11.16667	6.83333	11
2	60.33333	37.33333	16.16666	20.16666	18.50000	21.66666	28
3	60.16666	37.66666	29.50000	31.00000	26.50000	35.83333	27
4	46.16666	24.16666	29.33333	27.00000	16.33333	12.16667	8
5	67.83333	43.83333	42.66666	52.50000	50.50000	53.66666	39

A = 2

C	D = 1	2	3	4	5	6	
1	26.66666	7.00000	11.50000	15.16667	10.00000	9.33333	8
2	25.33333	10.66667	5.00000	12.66667	9.50000	10.50000	10
3	42.00000	16.83333	13.83333	17.50000	18.33333	21.33333	19
4	38.16666	19.33333	12.16667	13.83333	10.66667	8.66667	7
5	30.50000	11.16667	7.66667	12.66667	10.50000	5.16667	8

T = 1 A = 1

C	D = 1	2	3	4	5	6	
1	34.33333	19.66666	14.00000	24.33333	13.00000	5.00000	19
2	41.66666	43.66666	21.00000	12.33333	9.33333	11.33333	13
3	49.66666	31.00000	28.00000	21.00000	16.33333	16.33333	28
4	42.00000	18.00000	23.33333	25.33333	12.00000	10.00000	11
5	80.00000	54.00000	72.33333	84.00000	90.33333	90.66666	63

T = 1 A = 2

C	D = 1	2	3	4	5	6	
1	12.66667	6.33333	15.33333	22.33333	11.00000	13.00000	13
2	17.66666	10.33333	4.66667	17.00000	13.00000	9.33333	7
3	52.66666	26.00000	23.00000	27.33333	30.00000	36.66666	33
4	43.00000	19.66666	15.00000	14.66667	11.33333	10.00000	7
5	17.00000	6.00000	9.33333	17.33333	10.33333	4.33333	12

T = 2 A = 1

C	D = 1	2	3	4	5	6	
1	49.00000	9.00000	10.33333	18.33333	9.33333	8.66667	3
2	79.00000	31.00000	11.33333	28.00000	27.66666	32.00000	43
3	70.66666	44.33333	31.00000	41.00000	36.66666	55.33333	25
4	50.33333	30.33333	35.33333	28.66666	20.66666	14.33333	6
5	55.66666	33.66666	13.00000	21.00000	10.66667	16.66666	14

T = 2 A = 2

C	D = 1	2	3	4	5	6	
1	40.66666	7.66667	7.66667	8.00000	9.00000	5.66667	4
2	33.00000	11.00000	5.33333	8.33333	6.00000	11.66667	13
3	31.33333	7.66667	4.66667	7.66667	6.66667	6.00000	6
4	33.33333	19.00000	9.33333	13.00000	10.00000	7.33333	6
5	44.00000	16.33333	6.00000	[illegible].00000	10.66667	6.00000	3

CELL DEVIATIONS

X(T....) - X(.....)

T =	1	2
	2.14049	-2.14047

X(.A...) - X(.....)

A =	1	2
	8.07858	-8.07856

X(..C..) - X(.....)

C =	1	2	3	4	5
	-8.06189	-2.39523	5.50952	-3.31190	8.25952

X(....D) - X(.....)

D =	1	2	3	4	5	6
	21.02382	-0.62619	-4.85951	-0.47618	-4.65952	-4.34285

-6

X(TA...) - X(.A...) - X(T....) + X(.....)

	A =	1	2
T =	1	-0.23097	0.23094
	2	0.23094	-0.23096

X(T.C..) - X(..C..) - X(T....) + X(.....)

	C =	1	2	3	4	5
T =	1	-0.96192	-6.05716	-0.53334	-2.87859	10.43095
	2	0.96190	6.05714	0.53334	2.87857	-10.43095

X(.AC..) - X(..C..) - X(.A...) + X(.....)

	C =	1	2	3	4	5
A =	1	-5.90002	0.36189	-1.04286	-4.22144	10.80238
	2	5.89999	-0.36191	1.04286	4.22143	-10.80238

X(T...D) - X(....D) - X(T....) + X(.....)

	D =	1	2	3	4	5	6	
T =	1	-6.95715	-0.90715	2.45950	2.04285	1.32617	0.00351	2
	2	6.95714	0.90715	-2.45953	-2.04286	-1.32619	-0.00354	-2

X(.A..D) - X(....D) - X(.A...) + X(.....)

	D =	1	2	3	4	5	6	
A =	1	3.27141	1.15475	-0.11192	-0.06192	-1.67859	-0.56192	-2
	2	-3.27145	-1.15476	0.11189	0.06190	1.67856	0.56190	2

X(..C.D) - X(....D) - X(..C..) + X(.....)

	D =	1	2	3	4	5	6	
C =	1	-1.65479	-3.50476	1.89523	3.92856	0.44523	-2.37144	1
	2	1.34523	4.16191	-5.02143	-3.57144	-1.80476	-0.03810	4
	3	1.69048	-0.49284	-1.84286	-3.64285	-1.29286	4.55714	1
	4	1.59523	2.82858	6.06190	1.34523	-1.38809	-4.78809	-5
	5	-2.97620	-2.99284	-1.09286	1.94048	4.04048	2.64047	-1

X(TAC..) - X(.AC..) - X(T.C..) - X(TA...) + X(..C..) +
+ X(T....) - X(.....)

T = 1

	C =	1	2	3	4	5
A =	1	0.60002	-2.99521	-9.49522	-2.14998	14.04048
	2	-0.59998	2.99526	9.49525	2.15002	-14.04047

T = 2

	C =	1	2	3	4	5
A =	1	-0.59998	2.99524	9.49524	2.15001	-14.04048
	2	0.60000	-2.99524	-9.49524	-2.15000	14.04048

X(TA..D) - X(.A..D) - X(T...D) - X(TA...) + X(....D) +
+ X(T....) - X(.....)

T = 1

	D =	1	2	3	4	5	6	
A =	1	-0.65236	0.79764	1.39764	-0.95236	0.36432	-1.28569	0
	2	0.65240	-0.79761	-1.39759	0.95239	-0.36426	1.28574	-0

T = 2

	D =	1	2	3	4	5	6	
A =	1	0.65239	-0.79762	-1.39760	0.95239	-0.36427	1.28574	-0
	2	-0.65238	0.79761	1.39763	-0.95238	0.36429	-1.28570	0

X(T.C.D) - X(..C.D) - X(T...D) - X(T.C..) + X(....D) +
+ X(T....) - X(.....)

T = 1

	D =	1	2	3	4	5	6	
C =	1	-4.88807	2.06191	-0.80474	1.86191	-1.08808	-0.27141	3
	2	-2.29285	7.82382	3.70717	0.12383	-0.24283	-1.84283	-7
	3	5.43333	0.55000	-0.23331	-3.73334	-2.18332	-3.69998	3
	4	8.02859	-1.27142	-3.30475	-1.72141	-2.42141	0.31193	0
	5	-6.28094	-9.16429	0.63573	3.46904	5.93571	5.50240	-0

T = 2

	D =	1	2	3	4	5	6	
C =	1	4.88811	-2.06191	0.80477	-1.86190	1.08810	0.27144	-3
	2	2.29286	-7.82382	-3.70714	-0.12381	0.24285	1.84286	7
	3	-5.43333	-0.55002	0.23333	3.73332	2.18332	3.70000	-3
	4	-8.02856	1.27141	3.30476	1.72144	2.42143	-0.31189	-0
	5	6.28096	9.16428	-0.63570	-3.46904	-5.93571	-5.50235	0

X(.AC.D) - X(..C.D) - X(.A..D) - X(.AC..) + X(...D)
+ X(.A...) - X(.....)

A = 1

C \ D	1	2	3	4	5	6	
1	2.05003	0.33336	-1.73330	0.96669	0.08337	-2.86662	1
2	5.78812	3.73810	-2.74523	-4.62856	-2.26189	-2.29523	2
3	-1.22380	2.22618	0.90955	-0.22380	-1.27379	0.77620	-1
4	-3.12856	-2.59525	4.83810	2.78812	0.65477	-1.54522	-1
5	-3.48570	-3.70239	-1.26904	1.09763	2.79762	5.93095	-1

A = 2

C \ D	1	2	3	4	5	6	
1	-2.04998	-0.33333	1.73335	-0.96666	-0.08332	2.86667	-1
2	-5.78808	-3.73810	2.74524	4.62858	2.26191	2.29524	-2
3	1.22382	-2.22620	-0.90951	0.22381	1.27381	-0.77619	1
4	3.12858	2.59522	-4.83810	-2.78809	-0.65477	1.54523	1
5	3.48574	3.70237	1.26906	-1.09762	-2.79762	-5.93094	1

X(TAC.D) - X(.AC.D) - X(T.C.D) - X(TA..D) - X(TAC..) +
+ X(.A..D) + X(T...D) + X(.AC..) + X(T.C..) + X(TA...) -
- X(..C..) - X(.A...) - X(T....) + X(.....)

T = 1 A = [illegible]

C \ D =	1	2	3	4	5	6	
1	3.61664	1.83329	-2.76670	-1.50002	-0.31671	-1.83337	0
2	-1.62146	5.76187	4.41188	-1.90478	-3.47146	-0.07145	-3
3	-0.20477	1.01190	2.99521	0.76190	-1.55479	-6.40479	3
4	-1.46669	-1.66667	-3.43335	2.08330	-0.48336	1.91664	3
5	-0.32382	-6.94048	-1.20715	0.55952	5.82617	6.39284	-4

T = 1 A = 2

C \ D =	1	2	3	4	5	6	
1	-3.61664	-1.83334	2.76664	1.49999	0.31664	1.83331	-0
2	1.62142	-5.76192	-4.41193	1.90474	3.47140	0.07140	3
3	0.20473	-1.01190	-2.99527	-0.76190	1.55475	6.40471	-3
4	1.46663	1.66666	3.43332	-2.08335	0.48331	-1.91669	-3
5	0.32381	6.94051	1.20713	-0.55952	-5.82618	-6.39285	4

T = 2 A = 1

C \ D =	1	2	3	4	5	6	
1	-3.61668	-1.83335	2.76665	1.49998	0.31665	1.83329	-0
2	1.62143	-5.76189	-4.41189	1.90477	3.47142	0.07143	3
3	0.20476	-1.01189	-2.99525	-0.76190	1.55474	6.40475	-3
4	1.46666	1.66669	3.43332	-2.08336	0.48331	-1.91669	-3
5	0.32381	6.94049	1.20715	-0.55952	-5.82618	-6.39288	4

T = 2 A = 2

C \ D =	1	2	3	4	5	6	
1	3.61666	1.83334	-2.76668	-1.50000	-0.31667	-1.83334	0
2	-1.62144	5.76192	4.41191	-1.90476	-3.47142	-0.07144	-3
3	-0.20476	1.01192	2.99523	0.76191	-1.55475	-6.40476	3
4	-1.46667	-1.66664	-3.43334	2.08333	-0.48333	1.91666	3
5	-0.32384	-6.94048	-1.20716	0.55952	5.82618	6.39281	-4

DEPENDENT VARIABLE 3 (TOTAL RESP.)

MEAN 297.27368

CELL MEANS

T =	1	2
	294.94263	299.60474

A =	1	2
	297.81421	296.73315

C =	1	2	3	4	5
	300.85693	275.29761	298.19043	300.13086	311.89282

D =	1	2	3	4	5	6	
	404.39990	315.19995	282.89990	300.83325	274.16650	253.08325	245

	A =	1	2
T =	1	296.55225	293.33325
	2	299.07617	300.13330

	C =	1	2	3	4	5
T =	1	300.14282	266.92847	307.30933	271.07129	329.26172
	2	301.57129	283.66650	289.07129	329.19043	294.52368

	C =	1	2	3	4	5
A =	1	302.38086	273.52368	291.50000	302.76172	318.90454
	2	299.33325	277.07129	304.88086	297.50000	304.88086

	D =	1	2	3	4	5	6	
T =	1	380.19995	298.39990	294.89990	313.19995	278.86646	246.86665	252
	2	428.59985	332.00000	270.89990	288.46655	269.46655	269.29980	238

	D =	1	2	3	4	5	6	
A =	1	365.19995	305.83325	299.93311	312.39990	275.83325	273.16650	252
	2	443.59985	324.56665	265.86646	289.26660	272.50000	243.00000	238

	D =	1	2	3	4	5	6	
C =	1	437.41650	325.50000	303.16650	309.75000	259.00000	238.08333	233
	2	387.66650	285.33325	281.08325	273.00000	233.50000	232.25000	234
	3	364.33325	299.41650	262.75000	287.33325	274.25000	305.41650	293
	4	419.41650	335.08325	292.83325	310.16650	284.41650	245.50000	213
	5	413.16650	330.66650	274.66650	323.91650	319.66650	269.16650	252

T = 1

	C = 1	2	3	4	5
A = 1	295.66650	259.19043	274.85693	264.95215	388.09521
2	304.61890	274.66650	339.76172	277.19043	270.42847

T = 2

	C = 1	2	3	4	5
A = 1	309.09521	287.85693	308.14282	340.57129	249.71428
2	294.04761	279.47607	270.00000	317.80933	339.33325

T = 1

	D = 1	2	3	4	5	6	
A = 1	352.73315	303.53320	322.13330	314.66650	275.59985	248.39999	258
2	407.66650	293.26660	267.66650	311.73315	282.13330	245.33333	245

T = 2

	D = 1	2	3	4	5	6	
A = 1	377.66650	308.13330	277.73315	310.13330	276.06665	297.93311	245
2	479.53320	355.86646	264.06665	266.79980	262.86646	240.66666	231

T = 1

	D = 1	2	3	4	5	6	
C = 1	424.33325	298.66650	321.33325	316.83325	268.33325	225.83333	245
2	387.33325	310.50000	292.16650	266.83325	213.16666	197.83333	200
3	351.33325	309.16650	269.33325	300.00000	298.66650	292.16650	330
4	381.33325	285.66650	279.66650	294.00000	245.50000	211.00000	200
5	356.66650	288.00000	312.00000	388.33325	368.66650	307,50000	283

T = 2

	D = 1	2	3	4	5	6	
C = 1	450.50000	352.33325	285.00000	302.66650	249.66666	250.33333	220
2	388.00000	260.16650	270.00000	279.16650	253.83333	266.66650	267
3	377.33325	289.66650	256.16650	274.66650	249.83333	318.66650	257
4	457.50000	384.50000	306.00000	326.33325	323.33325	280.00000	226
5	469.66650	373.33325	237.33333	259.50000	270.66650	230.83333	220

A = 1

C	D = 1	2	3	4	5	6	
1	381.00000	291.83325	301.16650	344.33325	281.50000	256.33325	260
2	359.33325	305.16650	304.00000	274.33325	228.66666	220.93333	222
3	309.00000	302.16650	274.33325	278.00000	255.16666	324.66650	297
4	420.00000	309.83325	312.83325	321.00000	288.16650	260.16650	207
5	356.66650	320.16650	307.33325	344.33325	325.66650	303.83325	274

A = 2

C	D = 1	2	3	4	5	6	
1	493.83325	359.16650	305.16650	275.16650	236.50000	219.83333	205
2	416.00000	265.50000	258.16650	271.66650	238.33333	243.66666	246
3	419.66650	296.66650	251.16666	296.66650	293.33325	286.16650	290
4	418.83325	360.33325	272.83325	299.33325	280.66650	230.83333	219
5	469.66650	341.16650	242.00000	303.50000	313.66650	234.50000	229

T = 1 A = 1

C	D = 1	2	3	4	5	6	
1	365.66650	285.00000	307.33325	330.00000	287.33325	219.33333	275
2	356.66650	337.00000	339.00000	240.66666	194.00000	168.66666	178
3	297.66650	256.66650	277.00000	251.00000	244.00000	264.33325	333
4	376.66650	290.66650	278.33325	307.00000	225.00000	195.66666	181
5	367.00000	348.33325	409.00000	444.66650	427.66650	394.00000	326

T = 1 A = 2

C	D = 1	2	3	4	5	6	
1	483.00000	312.33325	335.33325	303.66650	249.33333	232.33333	216
2	418.00000	284.00000	245.33333	293.00000	232.33333	227.00000	223
3	405.00000	361.66650	261.66650	349.00000	353.33325	320.00000	327
4	386.00000	280.66650	281.00000	281.00000	266.00000	226.33333	219
5	346.33325	227.66666	215.00000	332.00000	309.66650	221.00000	241

T = 2 A = 1

C	D = 1	2	3	4	5	6	
1	396.33325	298.66650	295.00000	358.66650	275.66650	293.33325	246
2	362.00000	273.33325	269.00000	308.00000	263.33325	273.00000	266
3	320.33325	347.66650	271.66650	305.00000	266.33325	385.00000	261
4	463.33325	329.00000	347.33325	335.00000	351.33325	324.66650	233
5	346.33325	292.00000	205.66666	244.00000	223.66666	213.66666	222

T = 2 A = 2

C	D = 1	2	3	4	5	6	
1	504.66650	406.00000	275.00000	246.66666	223.66666	207.33333	195
2	414.00000	247.00000	271.00000	250.33333	244.33333	260.33325	269
3	434.33325	231.66666	240.66666	244.33333	233.33333	252.33333	253
4	451.66650	440.00000	264.66650	317.66650	295.33325	235.33333	220
5	593.00000	454.66650	269.00000	275.00000	317.66650	248.00000	218

CELL DEVIATIONS

X(T....) - X(.....)

T =	1	2
	-2.33105	2.33105

X(.A...) - X(.....)

A =	1	2
	0.54053	-0.54053

X(..C..) - X(.....)

C =	1	2	3	4	5
	3.58325	-21.97607	0.91675	2.85718	14.61914

X(....D) - X(.....)

D =	1	2	3	4	5	6	
	107.12622	17.92627	-14.37378	3.55957	-23.10718	-39.19043	-51

X(TA...) - X(.A...) - X(T....) + X(.....)

	A =	1	2
T =	1	1.06909	-1.06885
	2	-1.06909	1.06909

X(T.C..) - X(..C..) - X(T....) + X(.....)

	C =	1	2	3	4	5
T =	1	1.61694	-6.03809	11.44995	-26.72852	19.69995
	2	-1.61670	6.03784	-11.45020	26.72852	-19.70020

X(.AC..) - X(..C..) - X(.A...) + X(.....)

	C =	1	2	3	4	5
A =	1	0.98340	-2.31445	-7.23096	2.09033	6.47119
	2	-0.98315	2.31421	7.23096	-2.09033	-6.47144

X(T...D) - X(....D) - X(T....) + X(.....)

	D =	1	2	3	4	5	6	
T =	1	-21.86890	-14.46899	14.33105	14.69775	7.03101	-8.88554	9
	2	21.86890	14.46899	-14.33105	-14.69775	-7.03101	8.88550	-9

X(.A..D) - X(....D) - X(.A...) + X(.....)

	D = 1	2	3	4	5	6	
A = 1	-39.74048	-9.90723	16.49268	11.02612	1.12622	14.54272	6
2	39.74048	9.90723	-16.49292	-11.02612	-1.12598	-14.54272	-6

X(..C.D) - X(....D) - X(..C..) + X(.....)

	D = 1	2	3	4	5	6	
C = 1	29.43335	6.71680	16.68335	5.33350	-18.74976	-23.58318	-15
2	5.24268	-7.89063	20.15942	-5.85718	-18.69043	-3.85718	10
3	-40.98340	-16.70020	-21.06665	-14.41675	-0.83325	46.41650	47
4	12.15942	17.02612	7.07617	6.47607	7.39282	-15.44043	-34
5	-5.85254	0.84741	-22.85254	8.46411	30.88086	-3.53589	-7

X(TAC..) - X(.AC..) - X(T.C..) - X(TA...) + X(..C..) +
+ X(T....) - X(.....)

T = 1

	C = 1	2	3	4	5
A = 1	-7.06934	-7.03320	-26.83105	-9.81909	50.75269
2	7.06860	7.03320	26.83081	9.81885	-50.75244

T = 2

	C = 1	2	3	4	5
A = 1	7.06909	7.03345	26.83105	9.81909	-50.75203
2	-7.06909	-7.03320	-26.83081	-9.81934	50.75244

X(TA..D) - X(.A..D) - X(T...D) - X(TA...) + X(....D) +
+ X(T....) - X(.....)

T = 1

	D = 1	2	3	4	5	6	
A = 1	10.66406	13.43091	9.13110	-11.16919	-6.00244	-14.61900	-1
2	-10.66455	-13.43115	-9.13110	11.16870	6.00220	14.61877	1

T = 2

	D = 1	2	3	4	5	6	
A = 1	-10.66431	-13.43091	-9.13086	11.16919	6.00244	14.61914	1
2	10.66431	13.43066	9.13110	-11.16919	-6.00269	-14.61899	-1

X(T.C.D) − X(..C.D) − X(T...D) − X(T.C..) + X(....D) +
+ X(T....) − X(.....)

T = 1

C \ D =	1	2	3	4	5	6	
1	9.49976	-11.65039	4.54980	-6.90039	3.01636	-2.65034	4
2	29.90479	48.00488	5.12134	-12.49536	-18.99521	-17.16199	-34
3	-0.25000	15.10010	-16.86670	-11.14990	8.26660	-13.48335	18
4	12.84521	-5.88818	1.56177	-1.80469	-16.88794	3.44511	6
5	-52.00000	-45.56641	5.63354	32.35010	24.60010	29.85014	5

T = 2

C \ D =	1	2	3	4	5	6	
1	-9.49976	11.64990	-4.54980	6.89990	-3.01669	2.65015	-4
2	-29.90430	-48.00464	-5.12109	12.49536	18.99544	17.16211	34
3	0.25024	-15.09985	16.86670	11.15015	-8.26653	13.48364	-18
4	-12.84497	5.88818	-1.56177	1.80493	16.88818	-3.44507	-6
5	52.00024	45.56689	-5.63298	-32.34961	-24.59985	-29.84953	-5

X(.AC.D) − X(..C.D) − X(.A..D) − X(.AC..) + X(....D) +
+ X(.A...) − X(.....)

A = 1

C \ D =	1	2	3	4	5	6	
1	-18.19995	-25.28345	-20.01660	22.03320	19.84985	2.18327	19
2	13.18115	31.51440	8.19800	-7.91895	-4.18564	-24.18547	-16
3	-8.90234	19.34766	1.78101	-13.66895	-13.51913	11.39771	3
4	37.69312	-17.97363	0.87646	-2.82349	-0.00708	-2.50708	-15
5	-23.77124	-7.60449	9.16235	2.37891	-2.13794	13.11230	8

A = 2

C \ D =	1	2	3	4	5	6	
1	18.19995	25.28296	20.01660	-22.03369	-19.85034	-2.18359	-19
2	-13.18066	-31.51416	-8.19751	7.91895	4.18562	24.18570	16
3	8.90234	-19.34766	-1.78085	13.66895	13.51880	-11.39771	-3
4	-37.69287	17.97363	-0.87622	2.82373	0.00684	2.50691	15
5	23.77148	7.60474	-9.16162	-2.37842	2.13794	-13.11182	-8

	1	2	3	4	5	6	
	- X(TAC.D) + X(.A..D) - X(..C..)	- X(.AC.D) + X(T...D) - X(.A...)	- X(T.C.D) + X(.AC..) - X(T....)	- X(TA..D) + X(T.C..) + X(.....)	- X(TAC..) + X(TA...)		+ -

T = 1 A = 1

C	D = 1	2	3	4	5	6	
1	-6.91406	12.56958	-15.13086	-4.24707	8.50269	-4.13068	9
2	-7.03345	-0.80005	20.74976	-10.36655	-2.36676	2.83311	-3
3	16.76440	-42.91895	12.71436	-2.73560	-3.81876	-6.70229	26
4	-7.16431	25.56909	-21.71436	22.08569	-9.49756	-6.63084	-2
5	4.34766	5.58057	3.38037	-4.73608	7.18066	14.63048	-30

T = 1 A = 2

C	D = 1	2	3	4	5	6	
1	6.91479	-12.56836	15.13135	4.24829	-8.50188	4.13147	-9
2	7.03345	0.80005	-20.74968	10.36719	2.36679	-2.83311	3
3	-16.76392	42.91919	-12.71426	2.73608	3.81934	6.70276	-26
4	7.16455	-25.56885	21.71460	-22.08545	9.49780	6.63123	2
5	-4.34741	-5.58090	-3.38110	4.73584	-7.18091	-14.63098	30

T = 2 A = 1

C	D = 1	2	3	4	5	6	
1	6.91406	-12.56909	15.13086	4.24756	-8.50259	4.13086	-9
2	7.03320	0.80005	-20.75024	10.36670	2.36647	-2.83333	3
3	-16.76440	42.91895	-12.71436	2.73560	3.81886	6.70239	-26
4	7.16406	-25.56909	21.71411	-22.08594	9.49756	6.63086	2
5	-4.34782	-5.58122	-3.38144	4.73518	-7.18117	-14.63144	30

T = 2 A = 2

C	D = 1	2	3	4	5	6	
1	-6.91455	12.56958	-15.13110	-4.24716	8.50269	-4.13101	9
2	-7.03369	-0.79980	20.74976	-10.36638	-2.36653	2.83319	-3
3	16.76416	-42.91879	12.71411	-2.73552	-3.81885	-6.70247	26
4	-7.16431	25.56958	-21.71436	22.08594	-9.49707	-6.63077	-2
5	4.34766	5.58105	3.38054	-4.73584	7.18115	14.63063	-30

DEPENDENT VARIABLE 4 (CALCULATED RESP LATENCY)

MEAN 4.67163

CELL MEANS

T =	1	2
	4.67111	4.67218

A =	1	2
	4.62892	4.71436

C =	1	2	3	4	5
	4.66252	4.69144	4.59561	4.67257	4.73629

D =	1	2	3	4	5	6	
	3.76624	4.48353	4.80081	4.68344	4.92865	4.99928	5

	A = 1	2
T = 1	4.68363	4.65865
2	4.57428	4.77013

	C = 1	2	3	4	5
T = 1	4.66094	4.74711	4.56986	4.74840	4.62963
2	4.66420	4.63583	4.62143	4.59683	4.84303

	C = 1	2	3	4	5
A = 1	4.69639	4.60686	4.59594	4.62932	4.61652
2	4.62876	4.77609	4.59536	4.71591	4.85613

	D = 1	2	3	4	5	6	
T = 1	3.83512	4.46924	4.73883	4.64940	4.92111	5.09149	4
2	3.69737	4.49782	4.86280	4.71749	4.93623	4.90710	5

	D = 1	2	3	4	5	6	
A = 1	3.81826	4.38157	4.69600	4.61513	4.93191	4.95603	5
2	3.71423	4.58549	4.90563	4.75177	4.92542	5.04256	5

	D = 1	2	3	4	5	6	
C = 1	3.72018	4.49931	4.69430	4.60925	4.96376	5.04557	5
2	3.77799	4.44064	4.83507	4.72624	4.99621	5.06034	5
3	3.79234	4.44640	4.80581	4.70659	4.86940	4.73758	4
4	3.73028	4.43189	4.69619	4.68474	4.93567	5.04966	5
5	3.81045	4.59941	4.97273	4.69044	4.87830	5.10333	5

T = 1

	C = 1	2	3	4	5
A = 1	4.80163	4.75333	4.68212	4.78020	4.40111
2	4.52026	4.74089	4.45761	4.71660	4.85815

T = 2

	C = 1	2	3	4	5
A = 1	4.59114	4.46038	4.50976	4.47844	4.83193
2	4.73725	4.81129	4.73310	4.71521	4.85412

T = 1

	D = 1	2	3	4	5	6	
A = 1	3.88122	4.36815	4.64173	4.69675	5.00419	5.15815	5
2	3.78902	4.57033	4.83593	4.60206	4.93803	5.02483	4

T = 2

	D = 1	2	3	4	5	6	
A = 1	3.75531	4.39499	4.75027	4.53351	4.85964	4.75392	4
2	3.63943	4.60066	4.97534	4.90148	5.01282	5.06029	5

T = 1

	D = 1	2	3	4	5	6	
C = 1	3.77932	4.55830	4.65815	4.62293	4.93247	5.12024	4
2	3.85429	4.32057	4.72275	4.73734	5.10301	5.28676	5
3	3.83053	4.36389	4.76744	4.70423	4.86525	4.79620	4
4	3.77440	4.53515	4.75700	4.74107	5.02778	5.21290	5
5	3.93707	4.56829	4.78883	4.44146	4.67705	5.04137	4

T = 2

	D = 1	2	3	4	5	6	
C = 1	3.66104	4.44032	4.73044	4.59558	4.99506	4.97090	5
2	3.70169	4.56071	4.94740	4.71514	4.88941	4.83392	4
3	3.75415	4.52892	4.84419	4.70895	4.87355	4.67897	4
4	3.68615	4.32864	4.63538	4.62840	4.84355	4.88643	5
5	3.68384	4.63053	5.15662	4.93942	5.07957	5.16530	5

A = 1

	D = 1	2	3	4	5	6	
C = 1	3.82400	4.55251	4.74472	4.58801	4.98326	5.10002	5
2	3.75614	4.19051	4.68227	4.66634	4.98391	5.01936	4
3	3.98769	4.31341	4.73540	4.64889	4.93372	4.72054	4
4	3.70761	4.38850	4.52326	4.61469	4.92249	5.01370	5
5	3.81590	4.46292	4.79437	4.55770	4.83619	4.92458	4

A = 2

	D = 1	2	3	4	5	6	
C = 1	3.61636	4.44612	4.64388	4.63049	4.94427	4.99112	5
2	3.79984	4.69077	4.98788	4.78613	5.00852	5.10132	5
3	3.59699	4.57940	4.87622	4.76429	4.80508	4.75463	4
4	3.75294	4.47530	4.86912	4.75478	4.94885	5.08562	5
5	3.80502	4.73590	5.15108	4.82318	4.92042	5.28009	5

T = 1 A = 1

C \ D	1	2	3	4	5	6	
1	3.89381	4.58167	4.88544	4.83924	5.05426	5.35772	4
2	3.92168	4.09379	4.50436	4.88638	5.27675	5.35422	5
3	4.08003	4.45890	4.66890	4.74570	5.04950	4.99102	4
4	3.79477	4.51100	4.72564	4.68226	5.13740	5.30205	5
5	3.71584	4.19541	4.42436	4.33017	4.50306	4.78577	4

T = 1 A = 2

C \ D	1	2	3	4	5	6	
1	3.66484	4.53495	4.43087	4.40662	4.81069	4.88276	4
2	3.78690	4.54736	4.94116	4.58831	4.92928	5.21930	5
3	3.58104	4.26890	4.86598	4.66277	4.68102	4.60138	4
4	3.75405	4.55930	4.78836	4.79988	4.91817	5.12375	5
5	4.15832	4.94118	5.15332	4.55276	4.85105	5.29698	5

T = 2 A = 1

C \ D	1	2	3	4	5	6	
1	3.75420	4.52335	4.60401	4.33680	4.91227	4.84232	5
2	3.59060	4.28724	4.86020	4.44631	4.69107	4.68450	4
3	3.89536	4.16793	4.80191	4.55209	4.81795	4.45005	4
4	3.62046	4.26600	4.32089	4.54713	4.70758	4.72536	5
5	3.91596	4.73045	5.16439	4.78524	5.16934	5.06741	4

T = 2 A = 2

C \ D	1	2	3	4	5	6	
1	3.56790	4.35730	4.85689	4.85437	5.07786	5.09949	5
2	3.81279	4.83420	5.03460	4.98397	5.08776	4.98336	4
3	3.61294	4.88991	4.88648	4.86582	4.92916	4.90790	5
4	3.75185	4.39130	4.94988	4.70969	4.97954	5.04751	5
5	3.45172	4.53063	5.14886	5.09360	4.98980	5.26321	5

CELL DEVIATIONS

X(T....) - X(.....)

T =	1	2
	-0.00052	0.00055

X(.A...) - X(.....)

A =	1	2
	-0.04271	0.04274

X(..C..) - X(.....)

C =	1	2	3	4	5
	-0.00910	0.01981	-0.07602	0.00094	0.06466

X(....D) - X(.....)

D =	1	2	3	4	5	6	
	-0.90538	-0.18810	0.12918	0.01181	0.25702	0.32765	0

X(TA...) - X(.A...) - X(T....) + X(.....)

T = \ A =	1	2
1	0.05523	-0.05519
2	-0.05519	0.05522

X(T.C..) - X(..C..) - X(T....) + X(.....)

T = \ C =	1	2	3	4	5
1	-0.00106	0.05619	-0.02522	0.07635	-0.10614
2	0.00112	-0.05615	0.02527	-0.07629	0.10619

X(.AC..) - X(..C..) - X(.A...) + X(.....)

A = \ C =	1	2	3	4	5
1	0.07657	-0.04187	0.04304	-0.00055	-0.07706
2	-0.07651	0.04191	-0.04299	0.00060	0.07711

X(T...D) - X(....D) - X(T....) + X(.....)

	D =	1	2	3	4	5	6
T =	1	0.06940	-0.01377	-0.06145	-0.03352	-0.00702	0.092[illegible]
	2	-0.06942	0.01374	0.06145	0.03351	0.00703	-0.09[illegible]2

X(.A..D) - X(....D) - X(.A...) + X(.....)

	D =	1	2	3	4	5	6	
A =	1	0.09473	-0.05925	-0.06210	-0.02561	0.04597	-0.00053	0
	2	-0.09476	0.05923	0.06209	0.02559	-0.04596	0.00054	-0

X(..C.D) - X(....D) - X(..C..) + X(.....)

	D =	1	2	3	4	5	6	
C =	1	-0.03696	0.02488	-0.09741	-0.06509	0.04421	0.05540	0
	2	-0.00807	-0.06270	0.01446	0.02299	0.04775	0.0412[illegible]	-0
	3	0.10211	0.03889	0.08103	0.09917	0.01677	-0.18567	-0
	4	-0.03691	-0.05258	-0.10556	0.00035	0.00607	0.04944	0
	5	-0.02045	0.05122	0.10726	-0.05766	-0.11501	0.03940	-0

X(TAC..) - X(.AC..) - X(T.C..) - X(TA...) + X(..C..) +
+ X(T....) - X(.....)

T = 1

	C =	1	2	3	4	5
A =	1	0.05160	0.03557	0.05670	0.01982	-0.16398
	2	-0.05172	-0.03568	-0.05681	-0.01994	0.16387

T = 2

	C =	1	2	3	4	5
A =	1	-0.05172	-0.03568	-0.05681	-0.01994	0.16387
	2	0.05161	0.03558	0.05670	0.01983	-0.16397

X(TA..D) - X(.A..D) - X(T...D) - X(TA...) + X(....D) +
+ X(T....) - X(.....)

T = 1

	D =	1	2	3	4	5	6	
A =	1	-0.06115	-0.05435	-0.04752	0.06043	0.02459	0.05468	0
	2	0.06111	0.05432	0.04746	-0.06048	-0.02466	-0.05475	-0

T = 2

	D =	1	2	3	4	5	6	
A =	1	0.06111	0.05432	0.04746	-0.06048	-0.02466	-0.05475	-0
	2	-0.06114	-0.05435	-0.04752	0.06044	0.02460	0.05468	0

X(T.C.D) - X(..C.D) - X(T...D) - X(T.C..) + X(....D) +
+ X(T....) - X(.....)

T = 1

	D =	1	2	3	4	5	6	
C =	1	-0.00867	0.07435	0.02689	0.04877	-0.02269	-0.01648	-0
	2	-0.04877	-0.16197	-0.10654	-0.01106	0.05815	0.07801	0
	3	-0.00546	-0.04300	0.04882	0.05690	0.02862	-0.00838	-0
	4	-0.10110	0.04119	0.04643	0.01402	0.02331	-0.00533	-0
	5	0.16389	0.08931	-0.01578	-0.10880	-0.08758	-0.04804	0

T = 2

	D =	1	2	3	4	5	6	
C =	1	0.00861	-0.07441	-0.02698	-0.04885	0.02260	0.01638	0
	2	0.04873	0.16193	0.10648	0.01100	-0.05822	-0.07809	-0
	3	0.00541	0.04294	-0.04889	-0.05697	-0.02870	0.00829	0
	4	0.10104	-0.04125	-0.04651	-0.01410	-0.02340	0.00523	0
	5	-0.16393	-0.08936	0.01571	0.10878	0.08750	0.04795	-0

X(.AC.D)	- X(..C.D)	- X(.A..D)	- X(.AC..)	+ X(....D)	+	
+ X(.A...)	- X(.....)					

A = 1

C \ D =	1	2	3	4	5	6	
C = 1	-0.02477	0.07859	0.07866	-0.02949	-0.06033	0.02112	-0
2	-0.03200	-0.10629	-0.00612	0.05029	0.02631	0.04413	0
3	0.10030	-0.07407	-0.00865	-0.03242	0.01802	-0.01684	0
4	-0.07414	0.05911	-0.06758	-0.00118	-0.01589	0.00782	0
5	0.03049	0.04254	0.00351	0.01264	0.03169	-0.05645	-0

A = 2

C \ D =	1	2	3	4	5	6	
C = 1	0.02471	-0.07865	-0.07874	0.02941	0.06024	-0.02122	0
2	0.03196	0.10625	0.00606	-0.05035	-0.02638	-0.04421	-0
3	-0.10034	0.07402	0.00857	0.03236	-0.01810	0.01676	-0
4	0.07408	-0.05916	0.06750	0.00111	0.01581	-0.0[illegible]792	-0
5	-0.03053	-0.04258	-0.00358	-0.01270	-0.03177	0.05[illegible]37	0

X(TAC.D)	- X(.AC.D)	- X(T.C.D)	- X(TA..D)	- X(TAC..)	+
+ X(.A..D)	+ X(T...D)	+ X(.AC..)	+ X(T.C..)	+ X(TA...)	-
- X(..C..)	- X(.A...)	- X(T....)	+ X(.....)		

T = 1 λ = 1

C \ D =	1	2	3	4	5	6	
C = 1	-0.03501	-0.08230	0.11756	0.07030	-0.02913	0.02153	-0
2	0.05959	-0.01310	-0.10888	0.05771	0.07065	-0.03703	-0
3	0.00336	0.17042	-0.09253	-0.07319	-0.01659	0.04527	-0
4	0.02913	-0.00144	0.11404	-0.12424	0.02316	-0.00461	-0
5	-0.05678	-0.07329	-0.02985	0.06977	-0.04772	-0.02478	0

T = 1 λ = 2

C \ D =	1	2	3	4	5	6	
C = 1	0.03514	0.08243	-0.11741	-0.07014	0.02929	-0.02137	0
2	-0.05948	0.01320	0.10901	-0.05758	-0.07051	0.03717	0
3	-0.00325	-0.17031	0.09267	0.07332	0.01674	-0.04512	0
4	-0.02900	0.00157	-0.11389	0.12439	-0.02300	0.00477	0
5	0.05689	0.07340	0.02998	-0.06963	0.04786	0.02493	-0

T = 2 λ = 1

C \ D =	1	2	3	4	5	6	
C = 1	0.03514	0.08243	-0.11741	-0.07015	0.02928	-0.02137	0
2	-0.05948	0.01321	0.10901	-0.05758	-0.07051	0.03717	0
3	-0.00325	-0.17031	0.09267	0.07332	0.01674	-0.04512	0
4	-0.02900	0.00157	-0.11389	0.12439	-0.02300	0.00478	0
5	0.05689	0.07341	0.02998	-0.06963	0.04787	0.02493	-0

T = 2 λ = 2

C \ D =	1	2	3	4	5	6	
C = 1	-0.03502	-0.08231	0.11756	0.07029	-0.02913	0.02153	-0
2	0.05959	-0.01310	-0.10889	0.05770	0.07065	-0.03704	-0
3	0.00336	0.17042	-0.09253	-0.07319	-0.01659	0.04527	-0
4	0.02912	-0.00144	0.11404	-0.12425	0.02316	-0.00461	-0
5	-0.05679	-0.07329	-0.02985	0.06976	-0.04772	-0.02478	0

DEPENDENT VARIABLE 5 (TIME/TOT RESP LATENCY)

MEAN 5.94964

CELL MEANS

T =	1	2
	5.92272	5.97657

A =	1	2
	6.09679	5.80250

C =	1	2	3	4	5
	5.75744	6.08257	6.28177	5.70008	5.92656

D =	1	2	3	4	5	6	
	5.73038	5.80003	6.56414	5.63952	5.90753	6.01514	5

	A = 1	2
T = 1	6.03607	5.80942
2	6.15756	5.79564

	C = 1	2	3	4	5
T = 1	5.79818	6.11550	5.92782	5.89263	5.87995
2	5.71681	6.04975	6.63581	5.50766	5.97328

	C = 1	2	3	4	5
A = 1	5.79625	6.22447	6.77418	5.64189	6.04762
2	5.71875	5.94078	5.78945	5.75840	5.80561

	D = 1	2	3	4	5	6	
T = 1	5.96098	5.85376	6.08884	5.55242	5.90387	6.16146	5
2	5.49981	5.74636	7.03952	5.72666	5.91127	5.86889	6

	D = 1	2	3	4	5	6	
A = 1	6.00422	5.87656	6.87710	5.70780	6.07507	6.10710	6
2	5.45657	5.72356	6.25126	5.57128	5.74006	5.92325	5

	D = 1	2	3	4	5	6	
C = 1	5.36089	5.68554	5.76651	5.47393	6.00285	5.98964	6
2	6.07677	5.82613	6.21767	5.76114	6.16226	6.38593	6
3	6.08988	5.96069	8.48549	5.93982	6.11037	5.68014	5
4	5.36637	5.62655	6.00721	5.43340	5.51343	5.90523	6
5	5.75808	5.90140	6.34403	5.58942	5.74833	6.11434	6

T = 1

	C = 1	2	3	4	5
A = 1	5.96896	6.25354	6.30572	5.98053	5.67196
2	5.62741	5.97747	5.54993	5.80472	6.08734

T = 2

	C = 1	2	3	4	5
A = 1	5.62354	6.19540	7.24265	5.30324	6.42328
2	5.81008	5.90409	6.02898	5.71207	5.52328

T = 1

	D =	1	2	3	4	5	6	
A =	1	6.14322	5.81885	5.92659	5.73958	6.17200	6.41283	6
	2	5.77874	5.88867	6.25110	5.36525	5.63575	5.91010	5

T = 2

	D =	1	2	3	4	5	6	
A =	1	5.86522	5.93427	7.82761	5.67602	5.97816	5.80137	6
	2	5.13441	5.55845	6.25142	5.77731	5.84438	5.93641	6

T = 1

	D =	1	2	3	4	5	6	
C =	1	5.72809	5.80800	5.76353	5.56493	5.80663	6.06942	5
	2	6.06475	5.52364	6.08280	5.75581	6.25277	6.76336	6
	3	6.24638	5.88810	6.55002	5.71000	6.02597	5.73747	5
	4	5.59886	5.98094	5.92822	5.50633	5.90170	6.15109	6
	5	6.16683	6.06813	6.11966	5.22503	5.53230	6.08598	5

T = 2

	D =	1	2	3	4	5	6	
C =	1	4.99370	5.56308	5.76950	5.38298	6.19908	5.90987	6
	2	6.08878	6.12863	6.35253	5.76647	6.07175	6.00850	5
	3	5.93338	6.03327	10.42096	6.16965	6.13478	5.62282	6
	4	5.13388	5.27216	6.08619	5.36047	5.12517	5.65938	5
	5	5.34933	5.73467	6.56841	5.95382	5.36557	6.14390	6

A = 1

	D =	1	2	3	4	5	6	
C =	1	5.53913	5.97647	5.87966	5.47039	5.92944	5.95644	5
	2	6.34396	5.69980	6.18199	5.83777	6.41913	6.69835	6
	3	6.68029	6.09364	10.40933	6.13243	6.47556	5.81120	5
	4	5.26126	5.58487	5.58995	5.44102	5.57493	5.30170	6
	5	6.19648	6.02802	6.32456	5.65739	5.97632	6.16782	5

A = 2

	D =	1	2	3	4	5	6	
C =	1	5.18265	5.39461	5.65337	5.47747	6.07627	6.02285	6
	2	5.80958	5.95247	6.25335	5.68451	5.90540	6.07351	5
	3	5.49947	5.82774	6.56165	5.74721	5.74518	5.54908	5
	4	5.47148	5.66822	6.42447	5.42578	5.45194	5.90876	5
	5	5.31968	5.77478	6.36350	5.52146	5.52155	6.06207	6

T = 1 A = 1

C \ D	1	2	3	4	5	6	
1	6.00173	5.97949	6.09381	5.90559	5.87612	6.22523	5
2	6.34055	5.15863	5.65642	6.10619	6.65336	7.27726	6
3	6.73489	6.39740	6.42134	5.99072	6.66946	6.30632	5
4	5.63615	5.88692	5.96230	5.53624	6.10882	6.35585	6
5	6.00283	5.67181	5.49909	5.15919	5.55224	5.89951	5

T = 1 A = 2

C \ D	1	2	3	4	5	6	
1	5.45444	5.63651	5.43325	5.22428	5.73714	5.91360	5
2	5.78896	5.88865	6.50920	5.40544	5.85219	6.24947	6
3	5.75787	5.37880	6.67871	5.42927	5.38249	5.16862	5
4	5.56158	6.07497	5.89415	5.47643	5.69458	5.94633	5
5	6.33085	6.46445	6.74022	5.29087	5.51236	6.27246	6

T = 2 A = 1

C \ D	1	2	3	4	5	6	
1	5.07654	5.97345	5.66552	5.03520	5.98277	5.68765	5
2	6.34737	6.24097	6.70757	5.56936	6.18491	6.11945	6
3	6.62569	5.78987	14.39734	6.27414	6.28168	5.31609	6
4	4.88639	5.28284	5.21761	5.34580	5.04104	5.44756	5
5	6.39015	6.38424	7.15003	6.15559	6.40041	6.43613	6

T = 2 A = 2

C \ D	1	2	3	4	5	6	
1	4.91086	5.15271	5.87348	5.73066	6.41540	6.13210	6
2	5.83020	6.01630	5.99750	5.96359	5.95861	5.89756	5
3	5.24108	6.27668	6.44459	6.06516	6.10788	5.92955	6
4	5.38138	5.26149	6.95478	5.37514	5.20931	5.87119	5
5	4.30853	5.08512	5.98678	5.75204	5.53074	5.85168	6

CELL DEVIATIONS

X(T....) - X(.....)

T =	1	2
	-0.02691	0.02694

X(.A...) - X(.....)

A =	1	2
	0.14715	-0.14713

X(..C..) - X(.....)

C =	1	2	3	4	5
	-0.19220	0.13293	0.33213	-0.24955	-0.02308

X(....D) - X(.....)

D =	1	2	3	4	5	6	
	-0.21926	-0.14961	0.61450	-0.31012	-0.04210	0.06550	0

X(TA...) - X(.A...) - X(T....) + X(.....)

	A =	1	2
T =	1	-0.03381	0.03383
	2	0.03383	-0.03381

X(T.C..) - X(..C..) - X(T....) + X(.....)

	C =	1	2	3	4	5
T =	1	0.06766	0.05985	-0.32703	0.21946	-0.01970
	2	-0.06757	-0.05975	0.32710	-0.21937	0.01978

X(.AC..) - X(..C..) - X(.A...) + X(.....)

	C =	1	2	3	4	5
A =	1	-0.10834	-0.00525	0.34526	-0.20535	-0.02609
	2	0.10844	0.00535	-0.34519	0.20544	0.02618

X(T...D) - X(....D) - X(T....) + X(.....)

	D =	1	2	3	4	5	6	
T =	1	0.25751	0.08065	-0.44838	-0.06019	0.02325	0.17324	-0
	2	-0.25750	-0.08060	0.44844	0.06021	-0.02320	-0.17319	0

X(.A..D) - X(....D) - X(.A...) + X(.....)

	D =	1	2	3	4	5	6	
A =	1	0.12669	-0.07062	0.16580	-0.07887	0.02039	-0.05519	-0
	2	-0.12668	0.07067	-0.16574	0.07890	-0.02034	0.05525	0

X(..C.D) - X(....D) - X(..C..) + X(.....)

	D =	1	2	3	4	5	6	
C =	1	-0.17729	0.07771	-0.60543	0.02661	0.28752	0.16670	0
	2	0.21346	-0.10682	-0.47940	-0.01131	0.12180	0.23786	0
	3	0.02737	-0.17147	1.58922	-0.03183	-0.12929	-0.66713	-0
	4	-0.11446	0.07607	-0.30738	0.04344	-0.14455	0.13964	0
	5	0.05078	0.12445	-0.19703	-0.02702	-0.13552	0.12288	0

X(TAC..) - X(.AC..) - X(T.C..) - X(TA...) + X(..C..) +
+ X(T....) - X(.....)

T = 1

	C = 1	2	3	4	5
A = 1	0.16577	0.02994	-0.08071	0.17991	-0.29524
2	-0.16591	-0.03008	0.08059	-0.18005	0.29511

T = 2

	C = 1	2	3	4	5
A = 1	-0.16591	-0.03008	0.08060	-0.18005	0.29511
2	0.16577	0.02994	-0.08071	0.17991	-0.29524

X(TA..D) - X(.A..D) - X(T...D) - X(TA...) + X(....D) +
+ X(T....) - X(.....)

T = 1

	D = 1	2	3	4	5	6	
A = 1	-0.05779	-0.07764	-0.44141	0.15269	0.13439	0.19322	0
2	0.05774	0.07755	0.44131	-0.15276	-0.13449	-0.19331	-0

T = 2

	D = 1	2	3	4	5	6	
A = 1	0.05773	0.07755	0.44130	-0.15276	-0.13449	-0.19331	-0
2	-0.05779	-0.07764	-0.44141	0.15269	0.13439	0.19322	0

X(T.C.D) - X(..C.D) - X(T...D) - X(T.C..) + X(....D) +
+ X(T....) - X(.....)

T = 1

	D = 1	2	3	4	5	6	
C = 1	0.06834	0.00107	0.40465	0.11046	-0.26022	-0.13421	-0
2	-0.30246	-0.41608	0.28058	0.02192	0.03432	0.17126	0
3	0.25293	0.20071	-1.13314	0.18431	0.24629	0.23804	0
4	-0.21757	0.08120	0.17685	-0.05948	0.17247	-0.11992	-0
5	0.19785	0.13270	0.27062	-0.25759	-0.19327	-0.15558	0

T = 2

	D = 1	2	3	4	5	6	
C = 1	-0.06906	-0.00123	-0.40482	-0.11058	0.26006	0.13405	0
2	0.30234	0.41592	-0.28076	-0.02206	-0.03449	-0.17142	-0
3	-0.25303	-0.20085	1.13299	-0.18442	-0.24643	-0.23817	-0
4	0.21744	-0.08136	-0.17702	0.05929	-0.17263	0.11976	0
5	-0.19797	-0.13284	-0.27079	0.25747	0.19312	0.15543	-0

X(.AC.D) - X(..C.D) - X(.A..D) - X(.AC..) + X(....D) +
+ X(.A...) - X(.....)

A = 1

C \ D =	1	2	3	4	5	6	
1	0.01274	0.32274	-0.09146	0.03653	-0.13261	-0.01682	-0
2	-0.00140	-0.19762	-0.34339	0.01360	0.09457	0.22571	0
3	-0.02869	-0.28884	1.26563	-0.22093	-0.14761	-0.30615	-0
4	-0.17360	0.08714	-0.52487	0.14469	0.09930	0.10986	0
5	0.19065	0.07618	-0.30633	0.02578	0.08594	-0.01299	-0

A = 2

C \ D =	1	2	3	4	5	6	
1	-0.01287	-0.32290	0.09129	-0.03666	0.13244	0.01666	0
2	0.00127	0.19746	0.34321	-0.01375	-0.09475	-0.22588	-0
3	0.02859	0.28870	-1.26578	0.22081	0.14746	0.30602	0
4	0.17348	-0.08730	0.52469	-0.14483	-0.09947	-0.11003	-0
5	-0.19077	-0.07633	0.30616	-0.02591	-0.08610	0.01283	0

X(TAC.D) - X(.AC.D) - X(T.C.D) - X(TA..D) - X(TAC..) +
+ X(.A..D) + X(T...D) + X(.AC..) + X(T.C..) + X(TA...) -
- X(..C..) - X(.A...) - X(T....) + X(.....)

T = 1 A = 1

C	D = 1	2	3	4	5	6	
1	0.02123	-0.17377	0.52658	0.05954	-0.12345	-0.13616	-0
2	0.07027	-0.15717	0.05457	0.12492	0.01320	0.01213	-0
3	0.07041	0.56850	-1.49661	0.04994	0.25842	0.35909	0
4	0.05408	-0.12081	0.74664	-0.27650	-0.13486	-0.13103	-0
5	-0.21557	-0.11625	0.16936	0.04255	-0.01278	-0.10352	0

T = 1 A = 2

C	D = 1	2	3	4	5	6	
1	-0.02106	0.17397	-0.52636	-0.05935	0.12366	0.13637	0
2	-0.07009	0.15737	-0.05434	-0.12474	-0.01298	-0.01192	0
3	-0.07026	-0.56832	1.49680	-0.04978	-0.25823	-0.35890	-0
4	-0.05391	0.12102	-0.74642	0.27669	0.13508	0.13124	0
5	0.21573	0.11645	-0.16915	-0.04237	0.01299	0.10372	-0

T = 2 A = 1

C	D = 1	2	3	4	5	6	
1	-0.02106	0.17398	-0.52635	-0.05935	0.12367	0.13637	0
2	-0.07009	0.15738	-0.05434	-0.12473	-0.01298	-0.01191	0
3	-0.07026	-0.56833	1.49680	-0.04978	-0.25823	-0.35891	-0
4	-0.05391	0.12102	-0.74642	0.27669	0.13507	0.13124	0
5	0.21573	0.11646	-0.16915	-0.04237	0.01300	0.10373	-0

T = 2 A = 2

C	D = 1	2	3	4	5	6	
1	0.02123	-0.17376	0.52657	0.05954	-0.12345	-0.13616	-0
2	0.07027	-0.15717	0.05456	0.12498	0.01320	0.01213	-0
3	0.07041	0.56851	-1.49661	0.04994	0.25842	0.35908	0
4	0.05408	-0.12081	0.74664	-0.27650	-0.13486	-0.13103	-0
5	-0.21556	-0.11625	0.16936	0.04256	-0.01279	-0.10352	0

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