CONTINGENT NEGATIVE VARIATION AS AN INDEX OF PRECOGNITIVE INFORMATION

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The contingent negative variation (CNV) is a slow, surface-negative electrical brainwave studied in experiments which emphasize the association (contingency) of two successive stimuli. It was first described by Walter et. al. (1964) who used the term 'expectancy' to describe the primary psychological variable underlying its development. In the present study it is used as a physiological index of information about a future event. The merit of this kind of parapsychological experiment is that no consciously mediated response is sought from the subject. Instead, the brainwave is examined for evidence of paranormally derived information. The principal disadvantage of the method lies in the difficulties associated with recording and analysing the CNV data. This paper describes in detail some novel strategies used to cope with these demands in the present experiment.

At least one previous series of experiments have been done in which the CNV was assessed for its usefulness to parapsychology (Levin & Kennedy, 1975; Kennedy, 1977). No significant results were obtained. Grey Walter himself (1970) was the first to suggest the appropriateness of such an investigation, and the a priori strength of the idea seemed sufficient to warrant at least an additional experiment. It might also be noted that the past few years have seen a marked increase in the quality and sophistication of the psychophysiological laboratory facilities available for parapsychology experiments. This is especially true at the University of Utrecht. Thus it recently became feasible to conduct a very careful experiment, improving upon the earlier attempt in design, instrumentation and analysis.

In the usual investigation of CNV, the first stimulus serves as a warning or preparatory signal. It is followed a few seconds later by the second or 'imperative' stimulus which (usually) requires that some definite response be made by the subject. The negative

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shift in the electroencephalogram (EEG) during this interstimulus interval is the CNV. Tecce (1972) has reviewed early research relating the form and size of this shift to psychological processes in man. He concluded that attention to the anticipated occurrence of the imperative stimulus is the essential variable governing the magnitude of the CNV.

In more recent years at least two distinct component waves have been identified by the use of longer interstimulus intervals (Loveless & Stanford, 1975). Functional and topographic differences allowed Rohrbaugh, et.al. (1976) to distinguish between an early wave elicited by the warning stimulus and a later wave identified with preparation for a motor response. The later wave is maximal over the motor cortex contralateral to the responding hand and shares critical features with the motor readiness potential first described by Kornhuber and Deeke (1965).

The earlier wave has maximal negativity over the frontal regions and represents a response to the warning stimulus. Positive waves of a similar time course are elicited at parietal sites. These latter responses have been studied extensively as indicators of stimulus relevance. A critical review of this research has been published by Näätänen (1975). It is known that evoked responses of this latency can be influenced by stimulus meaning, as distinct from such sensory parameters as intensity or form (Sutton, et.al. 1967).

BACKGROUND

It is to be noted that the precise waveforms obtained in slow potential experiments are highly individualized. Signals derived from one subject under two experimental conditions can be expected to show more similarities than signals obtained from two subjects under the same condition. Consequently there are important advantages to experimental procedures which emphasize comparisons across conditions within subjects. These advantages are generally to be weighed against the hazards of offering to many experimental conditions to each subject. Typically a dozen or more artifact-free trials are needed within each condition if a reliable estimate of the CNV signals are to be formed.

It may be conjectured that a similar tradeoff exists in the way in which several experimental conditions influence performance on a parapsychological task. The presence of a few psychologically similar conditions may be desirable if they introduce beneficial demand characteristics. Correct responses may then often be expected within the experiment as a whole, and no great distinction need be made between psi-mediated trials and those of other types. Thus it is hoped that the several experimental conditions will contribute to a psychological environment in which the subject has 'permission to score' on the psi task. This advantage is once again balanced by the boredom of long experimental regimens and the seeming affinity of psi for novel situations. Thus both technical and psychological factors recommend a procedure with few experimental conditions for each subject.

EXPERIMENTAL DESIGN

The present experiment is organized as a precognition or psychokinesis study. It differs from most other parapsychology experiments in several ways. First, no consciously mediated response or guess is required. The analysis is entirely concerned with examining a subject's preparation for the imperative stimulus as reflected in his brain waves. Second, the subject is given a reaction time task and a psychological set that strongly condition him to focus upon sensory input. This may be considered a disadvantage, as there is a widely held belief backed by experimental data that paranormal phenomena are more likely to be manifest in situations which minimize the importance of sensory input by focusing a subject's attention internally (see, for instance, Honorton 1977). Finally it may be noted that the present study is a highly automated one. All data collection and delivery of stimuli are under the programmed control of a medium-sized laboratory computer. As they are gathered the data are stored on magnetic discs for subsequent multivariate statistical analysis on the same machine.

The study was designed to contrast two situations which are quite dissimilar in terms of the response expected from a subject. In one instance he glimpses a picture of a person opposite his sex and responds as quickly as possible by pressing a button. In the other instance the picture is of a person of his own sex, and no motor response is made. These two types of pictures (projected transparencies) serve as the imparative stimuli for a CNV study.

The warning stimuli are also projected transparencies, each of which provides one of three distinct levels of information about the imperative stimulus which follows it. These slides show a stylized face smiling, frowning, or with no mouth at all. They are equalized for overall brightness, and are projected briefly (about 150 milliseconds). A smiling face implies that an imperative stimulus depicting a person of the opposite sex will follow, so that the subject should prepare himself to make a rapid motor response upon its presentation. A frowning face means that the imperative stimulus will depict someone of the same sex so that no motor response will be required. A face without a mouth may be followed by either sex.

One third of the warning slides are of high contrast so that the subject is fully informed about the imperative stimulus which follows. One third of the warning slides are of very low contrast so that the subject is less well informed about the imperative stimulus. The brightness of the projected image is adjusted to yield a scoring rate of 75% in a preliminary forced-choice guessing test using only the low contrast smiles and frowns. Thus these stimuli are said to be of a low information level. The final third of the warning slides are also of low contrast but show no mouth so that they provide no information about the imperative stimulus to follow. Trials using these warnings constitute the parapsychological or 'ESP' portion of the experiment.

A set of six CNV's are estimated for each subject. These correspond to the two kinds of imperative stimuli with each of the three levels of information. Previous research (Kennedy 1977) made it seem unlikely that a multivariate test would reveal significant differences between the two ESP conditions. Consequently the differences found at the other levels of information are used to generate a specific univariate hypothesis about the differences to be expected for the ESP trials. In this way the analysis is tailored to the kinds of CNV differences that seem relevant to each individual subject. Including an intermediate level of information allows a measure of the consistency of the CNV differences as information is decreased and the subject becomes uncertain about the response he must make.

The low information trials also serve to establish a psychological context for the ESP trials. Subjects are often uncertain about whether a given warning slide provides information or not as well as being uncertain about the sex of the person to be shown in the imperative stimulus. Nevertheless, the subject knows that some information is often provided by such slides as he has been able to guess them correctly more often than chance would predict. Consequently the instructions encourage him to prepare his response based upon whatever clues he might have.

A total of 160 trials are given in four runs of 40. A circular tray holds the slides in a predetermined order. In fixing this sequence a shuffling procedure based upon the FORTRAN subroutine RANDU is used to intermix the types of warning stimuli. These slides are apportioned as follows: 7 high contrast smiles, 7 high contrast frowns, 7 low contrast smiles, 7 low contrast frowns, and 12 low contrast faces without mouths. These slides are placed in alternate positions in a tray with a total capacity of 80 slides. An appropriate imperative stimulus is paired with each warning slide which shows a smile or a frown. This slide immediately follows the warning slide in the tray. Two imperative stimuli (one depicting a person of each sex) are associated with each warning slide which shows no mouth. These immediately precede and follow it in the tray.

A Schmidt-type random number generator employing a high frequency noise diode is used to determine which of these slides is shown.

This choice is made immediately after the warning slide is projected. Ordinarily the projector is stepped forward after each slide is shown. A proper choice by the random number generator, however, causes the computer to move the projector backwards to the preceding slide. If this occurs, the projector is advanced three steps following this presentation instead of the usual one. The entry point in the tray is randomly determined at the start of each run in order to provide a modicum of variety to the sequence of warning stimuli. The imperative stimuli depict a number of different individuals in a variety of poses in order to make the experiment as interesting as possible.

Considerable care is used in shielding the subject from sounds made by the projector which could inform him of the direction of its movement. A rear projection system is employed that allows the projector to be located two rooms away from the subject. The windows in both intervening walls are doubly glazed to improve sound attenuation. With the doors closed, no projector sounds were audible to the laboratory staff when seated in the subject's chair.

As an added precaution, however, a white masking noise was introduced to the subject's room. This has the extra benefit of aiding concentration by covering extraneous noises that may arise from the building or street. It is to be noted that the type of imperative stimulus selected in the case of the ESP trials depends not only upon the direction of projector movement, but also upon the type of imperative stimulus which immediately precedes this warning slide in the tray. This latter fact is usually determined by the preceding warning slide, but in case it also showed no mouth the situation is determined by the trial which preceded it, and so on.

A small red lamp glows near the center of the screen throughout the experiment to provide a place for the subject to fix his gaze. Weerts and Lang (1973) found this technique helpful in reducing eye movements during the interstimulus interval. A timing diagram showing the events for each trial is given in figure 1. The period between trials is approximately seven seconds, varying slightly from trial to trial.

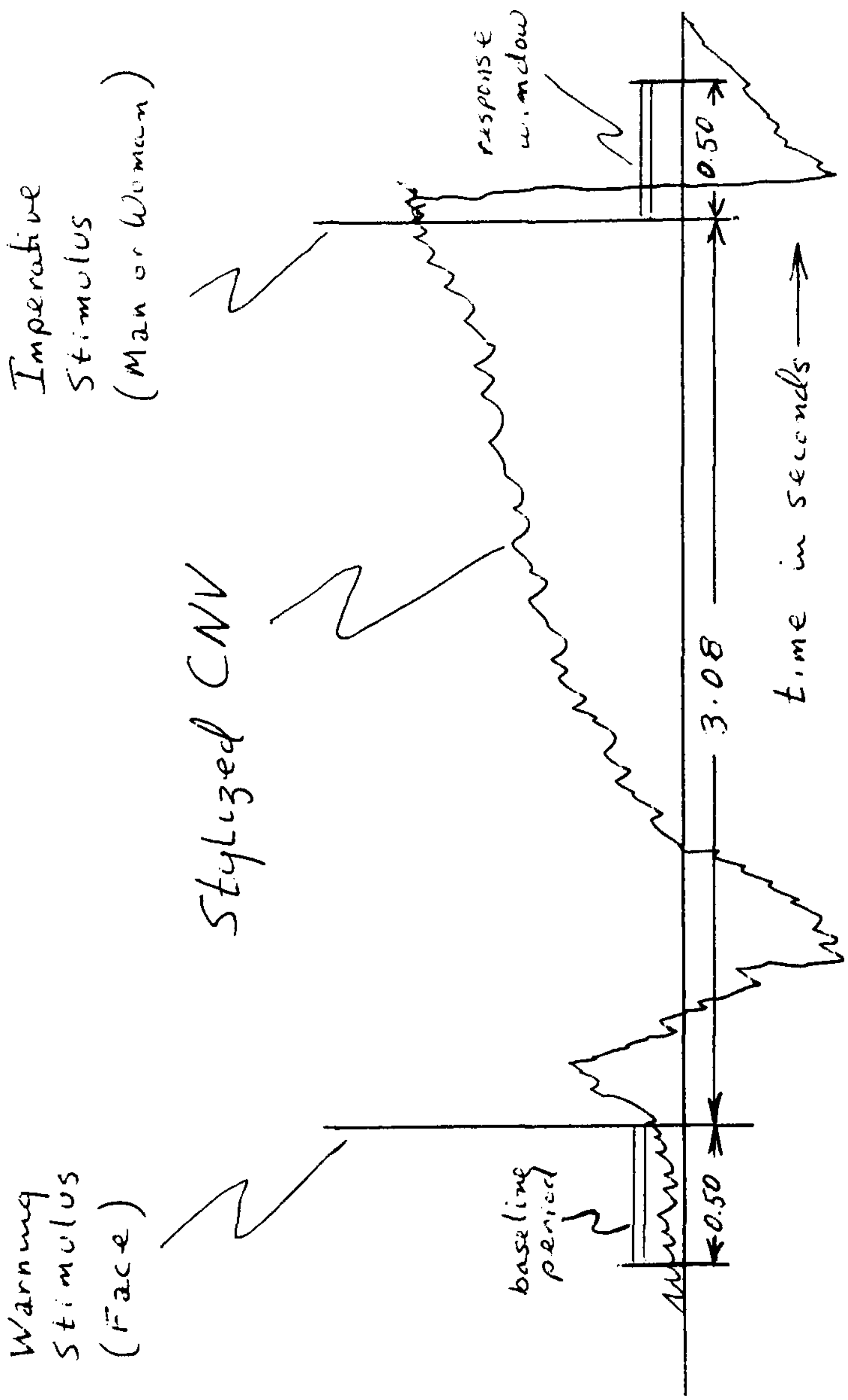

FIGURE 1

Timing diagram for each trial

EEG is recorded from three electrodes located along the midline in frontal, central, and parietal positions (F_Z, C_Z, and P_z according to the International 10/20 system). An additional electrode located just above one eye is used to detect blinks and eye movements. The electrodes are of the silver cup variety and are carefully chlorided and maintained. They are held off the skin by means of an epoxy coating applied around the lip. All four channels are referenced to yoked ear lobes and are amplified using a low frequency time constant of 10 seconds and a bandwidth of 35 Hz. (Above 35 Hz the amplifiers roll off very sharply to reject 50 Hz noise from the power lines.) EEG and eye data are displayed on an oscillograph and are digitized by the laboratory computer at the rate of one sample every 7.0 milliseconds (about 142 samples per second). A total of 512 samples are gathered from each channel during the half second baseline period and the 3.08 second interstimulus interval of each trial.

The computer program which controls the stimuli and samples the physiology also checks for contamination by artifact. Data for each trial are first inspected to ensure that they lie within the useful analog to digital converter range. If so, they are examined for eye movements or blinks. If excursions in the eye channel exceed a criterion value set separately for each subject, the trial is disregarded. The program next applies a fast Fourier transform to each EEG channel and examines the power spectra for evidence of muscle artifact. If any channel contains greater power above 15 Hz than below, it is judged to be contaminated, and the data from all electrodes for that trial are omitted from further analysis. The first four trials from each run of forty are thought of as 'practice' and are similarly discarded by the program. Trials on which the subject makes a premature button press are also excluded. Data from trials judged by these criteria to be free from artifact are reduced to 256 points per channel by digitally filtering above 35 Hz. They are re-transformed, and stored on a removable cartridge disc pack for subsequent off-line analysis.

SUBJECTS

Ten subjects (six males) were chosen from those volunteering. Their selection was governed in part by convenience in scheduling the use of the laboratory facilities. All subjects were previously acquainted with the nature and purpose of the experiment. Some were laboratory personnel. Others were family or friends of the experimenters. Most of the volunteers had previous experience as subjects in psychophysiological experiments. As a group they displayed a high tolerance for the minor discomforts associated with the electrodes and the experimental procedures. Most were very cooperative in holding eye movements and blinks to a minimum, although this occasionally proved to be a difficult task.

One child aged eleven years was included in the group. The others spanned the range from 18 to 48 years. One subject reported a recent serious head injury with attendant EEG slowing; however, no abnormality was evident from the data of this experiment.

The subjects were welcomed as collaborators in the research. Their questions about the experiment were answered as fully as possible, and their occasional comments or suggestions were taken seriously.

PROCEDURE

Experimental sessions were held during the evening when the building is quiet. Normally three persons were present in addition to the subject. The author was present on all occasions. He was usually assisted by two advanced students. These women welcomed the subject in English or in Dutch, applied the electrodes, read the standardized instructions and generally tried to provide a hospitable setting. The entire experimental procedure consumed about two and one half hours per subject.

Upon arrival the subject was led to the experimental room to begin a fifteen minute period of eye adaptation seated in front of the back-lighted opaline projection screen. This period provided an occasion for music and light conversation. The purpose of the preliminary forced-guessing experiment with the low contrast smiles and frowns was explained to the subject and some example slides were shown.

The forced-guessing task was then given with 34 low contrast smiles and frowns presented in a pseudo-random order. If the subject scored significantly above 75% the brightness of the projected images was reduced, or if he scored below it was increased, and the test was given again (with the slides in inverted order). A satisfactory scoring rate (22 through 29 correct) was usually achieved after only a couple of iterations.

The subject was next taken to another room for electrode application. Seven electrodes were applied after a thorough cleaning of the sites with acetone. The three electrodes along the midline were affixed with collodion. The remaining electrodes were applied to the skin with adhesive collars. An electrode paste containing sodium chloride was injected into each electrode through a small hole, and each site was lightly punctated until its impedance to the earth electrode was reduced below 10 Kilohms as measured at 15 Hz. The application of electrodes generally required at least half an hour. The time was passed as pleasantly as possible with music, coffee and conversation.

Electrodes in place, the subject returned to the experimental room for another period of eye adaptation. During this time he was read a set of standardized instructions (see Appendix) in either Dutch or English and shown examples of both the warning slides and the imperative stimuli. Finally he was given twenty to thirty practice trials, offered feedback about eye blinks, and encouraged to respond with the button presses very quickly.

The first two experimental runs of forty trials each were given next separated by only a brief rest. The second two experimental runs followed a longer interval. Some subjects left the room during this break and consequently required an additional period of eye adaptation. Feedback about reaction times and the number of trials lost to artifact was given at the end of every run.

ANALYSIS

All analyses were carried out on seven-variable representations of the CNV waveforms. The seven variables chosen were the dc component and both phases of the first three Fourier frequency terms. These variables were selected following the pilot study in which they appeared to give stronger results than a comparable number of variables formed by averaging over adjacent time points. Although these variables permit the general shape of the CNV waveform to be resolved from the background EEG efficiently, they would not allow a detailed analysis of its faster components such as the evoked potential which follows the warning stimulus. In fact no separate analysis of this portion of the curves was carried out for lack of a well-framed hypothesis.

An extensive analysis procedure established before any data were collected was applied separately to each of the ten subjects and each of the three electrode sites. This procedure aimed at classifying the CNV's from a subject's ESP trials using a reliable discriminant function derived from trials on which the warning stimulus provided some information. This was not always possible to do, as it sometimes happened that no suitable discriminant function could be fashioned.

For this study a discriminant function was deemed reliable if it were derived from data showing a multivariate difference significant at the 0.05 level. Nineteen of the thirty electrodes yielded data with suitable differences. Every subject contributed at least one such electrode to the analysis, and some contributed all three.

The central electrode position provided the greatest number of reliable discriminant functions, eight, while the parietal site provided six and the frontal five.

It was thought on a priori grounds that the ESP trials should more resemble the low information ones than those for which full information was provided. Consequently it was desired to base the discriminant function upon these trials whenever that proved possible. Eight of the nineteen discriminant functions were obtained from the low information trials. When a reliable discriminant function could not be obtained from them alone (i.e. when they did not themselves show significant differences), an attempt was made to base one upon the combined low information and full information trials. Such combined data provided ten of the discriminant functions. The full information trials were viewed as being somewhat more distantly related to the ESP trials, A reliable discriminant function was sought from them only when one could not be obtained from data which included the low information condition. Only one discriminant function was in fact obtained from the full information trials alone.

The discriminant functions were applied to the CNV's recorded at the corresponding electrodes during the ESP trials. In this way a single number was attached to each such trial indicating its position along the dimension which best separates the trials on which the discriminant function was based, A t-test on these numbers then reflects the degree of separation found between the two kinds of ESP trials along this same dimension. In this way the analysis seeks to determine if the ESP trials show differences of the same kind as those evident on trials where information was provided,

RESULTS

The experimental procedure was successful in producing well-developed CNV's. In the case of the full information trials the averaged waveforms generally showed clear differences of the expected type when visually displayed. The low information trials were less clearly distinguishable for most subjects, and visual difference were rarely apparent for the ESP trials. The averaged waveforms for one subject are shown in figures 2, 3, and 4, The upper (more negative) traces in the photos of figure 2 correspond to the opposite-sex situation in which a rapid response was made by the subject. Some differences are also discernible here in the positive components of the wave evoked by the warning stimulus. These may also be seen in the averages for the low information trials in figure 3. The latter effect was not consistently observed

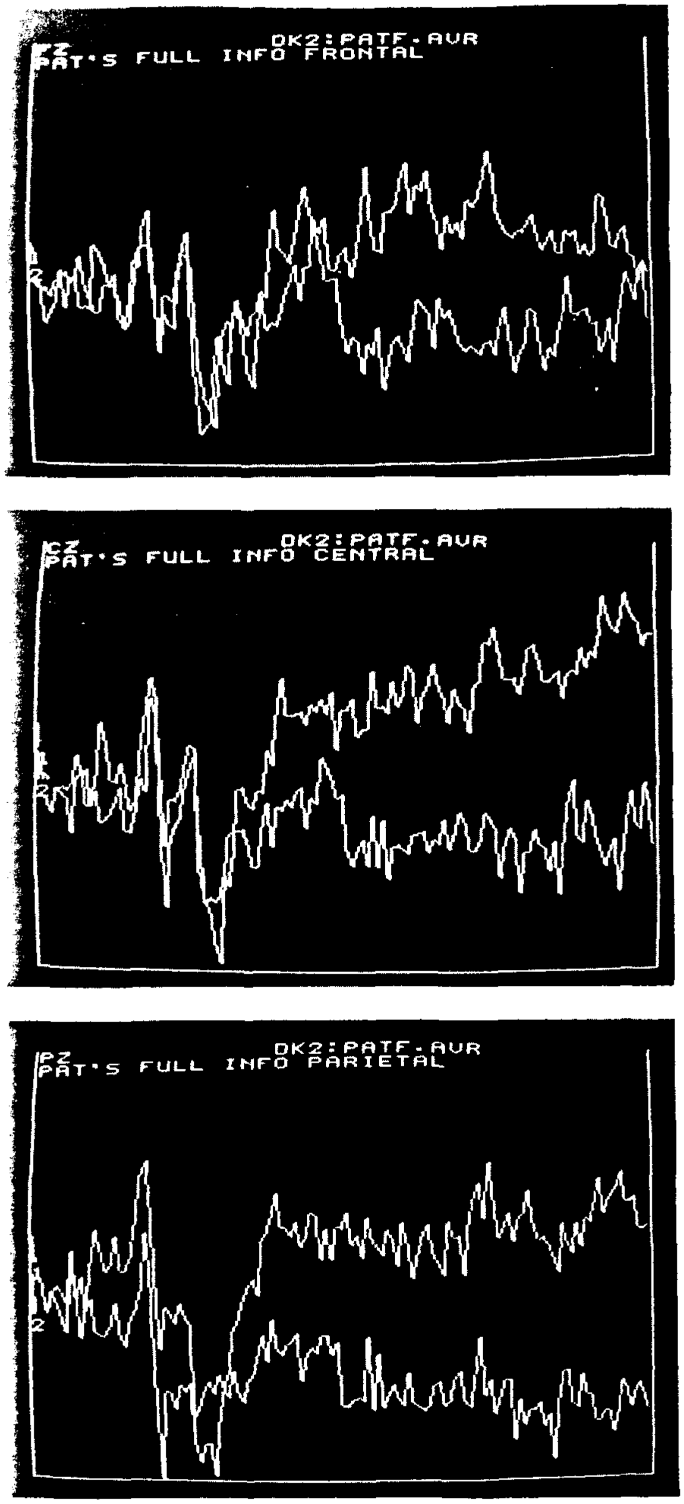

Figure 2

Averaged CNV waveforms for one subject's full information trials

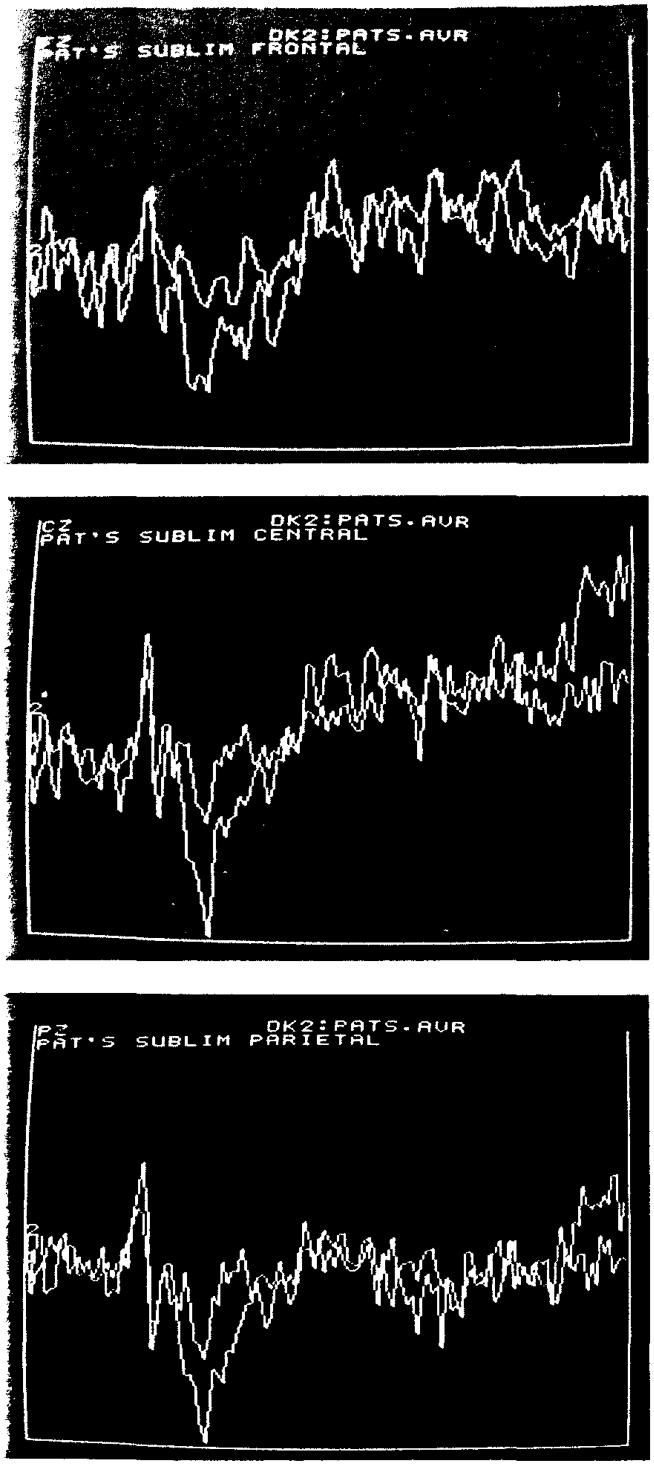

Figure 3

Low information trials - same subject

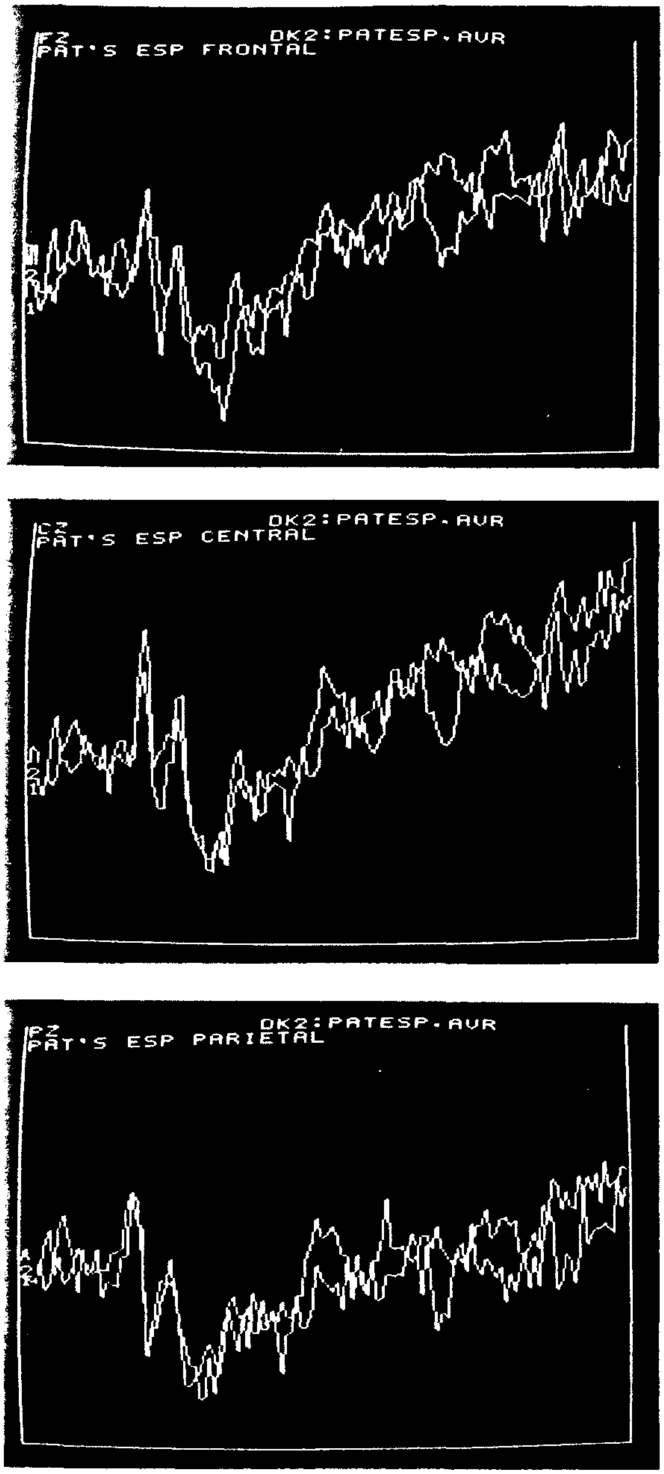

Figure 4

ESP trials - same subject

across subjects,,

Nineteen classification tests were carried out and their results are displayed in table 1. The degrees of freedom shown for the subjects are derived from the number of ESP trials classified. This varied from subject to subject depending upon the number of trials identified as contaminated by artifact and omitted from further consideration by the data-gathering program. Nevertheless each entry might be conveniently regarded as approximately a z-score. The literal notation following each entry designates the source of the discriminant function used in the classification (F for full information, L for low information, and FL for their combination).

The entries in each column of table 1 are independent. It can be seen that the column means do not depart significantly from zero. Thus no single electrode site showed evidence for classifiable CNV differences in the ESP trials. A more inclusive multivariate analysis adequately accounting for the correlations along the rows of the table is not possible owing to the large number of vacant cells. Only one entry in the table has an a priori probability of less than 0.05. It is not unreasonable, on the chance hypothesis, to encounter such a value among nineteen entries.

A post-hoc examination was made for evidence of PK upon the random number generator. It was found that same-sex imperative stimuli were selected following the ESP warning slides more often than expected. This effect derived almost entirely from the first run for each subject where the rate was 62% (p less than .01). The

Table 1

Classification of ESP trials by discriminant functions

subject	df	F_z	C_z	P_z
BM	32	-1.338 (FL)	-0.243 (FL)	nc
MJ	31	nc	0.207 (FL)	nc
LS	21	nc	-0.930 (L)	-0.445 (L)
JK	30	0.600 (FL)	1.604 (FL)	0.890 (FL)
HB	34	nc	-0.667 (F)	nc
PH	41	0.326 (FL)	0.210 (L)	0.047 (FL)
MS	33	nc	"2.226 (L)	1.693 (L)
SH	23	0.734 (L)	0.448 (L)	0.013 (L)
TH	31	0.600 (FL)	nc	nc
WH	40	nc	nc	-0.662 (FL)
means		.1844	.3568	.2560

" p < .05

random generator has been thoroughly studied in other laboratory operations, and the effect may be a genuine one,

DISCUSSION

This study provides no evidence in favor of the psi-related hypothesis it was designed to test. Thirteen of the nineteen classifications of table 1 are in the predicted direction, but any real effects fall well below the sensitivity of the experiment. The procedures were sufficiently sensitive, however, to reveal the presence of information in the CNV's to the low contrast stimuli.

An analysis to show this was undertaken in order to demonstrate the & priori reasonableness of the ESP hypothesis. Briefly, this analysis used discriminant functions derived from the full information trials to classify those with low information warning slides. In this way it was hoped to show that the CNV*s continued to encode information in the absence of certainty, thus making them candidates to expose this situation in the ESP trials. In fact, this analysis succeeded (see table 2) even though very few electrodes provided significant differences among the full information trials alone. The reasons for this limitation were explored, as they are

TABLE 2

Classifications using discriminant functions from the full information trials. The data show the decreasing discriminability of the CNV's as less information is provided in the warning stimulus

electrode	subject	full	low	ESP
F	BM	4.609	1.322	0.191
P	PH	7.187	1.911	-0.047
C	BM	6.320	1.929	0.571
C	HB	4.828	0.749	-0.667
C	JK	4.960	2.282	0.957
C	PH	5.143	2.729	-0.629
C	mean	5.313	1.922 (p=.02)	0.058

factors which limit the sensitivity of the method generally. Two major sources of difficulty were identified in what was necessarily an entirely post-hoc proceeding.

Small but consistent eye movements sometimes obliterate the CNV differences. Following a clearly-seen frown, some subjects often lowered their gaze, inducing a negative potential in the EEG electrodes which resembles the negative CNV shift that appropriately follows smiles. It is thought that the tendency to consistent eye movements could be reduced by making the back-lighted screen dimmer and hence easier to look at. As this would increase the recognizability of the low contrast warning stimuli, new slides compensating for this change would also be required. A brighter and smaller eye fixation lamp might also reduce the prevalence of eye movements.

Several of the Fourier coefficients used in the present analysis did not significantly aid in discriminating the CNV's at any information level. Their presence only serves to increase the variance in all tests and to increase the degrees of freedom for the hypothesis in the multivariate tests. Eliminating them would strengthen the study in two ways. First, the increased significance levels would allow discriminant functions to be constructed for more electrodes. Second, the increased signal to noise ratio would permit better classifications to be made.

It is possible to fashion an analytic measure of the sensitivity of the total experiment. This measure inextricably mixes limitations which derive from experimental procedures poorly suited to the production of discriminable CNV's with those that are caused by less than optimum analysis procedures. Nevertheless a measure of the overall ability of the experiment to find an effect like that hypothesized (i,e. to reject the null hypothesis) is important, especially given the negative results obtained.

The hypothesis is that CNV's to the ESP trials will display differences of the same type as those seen when information is provided. Consequently it is desired to know how small this resemblance might be and still be detected. One way to do this is to assume a significant result and to work backwards from the answer. For the central electrode, for example, eight classifications were made so that the chance hypothesis could have been rejected for an average classification t-value exceeding 1.19. The ability of the discriminant functions used to reveal differences of the type hypothesized was tested by applying them to the training data. The resulting t-values were corrected for the differing numbers of trials for comparison with the ESP requirements. At the central electrode these corrected values averaged 4.62. Now the background EEG (which contributes the variance) is by hypothesis the same for both kinds of trials. Consequently it would be possible to detect a difference in CNV's like that seen in the informed trials but reduced in magnitude by the ratio 1.19/4.62, or about 26%.

It is clear that this sensitivity could be improved either by experimental procedures which produced larger and more consistent CNV differences or by a selection of analysis variables which better extract these differences from the noise. The parietal suffers from fewer attempted classifications and the differences there would have needed to exceed about 32% of their size in the training trials to have been seen. The frontal electrode not only had fewer attempted classifications but also had generally weaker differences in the trials used to generate the discriminant functions. The sensitivity there to reject the null hypothesis was about 49% of the informed differences.

It is also possible to interpret the results actually obtained in these terms. The mean classification statistic was in the predicted direction at each electrode. These means fall consistently below the corresponding significance thresholds and are reasonably attributed to chance. They might nonetheless be taken as estimates of differences actually present in the CNV's for the psi-mediated trials. The frontal differences would then represent about 23% of those seen on the training trials, the central about 5%, and the parietal about 10%,

It should be remarked that a variation on this experiment was also developed and tested with three pilot subjects. It sought to combine the CNV analysis reported here with a forced-choice guessing task by requiring subjects to respond to a neutral imperative stimulus (extinguishing the eye-fixation lamp). The photograph of the man or woman was offered one second later as feedback about the correctness of the guess. This test was self-paced as the subject could initiate each new trial at his own discretion by pressing a button. It was conjectured that these differences would serve to increase the cognitive involvement of the subjects in the performance of the task. Poorly developed CNV's were obtained, and the procedure was judged by the author to be excessively tiresome. It was consequently abandoned in favor of devoting additional attention to the task reported here.

These results do not encourage the widespread adoption of this experimental technique. The difficulties and expense associated with recording and analyzing the data do not recommend the approach as a screening procedure. Investigations of this type would appear to be more appropriate as tools for elucidating the processes of psi in highly selected subjects.

ABSTRACT

The CNV's of ten subjects were examined for differences depending upon the nature of the stimulus about to be presented. The differences sought were those found for the same subject under conditions which provided information about the stimulus to come.

The criteria used were derived from applying multiple discriminant analysis to the Fourier coefficients of the CNV waveforms$_0$ Although the experiment was sufficiently sensitive to detect differences ^{on} the order of 30% of those seen in the informed condition, there was no evidence for psi-derived information.

ACKNOWLEDGEMENTS

Many of the laboratory facilities and analysis programs used in this experiment have been developed over the past several years by other researchers. The contributions made by Sybo Schouten and Ed Kelly have been particularly important to this study. Bea Zant and Lydia Ferrari supported the experimental effort from the critical phases of the pilot studies through the final acquisition of data. To them the study owes its standardized instructions and many competently applied electrodes as well as much of its general psychological tone. Special electronic apparatus of high quality was developed by Arie Vliegenthart and by Wim Harmsen. The author gratefully acknowledges his indebtedness to these people and to his other colleagues in the Parapsychology Laboratory.

REFERENCES

Honorton, C. — Psi and internal attention states. In Wolman (Ed.), Handbook of Parapsychology, Van Nostrand, Reinhold Co, N.Y., 1977.

Kennedy, J. — Possible paranormal components of anticipation: Psychophysiological explorations. Unpublished manuscript, FRNM, Durham, N.C. [Available at http://jeksite.org/psi/cnv1.pdf]

Komhuber, H. Deeke, L. — Pfluegers Arch, Gesarate Physiol* Menschen Tiere, 1965, 284, p.l.

Levin, J. Kennedy, J.	The relationship of slow cortical potentials to psi information in man (abstract), J. Parapsychology, 1975, 39, 25-26. [see http://jeksite.org/psi/cnv1.pdf]
Loveless, N. Sanford, A.	The impact of warning signal intensity on reaction time and components of the contingent negative variation. Biological Psychology, 1975, 2, 217-226.
Näätänen, R.	Selective attention and evoked potentials in humans - a critical review. Biological Psychology, 1975, 2, 237-307.
Rohrbaugh, J. Syndulko, K. Lindley, D.	Brain wave components of the contingent negative variation in humans. Science, 1976, 191, 1055-1057.
Sutton, S. Tueting, P. Zubin, J. John, E.	Information delivery and the sensory evoked potential. Science, 1967, 155, 1436-1439.
Tecce, J.	Contingent negative variation (CNV) and psychological processes in man. Psychological Bull., 1972, 77, 73-108.
Walter, W. Cooper, R. Alderidge, V. McCallum, W. Winter, A.	Contingent negative variation: an electrical sign of sensorimotor association and expectancy in the human brain. Nature, 1964, 203, 380-384.
Walter, W.	The contingent negative variation and its significance for psi research. In Cavanna (Ed.), Psi favorable states of consciousness. Parapsychology Foundation, 1970.
Weerts, T. Lang, P.	The effects of eye fixation and stimulus and response location on the contingent negative variation (CNV). Biological Psychology, 1973, 1, 1-19.

APPENDIX

INSTRUCTIONS TO SUBJECTS

This is an experiment in which we measure your reaction time to certain pictures. During the experiment we will also study a special brainwave that appears when a person is preparing to respond rapidly.

The pictures are projected onto the screen in front of you. They are given in pairs, and your task is to respond to the second picture of each pair. The first picture may help you to prepare your response by providing some information about the second one.

The first picture of each pair shows a stylized face. Sometimes the face is shown with a smiling mouth and sometimes with a frowning mouth. On some of the trials the face is shown clearly and on others it is more or less difficult to see. Here are some examples of the faces:

The second picture of each pair is a photograph of a man or a woman. You will be responding when you see a picture of a woman (man). Here are some examples of these pictures:

The faces should help you anticipate the sex of the person to be shown in the next picture. A frown is always followed by a man (woman), and a smile is always followed by a woman (man). In the experiment the faces are shown only briefly so that you may not always be certain which one you have seen. You should prepare your response as well as you can based upon whatever information you have.

Throughout the experiment a small red lamp will glow near the center of the screen. Fix your eyes upon it so that you will be prepared when the face is shown. Following the appearance of the face you will have a few seconds in which to prepare your response before the second picture of the pair is seen. When it appears you should press the button in your hand as quickly as you can if and only if it shows a woman (man). Please notice: you are to make no response if it shows a man (woman).

The brainwaves that we want to study cannot be measured in the presence of eye movements or blinks. Consequently it is important for you to fix your eyes steadily upon the small red lamp and to hold them there until after you have made your response. You may find it helpful to rest your eyes by blinking them at the conclusion of each trial, as several seconds will pass before the next face is shown.

Please give your undivided attention to the task. With a little practice you will find it possible to anticipate the time at which the second picture is shown so that your responses can be registered very quickly. Some incorrect responses are expected, so do not be concerned if they occur.

Here are some practice trials to familiarize you with the procedure:

Do you have any questions?

Please sit quietly for a moment. We will ask you to begin the experiment soon.

[From the *European Journal of Parapsychology*, 1978, Vol. 2, No. 2]

PUBLICATION POLICY

Twice a year the Parapsychology Laboratory of the University of Utrecht publishes the European Journal of Parapsychology. The object of the European Journal of Parapsychology is to stimulate and enhance the interest within this field, especially in our corner of the world, by communicating research results and issues related to professional parapsychology. Although there will be an emphasis on experimental work, theoretical articles are also welcome. Contributions from all over the world will appear in the journal.

A hallmark of the European Journal of Parapsychology is the attempt to avoid selective reporting, that is, the tendency to bury 'negative' results and only to publish studies that 'turn out'. To avoid turning the journal into a graveyard for all 'unsuccessful' studies, we require that the acceptance or rejection of a manuscript should take place prior to the phase when the experimental data are collected. The quality of the design and methodology and the rationale of the study should be judged as per se more important than the level of significance of the outcome of the study. As a practical rule, we advice a contributor of an article to submit a design of his planned study before the study is actually carried out. The rationale of the study should be stated, as well as all the hypotheses related to it. Furthermore one should try to specify the number of subjects, the number of trials, etc., plus the type of statistical methods one plans to use for one's evaluation.

Priority will be given to the publication of studies which fulfil the above-stated publication policy.

The final manuscript with presentation of results must reach us two months in advance of the official publication date, that is May 1st and November 1st.

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