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SYMPOSIUM ON ASYMMETRIES IN VISUAL SEARCH

Asymmetries in visual search: An introduction

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In visual search tasks, observers look for a target stimulus among distractor stimuli. A visual search asymmetry is said to occur when a search for stimulus A among stimulus B produces different results from a search for B among A. Anne Treisman made search asymmetries into an important tool in the study of visual attention. She argued that it was easier to find a target that was defined by the presence of a preattentive basic feature than to find a target defined by the absence of that feature. Four of the eight papers in this symposium in *Perception & Psychophysics* deal with the use of search asymmetries to identify stimulus attributes that behave as basic features in this context. Another two papers deal with the long-standing question of whether a novelty can be considered to be a basic feature. Asymmetries can also arise when one type of stimulus is easier to identify or classify than another. Levin and Angelone's paper on visual search for faces of different races is an examination of an asymmetry of this variety. Finally, Previc and Naegele investigate an asymmetry based on the spatial location of the target. Taken as a whole, these papers illustrate the continuing value of the search asymmetry paradigm.

For more than 20 years, visual search tasks have been an important tool in research on visual attention and, for about the same length of time, visual search asymmetries have been an important tool for understanding those visual search tasks. In visual search tasks, an observer looks for a target item among a number of distractor items. One measure of the efficiency of the search is the slope of the function relating reaction time (RT) to the number of items (set size). Searches vary in their efficiency. Thus, in a search for a red item among green distractors, the number of green distractors does not make much difference. The slope of the resulting RT $\times$ set size function will be near zero (Treisman & Gelade, 1980). By contrast, other searches do depend on the number of distractors. For examples, in a search for a T among Ls of different orientation (see, e.g., Kwak, Dagenbach, & Egeth, 1991) or for a horizontal line among lines of many different orientations (e.g., Moraglia, 1989), RTs will increase at a rate of about 25–35 msec per item on trials when a target is present and about twice that when the target is absent. Search becomes much more inefficient if eye movements are required. The figures quoted here are for stimuli large enough and well spaced enough to be attended and identified without their needing to be fixated.

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The most efficient of searches are those in which the target is defined by a single basic feature (e.g., color) and in which the distractors are homogeneous. The least efficient are those in which targets and distractors share the same basic features (e.g., Ts and Ls are both composed of a vertical and a horizontal line element) and/or when the distractors are heterogeneous (Duncan & Humphreys, 1989). Intermediate search efficiencies occur when some feature information is available to guide attention (e.g., find the *red* T among red and green Ls; Egeth, Virzi, & Garbart, 1984).

What are the "basic features"? There appear to be about a dozen (Wolfe, 1998a), but this is a matter of some controversy, because the definition is not perfectly clear. It is not enough to say that efficient search is the mark of a basic feature, because there are situations in which search is very efficient even though no single feature defines the target (see, e.g., Theeuwes & Kooi, 1994). An attribute is more likely to be accepted as a basic feature if it passes several tests. Supporting efficient search is one such test. Basic features also support "effortless" texture segmentation (Bergen & Julesz, 1983; Caelli, Julesz, & Gilbert, 1978; Julesz, Gilbert, Shepp, & Frisch, 1973). That is, the shape of a region defined by a basic feature will be immediately apparent to a viewer. Finally, search for the presence of a basic feature is more efficient than search for its absence. This is one instance of a visual search *asymmetry.* Search asymmetries are the topic of the eight papers in the present symposium.

Search asymmetry can be defined a bit more generally. Given two types of stimuli, the efficiency of search and/or the overall speed of search can depend on which stimulus is the target. Thus, search for stimulus A among stimulus B distractors may be faster and/or more efficient than search

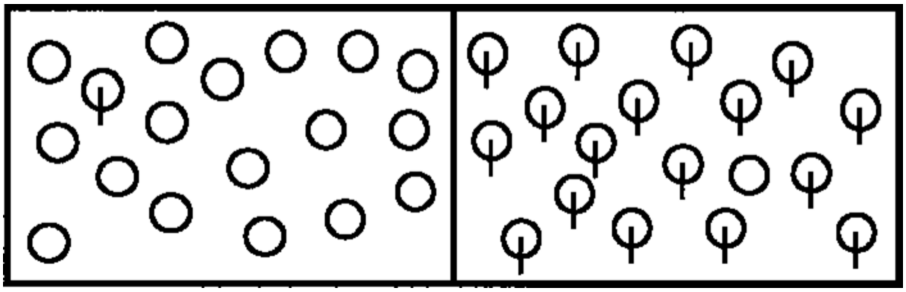

Figure 1. It is easier to find the circle with the vertical line among plain circles (left panel) than vice versa (right).

for B among A (Treisman & Gormican, 1988; Treisman & Souther, 1985). Search asymmetries have been of most value as a source of insight into the basic features of "preattentive visual processing." Neisser (1967) proposed a division of visual processing into preattentive processes that operate in parallel across the entire visual field and more limited capacity processes that have to be restricted or deployed to specific loci or objects by attention. Treisman was the first to argue that search asymmetry is one mark of a basic, preattentive feature. Specifically, it was Treisman who proposed that it is easier to find a target defined by the presence of a basic feature than by its absence. Thus, if you have a situation in which a search for A among B is highly efficient (flat slopes) whereas a search for B among A is less efficient, Treisman argues that this is a hint that stimulus A has the added basic feature (Treisman & Gormican, 1988; Treisman & Souther, 1985).

Figure 1 illustrates one of Treisman's most popular asymmetries (popular, in the sense that many others have used the same stimuli when they wanted to do a study with one "parallel" search task and one "serial" task; see, e.g., Klein, 1988; Zelinsky & Sheinberg, 1997). It should be introspectively obvious that it is easier to find the circle with the added vertical line in the left panel of Figure 1 than it is to find the circle *lacking* the line in the right panel of Figure 1. The presence of the line is easier to detect than its absence. It is less clear what basic feature is embodied in that added line. This may be a particularly effective search asymmetry stimulus, because the line adds at least four candidate basic features: orientation, size/length, intersection, and line termination.

Motion provides an example of a single-feature search asymmetry. It is intuitively clear that it will be easier to find a moving item among stationary items than a stationary item among moving items. Empirical support for that intuition can be found in one of the papers in this special issue (Royden, Wolfe, & Klempen, 2001). Asymmetries exist for other basic features as well. In color, it is easier to find orange among red than red among orange, apparently because, relative to red, orange can be detected by the presence of "yellowness," whereas, relative to orange, a red target is defined by the *absence* of yellow (Treisman & Gormican, 1988). In orientation, it is easier to find a tilted item among vertical items than a vertical item among tilted items (e.g., Foster & Ward, 1991). Wolfe, Friedman-Hill, Stewart, and O'Connell (1992) argued that, preattentively, orientations were categorized as "steep," "shallow," "tilted-left" or "tilted-right." Suppose that a search task involved a 0º (vertical) item and 15º (right-tilted) items. It would be easy to find a 15º item among 0º items because of the additional 15º "tilted-right" feature. It would be harder to find a 0º item among 15º items, because both targets and distractors would be "steep." The vertical target would be defined only by its absence of tilt (Treisman & Gormican, 1988).

This view of search asymmetries is challenged by Rosenholtz (2001) in this issue. She notes that some search asymmetries involve asymmetrical experimental designs. For example, returning to the case of motion, one could search for a stationary target among distractors moving in random directions or vice versa (Royden et al., 2001, report such a condition). This is quite strongly asymmetric. However, Rosenholtz points out that when the target is moving, the distractors are *homogeneously* stationary, but that when the target is stationary, the distractors are *heterogeneously* moving. It is known that distractor heterogeneity, by itself, makes search less efficient (Duncan & Humphreys, 1989). Thus, argues Rosenholtz, it is not informative to discover that finding a moving target among homogeneous distractors is more efficient than finding a stationary target among heterogeneous distractors. This analysis seems like a worthy warning for those who design asymmetry experiments. Potentially more damaging for the enterprise as a whole is Rosenholtz's conjecture that the background serves as a kind of distractor that needs to be taken into account when one is considering whether an asymmetry is a *real* asymmetry. If we return to the motion example, Royden et al. (2001) show that a search for a stationary target among homogeneous moving distractors is less efficient than a search for a moving target among homogeneous stationary distractors. The effect is less pronounced than in the case of heterogeneous distractors, but it is still present. However, what if we consider the background to be some sort of "stationary" distractor in its own right? Then the less efficient stationary target is being looked for in a *heterogeneous* display of moving distractors and a stationary background. This challenge to the most basic class of search asymmetries needs to be tested experimentally.

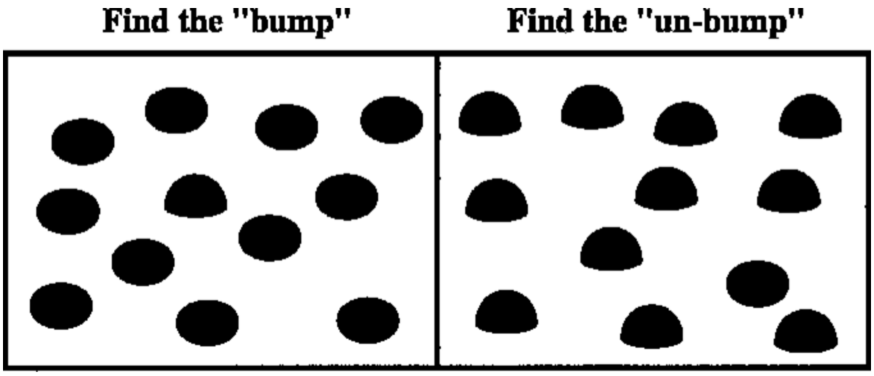

Figure 2. The asymmetry between search for an item with and without a curvature discontinuity is quite clear (redrawn from Kristjánsson & Tse, 2001).

New Features and New Asymmetries

The 15+ years since the appearance of Treisman's papers on search asymmetries have seen a continuing stream of papers using the asymmetries, and many labs have used the existence of a search asymmetry as part of an argument for elevating some stimulus attribute to the level of "basic feature." The clearest example in the present issue is found in the paper by Kristjánsson and Tse (2001). As noted in connection with Treisman's "O"and "Q" stimuli, the identity of the basic features defining form is not clear. Kristjánsson and Tse make a case for the featural status of curvature discontinuities. Figure 2 illustrates the phenomenon. It is easier to detect the bump as opposed to the absence of a bump. Many experiments show that 3-D depth cues operate as basic features in visual search (Enns & Rensink, 1990, 1991; Previc & Blume, 1993; Sun & Perona, 1996; von Grünau & Dubé, 1994). What makes the Kristjánsson and Tse paper interesting is a series of experiments that show that the asymmetry of Figure 2 is not a by-product of some sort of 3-D processing. They obtain the same basic result even when the stimuli do not give rise to an impression of depth. The feature, in this case, may be a building block of the 3-D representation.

Two other papers in this issue expand our understanding of existing asymmetries. Boutsen and Marendaz (2001) exploit the well-known asymmetries in orientation search in an investigation of the preattentive analysis of the axes of objects. Previc and Naegele (2001) use 3-D asymmetries to continue Previc's study of asymmetries in space. Notably, they find differences between search of the upper and of the lower parts of a visual stimulus (see also Previc, 1996, and Previc & Blume, 1993, as well as He, Cavanagh, & Intriligator, 1996).

Other Sources of Asymmetry

The presence versus absence of a basic feature is not the only route to a search asymmetry. There are several others—all proposed in Treisman's work on the topic. Thus, if one item has *more* of a feature than another, then search for the item with more among items with less will be more efficient than search for the item with less among more. Thus, search for long lines (more) among short lines (less) is more efficient than the reverse, and search for dark gray lines on a white background (more) among light gray lines (less) is more efficient than the reverse (Treisman & Gormican, 1988, p. 41). Treisman also proposes that it is easier to find deviations among canonical stimuli than vice versa. This provides a slightly different way to describe the fact that it is easier to find a tilted item among vertical distractors than it is to find a vertical item among tilted distractors, with Wolfe et al. (1992) emphasizing the presence of "tilt" and Treisman emphasizing the deviation from a canonical "vertical" feature—a subtle difference with some implications for our understanding of the preattentive processing of orientation.

The various forms of search asymmetry described thus far are products of the preattentive, parallel processing of basic features. There is another possible class of search asymmetry, also proposed by Treisman. If there is a difference "in the speed at which distractors can be serially checked to determine if they meet the target specification" (Treisman & Souther, 1985, p. 292), then the RT × set size slope will be steeper for the condition in which the slower type of item is in the distractor set. The examples offered by Treisman and Souther are searches for letters among mirror-reversed letters and vice versa (Frith, 1974; Reicher, Snyder, & Richards, 1976; Richards & Reicher, 1978). The general finding is that it is easier to find mirror-reversed letters among normal letters than vice versa. The basic phenomenon is illustrated in Figure 3. In these early reports, the slopes were all rather steep—in the range often taken to indicate serial deployment of attention from item to item rather than parallel processing of the whole set. Treisman and Souther argued that asymmetry arose in this serial deployment stage. Subjects were faster to *reject* familiar, normal letters than to reject unfamiliar, mirror-reversed letters. As a consequence, they were faster to find the unfamiliar item among familiar items than vice versa (see Flowers & Lohr, 1985).

Similar asymmetries exist in visual search for faces. It is easier to find the unfamiliar inverted face among upright faces than vice versa (see, e.g., Nothdurft, 1993), but

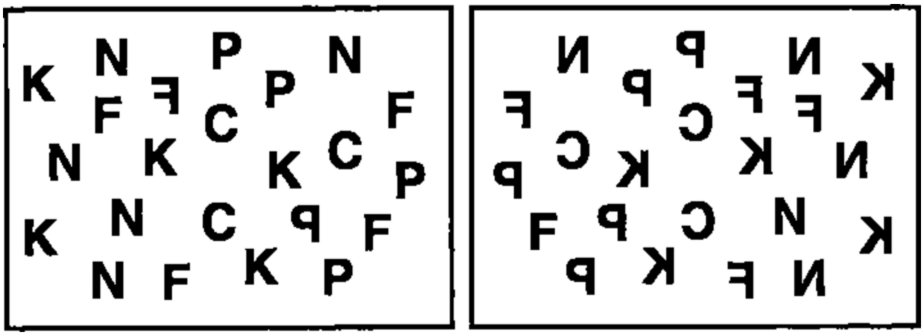

Figure 3. In each panel there are two targets. On the left, they are mirror-reversed letters. On the right, they are normal. The standard finding is that it is easier to find the unfamiliar, mirror-reversed items.

both the easier and the harder search are very inefficient in this case. The asymmetry seems to arise from the differences in the speed of serial processing of upright and inverted faces. In fact, not only are faces not basic, preattentive features, but basic features like curvature (Wolfe, Yee, & Friedman-Hill, 1992) can lose their ability to support efficient search if they form part of a face (Suzuki & Cavanagh, 1995). In 1996, Levin reported that white subjects were able to detect the presence of a face of another race among white faces faster than they were to detect a white face among cross-race distractors. As with the other face asymmetries, the slopes of the searches in these experiments suggest a serial search asymmetry. One could propose that subjects would be a bit faster when searching though same-race distractors than when searching through cross-race distractors. The result would be an advantage for the detection of cross-race targets. Levin and Angelone (2001) test that hypothesis in an article in the current issue. By distorting faces toward or away from a prototypical face, they obtain evidence that distractor rejection is at the heart of the race-of-the-face asymmetry.

Is "Novelty" a Basic Feature?

One can take a different view of the relatively efficient search for stimuli such as cross-race faces, inverted faces, and inverted letters. Recall Treisman's hypothesis that it is easier to detect a deviant among standard stimuli than to find the standard stimulus hiding among deviants (Treisman & Gormican., 1988, p. 42). An extension of this position is the proposition that deviation or novelty *per se* has preattentive status as a feature. That is, novelty might be a feature such as color or size, though perhaps a bit weaker in its ability to support efficient visual search. Treisman and Gormican do not explicitly advocate this position, but others have done so subsequently (e.g., the work on "novel pop-out"; Hawley, Johnston, & Farnham, 1994; Johnston, Hawley, & Farnham, 1993).

This position received important empirical support from Wang, Cavanagh, and Green (1994). Novelty would be a more compelling candidate for featural status if search for novel among standard stimuli produced shallow RT × set size functions. This would argue against the notion that the searches for novel stimuli were more efficient *only* because standard stimuli were easier to reject when they were the distractors. Wang et al. argued that the earlier letter search experiments had not revealed highly efficient search for novel letters because the tasks involved heterogeneous distractors, a factor known to slow search (Duncan & Humphreys, 1989), and because the targets and distractors had different overall shapes (convex hulls). In an effort to address these issues, Wang et al. had subjects search for Ns among mirror-Ns and vice versa, as well as Zs among mirror-Zs and vice versa. They obtained very shallow slopes for the search for the novel, mirror-reversed items (1 or 2 msec/item for target-present slopes). They obtained much steeper slopes for the search for familiar letters (N, 43 msec/item and Z, 29 msec/item for target present; 56 and 47 msec/item for target absent.). They concluded that, taken with other evidence, "this suggests that familiarity itself might be considered a primitive feature which can be processed preattentively" (Wang et al., 1994, p. 499). Following Treisman's general formulation, familiarity would be the canonical feature and "novelty" would "pop out" as a deviation from familiarity. The claim that familiarity/novelty can be processed preattentively is important, because it implies parallel processing of letter stimuli to a level of recognition adequate for one to distinguish novel letters from familiar letters. This is a form of a "late selection theory" (Deutsch & Deutsch, 1963). A claim of preattentive processing of letter identity would contradict "early selection" accounts that hold that attention is required for object recognition (Treisman, 1988; Treisman & DeSchepper, 1996; Treisman & Gelade, 1980; Wolfe, 1994; Wolfe & Bennett, 1997; Wolfe, Cave, & Franzel, 1989). The relevant background for the late selection, early selection debate is admirably reviewed in Pashler (1997).

Two papers in this issue address the Wang et al. (1994) finding directly (Malinowski & Hübner, 2001; Shen & Reingold, 2001). In both studies, the authors manipulated the familiarity of the items in a letter search. Malinowski and Hübner tested Slavic subjects who were familiar with N from the Latin alphabet and with mirror-N from the Cyrillic alphabet. (Apparently, it is hard to find Slavic subjects who know only the Cyrillic alphabet, at least in

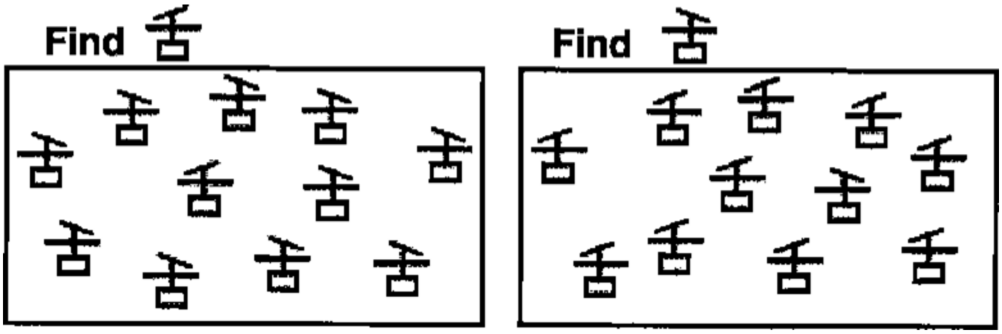

Figure 4. It is easier to find 舌 among 舌 if you do not know Chinese and do not know that the ideogram with the top sloping down and to the left means "tongue" whereas its mirror-reverse is meaningless. If you do know Chinese, the search for the novel target on the right is easier than the search for the familiar "tongue" ideogram on the left.

academic circles.) Subjects who were familiar with both N and mirror-N searched efficiently for either target. How did they do this? One possibility is that overlearned stimuli behave as basic features (Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977). However, if such is the case, it is hard to see why searches for familiar items among familiar items are not efficient. Consider search for a digital 2 (or S) among digital 5s and vice versa. Both characters are familiar, yet this is one of the standard inefficient "serial" searches (Wolfe, 1998b).

Perhaps once N and mirror-N are both familiar, it is easier to use the orientation of the diagonal line to guide attention. After all, orientation is a fairly uncontroversial basic feature (though see the Discussion in the Malinowski and Hübner paper for counterarguments). The Malinowski and Hübner results argue for the importance of the familiarity of the distractors. This point is made even more forcefully by the Shen and Reingold (2001) paper. Instead of Slavic subjects, Shen and Reingold used subjects familiar or unfamiliar with Chinese characters. It is possible to find characters that differ in the orientation of a single line (like N and mirror-N). When these are used, Chinese readers show the Wang et al. finding. The unfamiliar item is easy to find. Interestingly, English-only subjects are actually faster and more efficient than the Chinese readers with these stimuli (see Figure 4). Apparently, they can exploit the basic orientation feature, undisturbed by the meaning of the character. Importantly, Shen and Reingold tested pairs of characters in which both target and distractor were familiar and in which both were unfamiliar in addition to the usual familiar versus unfamiliar pairings. Within the Chinese-reading population, Shen and Reingold showed that search was more efficient when the distractors were familiar, regardless of the status of the target. The familiarity or novelty of the target was not a significant factor in its own right.

In my own lab, we have also done some recent experiments aimed at this question, and I will take the liberty of including some of our findings in this introduction to the papers in this symposium. For example, we have done what amounts to an English-speaking version of the Shen and Reingold (2001) experiment. We used As and Vs in upright (familiar) and inverted (unfamiliar) form. In this experiment, the target was a V or an inverted V. One or the other was present on every trial (no target-absent trials). The subjects' task was to press one key for V (familiar) and another for inverted V (novel). The distractors were As and inverted As. On a given trial, the distractors could be all familiar As, all novel inverted As, or a mixture of both distractor types. The two target types were crossed with the three distractor conditions, and all six resulting trial types were randomly intermixed in two blocks of 450 trials. Like that of the Shen and Reingold study, this design allowed us to look at the effect of distractor familiarity separately from the effects of target familiarity. Set sizes were 5, 9, and 13. Twelve subjects were tested.

Our results paralleled those of Shen and Reingold (2001). The standard search asymmetry was replicated. Search for a novel, inverted V among familiar As produced a slope of 21.9 msec/item. This was more efficient than the search for a familiar V among unfamiliar, inverted As (31.5 msec/item). The interesting question was whether the novelty/familiarity of the targets or distractors was the important factor. When averaged across distractor types, searches for the familiar Vs produced essentially the same slopes as did search for unfamiliar inverted Vs (25.2 vs. 25.3 msec/item). However, when averaged across target types, search through unfamiliar distractors produced less

Table 1
Slopes of Reaction Time × Set Size Functions for Searches for a Letter Among Its Mirror-Reversed Form, or Vice Versa

	Target-Present Slopes		Target-Absent Slopes	
Letter	T:normal	T:mirrored	T:normal	T:mirrored
N	81.8	6.0	102.8	30.5
P	39.6	16.3	48.4	31.8
K	32.9	13.7	53.8	31.5
f	30.5	17.5	37.1	26.4
y	19.1	14.1	26.4	19.1

Note—y was inverted, not mirrored.

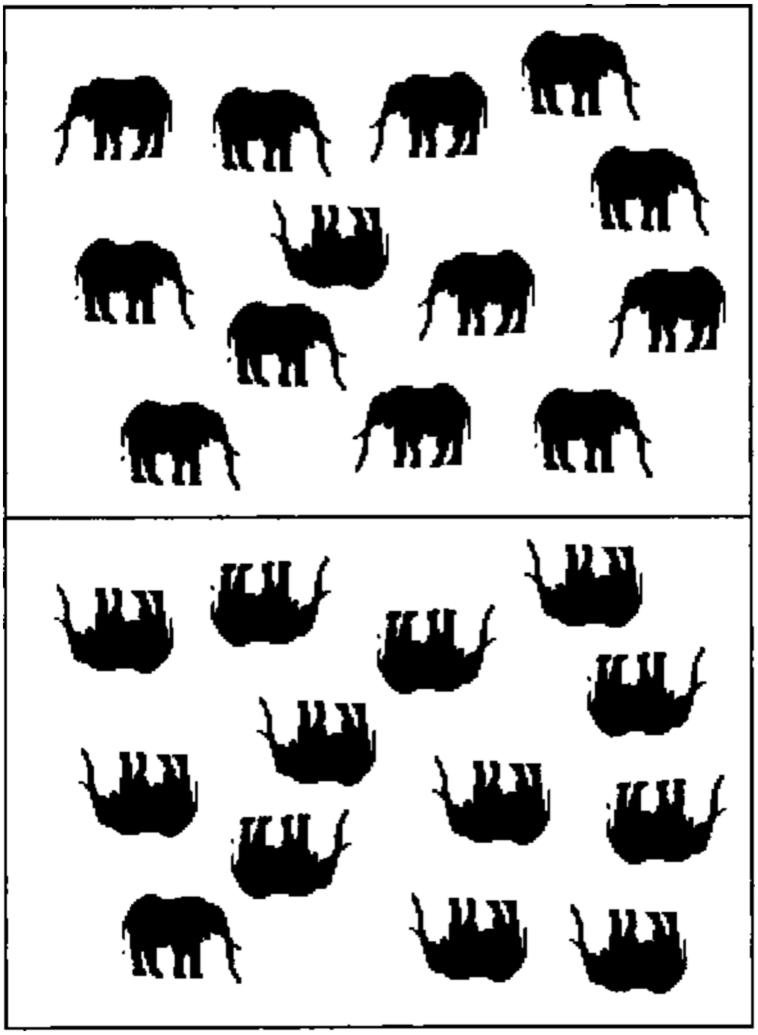

Figure 5. Find the "dead" elephant in the upper panel and the "live" elephant in the lower panel.

efficient search (24.8 msec/item) than did search through familiar distractors (18 msec/item). There was a main effect of distractor type on RT [ANOVA, $F(1,11) = 12.9$, $p = .0002$] and an effect on the slopes [ANOVA, interaction of distractor type and set size, $F(2,22) = 5.2$, $p = .0015$]. As in the Shen and Reingold Chinese experiments, it was the distractor familiarity that was important.

It is interesting that the results from several labs show the effects with N and mirror-N stimuli to be more dramatic than the effects with most other pairs of letter stimuli. We repeated the N versus mirror-N experiment from Wang et al. (1994), and then we tried a few other letters that seemed reasonably similar to the N, mirror-N case. We tried P, K, f, and y. In the case of the y, we tested y against inverted y rather than mirror-y.

Table 1 gives the average slopes of the RT × set size functions for these various letters. All of these averages are based on a minimum of 10 subjects tested for a minimum of 300 trials. The pattern of results is rather interesting. Three points are worth mentioning.

1. As in Wang et al. (1994), there is a very striking N versus mirror-N asymmetry, and the slope for finding a mirror-N target is a shallow 6 msec/item.

2. All the other letters produce asymmetries, too. They are quite substantial, but less dramatic than the N asymmetry. The slopes for finding these other mirrored targets are all quite similar—about 2.5 times the mirror-N slope. These slopes are somewhat shallower than the 20–30 msec/item one would expect to obtain in a classic "serial" search (e.g., T among Ls or 2 among 5s).

3. The search for a normal N among mirror-Ns is extremely inefficient. Not only is search for a mirror-N about 2.5 times more efficient than search for a mirror P, K, or f, but search for an N among mirror-Ns is about 2.5 *less efficient* than search for a normal P, K, or f among mirrored distractors.

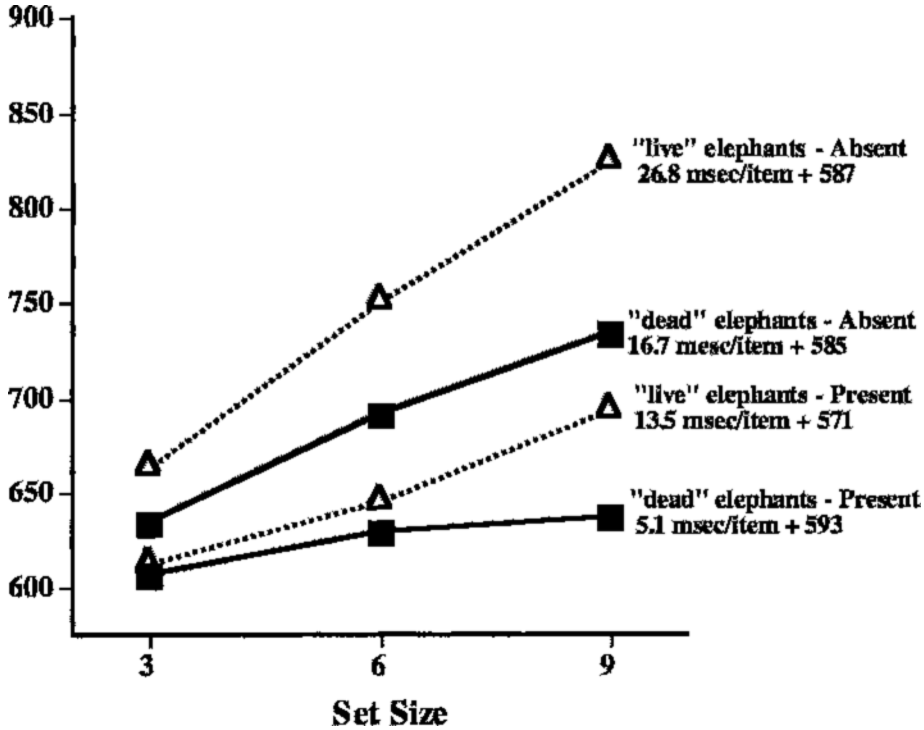

Figure 6. Search for a "dead" elephant is very efficient. Search for a "live" elephant is less efficient.

In their Experiment 1, Shen and Reingold also tried a variety of other pairs of letter versus mirror-letter searches (see their Table 1). They found consistent advantages for mirror-reversed targets. Their results for digital 4s and 6s are similar to our results for P, K, and f shown in Table 1. They also used a standard 4 (with an oblique line in it), F, and L. In these cases, the unfamiliar mirror-target produced very efficient search. One could argue that these searches provided more of a chance for other features to play a role (orientation in the case of the 4 and convex hull/curvature in the L and, perhaps, the F cases). They found the largest asymmetry in the N, mirror-N case as in Wang et al. and in our replication of Wang et al. Taken as a group, these experiments do not present a perfectly clear story. However, they suggest that the letter search will be most efficient when the distractors are familiar and when a basic feature (e.g., orientation) differentiates targets and distractors.

One More Asymmetry: "Dead" Elephants Are Hard to Hide

To end this introduction, consider one more set of stimuli that generate search asymmetries. These are upright and inverted silhouettes of animals. We have found that results with these stimuli parallel results with letters and illustrate that the effects of familiarity are quite general. Figure 5 illustrates that it is easier to find an inverted "dead" elephant silhouette among upright, "live" elephants (top panel) than it is to find live among dead (bottom panel).

In our actual experiment, elephants were silhouettes like those shown in the figure. Each subtended 4º × 3º. Three, six, or nine elephants were presented on an irregular 4 × 4 grid. The elephants, alive or dead, could face either left or right. Twenty subjects were tested for 30 practice and 300 experimental trials in "live" and "dead" elephant conditions. The average RT × set size functions are shown in Figure 6.

There is a search asymmetry. It is significantly easier to find a "dead" elephant among "live" ones than vice versa (paired t tests, $p < .01$ for both target-present and target-absent slopes). Moreover, the target-present slope of 5 msec/item for the "dead" condition is comparable to slopes for searches in which the target is defined by the presence of a preattentive feature. Error rates are very low (< 4%).

We also tried camels, swans, and a heterogeneous mix of animals. The results are shown in Table 2. In parallel with the letter data, it is easier to find the inverted, unfamiliar target than the upright, familiar target. There are clear

Table 2
Slopes for Upright Among Inverted Camels, Swans, and Mixed Animals

	Target-Present Slopes		Target-Absent Slopes	
	Inverted	Upright	Inverted	Upright
Swan	21	25.3	32	69
Camel	9.8	24.8	25.2	52.3
Animals	28.6	56.2	86.6	140.8

differences among animals as there are among letters. In both cases, it is hard to argue that one letter (e.g., N) or one animal (e.g., elephant) is more familiar than another (e.g., P or swan). It seems more likely that that the asymmetries in letter (and animal) search arise from the familiarity of the distractors as suggested by the Shen and Reingold (2001) and Malinowski and Hübner (2001) papers. Differences between different letters (or animals) seem to be related to the interplay of distractor familiarity with basic features such as orientation. The exact details of this interaction, it must be confessed, remain somewhat murky.

Summary

Taken as a group, the papers in this issue reveal both the promise and the problems to be found after 15+ years of work on search asymmetries. A paper like Kristjánsson and Tse's (2001) shows search asymmetry at its least problematic. Given the results of a series of elegant experiments, the authors could use the logic of search asymmetry to make the case that curvature discontinuity is computed preattentively and can be used to guide attention to a target. Rosenholtz (2001) warns us to be careful before accepting evidence of this sort, but Kristjánsson and Tse's experiments seem likely to pass the tests set up by Rosenholtz. One can argue that the experiments on the role of novelty are just as elegant, but in this case, reasonable authors can look at the same data and disagree about interpretation. On balance, I am inclined to interpret the data as arguing against a "novelty" feature or the learning of new basic features. However, looking at the same results, Malinowski and Hübner (2001) can argue in their abstract that their data "are also compatible with the idea that letters are standard or basic features, which implies that basic features can be learned" (pp. 458). Search asymmetries continue to provide puzzles and clues that point us toward a clearer understanding of preattentive processing and of visual search.

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