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PSYCHOLOGICAL ASPECTS OF CAMOUFLAGE DESIGN AND DETECTION PART 3

TOWARDS IMPROVED VALIDITY AND RELIABILITY OF CAMOUFLAGE ASSESSMENT

BY

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APPROVED

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16. Abstract

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ABSTRACT

Recent models of visual information processing have been applied to the results of a search/detection task involving photographic slides of concealed soldiers. It was postulated that since camouflaged men could be regarded as examples of threshold items, automatic detection should not occur. Even for relatively low load (easy) items, reaction times (RT) were slower than the values expected if automatic detection occurred. The systematic increase in RT with task load imples that feature integration processing was required to achieve target detection. In pointing towards a possible strategy for target detection using real-world stimuli, the results of this report may be important in the design and interpretation of camouflage detection trials.

INTRODUCTION

1. The aim of the present study was to apply some current concepts of visual information processing to the practical domain of camouflage assessment. This aim was approached by reviewing two models of human search/detection processes: the work of Shiffrin and Schneider (1977), and that of Treisman and Gelade (1980). The relevant implications of these two models were then compared with the observed performance data from a camouflage detection task. This comparison was intended to indicate whether the reviewed search/detection processes satisfactorily describe the task of camouflage detection. Finally, it was intended to consider published camouflage assessment procedures in the light of the implications of the present study, and to make suggestions for the design of future trials.

2. Whilst the task of assessing military camouflage represents a practical area where visual information processing theories may have useful application, it has been cautioned that visual information processing models have several deficiencies with respect to such practical tasks. The models have mainly been based on the analysis of laboratory tests dealing with simplified or artificial targets and background scenes (Silbernagel, 1982). Although functions relating to degree of camouflage or to detection rate have been studied in the laboratory, investigating for example colour and texture effects of embedded figures (Bloomfield, 1979), it has recently been suggested that "Specifically, how to confidently extrapolate functions derived from simple stimulus situations to the processing of an object in the context of a real-world scene is not known" (Biederman, Mezzanotte, Rabinowitz, Francolini and Plude, 1981, p 154).

3. Despite the difficulties of applying psychophysical models to the practical domain, measures of observer performance in search/detection trials continue to be used in the assessment of camouflage patterns. A number of recent studies have described various methods for comparing the effectiveness of different camouflage patterns for military uniforms. A common feature of these reports was the absence of a conceptual bridge linking either the experimental protocol or the results with contemporary models of visual information processing. The present study was aimed at building this bridge between theory and practice.

Two Models of Search/Detection

4. Schneider and Shiffrin (1977) and Shiffrin and Schneider (1977) have proposed a model of information processing in visual search tasks involving two alternative modes: controlled search, and automatic detection. Controlled search involves the serial comparison of items in a memory set with items of information in a display set. In the case of automatic detection, it is assumed that a parallel search of all items of information in the display occurs, ie that there is a simultaneous comparison of memory set items with display items.

5. Controlled search is said to be highly demanding of attentional capacity, is usually serial in nature with a limited comparison rate, is easily established by the subject, and search times are strongly dependent on load. In this context, load is taken to be represented by the number of comparisons to be made, or other attributes affecting the discriminability of the target. Thus for a given target group (memory set), search times may be expected to be affected by item difficulty, display field complexity, or target discriminability.

6. Automatic detection refers to relatively well learned targets stored in long term memory, is considered to be demanding of attention only when a target is detected, is parallel in nature, is difficult to ignore or to suppress once learned, and search times are virtually unaffected by load. Automatic detection can be employed in the case of a search for any member of a well learned category, and automatic encoding of arbitrary collections of characters can develop after prolonged training.

7. For automatic processing to run to completion in an accurate fashion, the input stimulation must be above some threshold level of both intensity and duration. If these conditions are not met, that is the target is presented at threshold, even well-learned targets may not qualify for automatic detection. With threshold targets the visual encoding of the relevant features of the display is incomplete and therefore ambiguous (Shiffrin and Schneider, 1977, p 168). A threshold target will give rise to feature sets consistent with either targets or distractors. Similarly, distractors will give rise to feature sets consistent with either distractors or targets. Therefore the subject will be forced to adopt controlled search on most of the trials which contain threshold targets. On such trials serial comparison processes will be necessary to match the activated features against the features of the members of the memory set. This process of building up confidence in the decision process by a serial matching of a number of features has been developed further in the feature integration model of information processing proposed by Treisman and Gelade (1980).

8. Feature integration theory applies to targets which can only be correctly detected by the conjunction of a number of attributes. This theory suggests that a visual scene is initially encoded as a set of features along number of separable dimensions. In this context, "dimension" refers to a complete range of variation (s as colour, orientation, or shape) whilst "feature" refers particular value on one of these dimensions (red, upright, triangular). The concept of dimensions in visual information is discussed in greater detail in Annex A. Focal attention is required to integrate the separable features into unitary objects; once they have been correctly registered the compound objects continue to be perceived and stored as such. Without focussed attention, features cannot be correctly related to each other. If a target can be correctly recognised by a single feature, then automatic detection can occur. However subsequent focussing of attention is still required to unite the target's perceived presence with other features such as its position or size. These feature integration operations are demanding of attentional capacity and their completion may follow the detection process by a finite time. The implications of this model are that target detection or recognition may precede correct location of the target, particularly when single feature target recognition is possible.

9. When feature integration is required for target detection, search times are dependent upon load and experimental evidence (Treisman and Gelade, 1980) indicates that load can refer to display size, number of serial comparisons to be made, number of conjunctions of features required for recognition, or ease of discrimination of target from non-target. In the case of negative trials, that is when no target is present and a negative response is required, experimental results (Shiffrin and Schneider, 1977; Treisman and Gelade, 1980) indicate that serial processes are required. There is no mechanism proposed for an automatic response on a negative trial, and therefore RTs on negative trials are determined by task load.

10. In summary, the models reviewed suggest that in a search/detection task, rapid (automatic) detection is possible by a process which is not demanding upon attentional capacity. The published data relating to automatic detection indicates that the response occurs in RTs of the order of 500 ms. If the memory set is not well learned, or if feature integration is required for detection (as with threshold targets), then longer RTs would occur. In the case of negative trials involving a search of a complex field, long RTs would be expected.

Camouflage Detection and Search/Detection Models

11. The present study relates to the search strategies involved in the detection of targets in a real-world situation: specifically the detection of men partially concealled among bushes. It could be argued that for human targets, the array of possible target elements (parts of the human body) which form the memory set should qualify as members of a well learned category for the observers. From this point of view serial processes should not be invoked and automatic processes should be possible. With automatic detection, providing that the response is a choice of "target present" or "target not present", RTs on positive trials (that is, when a target is present) may be expected to approach the latencies of approximately 500 ms reported for experiments using numbers, letters, or geometric shapes (Shiffrin and Schneider, 1977; Treisman and Gelade, 1980). In the case of negative trials (that is when no target is present) an exhaustive search of the display set should be required. When the display set is a complex outdoor scene, it is difficult to conceive a low load negative trial. Hence all negative trials may be expected to be responded to as high load items with correspondingly long RTs.

12. To this point, responses to camouflaged men have been discussed with respect to an automatic processing model. If camouflage is successful, the naive assumption of automatic processing is not very plausible. The process of camouflage has been conceived as interrupting the normal perceptual processing of targets: "The purpose of employing camouflage is to degrade a potential target's signature, so as to deny an enemy observer detection or acquisition information." (Braaten, 1980, p 15). The implication of this is that automatic processing is prevented by camouflage. If it is accepted that, for positive trials, a conjunction of two or more separable features of a target must be made before detection can occur, and this is the case for threshold targets, then feature integration processes would be required. In this case, for positive trials, a range of RTs should be expected with longer RTs corresponding to the more difficult high load items. In the case of negative trials, as with the automatic model, each item must be regarded as a high load item and therefore long RTs should occur. This expectation of long RTs should be so whether the process on negative items is modelled on serial search alone or serial search combined with a need for feature integration to achieve target detection.

13. In summary, the aim of the present paper was to review some current concepts of visual information processing with respect to the strategies involved in camouflage detection. The performance of subjects on a practical visual search task was used to infer the most appropriate model for describing the search strategies involved. From the reviewed models, the following results may be expected:

a. if automatic detection processes occur then constant RTs approaching 500 ms are expected for positive trials;

b. if integrations of features are required for target detection then a range of RTs should occur for positive trials;

c. if real-world scenes can be assumed to represent complex backgrounds then all cases of negative trials should yeild relatively constant, long RTs (indicating an exhaustive search).

METHOD

Subjects

14. Subjects were obtained from three sources:

a. 42 civilians between the ages of 25 and 40 years who were on a Government sponsored ski holiday;

b. 32 Army officers and enlisted men who were employed in clerical duties in a city environment;

c. 20 civilian subjects selected from experienced and novice parachutists at a civilian parachuting drop zone.

Apparatus

15. Color slides were rear-projected onto a screen to form a 9 by 14 deg. field of view (FOV) when viewed at 120 cm. The projector automatically prosented each slide for 2 s, followed by a pause of 1 s. Reaction time (RT) was recorded using a timer and printer. The timer was activated by the onset of each slide. The printer recorded response and RT measured to the nearest ms.

Stimuli

16. A set of 80 stimulus slides was selected from a large number of slides which had been taken for the purpose of comparing different uniforms in the Australian bush environment. The targets were men in Australian Army uniforms, with or without camouflage paint on the exposed skin. The selected group of slides was chosen to provide a wide range of detectability: some contained large targets in the foreground, some targets were concealed among bushes, whilst others contained no targets at all. Pilot data suggested that the selected group of slides formed a relatively rectangular frequency distribution of item difficulty.

Procedure

17. Subjects were instructed to press a key marked "YES" with the right hand if they detected a target, and to press a key marked "NO" with the left hand otherwise. After 10 practice slides, the 80 slides were shown. The centres of the targets were distributed over an area in the display defined by a mean radius of 1.2 degrees (s.d. 1.1 degrees) from the centre. This is within the target area used by Treisman and Gelade (1980) (8.5 x 5.5), and similar to the target area used by Schneider and Shiffrin (1977) (1.85 x 2.29 deg.). It is within the range where foveal processing is possible.

18. Each slide was presented for a period of 2 s with a 1 s break before the onset of the next slide. The observer could respond up until the onset of the next slide. In the absence of any response default scores of "NO" and a reaction time (RT) of 3.1 s were recorded.

RESULTS

Item Difficulty and Task Load

19. In laboratory experiments using letters and shapes the load of each item can be quantified by definable attributes which have been found to affect task difficulty. Examples of such attributes are total number of comparisons to be made, or ratio of diameter of target to distractor. Under these circumstances it has been reported that longer response times occur for items of greater task load. In the present study using slides of bush covered terrain it is not possible to make a reliable measure of the difficulty of the task by an inspection of the items. However the probability of detection, or item difficulty, based upon the results of a group of observers can be calculated.

20. In this study, the task load has been operationally defined for each slide in terms of the average probability of detection derived from one group of subjects, the 42 civilians. For this group an approximately rectangular distribution of item difficulty was obtained, as shown in Table 1. The average difficulty value of each slide for the civilian group was used as a measure of the task load in subsequent analyses for all groups. The probability for task load is from zero (low load, target seen by the observers) to 1 (high load, target seen by no observers). The special category of very low load items (load less than 0.05) has a disproportionate number of items because of the importance of this group to the concept of automatic detection.

21. The false alarm rate was 5%, which is in line with the results of similar published studies (Teichner and Mocharnuk 1979).

Comparison of Army and Civilian Results

22. The difficulty of assessing task load for real-world stimuli necessitated an operational definition in terms of performance. As the performance of the civilian group was accepted as the criterion for task load it is of importance to assess the generality of this measure with the military group. The average RT for each item based upon civilian results is compared with item RT based upon Army subjects in Figure 1. Figure 2 compares the task load scores for civilians and Army participants. The concordance between military scores and civilian scores is indicated by the correlation coefficients of 0.97 for RTs and 0.97 for load.

23. The superimposed line on each plot is the locus of y=x, that is, the line about which the data would fall in the case of no difference between the groups. It is evident that the military subjects were slightly faster to respond to each slide (mean military RT = 1.51 s, civilian = 1.69 s) while the average task load appears roughly similar for military and civilian subjects (mean military load = 0.38, civilian =0.36.)

Reaction Time and Task Load

24. The relationship between task load and RT for "NO" responses for all subjects is shown in Figure 3. Figure 3 shows that for "NO" responses, RT was unaffected by task load and was high for all negative responses. In contrast task load has a systematic linear effect on RT for "YES" responses (r = 0.95), as shown in Figure 4.

Reliability of Measures

25. The Chronbach alpha reliability coefficients for RT and for load were calculated using the observer x item matrix of results. These values are 0.93 for RT and 0.85 for load.

DISCUSSION

Automatic Detection

26. Both of the visual information processing models under consideration propose that automatic detection can occur under certain conditions. The feature integration model suggests that automatic detection can occur if the presence of a target can be recognised by a single feature, whilst Shiffrin and Schneider (1977) have stated that automatic detection can occur for a group of possible targets, providing that the memory set items are members of a well learned category. As the targets in the slides were men, the memory set items may be considered to be members of a well-learned category (parts of the human body), and for non-camouflaged men automatic detection processes may be expected. However as pointed out earlier, the effect of a camouflage procedure should be to interfere with automatic processing.

27. The results, as expected, do not support the concept of automatic detection in this task. There is a consistent increase in RT with taskload for YES responses, and this range of RT is not compatible with automatic detection. Only for the very easiest slides where the target was detected by all subjects did the RTs approach 0.5 s, the expected latency for automatic detection. As it has been suggested that each attention-demanding comparison process may require in the order of 60 ms (Treisman and Gelade, 1980), then the present results may be taken to suggest that a considerable number of cognitive operations may be involved in a camouflaged target detection task.

Feature Integration

28. The consistent increase of RT with task load on YES responses implies that attentional capacity was demanded in the target recognition process. Because of the familiarity of the observers with the memory set items, it is unlikely that the demand of the task was due to the need for serial consideration of memory set items. As the targets were partially concealed men, the results are compatible with an explanation that the RT/load relationship was due to feature-integration processing in order to achieve detection of camouflaged targets. In particular the results can be taken as a convincing example of the proposition of Shiffrin and Schneider (1977) that threshold targets require attentional capacity for detection.

Task Load for NO Responses

29. The plot of RT with load for NO responses (Figure 3) shows that there is a relatively constant average RT of approximately 2.3 s for NO responses. The scatter in RT values for items of low load may be due to the fact that these values are based on the means of very small groups; for example only 5% (or 4 observers) responded NO to an item of 0.05 load. Some of these NO responses to easy items may have been due to the accidential wrong choice of response.

30. In general, the results indicate that there is no easy way to reach a NO conclusion in the present type of task. A NO response is always associated with a high demand upon attentional capacity, as is indicated by the relatively long RTs. This finding which is based upon real life stimuli contrasts with laboratory experiments which have used relatively simple display formats for some negative trials. In such laboratory trials a rapid NO response may be expected, and has indeed been reported, for low load items.

Application to Camouflage Assessment Procedures

31. A summary of the important attributes of trials used to assess the efficacy of different camouflage patterns is given in Table 2. This table shows that a relatively large field of view, (FOV) from 35 deg. to 90 deg. is a common feature. The use of a wide FOV implies that the experiment has been designed in the belief that the search/detection process can proceed with a rapid rejection of non-target regions. Bailey (1972) has proposed a model of the search process which is in line with this assumption and which is based primarily upon mathematical considerations. He proposed that a single "glimpse" period of 1/3 s can provide sufficient information to allow a negative decision to be made with respect to each "glimpse aperature" or foveal field. The results of the present study support neither single glimpse detection nor single glimpse rejection.

32. It is relevant to note that Williams (1966) in an analysis of eye movements and fixation patterns (using a 40 by 40 degree field) had indicated that targets are not recognised at a single glimpse. He introduced the concept of "target conspicuity" to explain his data. Conspicuity was operationally defined in terms of the number of times the target was looked at before detection.

33. The proposition that processing time may be required for the detection of a target has also been confirmed in another experiment which was in some ways similar to camouflage detection (Nodine (1978). Nodine's study monitored eye movements in a search of a 24 by 24 deg FOV. The target, a word concealed in a line drawing, could be interpreted as another example of a threshold target. Although only 1/3 of the targets were detected in his experiment, it was reported that "the major reason for search failure ... was not inadequate sampling of the target areas. Of the 35 targets that were missed, 31 were sampled. Thus getting the eye on the target did not guarantee detection" (Nodine, 1978, p 275). The data reported for hits in Nodine's experiment indicated that if the target was viewed for approximately 1 s, then the probability of detection was 86% (that is a load of 0.14 in terms of the present experiment). His figures are in accord with the present results (see Figure 4) for low load items, however his overall hit rate was only 1/3. This illustrates the confounding effect of a large complex FOV on relatively easy targets. We would assert that the overall level of difficulty of the Nodine task was not primarily due to the camouflage effectiveness of the target, but due to the high load involved in rejecting non-target areas. The present experiments confirm the inevitable high load associated with non-target areas in complex scenes.

34. The present study has shown that with small FOV complex scenes, detection times can approach 3 s for difficult targets. Our results have also shown that to eliminate each non-target area always requires between 2 and 3 s. We would interpret a trial with a FOV of 90 degrees combined with a viewing time of 10 s (Lintern, 1974) as placing an unnecessarily high demand on the observer. The low reliability (0.42) reported for such a trial (Lintern, 1974) may be in part due to the use of wide angle FOVs.

35. In summary, the review of visual information processing theory and a consideration of some experimental results have led to the conclusion that detection/rejection processes may involve high cognitive load, and that significant processing time will be required for each foveal field. On the other hand, typical camouflage assessment trials are implicitly based upon the assumption of rapid detection/rejection decisions for each fixation point. the point has been made that the link between theories based upon laboratory experiments and "real-world" stimuli is tenuous. The experimental work described in this paper was therefore aimed at making an initial link between visual processing theory, and the practical issue of camouflage assessment.

36. We have shown that high reliability over a wide range of detection probability values can be achieved with a small FOV. The special advantage of the small FOV is that each observer spends all of his decision time processing relevant visual information from the target area.

37. Our study supports the conclusion that camouflage search/detection tasks can be interpreted in terms of feature integration processing of threshold targets.

38. Combining the inferences of some current models of visual information processing, selected empirical studies, and the results of the present experiments, it is suggested that large FOVs in camouflage detection trials, whilst adding apparent realism to the trial may in fact reduce the validity of the results. Time and mental processing effort will be wasted in a large FOV trial while the observer is looking at non-target regions. The relevant aspects of the camouflaged object are only under test when the observer is looking at the target region.

RECOMMENDATIONS

39. It is recommended that future trials of the effectiveness of camouflage items should consider the use of small angle displays.

40. It is recommended that further study be conducted to establish the practical limits of the FOV for human observers in camouflage detection.

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Table 1

Frequency distribution of task load

Task Load	Frequency
(low) < 0.05	24
0.05 to 0.3	15
0.3 to 0.7	18
> 0.7	23

Table 2

Methodology of recent camouflage detection trials

Reference	Viewing time(s)	Visual Angle (degrees)	Observer/ target distance (m)
Alderson & Overton (1972)	600	large	0 to 520
Bloomfield, Graf & Graffunder (1975)	90	34	.33 (slides)
Freeman, Jenkins & McNeil (1980)	15	90 (4 sectors)	50
Lintern (1974)	10	90 (3 sectors)	12 to 57
Whitehouse (1982)	25	40 (4 sectors)	slides
Smith, Skinner & Jenkins (1973)	30	55 (6 sectors)	50
Wynne (1972)	600	large	0 to 520
Bruzga (1980)	A "free format" experiment with observer moving slowly towards designated target area. Dependent variable was detection distance.		
Greef & smith (1973)	Comparison of two uniforms under conditions where "both jackets were visible, but not too conspicuously", with results indicating that one item was "rather less conspicuous" than the other.		

Figure 1: Comparison of Military with Civilian Results:

Mean RT on Each Item.

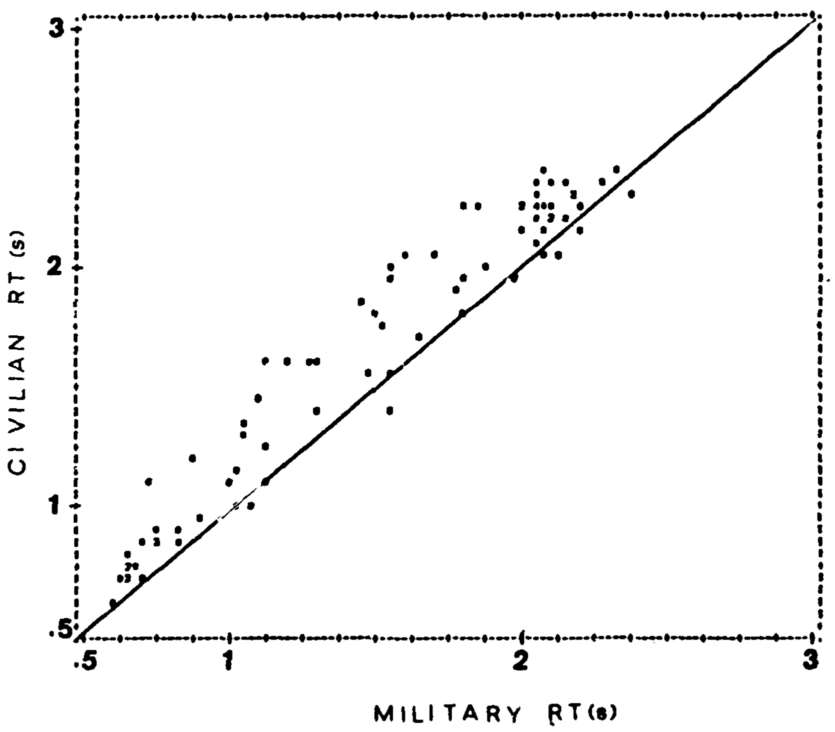
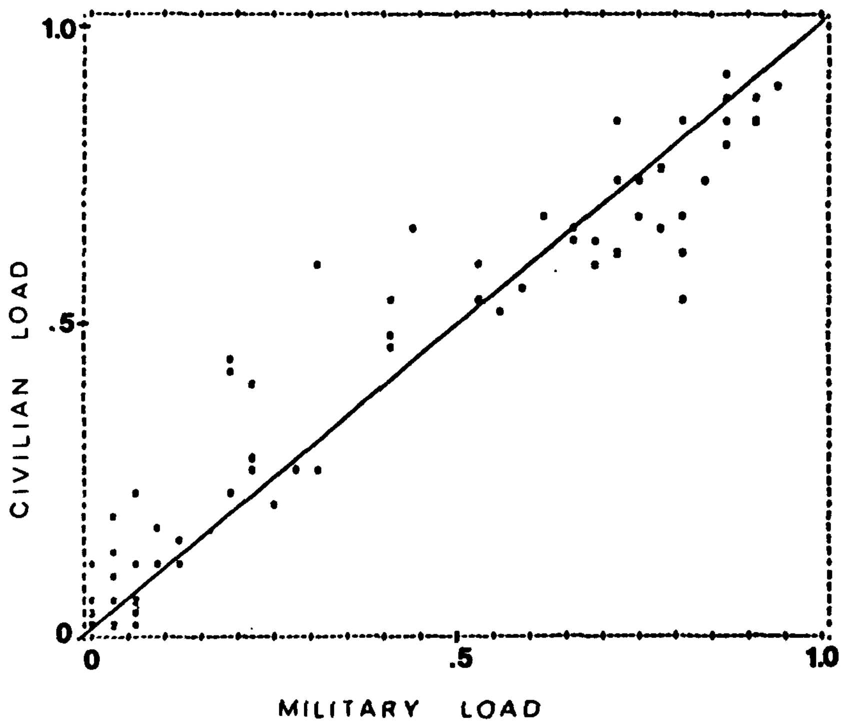

CIVILIAN RT (s)
MILITARY RT(s)
.5
1
2
3
.5
1
2
3

Figure 2: Comparison of Military with Civilian Results: Mean Load on Each Item.



CIVILIAN LOAD
MILITARY LOAD
0
.5
1.0

Figure 3: Mean RT for NO responses with Mean Item Load.

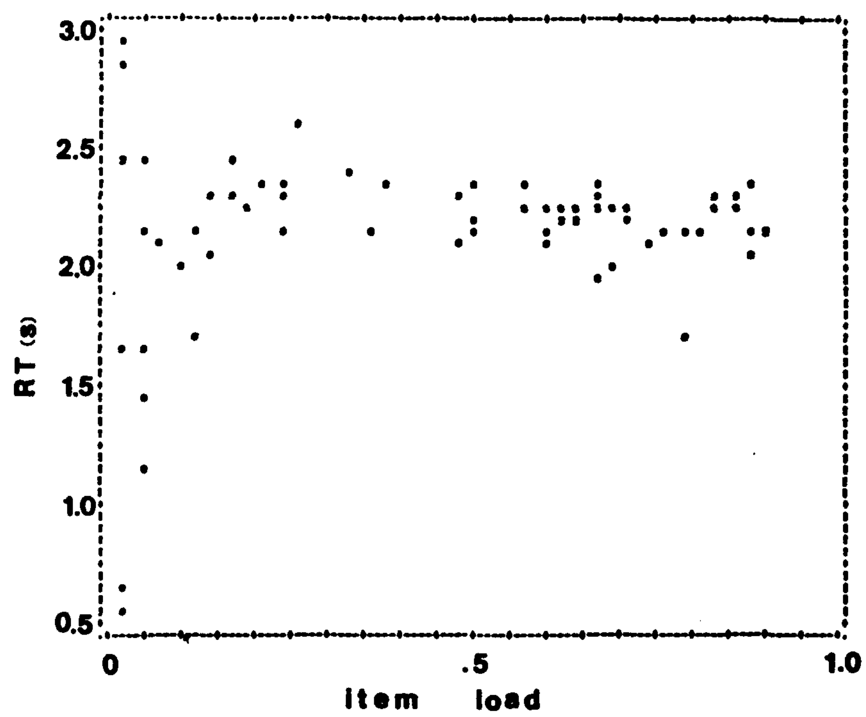
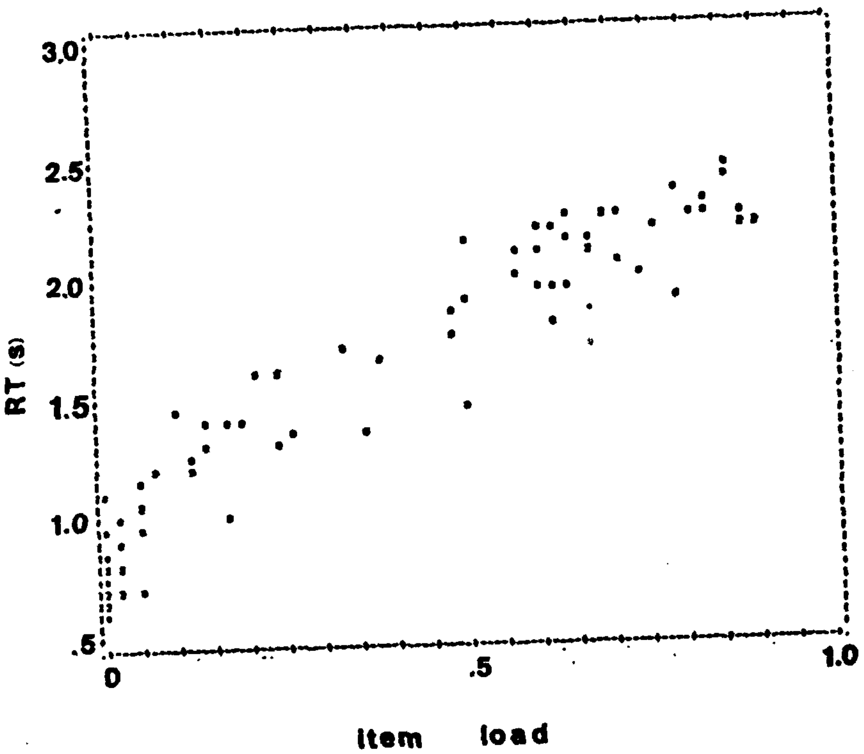

RT (s)
3.0
2.5
2.0
1.5
1.0
0.5
0
.5
1.0
item load

Figure 4: Mean RT for YES Responses with Mean Item Load.


RT (s)
3.0
2.5
2.0
1.5
1.0
.5
0
.5
1.0
item load

ANNEX A

VISUAL DIMENSIONS AND FEATURES

The concept of dimensions and features in visual information has been discussed recently by Teichner and Mocharnuk (1979). Although principle of defining a complex target as a multi-dimensional stimulus seems reasonable, questions arise when the principle is put into practice. What should be regarded as a dimension is not always apparent even when there are specifiable physical dimensions available. The problem is linked with the methods used by the observer to identify the target. It is reasonable to expect that, with practice, stimulus features which are irrelevant to the definition of the target may be given less attention than those which are relevant, although each might have received equal attention by a naive observer. It is also reasonable to expect that practice enables the observer to terminate the search/comparison process once the defining features have been located. Thus stimulus redundancy can play an important part in determining the level of dimensionality which operates in practice.

In a search task with multidimensional targets, performance appears to depend upon the correlations among the dimensions of the target. The nature and degree of correlation determine the form and amount of redundancy in the stimulus situation. Whether redundancy will aid performance depends upon its form and the nature of the task.

Redundancy can operate in two ways. With clearly visible and easily discriminable targets redundancy due to a correlation between the dimensions represented by some features should not aid performance. Furthermore, observers may process all of the stimulus features even when they may not have to do so. On the other hand when redundancy increases the opportunity to discriminate the target, this may aid performance under conditions of reduced visibility.

The implication of the practice effect is that when complex stimuli become so familiar that they are coded with unique names, they function as simple stimuli even though they are not in unidimensional in a physical sense. This would imply that the critical features were all that were processed, but it could also happen if the less critical and irrelevant features were also processed, but were processed at a higher speed than were the critical features.

In the case of real-world stimuli, focal attention is required to integrate the separable features into unitary objects. Without focussed attention features cannot be correctly related to each other and conjunctions of features can be formed on a random basis. Illusory conjunctiors of features can be formed. This explanation contrasts with what we consciously perceive. "Top-down" processing, the Gestalt belief that we initially register unitary objects and relationships and only later analyze these into their component parts, may be what we consciously experience, however a considerable weight of experimental evidence supports the feature-integration theory of visual information processing. Top-down processing can effectively occur when in a familiar context, and when focussed attention is prevented (for example by brief exposure or by overloading). Under these circumstances likely objects can be predicted, and their presence can be checked by matching their disjunctive features with those in the display. In the highly redundant and familiar environments in which we normally operate, this should seldom lead us astray. However when the environment is less predictable we are typically less efficient.

Although the model of visual information processing adopted for the present paper is based on the principle that for simple tasks involving single feature (Treisman and Gelade, 1980) or automatic (Shiffrin and Schneider, 1977) recognition there is no demand placed upon attentional capacity, the principle of automatic processing with an unlimited capacity has been questioned recently (Fisher, 1982).

Fisher suggested that an alternative to the parallel and serial model exists. Specifically subjects may be able to compare only a limited number of items in parallel, and that this limit may be in the order of six. Fisher claimed that the evidence that stimuli are processed in parallel in a constant mapping task is typically based on studies that have used a maximum of six distractors, and therefore the capacity of the system was not exceeded. This proposal is further modified by the suggestion that the number of channels available is varied according to the amount of information needed to recognize each frame stimulus, and thus the amount of information analyzed in parallel is kept constant. The model suggests that a relationship exists between the number of channels and an information-theoretic measure of task load. The Fisher model is apparently prepared to concede up to 30 channels for a very simple task, in order to accommodate the results of one of the Treisman and Gelade (1980) experiments.

> "There are good reasons to expect changes in the number of channels operating concurrently in consistent mapping and varied mapping paradigms, the number of channels being greater in the consistent mapping paradigm. One such reason ...(is) the information needed to discriminate the target and distractor stimuli may be much greater in the varied mapping paradigm than it is in the consistent mapping paradigm" (Fisher, 1982, p 688).

Task load was in these terms related to "degree of automaticity" achieved by the observer, the "stimulus complexity", the information needed to discriminate the target from distractor, and target "discriminability". Operational definitions of these descriptors were not given, neither was it made clear whether or not these task load attributes overlap.

Although the Fisher position is critical of the principle of automatic detection which was adopted in the Treisman and Gelade (1980) and the Shiffrin and Schneider (1977) model, his alternative approach is still consistent with the notion that a range of RTs should be achieved in accord with the degree of task difficulty. An additional possibility has been added to those providing for long RTs with complex stimuli: that when the limits to the number of channels available is exceeded a load will be placed upon attentional capacity.

This alternative view proposed by Fisher has been introduced in this paper primarily to indicate that interpretations other than the automatic/serial model can still lead to the position that a search/detection task with a complex field can result in a high cognitive load task.

The present experiments were not designed to be critical in the sense of distinguishing between competing visual information processing models. Rather the interpretation placed on the camouflage detection procedure is compatible with the presently evolving models of visual information processing.

REFERENCES TO ANNEX A

Fisher D.L.
Limited-Channel Models of Automatic Detection: Capacity and Scanning in Visual Search.
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