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**Global dominance in nonattended objects:
The effect of attentional strategy**

**by
Yuntai Wu, B.A**

**A thesis submitted to the Faculty of Graduate Studies
and Research in partial fulfilment of the requirements for the
degree of Master of Arts**

**Department of Psychology
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August 1992

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**The undersigned recommend to the Faculty of Graduate
Studies and Research acceptance of the thesis**

**"Global dominance in nonattended objects: The effect of
attentional strategy"**

submitted by

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**in partial fulfilment of the requirements for
the degree of Master of Arts**

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Abstract

Are there any processing difference between perceiving the individual parts (local aspect) and perceiving the overall configuration of the parts (global aspect)? Paquet (1992) observed that subjects can ignore the category of unattended local patterns but not that of global patterns. She proposed that processing of the global aspect is automatic whereas processing of the local aspect is more optional. Do her results reflect a priority for perception of global information or only reflect the use of an attentional strategy favouring global information? To explore this issue, subjects had to detect the presence of a target letter appearing at either the global or the local level of an attended object, and they were required to ignore letter distractors appearing either at the global or the local level of an unattended object. The subject's attentional strategy was manipulated by varying the probability that the target letter appeared at the local level of the attended pattern. In Experiment 1, the target letter appeared equally often at the global and the local level of the attended object, whereas in Experiment 2, the target appeared at the local level on 80% of the trials.

The results indicated that the probability manipulation influenced processing of the attended object; a global latency advantage was found in Experiment 1, whereas local advantage was obtained in Experiment 2. However, in neither experiment was a pattern of dominance found for the nonattended object,

and subjects were unable to ignore the category of both unattended local and global distractors. The results suggest that the pattern of dominance in nonattended objects is not related to the attentional strategy adopted by the subjects. The results are discussed in relation to theoretical models of global dominance.

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Introduction

How do people perceive visual objects? Do "the elements of a figure get together and build the whole or does the whole figure separate and organize the available elements" (Woodworth, 1954, p.403)? This problem has been a stock question in the history of psychology. In more recent terminology, the question is whether the processing of the overall configuration (termed the global aspect of an object) is more important than the processing of the parts (termed the local aspect of an object) or whether the processing of the parts has priority over the processing of the overall configuration.

Traditionally, a widely accepted view was that during visual information processing there was a priority for the local aspect. According to this view, the visual system first perceives components of the object and subsequently integrates them into an overall structure. For example, following structuralist thought (Titchener, 1909), several models (feature-accumulation models) proposed that we build up complex percepts from a set of elementary or atomic units (e.g., Gibson, 1969; Lindsay & Norman, 1972; Treisman & Gelade 1980).

Recently, the opposing view which suggests a priority in early perceptual processing for the more global features of a form has become popular.

Global precedence phenomenon

Navon (1977) argued that the more global features of a display are available first, and that only global features are automatically processed. In his experiment, subjects were shown compound stimuli such as those in Figure 1. They were asked: (1) to identify the global aspect (large letter) or (2) to identify the local aspect (small letters). In order to see if subjects could ignore any aspect at will, Navon presented two types of stimuli (1) consistent--global and local forms were identical (e. g. large H made up of smaller Hs in Figure 1), and (2) inconsistent--global and local forms were different (e. g. large H made up of smaller Ss in Figure 1). In his experiment, the height of the large letter subtended about 3.2° of visual angle and the large letter was made up of many small letters; the stimuli appeared randomly at either of the four quadrants of an oscilloscope for an exposure duration of 40 msec and were followed by a square of 33 by 33 dots which masked the stimuli. If the global aspect was available first, then Navon predicted that identification of the global forms should be faster than that of the local forms. Moreover, if only global processing was automatic, then subjects would not be able to ignore the identity of the global features when they were asked to focus on the local level but they could ignore the local features when they were asked to focus on the global aspect. The results verified these predictions. Identification of the global features was faster than that of the local features, and it made no

Figure 1: Example of the stimuli used by Navon (1977).

difference to global identification whether the local elements were consistent or inconsistent with the global form, but local identification latencies were significantly slower when the global forms were inconsistent than when they were consistent with the local forms.

Navon interpreted the interference pattern between the global and local aspects by stating that small letters had not been identified at the time information about the large letter was determining a response, but that the large letter had been identified earlier before decisions were made based on the small letters. More generally, the global features would always come first and have priority in perceptual processing. Navon's proposal is known as the global precedence hypothesis. However, two questions have been raised by many researchers since Navon's original experiment. First, is this global precedence phenomenon a universal law or a special case? Second, does global precedence implies that global features are identified before local features?

Global precedence as a special case

Various researchers argued that the precedence phenomenon found by Navon (1977) was due to the conditions that prevailed during his experiment which degraded local information in comparison with global information. Some key factors which seemed to affect the global precedence phenomenon were soon identified by researchers.

Overall size

Kinchla and Wolfe (1979) argued that the size of stimuli could affect the global precedence phenomenon. In their experiment subjects were shown stimuli such as those in Navon's experiment with the exception that the height of the large letter subtended 4.8°, 6.7°, 8.0°, 10.3° or 22.1° visual angle. The subjects' task was to decide whether or not a predefined target letter appeared in the display (either at the global level or at the local level). The results showed that the large letters were processed faster than the small ones only when the display was smaller than about 6° to 9° of visual angle. When the display was larger, the small letters were recognized faster than the large ones. This result seemed to support the claim that global precedence depends on the visual angle subtended by global and local letters. It was suggested by Kinchla and Wolfe (1979) that stimuli of a certain size (2° of visual angle) were processed first by our visual system, and larger or smaller ones were processed subsequently, because the larger and smaller forms might fall in regions of lower acuity.

However, this explanation was not supported by Lamb and Robertson (1990). They found that the transition from a global to a local reaction time (RT) advantage did not occur at a fixed size. In their experiment, there were two sets of compound stimuli. One set was the large-stimulus set, which contained global stimuli measuring 3°, 6°, 9°, or 12°. The

other was the small-stimulus set, which included global stimuli of 1.5°, 3°, 4.5°, or 6° visual angle. Subjects' task was to identify targets randomly appearing at either the local or the global level. The results showed that the transition from global to local RT advantage occurred at larger visual angle for the large-stimulus set (3° to 6°) than for the small-stimulus set (1.5° to 3°). This result suggests that sensory processes are not the only ones influencing global and local processing. Attentional processes, as Lamb and Robertson suggested, might also play an important role.

Furthermore, Navon and Norman (1983) argued that in Kinchla and Wolfe's study, the large size global letters were farther away from the fovea than the large size local letters. Thus, it is quite possible that the eccentricity (i.e., distance from the fovea), not the stimulus size, produced the effect found by Kinchla and Wolfe (1979). If the eccentricity was controlled, the global precedence phenomenon should be found under a wide range of visual angle. Navon and Norman employed Cs and Os as stimuli instead of Hs and Ss (as shown in Figure 2). The stimuli were presented in a fixed central location, in which the global and local aspects were presented at equal eccentricity. Subjects were asked to identify the opening (left vs. right) of the letter C. They found that the global aspect was processed faster than the local aspect under both small (2°) and large (17.25°) visual angle conditions.

It is not surprising that the stimulus size would affect

Figure 2: Example of stimuli used by Navon and Norman (1983).

the processing of compound stimuli: we would not see a forest if we were too close to it, just as Navon (1977, 1981) suggested. However, the question is under what range of size would global precedence hold? From the above evidence (Navon & Norman, 1983), we can see that the range is relatively wide. In fact, most objects we perceive in our daily life are within this range (Navon, 1981).

Sparsity

Martin (1979) showed that the results obtained by Navon (1977) were influenced by the sparsity or density of local elements. In her experiment, the sparsity of each stimulus was varied by manipulating the number of local letters (many or few local letters). Subjects were instructed to report the name of either the local or the global letters. The results showed that the global aspect was identified faster than local aspect only if the global forms were made up of many small local forms. Otherwise, if the global forms were made up of fewer local elements, then local identification was faster than global identification. Martin suggested that sparsity was a powerful factor which "determines the relative ease of processing global or local aspects" (Martin, 1979 p.483).

However as pointed by Navon (1981), these results may be due to the fact that letters made up of few elements did not match people's internal representation of that letter and it might have made the global forms less recognizable than the

local forms. Thus, it is quite possible that the goodness of the patterns, not the number of elements, affected global/local processing. If this was the case, then global precedence would occur even if the global forms were made out of few local elements, as long as it was a good pattern. Navon (1983) conducted an experiment to investigate this issue. In his experiment, there were two kinds of compound stimuli: large triangles made up of small triangles and large squares made up of small squares. In a same-different task, subjects were asked to decide whether the second stimulus (global or local) was different from the first one (global or local). Sparsity effects similar to the ones found by Martin occurred only with triangle stimuli. When the stimuli were compound squares, the global precedence was observed under both many and few elements conditions. Navon (1983) argued that global triangles with few elements hardly match people's prototype of a triangle, while the global squares with few elements still remained a good shape. In addition, Kimchi (1988) also found global precedence with few-element patterns (i.e. square and rectangle). Thus, it seems that the sparsity or the number of elements is not a factor that could affect the global/local processing.

Exposure duration

Paquet and Merikle (1984) found that exposure duration was also a factor that influenced global/local processing. At 10-msec exposure duration, only global to local

interference was observed, which was consistent with Navon's (1977) findings. But, at longer duration (40-msec and 100-msec), bidirectional interference (global-to-local and local-to-global) was found, despite the fact that global latency was faster than local latency. Thus, they suggested that global precedence was restricted to viewing conditions (e. g. short duration) which favour perception of global aspects. However, in other studies (e.g. Miller, 1981; Pomerantz, 1983; Navon, 1983, 1991) global precedence (faster global processing and asymmetrical interference) was obtained at longer exposure duration as well. The discrepancy might be due to the fact that the eccentricity of global and local levels in Paquet and Merikle's (1984) experiment were not equated (Navon, 1991).

It seems that short exposure duration plays a role in degrading the local information (Paquet & Merikle, 1984). However, no consistent results emerge for long exposure duration.

Spatial Uncertainty and Retinal Location

Grice, Canham and Boroughs (1983) argued that Navon's (1977) use of unpredictable peripheral locations for the stimuli would degrade local more than global information, because more time would be needed to find and fixate the small stimuli than the large ones. Thus the discriminability of the levels under spatial uncertainty would not be equated. Moreover, since Navon's stimuli were presented in the periphery, acuity difference could also degrade processing of

small stimuli much more than processing of large ones. In Grice et al.'s (1983) experiment, the stimuli were presented either in a fixed central location, or they were presented peripherally to the right or left of the fixation point, in an unpredictable fashion. The results of the uncertain stimulus locations condition provided a clear replication of Navon's result. RTs were significantly faster to identify the large targets than to identify small targets, and global-to-local interference was substantially larger than local-to-global interference. However, the results of the fixed stimulus location were entirely different: RTs to the large and small targets were about the same, and the interference effects were bidirectional. Similar results were also found by Pomerantz (1983).

However, in both Grice et al.'s (1983) and Pomerantz's (1983) experiments, spatial uncertainty was confounded with the retinal locus: A central location was used for the fixed condition, while peripheral presentations were employed for the uncertain condition (Kimchi, in press). Thus it is not clear which factor, spatial uncertainty or retinal location, might account for their results. In fact, it is not necessary for spatial uncertainty to be confounded with retinal locus. Kimchi (1988) employed stimuli presented in fixed peripheral location and she did not always find global precedence. Thus, it seems that retinal location is likely to be a factor to influence global precedence. However, the results (Kimchi,

1988) did not exclude the possibility that spacial uncertainty might also have some impact on global/local processing. In order to examine the effect of spacial uncertainty, Lamb and Robertson's (1988) did some experiments in which the central presentations were used for the uncertainty conditions. In their experiments, the stimuli were presented either in the centre or in the periphery, in an unpredictable fashion. They found that local processing was improved for central presentation in comparison with peripheral presentation, and that global-to-local interference decreased for central presentation. However, the global processing was not affected by the location of the stimuli. These findings suggest that retinal location, not spatial uncertainty, was more likely to be the factor to influence the global/local processing in Grice et al 's and in Pomerantz's studies. The peripheral presentation would degrade local information more than global information. However, even in the fixed central presentation condition, some authors have reported global precedence. Thus, Miller (1981, Experiment 2) found that the global aspect was processed faster than the local aspect, and Navon and Norman (1983) found global RT advantage and unilateral global-to-local interference when stimuli appeared at fixed central locations.

Overall, it seems that peripheral presentation may decrease the discriminability of local information. However, the effect observed under fixed central presentation

conditions are not consistent.

The issue of discriminability

All the above studies tried to clarify one question: Is the global precedence phenomenon (faster global processing and larger global-to-local than local-to-global interference) due to a perceptual rule by which global processing has a priority during perception of hierarchical forms (Navon, 1977, 1981, 1983), or is it due to a difference between the discriminability of global and local aspects (Garner, 1983; Pomerantz, 1983)? The latter hypothesis is based on the assumption that some factors (those discussed above) could affect the quality of the global/local information. According to this view, global precedence arises simply because the global aspect was more discriminable than the local aspect. Therefore, it was believed that if the discriminability of the two levels was equated, then no global precedence would be found.

However, there are some problems with the discriminability hypothesis. First, although factors such as visual angle, sparsity, spatial uncertainty, retinal locus and exposure duration have sometimes been found to affect the global/local processing, the findings reviewed above show that none of these factors appear sufficient or necessary to produce global precedence (Kimchi, in press). Secondly, there are several experiments demonstrating that the unilateral global-to-local interference is found even when the

discriminability of the two levels is equated (Ghim & Eimas, 1988; Hughes, Layton, Baird, & Lester, 1984; Ward, 1982). Two different indexes of discriminability have been used by different researchers. One is the reaction time for a baseline condition when the global and the local aspects are not both response alternatives (e.g. subjects are asked to judge if the compound stimulus is an E or H and the stimuli for the baseline condition can be large E or H made up of small O's or large O made up of small E's or H's). But, global precedence was found when the baseline RTs were equal (Ghim & Eimas, 1988; Hughes et al., 1984; Ward, 1982). In addition, and in contrast with the predictions from the discriminability account, unilateral global-to-local interference is not always accompanied by faster global responding. In some cases, the global aspects were more difficult to ignore than the local aspects even when global processing was slower than local processing (Lamb & Robertson, 1989; Lamb & Knight, 1990; Navon & Norman, 1983). This can hardly be explained by the discriminability account. The other index used to access the discriminability of the levels is the baseline error rates. Given that global precedence has typically been defined as faster global processing and asymmetrical interference, it is somewhat circular to use baseline RT as the index of discriminability (Paquet, 1992). Thus, the response accuracy for the baseline conditions should be employed as the discriminability index (Paquet & Merikle, 1988; Paquet, 1992).

When the baseline error rates for global and local levels are equal, global precedence is often observed nonetheless (Paquet, 1992; Paquet & Merikle, 1984, 1988). Therefore, contrary to the discriminability hypothesis, global precedence does not necessarily reflect the difference in the discriminability between the two levels.

Distribution of attentional resources

A further limitation to Navon's proposal is the demonstration that when the stimulus-related factors described above are held constant, observers can adopt an attentional strategy which can facilitate processing of either structural levels of a compound stimulus. In an experiment performed by Kinchla, Solis-Macias and Hoffman (1983), each trial began with the presentation of two target letters, followed by a test compound stimulus (a large letter made up of small letters). The subjects' task was to decide which of the two target letters appeared within the compound stimulus. For example, if the two target letters were F and E, and the test stimulus was a large H made up of small Es, the subject would press the button which indicated that an E was presented. The most important aspect was that the probability that a target letter would appear at the local level was varied ($p=.2$, $.4$, $.6$ and $.8$) and subjects were informed of this probability. Their hypothesis was that if subjects could adopt different attentional strategies which facilitate processing of the most probable target level, then performance should be influenced

by the probability of having the target letter at the global level. Specifically, if subjects adopt a global processing strategy when the probability for a target letter appearing at the local level was less than at the global level ($p=.2$ and $.4$), then, for those conditions, large letter judgements should be faster than small ones. On the other hand, if subjects adopt a local strategy when the probability for target letter appearing at the local level was greater than at the global level ($p=.6$ and $.8$), then the identification of small letters should be faster than that of large ones. The results confirmed their predictions. When the probabilities for target appearing at the local level were $.2$ and $.4$, the identification of large letter was faster than that of small letters; but when the probabilities were $.6$ and $.8$, the judgement of small letter was faster than that of large letters. Their results suggest that the distribution of attentional resources could affect the processing speed for global/local aspects. Observers can select one of two alternative attentional strategies to facilitate the processing of one level. Therefore, attention plays an important role in determining the relative speed of global and local processing.

Although it is clear that attentional strategy plays an important role, the particular cognitive mechanisms involved in such strategy is unclear. Kinchla et al. (1983) suggested some mechanisms which might account for the two processing

strategies. Subjects may selectively "tune their sensory system to different spatial frequency channels". Spatial frequency is defined as the number of cycles of sinusoidal gratings (i.e. dark-bar-light-bar pairs) per unit distance. Spatial frequency and size of bar have a reversed relation: A grating of high spatial frequency has narrow bars and a grating of low spatial frequency has wide bars (Graham, 1981). Correspondingly, the global aspect of compound stimuli corresponds to low spatial frequencies, while local aspects are represented by high spatial frequencies (Lovegrove, Lehmkuhle, Baro & Garzia, 1991; Shulman, Sullivan, Gish & Sakoda 1986; Shulman & Wilson, 1987). Some studies (Davis and Graham, 1981) have shown that subjects have attentional control over spatial frequency channels. Therefore, a global attentional strategy might lead to a tuning which favours the low spatial frequency channel, while a local attentional strategy may lead to a tuning favouring the high spatial frequency channel. Alternatively, the selection of global or local processing might occur when the features are organized (Pomerantz, 1981). Global attentional strategy may lead to organize features into global subset which is appropriate for the processing of the global forms but inconsistent with the processing of local ones, while local attentional strategy might lead to organize features into local subset which is in favour of local processing. Finally, "selectivity might be mediated by ordered memory comparison process" (Kinchla et al.

1983 p.8). Subjects may serially compare one of the aspect (global or local) with the memory set (target letters). Global attentional strategy may induce subject to compare the global aspect with the memory set first and respond if a match occurred or initiate a second comparison (compare local aspects with the memory set) if the first comparison did not produce match. RT would be slower if a second comparison is needed. All these alternatives are possible, but they cannot be discriminated from the available data.

Further evidence that attentional strategy affects global/local processing was provided by Ward (1982) who suggested that "the visual system might be biased to detect features faster or earlier that are at the same level of form as that last used on previous fixation", (Ward, 1982, p.565) this because more attention would be allocated to that level. He called this phenomenon the level-readiness effect. In his experiment the subjects were asked to perform two consecutive judgements concerning two compound stimuli presented sequentially, under four conditions: (a) identify the global aspect of the first compound stimulus and identify the global aspect of the second stimulus (GG); (b) identify the global aspect first and local aspect second (GL); (C) identify the local aspect first and the local aspect second (LL); (D) identify the local aspect first and the global aspect second (LG). Ward found that for the second judgement, the GG condition responses were faster than the LG condition

responses and the LL condition responses were faster than the GL condition responses. This finding indicates that the way subjects allocate their attention plays an important role in the processing of compound stimuli. The possible mechanism producing the level-readiness effect, as Ward pointed, could be what he call an "attentional frame". A particular attentional frame might be needed for processing of objects of a particular size. If some of the aspects of the object do not correspond to the attentional frame, there would be two options: One is that people only process the aspects corresponding to the frame, and the other is that people may adjust their attentional frame to match those aspects. For this study, when the task was LG or GL, subjects might have adjusted their frame, before further processing can take place. It took time for this adjustment.

From all the above evidence, we can see there are a lot of controversies regarding the factors that could affect global precedence. A consensus seems to be achieved that, within some "reasonable limits" (Navon, 1991, p.173), the global aspect is responded faster and more difficult to ignore than local aspect (Kimchi, 1992, Navon, 1991). Having recognized these limits, one question that remains to be answered is whether global precedence, (for those situation where it is observed) reflects the prior identification of global information (Navon, 1977, 1981).

A different account of global precedence

Contrary to Navon's interpretation that the global features are always processed first and have priority in early perceptual processing, Miller (1981a) suggested that Navon's results were due to global precedence in postperceptual (i.e. attentional and decision) processes. In his experiment, the subjects were asked to detect whether or not a target letter was presented at the global level or the local level of a compound stimulus. The target letter could be presented at the global level or the local level or both levels. If, as Navon suggested, the identification of the global aspect is always completed before that of the local aspect, then targets appearing at the global level should be detected faster than targets presented only at the local level. More importantly, however, response latencies on those trials with targets presented at both levels should be no faster than responses on trials with the target appearing only at the global level, because identification could be made strictly on the basis of global information since at that moment, local information should not be available. However, while Miller's results showed that responses based on only global level target were faster than those based on only local level target, the more important evidence was that targets presented at both levels were detected faster than targets presented only at global level. Miller argued that this latter result suggested that both sources of information are identified at approximately same time. Accordingly, global precedence, when it occurs,

could be better explained by the notion that "global information has more salience or more attention-grabbing power than local information" (Miller, 1981a, p.1164). In another word, it is more difficult to suppress the information from the global level than that from local level. This interpretation emphasizes that global precedence originates during attentional or decision processes.

Boer and Keuss (1982) have also suggested that global precedence takes place somewhere between perception and response selection. In their experiment, subjects were asked to judge only the global aspect (i. e. the orientation of a rectangle) of compound stimuli such as those displayed in Figure 3, under a deadline procedure. The position of the rectangle was 'standing' or 'lying' and the orientation of the local line could be consistent or conflicting with the orientation of the rectangle. Navon's interpretation of global precedence predicts that when subjects are forced to respond very quickly, no difference between consistent and conflicting stimuli would be expected, because the processing of local information would not be completed at this time. However, when the deadline becomes longer, an interference of local features would be expected. On the other hand, a postperceptual model like Miller's predicts that local interference should be observed under each value of the deadline, because local information becomes available at the same time as global information. The results showed that the

Figure 3: Example of the stimuli used by Boer and Keuss (1982)

consistent stimuli always had an advantage over conflicting stimuli, regardless of whether a short (250 msec) or a long (350 msec) deadline was used. Moreover, local information had an approximately equal effect on global latency over the whole deadline range studied. In agreement with Miller, this result suggested that global precedence originates in postperceptual processes.

The priority for global features in early perceptual processing

Although Miller and Boer and Keuss suggested that global and local features are identified at the same time, it still could be argued that, as Navon suggested, sometimes only global processing takes place, but only before attention selects an object (Paquet and Merikle, 1988). In fact, it is possible that the reason why only mandatory processing of global information is not always found is because researchers have only investigated global/local processing in attended objects. Indeed, Kahneman and Henik (1981) have suggested that all aspects or dimensions of an object may be identified once subjects focus their attention on the object, while the dimensions of objects which receive only pre-attentive processing would not all be identified. Therefore, it remains possible that during early, pre-attentive processing only the global features of an object would be analyzed.

Paquet and Merikle (1988) investigated this issue by examining local/global processing in attended and nonattended

objects. The stimuli used in their experiment were two compound letters, one was surrounded by a square and the other was surrounded by a circle (shown in Figure 4). The subjects were instructed to attend to the stimulus presented in the square (i.e. attended object) and ignore the other letters presented in the circle (i.e. nonattended object). They were asked to decide whether the large letter was H or E during a global-directed session or whether the small letters were Hs or Es during a local-directed session. On some trials, a distractor which was an additional letter H or E appeared either 1) within the attended object (e.g. Figure 4a,b,g,h), or 2) at the local level (e.g. Figure 4c,d,i,j) or 3) at the global level (e.g. Figure 4e,f,m,n,) of the nonattended object. The distractor was either consistent or conflicting with the identity of the target. On other trials only the letter O (neutral letter) appeared as a distractor (Figure 4o,p). This was a baseline condition. The predictions were (1) for those trials with distractor appearing within the attended object, both global and local intra-object congruency effect (i.e., the difference between consistent and conflicting trials) should be found because the assumption was that all aspects of an attended object should be identified once attention is focused on it. (2) More important, if there was a priority for global analysis in pre-attentive processing, then there should always be a RT difference between consistent and conflicting global distractors placed in the nonattended

Figure 4: Examples of the stimuli used by Paquet and Merikle (1988).

object. This global-interobject congruency effect, should be observed under both global and local directed instructions. On the other hand, since local identification might be optional, then subjects should be capable of ignoring local distractor placed within the nonattended object. Consequently, no local-interobject congruency effect should be found. The results showed that the global aspect was identified faster and was more difficult to ignore than the local aspects when the distractor were presented within the attended object. However, both global and local intra-object congruency effect were significant despite faster global RTs. More important, global inter-object congruency effect was only observed when attention was global-directed, and similarly local inter-object congruency effect was also only observed when attention was local-directed. This result disconfirmed the idea that global identification was inevitable during early pre-attentive processing.

Although no evidence was found to support the proposal that mandatory global identification would occur without attention, Paquet and Merikle argued that it did not necessary mean that global processing in nonattended objects was optional. Preattentive global processing may provide sufficient information leading to a general categorization instead of identification. This notion was based on studies that had found that classifying an object into broad categories may precede the more detailed process of

identifying the object (e.g. Brand, 1971; Ingling, 1972). Paquet and Merikle (1988) defined categorization as classifying a letter as either being a member of the target set (H and E) or of the nontarget set (letter O). In other words, both consistent and conflicting distractors in nonattended objects belong to the target set category and the neutral distractor (baseline condition) belongs to the nontarget set category. In order to see whether or not subjects categorized the global and local aspects in nonattended objects, regardless of their identity, Paquet and Merikle (1988) collapsed RTs for the consistent and conflicting trials and compare it with the RT for the baseline condition. They found that the presence of a global distractor within the nonattended object increased RT under both local-directed and global-directed instruction, in comparison with the neutral condition. On the other hand, local distractors within nonattended objects increased RT only under local-directed attention instruction. This result suggested that the subjects always established the distinction between global target letters and the neutral (nontarget) letter in the nonattended object, regardless of the direction of attention. This category effect was the basis for Paquet and Merikle's conclusion that there is a perceptual priority for the global aspect before attention selects an object. However, the priority, does not lead to a mandatory global identification as suggested by Navon, instead, the priority leads to a

mandatory categorization of the global aspect of the nonattended objects.

Global dominance in nonattended objects:

A re-interpretation

Although Paquet and Merikle interpreted their findings as evidence of mandatory global processing in early perceptual analysis, another explanation should be considered. Hence, subjects in Paquet and Merikle study may have adopted an attentional strategy (bias) which facilitated the processing of global information. Thus, the global categorization in nonattended objects may simply have been due to an attentional bias for global information (Kinchla et al., 1983; Ward, 1982). Specifically, the fact that subjects were required to search for the attended object by using detection of large frames (square/circle) could have facilitated the processing of any large aspects of the display (Ward, 1982; Lamb & Robertson, 1990). If this argument is correct, then local processing dominance in nonattended objects should be found if small aspects of the display were used to define the relevant objects.

This problem was addressed by Paquet (1992), who used the stimulus displays shown in Figure 5. For half of the trials, there was a small gap placed on the outline of the square (attended object), and for the remaining trials, the gap was placed on the outline of the circle (attended object). The gap

Figure 5: Example of the stimuli used by Paquet (1992).

was very close in size to the local letters. The subjects were instructed to focus on the opened frame and to ignore the closed frame. Paquet reasoned that because the gap and the local letters were more similar to each other (they were both components of large configurations and had similar size) than the gap and the global aspect, subjects may adopt a local strategy which would facilitate processing of local information. However, despite using a small component of larger configurations to define the relevant object, the results replicated those obtained by Paquet & Merikle (1988): the presence of global distractors always delayed RTs in comparison with the baseline condition, while the presence of local distractors delayed RTs only under local-directed instruction. This result suggested that the globality of the information used to find the relevant object does not affect the processing of the nonattended object.

However, Paquet's findings provide ambiguous evidence concerning the effect of attentional strategy on the processing of nonattended compound stimuli. On one hand, it can be argued that the failure to observe local processing dominance in nonattended objects was related to a failure to induce an appropriate local strategy which would have produced local dominance. In other words, her subjects may have used a global strategy to perform the task. Alternatively, a local strategy may have been successfully induced but because global dominance in nonattended objects is a processing rule, it had

no effect on the processing of the compound stimuli. Because in Paquet (1992), attentional strategy was not directly assessed, it is not possible to determine whether the adoption of a local attentional strategy would affect processing of nonattended object. Therefore, an important question remains unanswered: if a local strategy could be successfully induced, would evidence for global processing dominance be found or, as the attentional bias hypothesis implies, would local processing dominance emerge in nonattended objects?

The previous question was examined in the two studies reported in the present thesis, in which the subjects' processing strategy was manipulated more directly than in Paquet's previous studies. In fact, an adequate assessment of the bias hypothesis seems to require comparing global/local processing under two conditions where a) processing is neither locally nor globally biased (Experiment 1) and b) where processing is locally biased (Experiment 2). As discussed previously, Kinchla et al (1983) found that the speed of global/local processing in attended objects was affected by the attentional strategy adopted by subjects. They manipulated attentional strategy by varying the probabilities that a target letter appeared at the global or the local level of an attended compound stimulus. When the probability (p) that a target letter appeared at the local level was greater than that at the global level ($p > .5$), a local strategy was induced, and as a consequence, local information was processed faster

than global information. In the present studies, the focused attention task employed by Paquet (1992) and by Paquet and Merikle (1988) was replaced by a divided-attention task similar to that used by Kinchla et al (1983). Subjects were asked to decide whether or not (Yes-No decision), the target letter H or E appeared within the attended object (Miller, 1981). As seen in Figure 6, the attended object was a square with a gap similar to that used by Paquet (1992). Half of the subjects performed the task under a "no-bias" condition (Experiment 1) and the other half performed the task under a "local bias" condition (Experiment 2).

The predictions are straightforward. If global dominance in nonattended objects is a rule, then the presence of global distractors will always affect the detection of local targets more than the effect produced by local distractors on the detection of global targets and more important, when there is no target presented, global distractor will delay RTs and increase error more than local distractor in comparison with the baseline condition. However, if global dominance in nonattended objects is determined by an attentional bias, then global distractors and local distractors will have similar effect on RTs and error rates under the no-bias condition (Experiment 1) and local distractor will have more effect than global distractor under the local bias condition (Experiment 2).

Figure 6: Examples of the stimuli used in present experiments.

Experiment 1

As mentioned above, an evaluation of the attentional bias hypothesis requires that global/local processing in nonattended objects be measured under conditions where the subject's attentional set is neutral, i.e. under conditions where processing is neither locally nor globally biased. Therefore, in the present study, the target letter appeared equally often at the global and at the local levels of the attended compound stimulus ($p=.5$). In accordance with Kinchla et al's (1983) procedure, subjects were informed about this probability and were instructed to pay equal attention to the local and the global aspects of the attended object. In accordance with Paquet and Merikle (1988) procedure, on some trials, there was a distractor (E or H) appearing either at the global level or at the local level of the nonattended object. On other trials, only the letter O which was not a target set member appeared in the nonattended object (baseline condition). Local/global processing in the attended object was assessed by observing response latencies as a function of the globality level of the target. On the other hand, global/local processing in the nonattended object was assessed by examining how subjects' decision concerning the presence or absence of the target was affected by the presence of local and global distractors placed within the nonattended object. On the basis of Miller's (1981) study, where a similar yes/no decision task was used in a divided-attention paradigm, it was predicted

that detection of global targets should be faster than detection of local targets. Moreover, if global dominance in nonattended object is a processing rule, then local latencies and miss rate should be affected by the presence of global distractors, whereas global latencies and miss rate should not be influenced by local distractors in the nonattended object. In addition, global distractors should have more effect (delay RT and yield more false alarm) on "no" trials than local distractors. However, if the pattern of dominance is determined by the attentional strategy adopted by the subject, then neither global dominance nor local dominance in the nonattended object should be found when subjects are instructed to pay equal attention to global and local targets.

METHOD

Subjects. Eighteen subjects from Carleton University participated in the experiment for course credits. Three subjects were eliminated because their error rate in at least one experimental condition (in Paquet & Merikle previous study, about 30% subjects were discarded), was higher than 25% (Paquet & Merikle, 1988; Paquet, 1992)¹.

Apparatus. The stimuli were presented on an Electrohome high-resolution monitor with the aid of an Apple II⁺ microcomputer. The monitor was viewed through a hood and the viewing distance was 127cm.

A response box with three buttons was placed in front of the subjects. The centre button served to initiate the trial.

The other two buttons, located above and to the left or right of the centre button, was used to record the subject's responses. A YES response was made by pressing the left button whereas the right button indicated a NO response. The response box was connected to the microcomputer, which measured reaction time (RT) from display onset, until subjects responded.

Stimuli. The stimuli were large letters (H, E, or O) made of small letters (H, E, or O). As illustrated in Figure 6, each stimulus display consisted of two compound stimuli. One stimulus was surrounded by a closed square and the other stimulus was placed in a square with a gap. The square measured 2.5° on each side. The gap measured 0.6° and was placed on the outline of the square. The large letters subtended 1.9° vertically and 1.2° horizontally, whereas the small letters were 0.3° high and 0.14° wide, with a 0.14° inter-letter spacing. A distance of 0.2° separated the two squares. The gap appeared in the middle of the outline of the frame and was positioned 0.1° to the left or right of fixation. The stimuli appeared white on a black background.

Half of the target letters presented in the attended object were large letters and the other half were small letters.

Practice stimuli (Figure 7) consisted of standard letters measuring 1° vertically and 0.5° horizontally.

Experimental conditions. On half of the trials, a target

Figure 7: Example of practical stimuli.

letter (E or H) was presented within the attended object (i.e. "yes" or positive trials) and on the other half of the trials, no target letter appeared within the attended object (i.e. "no" or negative trials). For the "yes" trials, the experimental conditions were the outcome of the factorial combination of three variables: globality of the target letter (at the global level, Figure 6a, c, e, g; or at the local level of the attended object, Figure 6b, d, f, h), globality of the distractor in the nonattended object (at the global level, Figure 6a, b, e, f; or at the local level, Figure 6c, d, g, h), and the congruity between the identity of the target letter appearing in the attended object and the distractor appearing in the nonattended object (consistent i.e. Figure 6a, b, c, d; or conflicting i.e. Figure 6e, f, g, h). The baseline conditions were as shown in Figure 6i, j, a target letter appeared in the attended object and only letter O appeared in the nonattended object.

For the "no" trials, a single variable was manipulated which consisted of the globality of the distractor letter presented in the nonattended object (at the global level, Figure 6k; or at the local level, Figure 6l). The baseline condition was as shown in Figure 6m, no target appeared in the attended object and only letter O appeared in nonattended object.

Procedure. Subjects were informed that they should attend to the square with a gap and that they should ignore

the closed square. They were instructed to press the button labelled "Yes" if the target letter (H or E) appeared in the square with a gap, regardless of whether it was a large letter (global target) or a small letter (local target). In addition, subjects were told to press the "No" button if the attended object did not contain one of the target letters. Instructions stressed accuracy as well as speed.

Each session began with the presentation of one block of 72 practice trials. Two standard letters were presented and subjects were asked to respond if there was a target in the open square and to ignore the letter in the closed square.

Each experimental session was composed of 5 blocks of 96 trials. In each block of trials, 48 trials consisted of stimuli for which no target (no trials) appeared in the attended object and there were an equal number of presentation of the three display types: 1) global distractor (16 trials), 2) local distractor (16 trials), and 3) baseline condition (16 trials). In addition, 48 trials consisted of stimuli for which there was a target appearing in the attended object (yes trials). When there were distractors, half of them were consistent (congruent) with the identity of the target, and the other half were conflicting (incongruent) with the identity of the target. Those 48 trials were equally divided into the following 6 display types: 1) global target and global distractor, 2) global target and local distractor, 3) global target and baseline condition, 4) local target and

global distractor, 5) local target and local distractor, and 6) local target and baseline condition.

Subjects were informed that the target letter was equally likely to appear at the global level or at local level of the attended object, and that they should pay equal attention to both large and small letters. The location (i.e. left or right) of the attended object was varied unpredictably from trial to trial. For half of the trials, the attended object was presented to the left of fixation, and for the remaining trials, it was presented to the right of fixation.

Subjects were asked to fixate a cross which appeared in the middle of the monitor at the beginning of each trial. When they were ready, they initiated the stimulus presentation by pushing the start button. The cross disappeared and a stimulus was displayed for 150 msec. After subjects responded, the fixation cross reappeared.

Results

Median RTs for correct responses and error percentage were computed for each subject and each condition. Separate analyses were conducted for the conditions in which a target letter appeared in the attended object (i.e. "yes" trials), and those in which no target letter appeared in the attended object (i.e. "no" trials).

Analyses of the "yes" trials

Three separate analyses were performed. The first analysis was based on the RT data and was used to assess whether performance was affected by the congruency between the target and the distractor identity. In the second and third analyses, an attempt was made to determine whether the presence of global and local distractors affected latency (second analysis) and accuracy (third analysis) of 'yes' responding (regardless of target/distractor congruency) in relation to the control condition in which no distractor (neutral) appeared within the nonattended object.

Is target detection latency affected by target-distractor congruency?

Table 1 shows the mean median RTs for global and local target detection as a function of the globality and the congruency of the distractor.

A 2 x 2 x 2 repeated measures Anova was used to evaluate the effect of the globality of the target letter (i.e. global vs local), of the globality of the distractors (i.e. global vs local) and of target-distractor congruency (i.e. consistent i.e., same letters vs conflicting i.e., different letters).

The analysis (see Appendix A) showed that the main effect of target globality was significant [$F(1,14)=9.44$, $p<.01$, $MSe=6984$]; global detection (845 msec) was faster than local detection (892 msec). There was also a marginally significant effect of distractor globality [$F(1,14)=4.13$, $p<.07$, $MSe=2833$]; local distractor yielded longer response latencies

Table 1

Mean Median RTs (in Milliseconds) to Global and Local Targets
as a Function of Globality and Congruency of Distractor in
Experiment 1

Target Globality and Congruency	Distractor Globality	
	Global	Local
Global Target		
Congruent	836	837
Incongruent	890	817
Difference	54	-20
Local Target		
Congruent	847	941
Incongruent	861	919
Difference	14	-22

(879 msec) than did global distractor (859 msec). However, no reliable effect of congruency was found [$F(1,14)=.31$, $p>.5$, $MSe=3,657$]. Overall, target detection was equally fast whether the distractor was identical (866 msec) to the target or whether it was different (872 msec) from the target. The 2-way interaction between congruency and globality of target was not significant [$F(1,14)=.66$, $p>.1$, $MSe=3,413$]. However, there was a significant 2-way interaction between target-distractor congruency and the globality of the distractor [$F(1,14)=13.74$, $p<.01$, $MSe=1,626$]. Bonferroni t-tests showed that consistent trials (842 msec) were detected faster than conflicting trials (875 msec) when the distractor was at the global level, [$t(14)=2.31$, $p<.05$]. But, no difference was found when the distractor was at the local level, consistent trials (889 msec) were not detected significantly faster than conflicting trials (868 msec) [$t(14)=1.43$, $p>.1$]. The 2-way interaction between the globality of target and the globality of distractor was also significant [$F(1,14)=17.28$, $p<.01$, $Mse=5461$]. Local distractors yielded longer response latencies (930 msec) than global distractors (854 msec) when target was presented at the local level [$t(14)=2.0$, $p<.01$], while no RT difference between global distractors (863 msec) and local distractors (827 msec) was found when target was presented at the global level [$t(14)=1.33$, $p>.1$]. The 3-way interaction involving congruency, globality of target and globality of distractor was not significant [$F(1,14)=.57$,

$p > .1$].

Global and local category effects for the "yes" trials

In order to examine whether subjects performance was affected by the mere presence of distractors, regardless of their identity, median reaction times for the consistent and conflicting trials were averaged. Mean median reaction times are shown in Table 2.

A 2×3 repeated measures Anova was used to assess the effect of the globality of the target letter (i.e. global vs local) and of display type (i.e. global distractor, local distractor or baseline). In line with previous studies (Miller, 1981), the analysis (see Appendix B) showed that RT was shorter when the target letter appeared at the global level (835 msec) than at the local level (877 msec), [$F(1,14)=7.72$, $p < .05$, $MSe=5,131$]. There was also a significant main effect of display type, [$F(2,28)=9.98$, $p < .01$, $MSe=1,664$]; the local distractors (878 msec) yielded longer response latencies than for the baseline condition (832 msec) [$t(14)=2.96$ $p < .01$], but no significant difference was found between the global distractor (858 msec) and baseline conditions (832 msec) [$t(14)=1.56$ $p > .1$]. In addition, there was a significant 2-way interaction between target globality and display type [$F(2,28)=8.70$, $p < .01$, $MSe=2,774$]. From Figure 8, where global and local category effects (i.e. RT difference between global/local distractors and baseline conditions) are displayed for each target level, it appears that local

Table 2

Mean Median RTs (Msec) and Miss Rate (%) as a Function of Globality of Target and Display Type in Experiment 1

Display Type	Target Globality			
	Global		Local	
	RT	MISS	RT	MISS
Baseline Condition	816	6.0	848	5.2
Global Distractor	863	3.8	854	5.0
Local distractor	827	4.8	930	11.3

Figure 8: Category effects for the "yes" trials in Experiment

1.

distractors yielded longer response latencies than did baseline condition (930 vs. 848 msec) when the target was at the local level [$t(14)=4.32$, $p<.001$], not at the global level (827 vs. 816 msec) [$t(14)=.57$, $p>.5$]. Similarly, global distractors yielded longer response latencies than did baseline condition (863 vs 816 msec) when the target was at the global level [$t(14)=2.45$, $p<.05$], but not at the local level (854 vs 848 msec) [$t(14)=.36$, $p>.5$].

In order to see whether subjects were equally able to perceive global and local targets, the RTs for the baseline conditions were compared. The analysis (see Appendix C) showed that the RT for global target (816 msec) was not significantly different from that for local target (848 msec) [$F(1,14)=1.73$, $p>.1$ $MSe=4466$]. This result indicated that overall the discriminability of global and local letters was the same.

Is the miss rate affected by the presence of distractors?

The error data is shown in Table 2 and it represents the percentage of "yes" trials for which subjects incorrectly reported that the target was absent (miss rate).

A 2 x 3 repeated measures Anova (see Appendix B) was employed to evaluate the effect of the globality of the target and of the display type on the miss rate.

The analysis (see Appendix B) showed a marginal effect of the globality of the target [$F(1,14)=3.24$, $p<.1$, $MSe=.00$]. Subjects tended to miss local targets (7.0%) more often than

they missed global targets (4.8%). In addition, the main effect of display type was significant (8% for local distractor; 4.4% for global distractor; and 5.6% for baseline condition) [$F(2,28)=7.49$, $p<.01$, $MSe=.00$]. Finally, the interaction between globality of the target and display type was significant [$F(2,28)=9.37$, $p<.001$, $MSe=.00$]. Bonferroni t-tests showed that local distractors (11%) yielded more misses than the baseline condition (5.2%) when the target was at the local level [$t(14)=6.2$, $p<.001$], but not at the global level (4.8% vs. 6.0%) [$p>.1$]. On the other hand, global distractors did not produce more misses than the baseline condition when the target was either at the global (3.8% vs. 6.0%) or the local (5.0% vs. 5.2%) level [$p>.05$].

The discriminability issue was re-examined by comparing the miss rate of the baseline conditions. The analysis (see Appendix C) showed that the miss rates for global targets (6.0%) was not different from that for local targets (5.2%) [$F(1,14)=.29$, $p>.5$]. This result confirmed that, overall, the discriminability of global and local letters was the same.

Analyses for the "no" trials

Median Rts and false alarm rates (incorrectly responding 'yes' when no target was presented) were computed for each subject and each display type. The results are shown in Table 3 and Figure 9.

An Anova (see Appendix D) performed on the RT data revealed a main effect of display type [$F(2,28)=12.63$, $p<.001$,

Table 3

Mean Median RTs (Msec) and False Alarm Rate (F.A.) as a
Function of Display Type in Experiment 1

Display Type	RT	F.A.
Baseline	909	10.5
Global Distractor	992	15.4
Local Distractor	975	10.2

Figure 9: Category effects for the "no" trials in Experiment 1.

MSe=2,296)]. Planned comparisons showed that global distractors (991 msec) and local distractors (975 msec) yielded longer response latencies than did neutral (baseline condition) distractors (908 msec) [$F(1,14)=25.17$ $p<.001$, MSe=2069; and $F(1,14)=9.38$, $p<.01$, MSe=3490 respectively]. However, the difference in RT between global distractor and local distractor conditions was not significant [$F(1,14)=1.66$, $p>.1$].

An Anova performed on the false alarm error rates also indicated a main effect of display type [$F(2,28)=4.91$ $p<.05$, MSe=.00]. However, planned comparisons revealed that global distractors produced more false alarms (15.4%) than the baseline condition (10.5%), [$F(1,14)=6.22$, $p<.05$, MSe=.002]. However, no difference was found between the local distractor and baseline conditions. Moreover, global distractors produced more false alarm than did local distractors (10.2%), [$F(1,14)=6.42$, $p<.05$, MSe=.002].

DISCUSSION

The results replicate previous findings concerning global/local processing under divided-attention conditions (Miller, 1981; Kinchla & Wolfe, 1979). Thus, global targets were detected faster than local targets. This result confirmed that when stimuli measuring 2° of visual angle are viewed under conditions of spatial uncertainty, global information is processed faster than local information (Paquet & Merikle,

1988; Paquet, 1992). In addition, the analysis of the RTs and miss rate indicate that subjects were equally capable of perceiving local and global targets in the baseline condition. This finding supports the notion (Paquet, 1992) that the presence of a global advantage in reaction time (i.e. global targets were detected faster than local targets) is not the outcome of a discriminability difference favouring the global aspect.

The pattern of results from the nonattended object was somewhat different from that reported by Paquet and Merikle (1988) and by Paquet (1992). First, in the present study, the main effect of congruency was not significant. This result is not entirely surprising because the task in present study was target detection, not target identification. In the present study, both E and H belonged to the same response ("yes" response) and subjects did not need to distinguish between these two letters. In fact, at the level of the response, the target (H or E) and distractor (H or E) of the "yes" trials were always consistent as both indicated the same "yes" response. Therefore, that the main effect of target-distractor identity (same target letter vs. different target letter) did not influence RT is to be expected. However, the observation that the congruency of global distractors affected performance may indicate that subjects identified the global distractors even when the task did not require this level of analysis. This result seems to indicate a certain global dominance in

the processing of nonattended objects in that it suggests that subjects could prevent identification of local but not of global distractor. However, an examination of the data presented in Table 1 suggests that identification of the global aspect may have only occurred when subjects were detecting global targets. This observation certainly limits the generality of the previous conclusion in favour of global dominance.

Secondly, category effects from "yes" trials are partly inconsistent with those found with the target identification paradigm used by Paquet in her previous work. Thus she found that identification of local targets was affected by the presence of both global and local distractors, while the identification of global targets was only affected by global distractors. While the latter result was replicated in the present study, the former observation was not reproduced. Instead, it was observed that subjects were capable of ignoring global but not local distractors when they were detecting local targets. Therefore, it seems that there are fundamental differences between the present target detection paradigm and Paquet's target identification paradigm². In a sense, the data from the "yes" trials are more similar to the congruency effects reported by Paquet (Paquet & Merikle, 1988; Paquet, 1992) than to her category effect. In fact, the present data show that the response (in this case, target detection) is jointly affected by target globality and

distractor globality. As was the case with Paquet's congruency effect, the global responses were affected by global but not local distractors. Paquet has reported that identification of global letters was affected by the congruency of global but not local distractors. In a similar way, the present results showed that local responses were affected by local, but not global distractors. The pattern of inter-object congruency reported by Paquet showed similar effects in that local identification was affected by the congruency of local but not that of global distractors. However, before any conclusion can be drawn regarding the differences between detection and identification paradigm, it will be necessary to conduct a detection study under the focused-attention conditions which prevailed in Paquet's previous work. Hence, it is not clear at this point as to whether the present discrepancies with Paquet's previous results are produced by the target detection-identification difference or by the focused vs. divided attention difference between the two studies.

The finding that in the present divided-attention task, the pattern of interference between the target and the distractors is size-specific (i.e. global targets affected by global distractors and local targets affected by local distractors) can be explained by assuming that, evidence in favour of a "yes" response simultaneously accumulates from each aspect for both the attended and nonattended object. However, in order to perform the task correctly (i.e. avoid

false alarms), subjects must decide which source of stimulation will control their response. In other words, subjects must select the appropriate channel and inhibit the irrelevant signal. The present data suggested that selection of the relevant channel was easier when a size difference existed between the two signals (i.e. global target and local distractor, or local target and global distractor). This selection process may require two steps: first, subjects would decide whether to inhibit signals from large or small channels. For example, the presence of a global (large) target might lead to an inhibition (filtering out) of all responses associated with local information, but not that associated with global information within the nonattended object. A second selection stage would be required to select which of the two global channels would control response execution. This second stage would be completed faster when the irrelevant global channel contains a neutral letter than when it contains a distractor. This account can also explain the pattern of interference associated with the detection of local targets. In that case, global channels are filtered out before the response execution stage and, consequently, global distractors would not influence local target detection. On the other hand, filtering of local information in the nonattended object is delayed until the response execution stage and, consequently, it has a substantial impact on performance.

The data from "no" trials can also be accounted for by

assuming that the absence of a target delays filtering until the response execution stage. Therefore, for the "no" response, both local and global distractors would produce interference. The observation that global and local distractors equally increase the "no" responding time is consistent with this account.

One interesting aspect of latency data for the "no" trials is that neither local nor global dominance was observed. Therefore, it appears that both global and local targets were automatically detected. This suggests that, when subjects are told that the aspects of the stimulus display are equally important, the aspects would have similar impact on decision. This observation is inconsistent with Paquet and Merikle's claim that only global targets are always automatically detected. Instead, this finding provides converging evidence (Paquet 1992) that, under certain conditions, local targets can also be automatically processed. Paquet (1992) showed that subjects could not ignore the presence of local distractors in a nonattended object if they had previously received extensive (5 hrs) practice at identifying only local targets. She proposed that previous local practice would contribute to raise the importance of local information and would lead to the development of automatic local processing. The present finding shows that, in a divided attention task, the importance of local and global information can also be equated simply by instructing subjects

that both source of information are equally important for task completion. However, this conclusion is not supported by the pattern of results from the false alarm analysis. In fact, the false alarm data suggested that only global distractors affected "no" performance, while local distractors did not have an effect, in comparison with baseline condition. This suggested that global information had more weight in response selection than local information. This finding is consistent with the proposal that global processing in nonattended object is automatic, while local processing in nonattended object is optional.

Taken together, the overall results appear more consistent with the attentional bias hypothesis. Since the probability of global and local targets was equal, this hypothesis predicts that both global and local targets should be automatically detected and that neither global nor local dominance should be observed. This is precisely what was found in the latency data. However, a stronger test of the bias hypothesis will be provided in the next experiment.

Experiment 2

In Experiment 2, an attempt was made at inducing a local attentional set (bias) by increasing the probability that the target letters appear at the local level of attended objects ($p=.8$). Therefore, subjects were informed that they should mostly pay attention to the local aspect since on 80% of the

"yes" trials, the target would appear at that level.

According to Kinchla et al's (1983) results, this procedure should lead subject to adopt a local attentional strategy. The efficiency of this manipulation at inducing local strategy should be confirmed by observing that the response latencies on those trials with target letter appearing at the local level should be faster than that at the global level of the attended objects. Moreover, the attentional bias hypothesis predicts that target processing would be more affected by local distractors than global distractors placed in nonattended objects. However, if global dominance is a processing rule, then local distractors would not have more impact than global distractors.

METHOD

Subjects. Twenty students at Carleton University participated in the experiment. Subjects received course credits for participation. Five subjects were discarded because of their high error rates. The criterion for discarding subjects was same as that in Experiment 1.

Apparatus. The apparatus were identical to that used in Experiment 1.

Stimuli. The stimuli were identical to those described in Experiment 1.

Experimental conditions. They were identical to those used in Experiment 1.

Procedure. The procedure was similar to that described

in Experiment 1, with the exception that the experimental session was composed of 3 blocks of 240 trials. In each block, half of the trials (120 trials) were "no" trials and there were an equal number of presentation of the three display types: 1) global distractor (40 trials), 2) local distractor (40 trials), and 3) baseline condition (40 trials). The other half of the trials (120 trials) were "yes" trials, and 80% of those trials contained local targets. The 96 positive local target trials were equally divided into three display types: 1) local target and global distractor, 2) local target and local distractor, and 3) local target and baseline condition. The remaining 24 positive trials contained global targets and were equally divided into three display types: 1) global target and global distractor, 2) global target and local distractor, and 3) global target and baseline condition. Subjects were informed that 80% of the target letters would be located at the local level of the attended object, so they should pay more attention to local level of the compound stimuli.

Results

Median RTs for correct responses and error percentage were computed for each subject and each condition. The data analysis was identical to Experiment 1, with the one exception: a mixed-design Anova with Experiment as a between-subject factor was conducted to access more directly the

effect of the attentional strategy adopted by subjects³.

Analysis of the "yes" trials

Is target detection latency affected by target-distractor congruency?

Table 4 shows the mean median RTs for global and local target detection as a function of the globality and congruency of the distractor.

A 2 x2 x2 repeated measure Anova was conducted to assess the effect of the globality of the target letter (i.e. global target vs. local target), of the globality of the distractor (i.e. global distractor vs. local distractor) and of target-distractor congruency (i.e. consistent vs. conflicting letter).

The analysis (see Appendix E) showed that the main effect of the target globality was marginally significant [$F(1,14)=4.29$, $p<.06$]; local detection (736 msec) was faster than global detection (769 msec). The analysis also showed that, contrary to the results of Experiment 1, the main effect of congruency was significant [$F(1,14)=7.90$, $p<.05$, $MSe=3,532$]. Overall, RTs for consistent trials (737 msec) were faster than that for conflicting trials (767 msec). However, there was no main effect of distractor globality [$F(1,14)=.79$, $p>.1$].

In addition, the interaction between the globality of target letter and the target-distractor congruency was significant [$F(1,14)=10.58$, $p<.01$, $MSe=3,731$]. Bonferroni t-tests revealed that global targets were affected by target-

Table 4

Mean median RTs (Msec) to Global and Local Targets as a function of Globality and Congruency of Distractor in Experiment 2

Target Globality and Congruency	Distractor Globality	
	Global	Local
Global Target		
Congruent	723	748
Incongruent	796	808
Difference	73	60
Local Target		
Congruent	770	708
Incongruent	740	726
Difference	-30	18

distractor congruency; consistent trials (735 msec) were detected faster than conflicting trials (802 msec) [$t(14)=3.00$, $p<.01$]. No congruency effect was reliable when the target was at the local level (739 msec vs. 733 msec) [$t(14)=.26$, $p>.5$]. There was also an interaction between the globality of target and the globality of distractor [$F(1,14)=17.05$, $p<.001$, $MSe=1395$]. Global distractors yielded longer response latencies (755 msec) than did local distractors (717 msec) when the target was presented at the local level [$t(14)=3.8$, $p<.01$], while no RT difference between global distractors (761 msec) and local distractors (778 msec) was found when the target appeared at the global level [$t(14)=1.76$, $p>.1$]. However, unlike Experiment 1, the interaction between the globality of the distractor and the congruency [$F(1,14)=.77$, $p>.1$] was not significant.

The 3-way interaction among congruency, the globality of the target and the globality of the distractor was marginally significant [$F(1,14)=3.73$, $p<.08$, $MSe=1840$]. The Bonferroni t -tests revealed that when the target was at global level, congruent trials were processed faster than incongruent trials, for both global (723 msec vs. 796 msec) [$t(14)=4.66$, $p<.001$] and local (748 msec vs. 808 msec) [$t(14)=3.83$, $p<.001$] distractors. However, when the target was at the local level, neither the congruency of global distractors (770 vs. 740 msec) [$t(14)=1.91$, $p>.05$] nor that of local distractors (708 msec vs. 726 msec) [$t(14)=1.15$, $p>.1$] affected performance.

Global and local category effects for the "yes" trials

In order to examine whether subjects' performance was affected by the mere presence of distractors, regardless of their identity, median reaction times for the consistent and conflicting trials were averaged. Mean median reaction times are shown in Table 5 and the category effects are illustrated in Figure 10.

A 2 x 3 Anova (see Appendix F) revealed a main effect of globality of the target [$F(1,14)=6.96$, $p<.05$, $MSe=4,861$]. In contrast with the results of Experiment 1, the data showed that the local target detection (724 msec) was faster than the global target detection (763 msec). The main effect of display type was not significant [$F(2,28)=1.94$, $p>.1$, $MSe=3595$]. However, in agreement with Experiment 1, there was a significant interaction between the globality of the target and the display type [$F(2,28)=6.61$, $p<.01$, $MSe=1018$]. But, unlike Experiment 1, detection of local targets was not affected by presence of local distractors (703 vs. 717 msec) [$p>.1$], but it was greatly affected by the presence of global distractors (703 vs. 755 msec) [$t(14)=4.47$, $p<.01$]. On the other hand, the detection of global targets was unaffected by the presence either local (753 vs 778 msec) or global distractors (753 vs. 769 msec) [$p>.05$]. However, this lack of effect must be interpreted in light of the reliable congruency effects found during the detection of global targets. In fact, a comparison of the latency under baseline condition (753

Table 5

Mean Median RTs (Msec) and Miss Rate (%) as a Function of Globality of Target and Display Type in Experiment 2.

Display type	Target Globality			
	Global		Local	
	RT	MISS	RT	MISS
Baseline Condition	753	5.6	703	4.0
Global Distractor	760	6.7	755	7.4
Local Distractor	778	5.8	716	3.9

Figure 10: Category effects for the "yes" trials in Experiment

msec) with those displayed in Table 4 indicated that local and global distractors affected global target in a similar fashion. More precisely, the presence of identical target and distractors seemed to have mainly facilitated performance (global distractor 723 msec, [$p < .05$]; local distractor 748 msec, [$p > .1$]), while the presence of two different letters (global distractor 796 msec, [$p < .05$]; local distractor 808 msec, [$p < .05$]) inhibited responding.

As in Experiment 1, RT for the two baseline conditions was compared. Contrary to Experiment 1, RT for detecting global targets (753 msec) was slower than for detecting local targets (703 msec) [$F(1,14)=7.91, p < .05$, $MSe=2420$]. Thus, the local aspects were more discriminable than global aspects in this case, if RT for the baseline condition was employed as the index of discriminability.

Is the miss rate affected by the presence of distractors?

A 2 x 3 repeated measures Anova was used to investigate the effect of the globality of the target and distractor conditions based on the error data shown in Table 5.

Unlike Experiment 1, the Anova performed on the miss rates failed to uncover any significant effect.

In addition, the miss rates for the baseline conditions were compared. In agreement with Experiment 1, error rate for detecting global target (5.5%) was not different from that for detecting local target (4.0%) [$F(1,14)=1.35, p > .5$]. Therefore, if we choose error rates for the baseline condition as the

index of discriminability, then the discriminability for the global and local levels are same.

Analyses for the "no" trials

Median Rts and false alarm rates were computed for each subject and each condition. The results are shown in Table 6 and Figure 11.

The Anova performed on RT data replicated the results of Experiment 1; the main effect of display type was significant [$F(2,28)=267.68$, $p<.001$, $MSe=14,409$]. Planned comparisons showed that both global distractors (786 msec) and local distractors (801 msec) yielded longer response latencies than did the baseline condition (717 msec) [$F(1,14)=66.27$, $p<.001$, $MSe=544$ and $F(1,14)=78.30$, $p<.001$, $MSe=686$, respectively]. However the RT difference between the global and local distractor conditions was not reliable [$F(1,14)=2.76$, $p>.1$].

The analysis of false alarm rates mirrored the RT data. Thus, the main effect of the display type was significant [$F(2,28)=9.01$, $p<.001$, $MSe=.00$] and planned comparisons showed that both global (6.5%) and local distractors (7.7%) increase the false alarm rate in comparison with the baseline condition [$F(1,14)=13.97$, $p<.01$, $MSe=.00$ and $F(1,14)=13.23$, $p<.01$, $MSe=.00$, respectively], However, contrary to Experiment 1, the false alarm rate was the same for global and local distractors [$F(1,14)=1.57$, $p>.1$].

Difference across Experiments

Analyses of the "yes" trials

Table 6

Mean Median RT (Msec) False Alarm Rate (FA) (%) as a Function of Display Type for "no" trials in Experiment 2

Display Type	RT	FA
Baseline Condition	717	4.0
Global Distractor	786	6.5
Local Distractor	801	7.7

Figure 11: Category effects for the "no" trials in Experiment 2.

Mixed 2 (Experiment 1 vs. Experiment 2) by 2 (global target vs. local target) by 3 (global distractor, local distractor, and baseline condition) analyses on RT and miss rate were conducted (see Appendix I). The analysis of RT data showed that latency was faster in Experiment 2 (744 msec) than in Experiment 1 (856 msec) [$F(1,28)=5.21$, $p<.05$, $MSe=108,508$]. There was a significant interaction between experiment and the globality of the target [$F(1,28)=14.68$, $p<.01$, $MSe=4,996$]. In Experiment 1, global detection was faster than local detection, while in Experiment 2, local detection was faster than global detection. No interaction was found between either experiment and the globality of distractor [$F(2,56)=1.57$, $p>.1$] or between globality of the target and globality of the distractor [$F(2,56)=2.23$, $p>.1$]. In addition, the 3-way interaction involving experiment, globality of target and globality of distractor was significant [$F(1,28)=14.04$, $p<.001$, $MSe=1895$]. In Experiment 1, local distractors only affected local targets, while in Experiment 2, only global targets were affected by the presence of local distractors. Similarly, the presence of global distractors only affected the detection of global targets in Experiment 1, while it affected local targets as well in Experiment 2.

The analysis of miss rates failed to uncover a main effect of experiment [$p=.745$]. The 2-way interaction between the experiment and the globality of target was marginally significant [$F(1,28)=3.21$, $p=.084$, $MSe=.003$], the miss rates

of local target detection in Experiment 2 (5.1%) was less than in Experiment 1 (7.1%). However, the miss rate for global target detection in Experiment 2 (6.0%) was not different from that in Experiment 1 (4.9%). There was also a significant 2-way interaction between experiment and the globality of distractor [$F(2,56)=6.84$, $p<.01$]. In Experiment 1, more misses were produced by local distractors, while in Experiment 2, more misses were produced by global distractors. Finally, the 3-way interaction among experiment, globality of target and distractor conditions was significant [$F(2,56)=4.90$, $p<.05$, $MSe=.00$]. Local target detection was more affected by local distractor in Experiment 1; but by global distractors in Experiment 2.

Analysis of the "no" trials

A 2 X 2 mixed-design Anova was conducted on the RT data and on false alarm rate (see Appendix J). Overall, the RT for "no" trials in Experiment 2 (768 msec) was faster than that in Experiment 1 (958 msec) [$F(1,28)=11.35$, $p<.01$, $MSe=71541$]. No interaction was found between the experiment and display type [$p>.1$].

The analysis of false alarm rates also showed a main effect of experiment [$F(1,28)=16.24$, $p<.001$, $MSe=.00$]: in Experiment 2 subjects made less false alarm (6.06%) than in Experiment 1 (12.03%). However, an interaction between experiment and display type was also found [$F(1,28)=4.89$, $p<.05$, $MSe=.00$]. Bonferroni-t tests showed that the baseline

conditions (4.0% vs.10.5%) and the global (6.5% vs 15.4%) distractor conditions produced less false alarm in Experiment 2 than in Experiment 1, [$t(28)=4.4$, $p \leq .01$, and $t(28)=6.1$, $p < .01$, respectively]. However, the difference for the local distractor condition was not significant [$p > .05$].

DISCUSSION

The main purpose of this experiment was to see if local dominance would emerge when the target letter was more likely to appear at the local than at the global level of the attended compound stimulus. The results showed that the manipulation affected global/local processing in both attended and nonattended objects. For attended objects, local processing became faster than global processing. In addition, the miss rate for local target detection became the same as for global target detection. These observations indicate that local target detection was much easier in Experiment 2 than in Experiment 1, and are consistent with Kinchla et al's (1983) proposal that higher probability for local target should produce a local attentional strategy which would lead faster local processing in attended object. In sum, the data indicate that the present manipulation successfully induced a local attentional set.

The two discriminability indexes produced different results: The RTs of baseline conditions indicated that local aspects were more discriminable than global aspects, while the

miss rates of baseline conditions suggested that the discriminability of the local and global level were matched. Since the aspects of stimuli did not change in Experiment 2 from Experiment 1, the discriminability should not change either. Therefore, the miss rates of baseline conditions seem to be a good index of discriminability.

The pattern of results from the nonattended object was also different from those of Experiment 1. First, the main effect of congruency was significant, which may indicate that overall the impact of distractors was increased. In particular, the impact of local distractors on global target processing was increased by the present manipulation. However, it does not appear that local distractors were generally more difficult to ignore than in Experiment 1, because subjects were quite capable of ignoring local distractors when detecting local targets. On the other hand, it appears that global distractors were somewhat more difficult to ignore in Experiment 2 than in Experiment 1. This conclusion is supported by the observation that, in Experiment 1, global distractors affected only detection of global targets, while in Experiment 2, both local and global performance was affected by global distractors. In sum, what is clear from these results is that local dominance failed to emerge despite subjects adopting a local attentional set. In fact, contrary to the attentional bias hypothesis, it appears that it was global processing in the nonattended object that was more

efficient in the present study than in Experiment 1.

The results from "no" trials also reveal a failure to obtain local dominance. Both the RT data and the false alarm rate showed that global and local distractors had similar effect on performance. This result is inconsistent with the attentional bias hypothesis which suggests that local dominance should have appeared.

General Discussion

The purpose of present studies was to establish whether or not processing dominance of the global or local aspects for nonattended objects is determined by high level cognitive mechanisms such as the subject's attentional bias or set. The involvement of high level cognitive mechanisms under subject's control was demonstrated by previous studies (Kinchla et al, 1983; Ward, 1982) where the impact of attentional strategy on global/local processing was studied for attended objects. However, no experiment to our knowledge has directly manipulated the subject's attentional strategy to assess its influence on global/local processing in nonattended objects. Two alternative hypotheses were considered. First, according to an attentional bias hypothesis, the pattern of global dominance in nonattended objects reported earlier (Paquet & Merikle, 1988; Paquet, 1992) was simply due to the use of a global attentional strategy. Therefore, if subjects could successfully adopt a local attentional strategy, then local

dominance in nonattended objects would be observed. In contrast, the other alternative, termed the processing rule hypothesis, stipulates that global dominance in nonattended objects is a processing rule over which subjects have no control. Thus, global dominance should be observed despite a manipulation of subjects' attentional strategy.

The present studies investigated the influence of attentional strategy on global/local processing in both attended and nonattended objects. In each experiment, two compound stimuli were simultaneously presented and subjects were instructed to decide if there was a target appearing in the attended object and to ignore the nonattended object. The question of whether the presence of global and local distractors influenced target detection as a function of the probability ($p=.5$ and $.8$) that the target was presented at the local aspect of the attended object was studied. The main findings of present experiments are summarized as follow:

1. In Experiment 1 (where the probability for the presence of local and global targets was equal, i.e. $p=.5$), global and local distractors had similar impact on performance. Specifically, it was found that detection of global targets was only affected by the presence of global distractors, while local detection was only influenced by the presence of local distractors within the nonattended object. In addition, the latency data indicate that subjects' performance on "no" trials was equally affected by global and

local distractors. However, the accuracy data suggested that global distractors were more difficult to ignore than local distractors.

2. As previously observed (Kinchla et al.), global/local processing in attended objects was influenced by subjects adopting a local processing strategy. Thus, when the probability of finding the target at the local level was increased to 0.8 (Experiment 2), local processing in the attended object was more efficient than global processing. In particular, while global decisions were faster than local decisions in Experiment 1, the reverse pattern was found in Experiment 2.

3. Increasing the probability that the target letter appeared at the local aspect also had an impact on global/local processing in the nonattended object. The false alarm data suggested that local distractors have a similar effect on "no" performance as global distractor in Experiment 2. Hence, when no targets were presented, the local distractor was more difficult to ignore in Experiment 2 than in Experiment 1. More critical, however, was the failure to find local dominance in nonattended objects. Thus, in Experiment 2, subjects were unable to ignore global distractors which influenced performance as much as local distractors.

Inducing a local processing strategy

Did the present experiments successfully induced a local attentional strategy? As mentioned in the introduction,

previous studies (Kinchla et al., 1983; Lamb & Robertson, 1987; Miller, 1981; Ward, 1982) have shown that subjects' attention can be manipulated to reverse the typical performance advantage for global information into an advantage for local information. All of these studies showed that subjects can speed up local processing in attended objects by simply devoting more attention to the local than to the global level. The present study confirmed this result. The different pattern of global/local target detection latency between Experiment 1 (global detection was faster than local detection) and Experiment 2 (local detection is faster than global detection) is strong evidence that a local attentional set was successfully induced. This reinforced the claim (Ward, 1982) that for attended objects, subjects can control the speed of processing of features at a given level, and the more effort allocated to a level, the faster processing of that level will be.

Evaluation of rival interpretations of global dominance in nonattended objects

The present results, are problematic for the two accounts of global dominance in nonattended objects that were studied in the present thesis.

The attentional bias hypothesis, which suggests that the dominance of global/local processing in nonattended objects depends on high level cognitive mechanisms controlled by subjects, is consistent with the results of Experiment 1 where

the likelihood of global and local targets was equal. Under such conditions, neither a local nor a global processing bias should be induced, and as predicted by the attentional bias hypothesis, neither local nor global dominance in nonattended objects appeared. In fact, global and local distractors had similar impact on performance. However, the false alarm rate in Experiment 1, indicated that global distractors were more difficult to ignore than local distractors. This finding is inconsistent with the attentional bias account. Furthermore, a key prediction of the attentional bias account was that local dominance in nonattended objects would appear if a local attentional set was adopted. Clearly, the present results disconfirmed this prediction. Thus, the fact that local processing in attended objects was faster than global processing indicates that a local strategy was successfully induced. However, local distractors did not have more impact on performance than global distractors. Overall, the account that global/local dominance in nonattended object is due to subject's attentional strategy is not supported by the present data.

The processing rule interpretation of global dominance in nonattended object also faces some difficulties accounting for the present data. As some researchers suggested (e.g. Paquet & Merikle, 1988), only global processing (global categorization) in nonattended objects should be mandatory, while local processing (local categorization) should be

optional and under subject's control. However, the results of Experiment 1 do not support this view. Both global and local category effects emerged for the "no" trials, which indicates that both global and local processing in nonattended objects was unavoidable. Furthermore, an implication from this account is that the subject's attentional set should not influence processing in the nonattended objects and global dominance should be obtained independently of the subject's processing strategy. Contrary to this prediction, global dominance was not found in the present studies. Therefore, although the global aspect of the nonattended object was always categorized, this was insufficient to produce global dominance. In sum, the idea derived from the processing rule hypothesis that only global categorization is unavoidable seems to be untenable in light of the present data.

Although a strong version of the processing rule hypothesis is clearly inconsistent with the present results, a recent weaker version of this hypothesis which suggests that local processing can also become automatic under appropriate conditions (Paquet, 1992) is consistent with the present data. According to this hypothesis, global dominance results from an original imbalance in the strength of global and local channels favouring global information. However, it would be possible under certain conditions to enhance the strength of the local channel to a level that is more similar to that of the global channel. Under such conditions, neither global nor

local dominance should be observed and subjects should be unable to ignore both local and global distractors located in the nonattended object. According to this hypothesis instructing subjects to pay equal attention to the global and local aspects and presenting local targets as often as global target (Experiment 1) might have raised the strength of the local channel, sufficiently that local processing in nonattended objects also became automatic. In light of the results of Experiment 2, this hypothesis can be extended to include the postulate that making the local targets more likely than global targets does enhance the strength of local channel, but insufficiently to produce the strength imbalance required to obtain local processing dominance.

One implication of this hypothesis is that global processing in nonattended objects is always unavoidable, while local processing can become automatic only under certain conditions. However, for the present divided attention paradigm, the possibility that local distractors in nonattended objects are also always processed can not be eliminated. A further study in which global targets will be more likely than local target ($p=.2$) is needed to settle this question.

While the hypothesis developed by Paquet (1992) is in general agreement with the key results from the present studies, it fails to account for some aspects of the results. First, why was there a general improvement of performance in

Experiment 2? According to Paquet's hypothesis, only local performance improvement should have resulted from the higher likelihood of local targets. In fact, global channels should have been unaffected by this manipulation. Therefore, the improvement for global detection is unexpected. Further studies will be required to determine what mechanisms were involved in producing this effect.

Second, in Experiment 2 where the importance of the local aspect was presumably raised and that of global channels left unchanged, global distractors should not have had more influence on local detection than local distractors. Based on previous studies (Paquet & Merikle, 1988; Paquet, 1992) and the results of Experiment 1, local distractors should have had more impact on local detection than global distractors, and the presumed increase of the strength of local channel should have further increased the influence of local distractors. Therefore, the finding that global distractors affected local target detection more than local distractors is inconsistent with Paquet's previous data and hypothesis.

Third, the differences between the distractor effects observed with "yes" and "no" trials are difficult to understand in light of Paquet's hypothesis. In present experiments, subjects were required to make one of two judgments: "yes" or "no". For the "yes" trials, the target letter and the distractor letter belonged to the same response set (i.e. yes response), while for the "no" trials, two

different response set might be activated (i.e. "no" from the attended object, "yes" from distractors). Therefore, the nature of the distractor effect for the "yes" trials may differ from that for the "no" trials.

For "no" trials, where the distractor was always different from the required response, the presence of distractor, if it detected, should have disturbed responding (i.e. delaying RT and yielding more false alarm). In fact, the impact of the distractor for the "no" trials was very similar to the category effect observed by Paquet & Merikle (1988), and it appears a good index of global/local processing in nonattended objects.

On the other hand, for the "yes" trials, the distractor and the target belonged to same response set. If subjects cannot ignore the presence of distractors in nonattended objects, would the distractor inhibit or facilitate responding? The answer is unclear from the present results. Generally, the presence of distractors delayed "yes" responding. However, in Experiment 2, distractors that were identical to the target facilitated "yes" responding. This finding is difficult to explain with Paquet's (1992) hypothesis and further studies will be needed to gain further insight concerning this and the preceding unexplained results.

Summary and conclusion

The results of the present studies suggest several

conclusions. First, attentional strategy can be manipulated by using the present divided-attention paradigm. Second, neither global nor local distractors can be ignored when subjects are informed that both levels have the same importance. However, this manipulation is sufficient to eliminate global dominance in nonattended objects. Third, local dominance can not be induced by subjects adopting a local processing strategy. Neither the attentional bias account nor the global dominance as a processing rule approach are adequate to explain the results. A promising, although not problem-free, interpretation is that developed by Paquet (1992) where local processing in nonattended objects is more affected by high level cognitive mechanism than global processing. Therefore, in a limited sense, the present thesis provides some support for Navon's (1977) notion that there are fundamental differences between global and local processing, the latter being somewhat more under subject's control than the former.

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Footnotes

1: An programming error which allowed the error rates for some conditions where a global distractor was presented to go beyond 25% level was found after the experiments. Two subjects, one in Experiment 1 and the other in Experiment 2, were affected by this error.

2: A detection paradigm requires subjects to decide about the presence or absence of a target; while an identification paradigm requires subjects to tell precisely what a target is.

3: The between-subjects ANOVA violates the assumption that subjects should be randomly assigned to different treatments.

Appendix A

Reaction time data and summary of Anova for the "yes" trials and for conditions where a distractor appeared within the nonattended object for Experiment 1.

Subject	Globality of Target	Distractor Condition	Congruency	RT (Msec)
1	global	global	congruent	744.0
1	global	global	incongruent	993.0
1	global	local	congruent	851.4
1	global	local	incongruent	969.5
1	local	global	congruent	974.0
1	local	global	incongruent	1073.5
1	local	local	congruent	1138.0
1	local	local	incongruent	1123.0
2	global	global	congruent	772.0
2	global	global	incongruent	907.0
2	global	local	congruent	805.0
2	global	local	incongruent	675.0
2	local	global	congruent	681.0
2	local	global	incongruent	708.5
2	local	local	congruent	797.5
2	local	local	incongruent	850.0
3	global	global	congruent	863.0
3	global	global	incongruent	831.5
3	global	local	congruent	785.5
3	global	local	incongruent	782.0
3	local	global	congruent	758.5
3	local	global	incongruent	789.0
3	local	local	congruent	875.0
3	local	local	incongruent	861.0
4	global	global	congruent	865.5
4	global	global	incongruent	734.5
4	global	local	congruent	877.0
4	global	local	incongruent	760.5
4	local	global	congruent	824.5
4	local	global	incongruent	871.0
4	local	local	congruent	917.0
4	local	local	incongruent	877.5
5	global	global	congruent	719.0
5	global	global	incongruent	781.5
5	global	local	congruent	738.0
5	global	local	incongruent	773.5
5	local	global	congruent	662.0
5	local	global	incongruent	708.0
5	local	local	congruent	815.0
5	local	local	incongruent	673.0
6	global	global	congruent	835.0
6	global	global	incongruent	904.0

6	global	local	congruent	907.0
6	global	local	incongruent	743.0
6	local	global	congruent	930.5
6	local	global	incongruent	853.0
6	local	local	congruent	979.0
6	local	local	incongruent	917.0
7	global	global	congruent	747.0
7	global	global	incongruent	792.0
7	global	local	congruent	830.0
7	global	local	incongruent	706.0
7	local	global	congruent	772.0
7	local	global	incongruent	750.0
7	local	local	congruent	868.0
7	local	local	incongruent	874.5
8	global	global	congruent	944.0
8	global	global	incongruent	1056.0
8	global	local	congruent	899.0
8	global	local	incongruent	815.0
8	local	global	congruent	951.5
8	local	global	incongruent	904.0
8	local	local	congruent	991.0
8	local	local	incongruent	1014.0
9	global	global	congruent	829.0
9	global	global	incongruent	877.0
9	global	local	congruent	861.0
9	global	local	incongruent	918.0
9	local	global	congruent	852.0
9	local	global	incongruent	909.0
9	local	local	congruent	1008.0
9	local	local	incongruent	949.0
10	global	global	congruent	567.0
10	global	global	incongruent	669.0
10	global	local	congruent	602.0
10	global	local	incongruent	641.5
10	local	global	congruent	777.5
10	local	global	incongruent	637.0
10	local	local	congruent	719.0
10	local	local	incongruent	723.5
11	global	global	congruent	983.0
11	global	global	incongruent	1143.5
11	global	local	congruent	893.0
11	global	local	incongruent	1065.5
11	local	global	congruent	980.0
11	local	global	incongruent	1050.5
11	local	local	congruent	1109.0
11	local	local	incongruent	969.0
12	global	global	congruent	803.0
12	global	global	incongruent	827.0
12	global	local	congruent	634.0
12	global	local	incongruent	660.0
12	local	global	congruent	650.5
12	local	global	incongruent	640.5

12	local	local	congruent	803.0
12	local	local	incongruent	815.0
13	global	global	congruent	936.5
13	global	global	incongruent	905.5
13	global	local	congruent	898.5
13	global	local	incongruent	950.5
13	local	global	congruent	1022.0
13	local	global	incongruent	995.5
13	local	local	congruent	926.0
13	local	local	incongruent	904.5
14	global	global	congruent	954.0
14	global	global	incongruent	972.5
14	global	local	congruent	1095.0
14	global	local	incongruent	871.0
14	local	global	congruent	1004.5
14	local	global	incongruent	1075.0
14	local	local	congruent	1102.0
14	local	local	incongruent	1215.5
15	global	global	congruent	991.0
15	global	global	incongruent	960.0
15	global	local	congruent	880.0
15	global	local	incongruent	928.0
15	local	global	congruent	874.0
15	local	global	incongruent	950.5
15	local	local	congruent	1074.0
15	local	local	incongruent	1017.0

Summary of Analysis of Variance

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Globality of Target	1	65941	14	6984	9.44	.008
Distractor Condition	1	11701	14	2832	4.13	.062
Congruency	1	1116	14	3658	.31	.589
Target x Distractor	1	94360	14	5461	17.28	.001
Target x Congruency	1	3413	14	5187	.66	.431
Distractor x Congruency	1	22359	14	1627	13.74	.002
Target x Distractor x Congruency	1	2613	14	4624	.57	.465

Appendix B

Reaction time, miss rates and summery of analysis of variance for global distractor, local distractor and baseline condition for the "yes" trials in Experiment 1.

Subject	Globality of Target	Distractor Condition	RT (Msec)	Miss Rate(%)
1	global	control	851.5	0.0
1	global	global	868.5	5.0
1	global	local	910.5	0.0
1	local	control	995.0	12.5
1	local	global	1023.75	12.5
1	local	local	1130.5	25.0
2	global	control	663.0	2.5
2	global	global	839.5	2.5
2	global	local	740.0	5.0
2	local	control	741.0	0.0
2	local	global	694.75	0.0
2	local	local	823.75	10.0
3	global	control	684.0	7.5
3	global	global	847.25	5.0
3	global	local	783.75	7.5
3	local	control	806.6	0.0
3	local	global	773.75	2.5
3	local	local	868.0	10.0
4	global	control	797.5	0.0
4	global	global	799.5	2.5
4	global	local	818.75	0.0
4	local	control	887.0	5.0
4	local	global	847.75	7.5
4	local	local	897.25	0.0
5	global	control	741.5	0.0
5	global	global	750.25	2.5
5	global	local	755.75	5.0
5	local	control	769.0	2.5
5	local	global	685.0	0.0
5	local	local	744.0	7.5
6	global	control	845.0	15.0
6	global	global	869.5	10.0
6	global	local	835.0	15.0
6	local	control	867.0	17.5
6	local	global	891.75	7.5
6	local	local	948.0	17.5
7	global	control	771.0	10.0
7	global	global	769.5	2.5
7	global	local	768.25	5.0
7	local	control	783.5	0.0
7	local	global	761.0	0.0
7	local	local	871.25	2.5

8	global	control	847.0	15.0
8	global	global	1000.0	2.5
8	global	local	857.0	2.5
8	local	control	912.0	12.5
8	local	global	927.0	12.5
8	local	local	1002.5	20.0
9	global	control	889.0	5.0
9	global	global	853.0	2.5
9	global	local	889.5	5.0
9	local	control	868.0	2.5
9	local	global	880.5	7.5
9	local	local	978.5	12.5
10	global	control	606.6	2.5
10	global	global	618.0	5.0
10	global	local	621.75	0.0
10	local	control	679.0	2.5
10	local	global	707.25	7.5
10	local	local	721.25	7.5
11	global	control	868.0	12.5
11	global	global	1063.25	7.5
11	global	local	979.25	7.5
11	local	control	920.0	2.5
11	local	global	1015.25	7.5
11	local	local	1039.0	25.0
12	global	control	779.0	7.5
12	global	global	815.0	2.5
12	global	local	647.0	15.0
12	local	control	669.0	2.5
12	local	global	645.5	0.0
12	local	local	809.0	10.0
13	global	control	919.0	2.5
13	global	global	921.0	0.0
13	global	local	924.5	0.0
13	local	control	916.5	5.0
13	local	global	1008.75	5.0
13	local	local	915.25	7.5
14	global	control	927.5	5.0
14	global	global	963.25	2.5
14	global	local	983.0	2.5
14	local	control	1069.0	5.0
14	local	global	1039.75	2.5
14	local	local	1158.75	7.5
15	global	control	1047.0	5.0
15	global	global	975.5	5.0
15	global	local	904.0	2.5
15	local	control	836.0	7.5
15	local	global	912.25	2.5
15	local	local	1045.5	7.5

Summary of Analysis of Variance

Analysis of RT

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Globality of Target	1	39617	14	5131	7.72	.015
Distractor Condition	2	16621	28	1664	9.98	.001
Target x Distractor	2	24140	28	2774	8.70	.001

Analysis of Miss Rates

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Globality of Target	1	.01	14	.00	3.24	.094
Distractor Condition	2	.01	28	.00	7.49	.002
Target x Distractor	2	.01	28	.00	9.37	.001

Appendix C

Reaction time, miss rate and summary of analysis of variance for baseline conditions for the "yes" trials in Experiment 1.

Subject	Globality of Target	RT (Msec)	Miss Rate(%)
1	global	851.5	0.0
1	local	995.0	12.5
2	global	663.0	2.5
2	local	741.0	0.0
3	global	684.0	7.5
3	local	806.6	0.0
4	global	797.5	0.0
4	local	887.0	5.0
5	global	741.5	0.0
5	local	769.0	2.5
6	global	845.0	15.0
6	local	867.0	17.5
7	global	771.0	10.0
7	local	783.5	0.0
8	global	847.0	15.0
8	local	912.0	12.5
9	global	889.0	5.0
9	local	868.0	2.5
10	global	606.6	2.5
10	local	679.0	2.5
11	global	868.0	12.5
11	local	920.0	2.5
12	global	779.0	7.5
12	local	669.0	2.5
13	global	919.0	2.5
13	local	916.5	5.0
14	global	927.5	5.0
14	local	1069.0	5.0
15	global	1047.0	5.0
15	local	836.0	7.5

Summary of Analysis of Variance

Analysis of RT

Effect	d.f Effect	Ms Effect	d.f Error	Ms Error	F	Sig
Globality of Target	1	7728	14	4466	1.73	.21

Analysis of Miss Rate

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Globality of Target	1	.0008	14	.0014	.29	.596

Appendix D

Reaction time, false alarm rate and summary of analysis of variance for the "no" trials in Experiment 1.

Subject	Distractor Condition	RT (Msec)	False Alarm Rate(%)
1	control	1199.5	10.0
1	global	1174.0	6.3
1	local	1150.0	11.3
2	control	655.0	1.3
2	global	754.5	2.5
2	local	743.0	1.3
3	control	930.0	16.3
3	global	1171.0	16.3
3	local	1228.0	18.8
4	control	935.5	5.0
4	global	1090.0	16.3
4	local	991.0	15.0
5	control	875.5	12.5
5	global	913.5	12.5
5	local	963.5	7.5
6	control	840.0	8.8
6	global	868.0	8.8
6	local	913.0	10.0
7	control	745.0	12.5
7	global	795.0	17.5
7	local	762.0	5.0
8	control	900.0	10.0
8	global	964.0	26.3
8	local	959.0	10.0
9	control	901.0	13.8
9	global	922.0	12.3
9	local	936.0	1.3
10	control	678.0	5.0
10	global	823.5	7.5
10	local	805.5	6.3
11	control	1102.0	3.8
11	global	1154.0	11.3
11	local	1089.0	7.5
12	control	744.0	20.0
12	global	872.0	17.5
12	local	860.0	12.5
13	control	1015.0	17.5
13	global	1096.0	31.3
13	local	969.5	10.0
14	control	1026.0	11.3
14	global	1105.5	25.0
14	local	1113.0	11.3
15	control	1064.0	10.0

15	global	1175.5	20.0
15	local	1137.5	25.0

Summary of Analysis of Variance

Analysis of RT.

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Distractor Condition	2	29026	28	2297	12.64	.000

Analysis of F.A. Rate.

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Distractor Condition	2	.01	28	.00	4.91	.015

Appendix E

Reaction time data and summary of analysis of variance for the "yes" trials, for conditions where a distractor appeared within the nonattended object in Experiment 2.

Subject	Globality of Target	Distractor Condition	Congruency	RT (Msec)
1	global	global	congruent	721.5
1	global	global	incongruent	755.5
1	global	local	congruent	669.0
1	global	local	incongruent	815.0
1	local	global	congruent	841.0
1	local	global	incongruent	746.5
1	local	local	congruent	729.5
1	local	local	incongruent	756.5
2	global	global	congruent	837.0
2	global	global	incongruent	840.0
2	global	local	congruent	832.0
2	global	local	incongruent	812.0
2	local	global	congruent	834.5
2	local	global	incongruent	787.5
2	local	local	congruent	789.0
2	local	local	incongruent	800.5
3	global	global	congruent	571.5
3	global	global	incongruent	561.0
3	global	local	congruent	626.0
3	global	local	incongruent	631.0
3	local	global	congruent	613.5
3	local	global	incongruent	604.0
3	local	local	congruent	631.5
3	local	local	incongruent	619.0
4	global	global	congruent	562.0
4	global	global	incongruent	627.0
4	global	local	congruent	661.0
4	global	local	incongruent	700.5
4	local	global	congruent	638.0
4	local	global	incongruent	609.0
4	local	local	congruent	577.5
4	local	local	incongruent	556.0
5	global	global	congruent	542.5
5	global	global	incongruent	549.5
5	global	local	congruent	603.5
5	global	local	incongruent	630.0
5	local	global	congruent	626.0
5	local	global	incongruent	586.5
5	local	local	congruent	560.0
5	local	local	incongruent	537.0
6	global	global	congruent	488.5
6	global	global	incongruent	533.0

6	global	local	congruent	528.0
6	global	local	incongruent	628.5
6	local	global	congruent	543.5
6	local	global	incongruent	510.5
6	local	local	congruent	509.0
6	local	local	incongruent	539.5
7	global	global	congruent	748.0
7	global	global	incongruent	721.0
7	global	local	congruent	697.0
7	global	local	incongruent	796.0
7	local	global	congruent	935.5
7	local	global	incongruent	847.5
7	local	local	congruent	755.0
7	local	local	incongruent	840.0
8	global	global	congruent	560.0
8	global	global	incongruent	652.5
8	global	local	congruent	680.5
8	global	local	incongruent	611.0
8	local	global	congruent	596.5
8	local	global	incongruent	604.0
8	local	local	congruent	587.0
8	local	local	incongruent	607.5
9	global	global	congruent	980.5
9	global	global	incongruent	1097.0
9	global	local	congruent	923.5
9	global	local	incongruent	918.5
9	local	global	congruent	1019.5
9	local	global	incongruent	1003.5
9	local	local	congruent	897.0
9	local	local	incongruent	933.0
10	global	global	congruent	599.0
10	global	global	incongruent	638.5
10	global	local	congruent	626.0
10	global	local	incongruent	720.5
10	local	global	congruent	686.5
10	local	global	incongruent	636.5
10	local	local	congruent	595.5
10	local	local	incongruent	628.5
11	global	global	congruent	1079.0
11	global	global	incongruent	1146.0
11	global	local	congruent	1156.0
11	global	local	incongruent	1124.0
11	local	global	congruent	1032.0
11	local	global	incongruent	1003.5
11	local	local	congruent	929.0
11	local	local	incongruent	994.0
12	global	global	congruent	729.0
12	global	global	incongruent	998.0
12	global	local	congruent	824.0
12	global	local	incongruent	847.0
12	local	global	congruent	825.5
12	local	global	incongruent	743.5

12	local	local	congruent	745.0
12	local	local	incongruent	729.5
13	global	global	congruent	1021.0
13	global	global	incongruent	1116.5
13	global	local	congruent	859.0
13	global	local	incongruent	1139.5
13	local	global	congruent	924.0
13	local	global	incongruent	955.0
13	local	local	congruent	896.0
13	local	local	incongruent	918.0
14	global	global	congruent	798.5
14	global	global	incongruent	636.0
14	global	local	congruent	617.0
14	global	local	incongruent	648.0
14	local	global	congruent	630.0
14	local	global	incongruent	629.0
14	local	local	congruent	534.0
14	local	local	incongruent	583.0
15	global	global	congruent	707.0
15	global	global	incongruent	1080.0
15	global	local	congruent	914.0
15	global	local	incongruent	1102.0
15	local	global	congruent	810.0
15	local	global	incongruent	843.0
15	local	local	congruent	883.0
15	local	local	incongruent	849.0

Summary of Analysis of Variance

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Globality of Target	1	32456	14	7559	4.29	.057
Distractor Condition	1	3229	14	4112	.79	.391
Congruency	1	27923	14	3532	7.90	.014
Target x Distractor	1	23787	14	1395	17.05	.001
Target x Congruency	1	39476	14	3731	10.58	.006
Distractor x Congruency	1	2328	14	3025	.77	.395
Target x Distractor x Congruency	1	6863	14	1840	3.73	.074

Appendix F

Reaction time, miss rate and summary of analysis of variance for global distractor, local distractor and baseline condition for the "yes" trials in Experiment 2.

Subject	Globality of Target	Distractor Condition	RT (Msec)	Miss Rate(%)
1	global	control	788.00	8.3
1	global	global	738.50	0.0
1	global	local	742.00	12.5
1	local	control	738.50	2.1
1	local	global	793.75	3.0
1	local	local	743.00	0.0
2	global	control	771.50	0.0
2	global	global	838.50	0.0
2	global	local	822.00	4.2
2	local	control	815.50	2.1
2	local	global	810.75	3.2
2	local	local	794.75	4.2
3	global	control	605.00	12.5
3	global	global	566.25	4.2
3	global	local	628.50	4.2
3	local	control	569.50	2.1
3	local	global	608.50	6.3
3	local	local	625.25	1.0
4	global	control	730.50	8.3
4	global	global	594.50	33.3
4	global	local	680.75	4.2
4	local	control	613.00	3.1
4	local	global	623.50	3.1
4	local	local	566.75	1.0
5	global	control	756.50	0.0
5	global	global	546.00	0.0
5	global	local	616.75	4.2
5	local	control	644.00	3.1
5	local	global	606.25	3.1
5	local	local	548.50	4.2
6	global	control	514.00	4.2
6	global	global	510.00	0.0
6	global	local	578.25	0.0
6	local	control	503.50	2.1
6	local	global	527.00	6.3
6	local	local	524.25	1.0
7	global	control	766.00	16.7
7	global	global	734.50	12.5
7	global	local	746.50	25.0
7	local	control	816.00	8.3
7	local	global	891.50	18.8
7	local	local	797.50	17.7

8	global	control	567.00	4.2
8	global	global	606.25	8.3
8	global	local	645.75	0.0
8	local	control	560.00	1.0
8	local	global	600.25	4.2
8	local	local	597.25	0.0
9	global	control	953.00	0.0
9	global	global	1038.75	8.3
9	global	local	921.00	8.3
9	local	control	881.50	2.1
9	local	global	1011.50	0.0
9	local	local	915.00	4.2
10	global	control	607.50	8.3
10	global	global	618.75	4.2
10	global	local	673.25	0.0
10	local	control	620.50	4.2
10	local	global	661.50	6.3
10	local	local	611.75	2.1
11	global	control	1036.00	0.0
11	global	global	1112.50	4.2
11	global	local	1140.00	4.2
11	local	contr	934.50	0.0
11	local	global	1017.75	3.1
11	local	local	961.50	3.1
12	global	control	694.50	16.7
12	global	global	863.50	16.7
12	global	local	835.50	4.2
12	local	control	681.00	11.4
12	local	global	784.50	18.8
12	local	local	737.25	6.3
13	global	control	875.00	0.0
13	global	global	1068.75	0.0
13	global	local	999.25	0.0
13	local	control	815.00	3.1
13	local	global	939.50	16.7
13	local	local	907.00	6.3
14	global	control	629.50	0.0
14	global	global	672.25	4.2
14	global	local	632.50	8.3
14	local	control	562.00	5.2
14	local	global	629.50	7.3
14	local	local	558.50	1.0
15	global	control	1002.00	4.2
15	global	global	893.50	4.2
15	global	local	1008.50	8.3
15	local	control	784.50	10.4
15	local	global	826.50	11.5
15	local	local	866.00	6.3

Summary of Analysis of Variance

Analysis of RT

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Globality of Target	1	33823	14	4861	6.96	.019
Distractor Condition	2	6989	28	3596	1.94	.162
Target x Distractor	2	6725	28	1018	6.6	.004

Analysis of Miss kates

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Globality of Target	1	.00	14	.00	.53	.480
Distractor Condition	2	.00	28	.00	2.08	.144
Target x Distractor	2	.01	28	.00	.79	.463

Appendix G

Reaction time, miss rate and summary of analysis of variance for baseline conditions for the "yes" trials in Experiment 2.

Subject	Globality of Target	RT (Msec)	Miss Rate(%)
1	global	788.00	8.3
1	local	738.50	2.1
2	global	771.50	0.0
2	local	815.50	2.1
3	global	605.00	12.5
3	local	569.50	2.1
4	global	730.50	8.3
4	local	613.00	3.1
5	global	756.50	0.0
5	local	644.00	3.1
6	global	514.00	4.2
6	local	503.50	2.1
7	global	766.00	16.7
7	local	816.00	8.3
8	global	567.00	4.2
8	local	560.00	1.0
9	global	953.00	0.0
9	local	881.50	2.1
10	global	607.50	8.3
10	local	620.50	4.2
11	global	1036.00	0.0
11	local	934.50	0.0
12	global	694.50	16.7
12	local	681.00	11.4
13	global	875.00	0.0
13	local	815.00	3.1
14	global	629.50	0.0
14	local	562.00	5.2
15	global	1002.00	4.2
15	local	784.50	10.4

Summary of Analysis of Variance

Analysis of RT

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Globality of Target	1	19152	14	2420	7.91	.014

Analysis of miss rate

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Globality of Target	1	.00	14	.00	1.37	.262

Appendix H

Reaction time, false alarm rate and summary of analysis of variance for the "no" trials in Experiment 2.

Subject	Distractor Condition	RT (Msec)	Error Rate(%)
1	control	651.0	2.5
1	global	770.0	3.3
1	local	716.0	7.5
2	control	818.0	4.2
2	global	890.0	7.5
2	local	883.0	6.7
3	control	526.5	0.0
3	global	664.0	3.3
3	local	697.5	5.0
4	control	603.0	5.8
4	global	651.0	7.5
4	local	690.5	11.7
5	control	548.0	1.7
5	global	609.0	5.0
5	local	603.0	7.5
6	control	595.0	2.5
6	global	686.0	5.8
6	local	679.5	6.7
7	control	823.0	2.5
7	global	887.0	10.8
7	local	889.0	17.5
8	control	622.0	4.2
8	global	649.0	0.8
8	local	662.0	7.5
9	control	848.5	0.0
9	global	932.0	2.5
9	local	948.5	3.3
10	control	590.0	4.2
10	global	678.0	7.5
10	local	740.0	5.8
11	control	1023.0	4.2
11	global	1112.0	9.2
11	local	1069.0	5.0
12	control	621.5	1.7
12	global	679.0	4.2
12	local	741.5	3.3
13	control	802.0	7.5
13	global	827.5	6.7
13	local	877.0	10.8
14	control	827.5	8.3
14	global	679.5	10.0
14	local	691.5	8.3
15	control	1057.0	10.8

15	global	1081.5	13.3
15	local	1137.0	8.3

Summary of Analysis of Variance

Analysis of RT.

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Distractor Condition	2	30510	28	622	49.13	.000

Analysis of F.A. Rate.

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Distractor Condition	2	.01	28	.00	9.01	.001

Appendix I

Summary of Anova on RTs and miss rate for the "Yes" trials across experiments.

Analysis of RT

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Experiment	1	565,432	28	108,608	5.21	.03
Globality of Target	1	114	28	4996	.02	.88
Globality of Distractor	2	19,467	56	2630	7.40	.001
Experiment x Target	1	73,326	28	4996	14.68	.001
Experiment x Distractor	2	4142	56	2630	1.57	.216
Target x Distractor	2	4236	56	1896	2.23	.116
Experiment x Target x Distractor	2	26628	56	1896	14.0	.000

Analysis of miss rate

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Experiment	1	.0011	28	.01	.11	.745
Globality of Target	1	.0024	28	.004	.60	.445
Globality of Distractor	2	.0026	56	.002	1.32	.277
Experiment x Target	1	.01	28	.004	3.21	.084
Experiment x Distractor	2	.01	56	.002	6.84	.002
Target x Distractor	2	.005	56	.0016	2.87	.065
Experiment x Target Distractor	2	.01	56	.0016	4.9	.011

Appendix J

Summary of Anova on RT and false alarm rate for the "No" trials across experiments.

Analysis of RT

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Experiment	1	812,155	28	71,541	11.35	.002
Globality of Distractor	2	57,539	56	1459	39.49	.000
Experiment x Distractor	2	1997	56	1459	1.37	.263

Analysis of False Alarm

Effect	d.f Effect	MS Effect	d.f Error	MS Error	F	Sig
Experiment	1	.08	28	.005	16.24	.000
Globality of Distractor	2	.01	56	.0016	6.41	.003
Experiment x Distractor	2	.01	56	.0016	4.89	.011

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