

**INFORMATION PROCESSING IN ESP:
A SURVEY OF FORCED-CHOICE
EXPERIMENTS USING
MULTIPLE-ASPECT TARGETS**

By J. E. KENNEDY

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ABSTRACT: An important question regarding information processing in ESP is whether complex information is treated as a gestalt or whether the constituent elements are processed separately. Tasks using dual-aspect targets (e.g., playing cards) are one means of investigating this question. If the dual-aspect targets are treated as a unit, (1) the number of complete hits will be greater than that expected by a chance association of hits on the two separate aspects, and (2) there will not be a significant number of partial hits (i.e., hits on only one aspect). Since a dual-aspect trial can be viewed by the subject as two distinct tasks, a valid test of the unitary hypothesis requires that the subjects approach the target in a unitary manner.

A survey of the literature yielded six experiments that could be applied to the investigation of the unitary-information hypothesis. Five of the six experiments showed a significant association of hits on the two aspects; however, a significant number of partial hits was also found on five of the six experiments. This result probably reflects the tendency of the subjects to view each trial as having two distinct parts, and thus the available evidence provides no support for (or against) the unitary-information hypothesis.

The concept that ESP information appears by means of indeterminacy in normal cognitive processes suggests that ESP information processing can be expected to have characteristics similar to nonparanormal information processing.

The question of how complex information is handled in ESP is a fundamental problem for our understanding of psi. As yet there is little evidence for any limitations on the type and amount of information that can be acquired by ESP. This situation is in part the basis for difficulties relating to such topics as psi-mediated experimenter effects, since experimental subjects may possibly be responding to the wishes, expectations, and other psychological characteristics of the test personnel as well as to the designated ESP target (Kennedy & Taddonio, 1976; White, 1976a, 1976b). The investigation of complex ESP information should also provide insight into the cognitive information-processing aspects of ESP.

The central question is whether in ESP complex information is processed by communicating separately the constituent elements or whether the information is treated as a gestalt or unit. According to

the former view, complex targets or information should be difficult to communicate, while the latter view suggests that this may not necessarily be true. The method most frequently used to investigate this question is the examination of data from experiments using "multiple-aspect targets," i.e., targets that require the specification of more than one independent characteristic in order to completely identify the target. Various analyses may determine whether the subject has responded to the target as a unit or to each aspect separately. Playing cards, dual-aspect targets requiring identification of both the suit and the number, have been the most commonly used type of multiple-aspect target for forced-choice experiments.

One of the earliest attempts to apply experimental data to the unitary versus separate-aspects hypotheses was made by Thouless (1935). In commenting on Coover's (1917/1975) ESP experiments with playing cards, he noted that a significant effect occurred only on the complete card and that this outcome indicated that the "total recognition of the card is a unitary process" (p. 28). Likewise, E. B. Foster (1952) reviewed the published experiments utilizing dual-aspect targets and concluded that either the subjects "tended to obtain an ESP impression of the card as a whole" or "the opportunities to obtain ESP impressions of the several aspects varied together" (p. 21). The present paper provides a more up-to-date survey of the literature with further analyses of older and more recent data. First, various conceptual and methodological matters will be discussed, followed by the survey of the experimental findings and then the conclusions.

RELATED CONCEPTS OF INFORMATION PROCESSING

It may be useful to clarify the relationship between the topic under discussion in the present paper and some closely related concepts. The complexity of the psi task or the amount of information needed for success has been discussed in terms of three different aspects of the experimental design.

A. The Probability of a Hit

In the technical use of the term, information is a measure of uncertainty and is related to the a priori probability of the occurrence of the outcome (i.e., the *P*). An event that has a low probability of a hit requires a large amount of information for success. Although this topic is a fundamental aspect of psi operation, very

few relevant empirical data have been collected (for a review of the pertinent PK literature, see Kennedy, 1978).

The investigation of multiple-aspect targets is a special case of the more general investigation of the probability of a hit factor. Since the a priori (i.e., assuming no ESP) probability of getting a complete hit on a multiple-aspect trial is equal to the product of the probabilities of a hit for each aspect, the investigation of the hypothesis that in ESP a multiple-aspect target is processed as a unit is interlaced with the question of how the a priori probability of a hit affects the ESP results. That is, the nature and ease of information processing for two separate trials with P's of P_a and P_b may be different than for one unitary trial with $P = P_{ab}$ (i.e., $P = P_a \times P_b$). Note here also that the presence of multiple aspects or dimensions in a target is a reflection of the way the target is conceptualized. Playing cards are dual-aspect targets with P equal to $1/52$, while the digits 1 to 52 would be single-aspect targets with the same P . Likewise, any target with a low P can be classified and processed according to arbitrarily imposed dimensions or groupings (e.g., four equiprobable targets could arbitrarily be divided into two groups of two, etc.).

It is well known that in normal (as opposed to paranormal) cognitive information processing, a larger amount of information can be handled when using multidimensional stimuli rather than one-dimensional stimuli (see Garner, 1962).

B. The "Diametric" Hypothesis

In an early paper, A. A. Foster (1940) used the term *diametric* to indicate the hypothesis that "ESP proceeds (diametrically) to its end quite independently of the ordinary circumferential steps of logic" (p. 327). In this context, the amount of information required for a task is measured by using analogous sensory-technical systems as a frame of reference. For example, a blind-matching task (in which a deck of cards is matched against a set of target cards, with the order of both the call and target cards unknown to the subject) is considered more complex (i.e., requiring more information for success) than open matching (in which the subject knows the order of one set of cards), since an analogous sensory-technical task would require identification of both the target and call cards before the appropriate match could be made. According to the diametric hypothesis, ESP provides direct information about the correctness of the match in blind matching, bypassing the intermediate steps of identifying the cards.

In general, the diametric concept has been applied to tasks that can conceptually be divided into subtrials such that success on a trial would imply success on each step of the subtrials (e.g., the blind-matching task could be viewed as consisting of (1) identifying the call card and, (2) identifying the target card, before a successful match could take place). The experimental evidence generally supports the diametric hypothesis (e.g., Rhine et al., 1940, p. 315; Kanthamani, 1974; Stanford, 1977; Kennedy, 1978), although the evidence cannot be considered as conclusive. Few well-controlled experimental comparisons have been attempted, probably because of the difficulty (perhaps impossibility) of maintaining equivalent psychological conditions when comparing tasks in which the subjects possess different amounts of information.

The use of dual-aspect targets is also a situation in which success on a trial (i.e., a complete hit) requires success on subtrials (i.e., identification of the two independent aspects). However, when the probability of a hit factor is examined, a distinction can be made between tasks with multiple-aspect targets and the cases normally considered for the diametric concept. With tasks using multiple-aspect targets, the probability of a hit on the complete trial is different from that on the subtrials, so the presence of subtasks modifies the P for the complete trial. On the other hand, the probability of a hit is the same for blind- and open-matching procedures; thus, the view that two cards need to be identified by ESP on a blind-matching trial does not modify the probability of a hit (i.e., P is 1/5 rather than 1/25). In general, the diametric concept has been applied to cases in which the presence of the presumed subtasks does not change the a priori probability of a hit.

C. Redundancy of Information

The presence of redundancy can also be conceptualized as dividing a trial into subtrials; but while the situations discussed under B above require success on all steps or subtrials to obtain a hit on an overall trial, in a redundancy situation a hit will occur on the overall trial when some *but not all* of the subtrials are successful. The use of majority-vote procedures is the most common form of redundancy, but various other test procedures also have elements of redundancy. Like case B, the presence of redundancy generally does not modify the a priori probability of a hit on a task. For a review and discussion of the effects of redundancy in psi, see Kennedy (1979).

The recent concept that psi is a goal-oriented process which is independent of task complexity (e.g., Schmidt, 1974; Stanford, 1978) is an extension of A. A. Foster's diametric hypothesis and primarily has been considered for situations in categories B and C. As noted above, the investigation of multiple-aspect targets is conceptually related to topic B but is more directly involved with the probability of a hit factor (category A).

METHODOLOGICAL FACTORS

Separate responses to the two aspects of a dual-aspect target may appear in two ways. The most conspicuous result is a differential or preferential effect of positive scoring for one aspect and negative scoring for the other. While most differential or preferential effects occur between separate trials (Rao, 1965; Carpenter, 1977), a subject could view the two parts of a dual-aspect target as distinct trials and then respond differentially to them. E. B. Foster (1952) noted this possibility in her review of experiments with multiple-aspect targets, and shortly thereafter Hallet (1952) inadvertently found exactly such an effect in a preliminary study. Although the presumed preferential effect did not appear in his follow-up study specifically carried out to investigate it, he made the point that the subjects' views of, or responses to, the dual-aspect task could greatly influence the nature of the ESP information processing. When evaluating the hypothesis that complex ESP information is communicated as a unit, it should be kept in mind that *multiple-aspect tasks can apparently be presented in ways that will encourage responding to the target constituents separately.*

The second way in which separate ESP responses to the different aspects of a target may manifest is that the number of complete hits may represent only the coincidental association of hits on the different aspects. More specifically, the likelihood of a hit on one aspect would be independent of whether or not a hit was achieved on the other aspect. As was discussed by E. B. Foster (1952), a 2x2 chi-square contingency table examining hits and misses on each aspect can be used to determine if the scoring on the two target attributes are independent. A significant result on this hit-miss contingency table indicates that the number of complete hits is more than the chance association of the separate aspects and would be expected if the target was treated as a unit. However, Foster also pointed out that a significant result on this test indicates only that

success on each aspect tended to occur on the same trials—it does not tell why that happened. If each aspect of the target was processed separately but the ESP scoring varied with time (e.g., as with position effects), a significant outcome on this contingency table would result. A lack of independence between scoring on the separate attributes indicates covariations of scoring, but further analyses are required to establish that the complete target appeared as a unitary impression. The interpretation of a significant association of hits requires that the existence of any trends leading to clustering of hits must be considered. Even if such trends are not found, however, there is still no assurance that the subject responded to the multiple-aspect target as gestalt. It is possible that ESP occurred for brief periods encompassing only one trial at a time and without any noticeable global temporal effects. More will be said on this point below.

Besides evaluation of the number of complete hits, another statistical analysis must be carried out. E. B. Foster (1952) noted, with regard to playing cards as targets: "If a positively scoring subject responds to the target as a complete unit, his whole success will be in his complete card hits. . . . There will be no further deviation beyond chance on *suit* and *number* in the trials which are not complete card hits" (p. 12). However, she did not carry out a statistical analysis to test for the presence of partial hits, and the conclusions of her review would probably have been different had she done so.¹ The appropriate test to see if ESP occurred only on complete hits without significant partial hits was presented by Scott (1961). Referring to the hit-miss contingency table, Scott's recommendation was "to examine the three cells of the table which represent misses on one or both aspects and compare the observations with their theoretical expectations on the chance hypothesis [i.e., the hypothesis of no ESP hits on either aspect alone]. These expectations are in the ratio 1: $P_a/(1 - P_a)$: $P_b/(1 - P_b)$, and the

¹ Both Thouless (1935) and J. B. Rhine (1951) accepted the analyses of experiments with dual-aspect targets as indicating the "unitary" nature of ESP. At the same time, both writers interpreted the evidence that the positive and negative deviations were approximately of the same magnitude in high- and low-aim conditions as indicating that ESP involves "partial" information about the target. This reviewer has never been able to reconcile the apparent contradiction of the partial and unitary nature of ESP information. Partial information about a dual-aspect target would seem to lead to partial hits, i.e., hits on only one aspect. The contradictory position that ESP information is both unitary and partial may reflect the failure to consider partial hits in the dual-aspect data.

comparison may be made with a chi-square test on two degrees of freedom. A significant chi-square indicates rejection of the chance hypothesis, and hence of the hypothesis . . . that any psi effect is confined to hits on both aspects together" (p. 205). Further explanation is given in the appendix. It is possible that the tests for both the association of hits and partial hits could come out significant, indicating that both the unitary and the separate-aspects hypotheses must be rejected. This situation would apparently reflect a fluctuating ESP ability that sometimes gives complete information and at other times only partial information.

The best approach to the investigation of the unitary versus separate-aspects hypotheses seems to be to use the results of the statistical analyses combined with the subjects' introspective reports of how the impressions occurred. If a subject reports unitary impressions of the target and the statistical analyses verify this, then the unitary-target hypothesis would seem appropriate. Other cases (e.g., statistical results contradicting the subject's reports) would likely indicate that the subject responded to the two aspects separately.

SURVEY OF THE EXPERIMENTAL LITERATURE

As in E. B. Foster's (1952) review, only studies with significant evidence for ESP (i.e., an overall significant *CR*) are included in the present survey. Two of the reports discussed by Foster are being omitted here. The experiment by Soal is being left out because of the recent doubts about the validity of Soal's data (see Markwick, 1978). The experiments of the Sidgwicks and G. A. Smith (1889-1890) are omitted because (1) the procedure did not reasonably preclude sensory cues for many trials, and (2) this reviewer could not discern how Foster obtained the figures she presented. The applicable experimental results are summarized here (see Table 1), and more complete information for each data set is given in the appendix. In cases in which more than one series was carried out under approximately the same conditions, the data for the different series are pooled unless the scoring rates for complete hits are significantly different.

In Coover's experiments (1917/1975) 110 subjects each carried out 100 trials using playing cards with the face cards removed ($P = 1/4$ for suit and $P = 1/10$ for number). Approximately one-half of the trials were clairvoyance and the other trials were GESP; but since there was not a difference in scoring, the results for both

Table 1
SUMMARY OF RESULTS WITH DUAL-ASPECT TARGETS

| Report | Condition | No. S's | Trials | |
|--|-----------|--------------------------|----------------|--------|
| Coover (1975/1917) | 1 | Total | 110 | 11,000 |
| Schouten & Kelly (1978) and Kelly (personal communication) | 2a | First 7 sessions | 1 | 186 |
| | 2b | Last 17 sessions | 1 | 401 |
| | 2c | Total | 1 | 587 |
| Besterman (1929) | 3 | Total | 2 ^a | 4,712 |
| Mangan (1957) | 4a | First 2 sets/Direct Hits | 1 | 48 |
| | 4b | Last 2 sets/Direct Hits | 1 | 47 |
| | 4c | Total/Direct Hits | 1 | 95 |
| | 4d | First 2 sets/+1 displ. | 1 | 47 |
| | 4e | Last 2 sets/+1 displ. | 1 | 44 |
| | 4f | Total/+1 displ. | 1 | 91 |
| Kanthamani & Kelly (1974) | 5a | Series 1 | 1 | 676 |
| | 5b | Series 2 | 1 | 676 |
| | 5c | Series 3 + 4 | 1 | 1,040 |
| | 5d | Total | 1 | 2,392 |
| Kanthamani & Kelly (1975) ^b | 6a | Series 1 + 2 | 1 | 1,352 |
| | 6b | Series 3 | 1 | 676 |
| | 6c | Series 4 + 5 + 6 | 1 | 832 |
| | 6d | Total | 1 | 2,860 |
| Kelly et al. (1975) | 7 | Total/Visual Data | 1 | 3,900 |

^aThe brief abstract only mentions that several subjects were tested.

^bThe experimenters argue that the results with this procedure (the shuffle method) are likely to be due to PK. Also, the subject (B. D.) viewed the task as PK.

Table 1 (cont'd)

| Aspect One | | | Aspect Two | | | <i>p</i> for association- of-hits chi-square | <i>p</i> for partial- hits chi-square |
|------------|---------------|-------|------------|---------------|--------|---|--|
| MCE % | Observed % | CR | MCE % | Observed % | CR | | |
| 25.00 | 26.04 | 2.50 | 10.00 | 10.24 | .81 | < .05 | < .25 |
| 16.67 | 48.01 | 9.54 | 12.50 | 48.39 | 14.69 | < 10 ⁻⁹ | < 10 ⁻⁴ |
| 16.67 | 23.44 | 3.57 | 12.50 | 29.68 | 10.32 | < 10 ⁻¹² | < 10 ⁻⁴ |
| 16.67 | 29.64 | 8.38 | 12.50 | 35.60 | 16.86 | < 10 ⁻¹² | << 10 ⁻⁴ |
| 25.00 | 28.61 | 5.70 | 7.69 | 8.53 | 2.13 | < .10 | < 10 ⁻⁴ |
| 20.00 | 37.50 | 2.85 | 20.00 | 35.42 | 2.49 | < .0001 | > .5 |
| 20.00 | 10.64 | -1.42 | 20.00 | 38.30 | 2.95 | < .1 | < .0005 |
| 20.00 | 24.21 | .90 | 20.00 | 36.84 | 3.98 | < .05 | < .05 |
| 20.00 | 38.30 | 2.95 | 20.00 | 34.04 | 2.22 | < .005 | > .5 |
| 20.00 | 22.73 | .26 | 20.00 | 25.00 | .64 | > .5 | > .5 |
| 20.00 | 30.77 | 2.44 | 20.00 | 29.67 | 2.18 | < .05 | > .5 |
| 25.00 | 20.86 | -2.44 | 7.69 | 10.65 | 2.81 | > .5 | < .005 |
| 25.00 | 28.70 | 2.18 | 7.69 | 20.12 | 12.05 | < 10 ⁻⁵ | << 10 ⁻⁴ |
| 25.00 | 27.60 | 1.90 | 7.69 | 14.33 | 7.97 | < 10 ⁻⁴ | < .0005 |
| 25.00 | 26.00 | 1.11 | 7.69 | 14.92 | 13.24 | < 10 ⁻⁸ | << 10 ⁻⁴ |
| 25.00 | 29.36 | 3.67 | 7.69 | 10.58 | 3.93 | < .005 | < .05 |
| 25.00 | 30.18 | 3.06 | 7.69 | 14.35 | 6.42 | < 10 ⁻⁹ | > .5 |
| 25.00 | 34.86 | 6.53 | 7.69 | 18.99 | 12.16 | < 10 ⁻¹² | < .25 |
| 25.00 | 31.15 | 7.58 | 7.69 | 13.92 | 12.46 | << 10 ⁻¹² | < .01 |
| 25.00 | 78.51 | 77.16 | 7.69 | 72.44 | 151.70 | << 10 ⁻¹² | <<< 10 ⁻⁴ |

conditions are pooled for analysis here. The *CR* for complete hits was 2.90 and, as shown in Table 1 (line 1), the chi-square for the association of hits was significant at the .05 level. The chi-square for partial hits was not significant, but there was a suggestive tendency to get hits on suit even when the number was guessed wrong (see appendix for the figures). A sampling of the subjects' descriptions of their experiences (Coover, 1917/1975, p. 115) indicates that sometimes an impression of a complete card flashed forward; and on a fewer number of trials, the separate aspects appeared sequentially. Unfortunately, it is not possible to determine if the nature of the subjects' experiences were related to ESP success. Since the results for many subjects are pooled together and the significance levels are somewhat marginal, a clear interpretation of these data is not possible. It should also be noted that Coover (1939) argued that the conditions of his experiment were not adequate to eliminate non-psi explanations for the results.

Brugmans, Heymans, and Weinberg (Brugmans, 1922; Murphy, 1961) carried out an experiment in which one subject guessed which square of a 6 x 8 matrix was the target square. The rows ($P = 1/6$) and columns ($P = 1/8$) can be considered dimensions of a dual-aspect target. E. B. Foster (1952) presented results for the first seven sessions; however, her figures are approximations, based apparently on incomplete data. Recently the original records of the experiment were extensively reanalyzed by Schouten and Kelly (1978) and the results for all 24 sessions were made available. It appears that some of the figures given by Foster were incorrect.² The recent investigations also indicated that the targets were non-random; but when the proper corrections were made, the results were remarkably close to those obtained with standard binomial statistics. The analyses reported in the present paper assume a binomial distribution and are based on the figures given by Schouten and Kelly. Criticisms regarding possible sensory cues have been raised for these experiments (Soal & Bateman, 1954); however, information provided by Schouten and Kelly make that seem doubtful.

In Table 1, the first 7 sessions, the data originally reported by Brugmans (1922), are presented separately from the last 17 sessions; however, the pattern of the results is identical for both data sets. The chi-squares for the complete and partial hits are both

² Personal communication from Kelly.

extremely significant. This result reflects a strong tendency for complete hits and a lesser tendency for hits on columns even when the row is wrong. On the other hand, ESP hits on rows seem to occur only if the column is correct. Strong declines in scoring across sessions and clustering of hits were found by Schouten and Kelly (1978). They also reported that the subject used motoric rather than visual imagery on the task and that scanning hand movements before making the final response may have constituted a kind of subtrial. The subject apparently received impressions that guided his hand motions and separate impressions as to when the target was reached so that he should stop moving his hand. Schouten and Kelly also reported the presence of stronger response biases and sequential dependencies for rows than for columns. This finding could be related to the absence of partial hits for rows and provides further evidence that the subject did not treat the two dimensions identically. Unfortunately, further details about the subject's view of the task are not available.

An abstract of an experiment carried out by Dietz (reported in Besterman, 1929, p. 184) noted that several subjects guessed playing cards ($P = 1/4$ for suit and $P = 1/13$ for numbers). Details of the experimental conditions and individual scores are not available. For the overall results, the subjects obtained hits on suit independently of success on numbers. Thus, the chi-square for the association of hits is at chance, while that for partial hits is highly significant (line 3 in Table 1).

Mangan (1957) reported an experiment carried out through the mail with a subject who had previously been successful with that type of procedure. The targets were 25 dual-aspect cards with one aspect being the type or form of flower ($P = 1/5$) and the other aspect being the color of the flower ($P = 1/5$). In discussing the reasons for using the dual-aspect targets, Mangan said:

A question which is relevant to the selection of target material is that of whether ESP operates at a fairly low but uniform level or whether at times, perhaps with certain subjects, it operates sporadically, very high-level performance alternating with indifferent or unsuccessful attempts. If the former applies, then the use of a large number of trials with one-fifth probability material would seem the more efficient technique. If the latter is the case, however, the use of such a method may result in a gross underevaluation of the subject's ESP ability. In order to capitalize on high-level performance when it occurs, comparatively few trials utilizing low-probability targets would appear preferable, (p. 274)

Four sets of 25 trials at a rate of one trial per day were planned but because of errors on the part of the subject only 95 trials were completed. The subject had scored well on +1 displacement on previous tests, so both direct and +1 displaced hits were part of the planned analyses. Since the scoring rate on direct hits for the first two sets was different from that for the last two (13/48 complete hits compared to 0/47), the results for the two halves of the experiment are presented separately in Table 1.

With regard to direct (as opposed to displaced) hits in these data, the association of hits for the first two data sets pooled was very significant (line 4a in Table 1) and there was no evidence of partial hits. The entire significance was due to complete hits (see the appendix for the breakdown) which led Mangan to state, "Either the subject's responses were made to complete targets in a unitary fashion, or her hitting on separate aspects varied very closely" (p. 280). Unfortunately, no information about the nature of the subject's ESP impressions was provided to substantiate the unitary hypothesis and it is difficult to speculate on this matter, given that the subject called only one trial per day.

For the last two data sets combined (line 4b), there was significant scoring on the color aspect and a nonsignificant negative deviation on form. As is apparent from the fact that there were no complete hits, the entire significance for color is due to calls that were incorrect on form. The net result is a nonsignificant association of hits and a significant number of partial hits.

The results for +1 displacement showed a similar pattern except that the last two data sets gave no indication of any displaced ESP (line 4e in the table). Displaced scoring in the first two sets had a pattern identical to that for direct hits, with the significant results due entirely to simultaneous hits on both aspects (line 4d). Mangan noted that the displaced hits were localized to the first few trials in the first set and to the last few trials in the second set while the direct hits occurred in the remaining trials. It thus appears that the expression of ESP was changing during the course of the experiment, both with regard to the response to the two aspects of the targets and with regard to direct versus displaced hitting.

Kanthamani and Kelly (1974) reported four series of "single-card clairvoyance" experiments in which special subject B. D. guessed playing cards ($P = 1/4$ for suit and $1/13$ for number). In the first series (line 5a in Table 1) an apparent differential effect took place, with positive scoring on number independent of success on suit, and missing on suit whether or not the number was a hit.

This situation resulted in a nonsignificant association of hits and a significant number of partial hits. In the second series a large number of complete hits occurred, yielding a very significant outcome on the test of association of aspects. However, the number of partial hits was also extremely significant. Although B. D. scored significantly on suit only on trials for which his number call was correct, he scored significantly on number whether the suit call was or was not correct. The pattern of results for Series 3 and 4 (line 5c) was very similar to that of Series 2. Kanthamani and Kelly noted that "B. D. himself seems to fragment the response task; i.e., he reports that he tries very hard for the number and then equally hard for suit only if he feels fairly sure of the number" (p. 24). The statistical results are exactly in line with B. D.'s introspective reports and indicate that B. D. approached the dual-aspect task as two separate steps. This experiment is also another instance in which the nature of the subject's responses to the dual-aspect targets changed during the course of testing.

Six experimental series using playing cards in a psychic-shuffle procedure were also carried out with B. D. (Kanthamani & Kelly, 1975). The exact procedure varied from series to series, but in general a deck of cards shuffled by B. D. was matched against a deck shuffled by the experimenters. For the first two series pooled (Table 1, line 6a), the chi-squares for complete hits and for partial hits were both significant. The third series was much more significant overall and shows a very strong tendency for complete hits (line 6b) with no evidence for partial hits. Series 4, 5, and 6 used a less controlled procedure in which B. D. handled his deck inside a cardboard box, and the overall scoring rate for the series using the box was significantly greater than for the first three series ($\chi^2 = 40.43$, $df = 1$, $p < 10^{-9}$). Again there was an extremely significant tendency for the subject to make complete hits (line 6c), while the partial hits chi-square was not significant. When all six series are pooled (line 6d) the test of association of hits is extremely significant ($p \ll 10^{-12}$), while the partial hits are much weaker but still significant ($p < .01$). B. D. felt that he influenced the cards during shuffling and Kanthamani and Kelly (1975, p. 219) noted, "B. D. himself emphatically interpreted his task as a PK task and, moreover, one in which his objective was to produce only exact hits." Interpreting the psychic-shuffle results is difficult but it does appear that, whatever psi mechanisms were used, there was a very strong tendency to focus on complete hits, with a much weaker partial hits effect.

Some data collected with B. D. when he was given brief tachis-toscope exposure to slides of playing cards is also of interest (Kelly, Kanthamani, Child, & Young, 1975). Exposure conditions were chosen with the intent of (1) inducing a visual experience that approximated B. D.'s typical ESP imagery, and (2) eliciting a scoring rate above what could be expected by ESP. The scoring rate across the 75 runs increased from 45% for the first 15 runs to 77% for the last 15 runs, this occurring even though the exposure conditions were made more difficult to counteract the increasing success rate. As shown in Table 1 (line 7) both the tests of complete and partial hits were extremely significant. Partial hits occurred on both aspects rather than being limited to one aspect as was found in the single-card clairvoyance series (see the appendix), presumably indicating that B. D. tried equally hard for both aspects rather than focusing on the number as in the single-card clairvoyance ESP test.

Several other experiments with multiple-aspect targets have been carried out but are not applicable because the overall results were not significant or because pertinent data were not reported. One noteworthy study was reported by Schmeidler and Lewis (1968). Subjects called and received immediate feedback for each aspect of a triple-aspect target (symbol, $P = 1/5$; color of symbol, $P = 1/5$; position of symbol, $P = 1/12$). The only evidence for ESP was the semi—post hoc finding that for the 20 trials when both of the first two aspects were called correctly, the subjects obtained a significant number of hits on the third aspect. The authors suggested that this outcome could be attributed to the effects of feedback rather than to a unitary response to the target. This interpretation clearly seems most plausible, since each triple-aspect trial was broken into three sub trials.

DISCUSSION

The test of association of aspects for 10 of the 14 nonoverlapping data sets in the psi experiments cited above was significant, indicating that the number of complete hits was more than a chance association of hits on the two aspects of the targets. At the same time, however, the test for partial hits was also significant in 5 of these 10 cases, which means that for many trials, at least, the subjects *did not* respond to the two aspects as a unit. In terms of the totals for the various experiments, the association-of-hits test was significant at less than the .05 level for 5 of the 6 experiments, and

all 6 experiments gave $p < .1$ on this test. Five of the 6 experiments also had significant evidence for partial hits. This outcome is not surprising, since there are indications that the subjects typically viewed each trial as having two separate parts and then did not score uniformly on both parts.

The best evidence for unitary responses comes from the experiment by Mangan and the shuffle work with B. D.; however, the interpretation of these cases is very ambiguous. For the Mangan experiment the results are in line with a unitary response only for the first half of the data, and no information is provided as to whether the subject received impressions of the two aspects separately or as a unit. Given that only one trial was carried out per day, an association of hits on the two aspects would be expected even if the subject responded separately to them. For the B. D. shuffle data, there is some indication of partial hits although it is completely overshadowed by the dramatic number of complete hits. In this case it is clear that the subject approached the task in terms of complete hits as a unit, but he also viewed it as a PK task and the experimenters provide evidence that success was achieved by means of PK. Therefore, it seems doubtful that this study actually reflects the operation of ESP.

In short, the ESP experiments with dual-aspect targets offer no clear evidence either for or against the unitary nature of ESP. A fair test of the unitary hypothesis requires that the subject view the dual-aspect task as a unit since obviously the task can be presented in a way that will elicit separate responses to each aspect. As noted above, it is likely that none of the ESP experiments surveyed here met this criterion. The important fact that in two cases (Mangan's subject and the single-card clairvoyance experiment with B. D.) the nature of the subjects' responses to the dual-aspect targets changed during the course of the experiments suggests that the subjects' view of, and reactions to, the tasks rather than a more fundamental property of psi were the dominant variables. It is likely that the same situation will occur in other work with dual-aspect targets.

At this point it may be useful to examine more carefully the question we are asking. Like early investigators (Myers, 1903; War-collier, 1938; Tyrrell, 1946-1949), many later researchers have viewed ESP as a two-stage process. The first stage consists of acquisition of the ESP information on an unconscious level and the second stage involves the communication or "mediation" of the information into a conscious experience or response. Limitations on ESP could in principle arise in either stage, but generally it has

been assumed that essentially complete, correct information is available unconsciously and that errors occur as the information is mediated into consciousness. It is also generally thought that ESP information is mediated into consciousness by means of psychological mechanisms that in themselves are not paranormal (e.g., memories, dreams, associations, intuitions, etc.). Thus, the information that appears in the response may be limited by the availability and use of these (to use Tyrrell's term) "mediating vehicles." Now the question arises, when we ask if ESP information is handled in a unitary manner, whether we are referring to the first stage, the second stage, or the entire process. The only observable event is necessarily the output of Stage 2 and this situation raises questions as to whether it is possible to investigate the first stage. One could assume that characteristics which always occur even with diverse forms of mediating vehicles may reflect the Stage 1 operation of psi, while characteristics which only appear under certain circumstances result from the mediation process. Tyrrell (1946-1949), however, pointed out that it may in fact be erroneous to hypothesize the existence of Stage 1; he suggested that "the evidence points to the view that paranormal cognition, in its essence, may not be an *occurrence*. It may be the mediating vehicle only which occurs" (p. 117). The concept that psi is a goal-oriented process in which ESP is viewed as a goal-oriented PK effect on random processes in the brain (e.g., Stanford, 1978) is a recent refinement of the mediating-vehicle idea. This line of thought suggests that all limitations and characteristics of ESP information processing happen at the mediation stage and that the investigation of information processing in ESP is primarily investigating the presence and nature of indeterminacy in neural activity. If normal cognitive processes are used to mediate ESP information, the characteristics of ESP information processing in general and the handling of dual-aspect targets in particular would be expected to be the same as for nonparanormal information, and studies with dual-aspect targets should serve to verify this fact. In this context, future work should go beyond speculations about the unitary nature of ESP information. For example, facts such as that a larger amount of information can normally be processed using multidimensional stimuli than using one-dimensional stimuli (Garner, 1962) may provide a starting point for subsequent investigations.

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Institute for Parapsychology
College Station
Durham, North Carolina 27708

Information Processing in ESP

APPENDIX

The Appendix is not provided for the web copy of this paper. The key information is contained in Table 1.

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