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High-Priority Affective Stimuli and Visual Search

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Previous research offers conflicting suggestions about whether “high-priority” verbal stimuli such as an individual’s own name or emotionally charged words automatically grab attention and/or can be detected without the usual capacity limitations. Nine experiments investigated this issue, using visual search through displays of words. In speeded search tasks, the subject’s own name was detected more quickly than other targets, but in no case were search slopes flat enough to suggest parallel search or “pop-out”. Further, names were not found to be unusually potent distractors. Emotionally charged words were neither more readily detected as targets nor more potent as distractors as compared to neutral words. A comparison of observers’ accuracy in searching briefly exposed simultaneous versus successive displays provided further evidence that search for “high-priority” word targets is subject to the same severe capacity limitations as are found with search for neutral words.

People sometimes seem, rather uncannily, to notice when their name is mentioned in a conversation, even if they were not consciously attending to this conversation. Often, they say, it is as if the name seems to “jump out”. Similar effects have been reported with emotion-laden words and voices. The literature on the cognitive processing of such high-priority affective stimuli is somewhat confusing, however, with various conflicting results scattered around the literature. This paper describes a series of experiments undertaken to try to clarify the ways in which high-priority stimuli may be processed differently from other stimuli within one the context of a particular task: speeded or unspeeded visual search through displays of words.

Aside from their intrinsic interest, the effects of high priority affective stimuli may shed light on a number of issues. One is the long-running controversy over the extent to which unattended stimuli are processed to a semantic level, as suggested by “late-selection” theories. While many writers have advocated compromise formulations (Johnston and Dark, 1982; Lavie and Cox, 1997; Pashler, 1998), others continue to argue that all stimuli are subjected to an unselective semantic analysis limited only by the quality of sensory input. For some at least, the strongest appeal of late-selection theory seems to be its ability to account for effects involving high priority stimuli (Arnell, Shapiro, and Sorensen, 1999). Thus, an accurate empirical description of these phenomena should have relevance for classic issues in attention theory. Second, recent research suggests that what appeared to be particularly clear cases of bottom-up attentional capture, such as capture by abrupt onsets, depend critically on previously overlooked top-down influences (Folk, Remington, and Johnston, 1992; for a review, see Pashler, Johnston and Ruthruff, 2001). Thus, it should be interesting to find out whether high-priority affective stimuli capture attention in a non-contingent fashion. Finally and more generally, while contemporary attention research has (understandably) focused largely on affectively neutral stimuli, our brains were subject to especially strong adaptive pressure to deal appropriately with events that have strong motivational significance. It is possible that the mechanisms available for these stimuli cannot be fully unraveled by studies examining only neutral stimuli.

Moray’s Study

A very famous study by Moray (1959) provided the first objective evidence that a person’s own name can sometimes evoke different effects than other stimuli within a selective attention experiment. Moray played a spoken message in each channel on stereo headphones while subjects shadowed (immediately repeated back) the input to one ear. When lists of ordinary words were played to the unattended ear, subjects were unable even to recognize words that had been played dozens of times. However, when the subject’s own name was played to the unattended ear, about one-third of the subjects noticed and remarked upon this. Moray’s finding has frequently been discussed in connection with the long-running debate about the extent to which unattended stimuli are processed. Some writers have taken the detection of names as evidence that unattended messages are fully analyzed, whereas others have argued that detection of a name might reflect something less than “complete” semantic analysis.

In light of the fact that Moray’s work has been cited so often in discussions of attention over four decades, it is surprising how little research has been undertaken to follow up on his findings (especially because the Moray study itself was described by its author as small and preliminary). The most direct follow-up work using auditory stimuli was reported by Wood and Cowan (1995). These writers confirmed Moray’s basic results in all essentials, and also showed that when the name is detected, shadowing of the attended message is impaired. In a related study, Oswald, Taylor and Treisman (1960) found that playing an individual’s name while he or she slept frequently awakened the subject or produced EEG

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patterns suggestive of partial awakening (see also Perrin, Garcia-Larrea, Mauguiere, and Bastuji, 1999).

High Priority Stimuli in Vision

Over the years, a number of researchers have examined processing of one's own name using visual stimuli. The most recent studies have examined effects involving rapid serial visual presentations. One of these is the attentional blink effect (impaired detection of an initial target impairs detection of additional target items that follow close on its heels). Shapiro and his colleagues found that when the observer's own name was a follow-on target, the attentional blink effect was less pronounced than when that target had no particular significance to the observer (Shapiro, Caldwell, and Sorenson, 1997). Another study from the same research group reported that the "repetition blindness effect" (undercounting of identical targets) was attenuated when the target was the subject's own name (Arnell et al., 1999). The implications of these intriguing findings will be considered in the General Discussion below.

In an older study designed to provide a fairly close visual analogue of Moray's classic study, Wolford and Morrison (1980) showed subjects a display consisting of two digits located on either side of a single centrally presented word. Subjects were instructed to make a speeded response indicating whether the digits had the same parity as each other (both odd or both even versus one of each). Displays were brief and unmasked. In each of the last four blocks of the experiment, the subject's name was inserted once in place of the central word. Responses to the digits were substantially slowed on those trials. At the end of the experiment, 80% of subjects recognized their own name as having been presented, as compared to 68% for control words. The authors concluded that the name attracted subjects' attention, thereby impairing performance on the primary digit task.

More recently, Bundesen, Kyllingsbaek, Houmann, and Jensen (1997) presented visual displays consisting of four first names, two in red letters and two in white. Displays were presented for 150 msec, followed by a mask. The subject's task was to try to report the two names that appeared in red. On five percent of trials, the subject's own name was presented. The name was equally likely to be red or white; thus, there was no incentive for the subject to try to search for the name or to guess that a target (red item) was more likely to be his name than a distractor (white item). When the subject's name was a distractor, accuracy (56% correct) was not significantly different than when the subject's name was absent from the display (57%), suggesting that the name did not draw attention involuntarily. However, subjects were more accurate in reporting their name than in reporting other stimuli (something the authors also observed in a control experiment involving single words). Bundesen et al. concluded that while attention is not drawn to the subject's own name, people are better able to identify their own name as compared to personally insignificant stimuli.

Mack and Rock (1998) reported a number of visual search studies that examined search for a subject's own name. In several of these studies, subjects searched either for their own first name or for a control name in displays of 1, 6 or 12 words. In one such experiment, the distractor was a particular fixed word (*House, Time,* or *Cat,* for different subjects). Eight subjects' mean RTs were several hundred msec faster for the own-name target, and most critically, slopes almost flat in this condition (5.7 msec/item for own-name target-present versus 50.6 msec/item for control-name target present). The 5.7 msec/item slope is in the range commonly taken to suggest capacity-free, parallel search (see Wolfe, 1998, for a discussion). Similar results were obtained in another experiment when the subject's own name and a control name played either the role of target and distractor, respectively, or distractor and target. Ten subjects showed slopes of 6.5 msec/item when their own name was the target, versus 80.7 msec/item when it was the distractor. The authors concluded that a subject's own name "pops out" of a display much as Treisman and her colleagues had found with arrays of simple stimuli differing in features like color and orientation (Treisman and Gelade, 1980).

Emotionally Charged Stimuli and Attention

Another class of high priority stimuli with strong motivational significance are emotionally charged stimuli and events. Processing of these stimuli might or might not share common features with processing of an individual's own name. The most thoroughly studied phenomenon relating to attention and the processing of emotionally charged stimuli does not involve search, but rather the so-called "Emotional Stroop Effect". Here, as in the classic Stroop effect, subjects attempt to name the color of a word aloud as fast as possible. Responses to emotional words, such as PANIC, are sometimes slower than responses to non-emotional words, such as FLUTE (Eysenck, 1992; Matthews and MacLeod, 1985). This effect has often been found with anxious individuals, and occurs only intermittently with normal individuals (e.g., McKenna and Sharma, 1995).

The most common interpretation of the emotional Stroop effect assumes that, at least for anxious subjects, the emotionality of a word causes "more attention" to be devoted to processing the identity of the word, thereby amplifying response competition from the word name. However, alternative accounts are possible, e.g., an emotional stimulus might produce a defensive reaction which directly retards motor responses (cf. De Ruiter and Brosschot, 1994 for related suggestions). Furthermore, it could be that familiarity rather than emotionality is the critical factor in slowing responses. Dalgleish (1995) found that ornithologists were slower to name the color in which bird names were printed; perhaps anxious subjects have greater interest in or acquaintance with fear-related concepts than do other people.

Several other studies have found that emotional stimuli can affect the spatial deployment of attention; these studies presented emotional words and required responses to stimuli presented shortly afterwards. Stormark, Nordby and Hugdahl (1995) presented an emotional or neutral word followed (on most trials) by a dot in the same or a different location; subjects made a simple detection response to the dot. The position of the word predicted the position of the dot on most trials. When the word was emotional, the location priming effect (speeding of the response to the dot in the same position as the word) was slightly greater than with neutral words. MacLeod, Matthews and Tata (1986) reported a similar effect: when both an emotional and non-emotional word were presented at the same time, subjects were faster to respond to a probe stimulus that replaced the emotional word, compared to a probe replacing the nonemotional word (see also Broadbent and Broadbent, 1988). One recent study using pictures of faces with emotional expressions rather than fear-related words found the effect actually reversed for “non-dysphoric” individuals, but again the effects were extremely small (Bradley, Moggs, Millar, Bonham-Carter, Fergusson, Jenkins, and Parr, 1997). All in all, spatial attentional effects do not appear powerful and robust.

A tendency for emotionally charged stimuli to grab attention has also sometimes been invoked to explain observations involving memory for emotionally charged materials. Heuer and Reisberg (1992; Reisberg and Heuer, 1995) found that emotionally charged stories often produce superior memory for specific details of the central characters in these plots, even when these details are themselves irrelevant to the plot (e.g., the number printed on the jersey worn by a person who falls prey to violence). They suggested that this occurs because attention is drawn to emotionally salient objects (in this case, the victim). Further, Christianson, Loftus, Hoffman, and Loftus (1991) found that emotionality enhanced memory and showed that these effects could not be completely explained by the subject making more eye fixations on the better-remembered objects[1]. In contrast, other investigators have sometimes found impaired rather than enhanced memory for emotionally charged events (e.g., Christianson and Nilsson, 1984). The reasons for this discrepancy have not been fully worked out (cf. Christianson et al, 1991 for discussion), but it is possible that attention shifts could underly both the costs and benefits of emotionally charged stimuli; depending on the details of the stimuli and the emotionally significant events, such shifts could create a tradeoff between memory for some items and memory for others. It is also possible that memory enhancement effects do not reflect any immediate changes in attention at all. Rather, subjects in these experiments (almost all of which involve retention intervals of at least a few minutes) may tend to ruminate consciously about emotionally charged stimuli during the retention interval, and it may be rumination, rather than immediate changes in attention, that enhances (and in some cases impairs) later memory.

In summary, there is reasonable but not completely compelling evidence that emotionally charged materials may sometimes attract attention automatically, at least for some individuals; these results have not been shown in true divided-attention designs, however, but rather in a variety of selective attention and memory paradigms.

Present Investigation

The results described above relating to processing of an individual’s own name present a somewhat bewildering situation[2]. On the one hand, there is evidence that presenting a person’s own name causes an automatic shift of attention to this word, thereby impairing concurrent task performance (Wolford and Morrison, 1980). Furthermore, at least according to Mack and Rock, the subject’s own name “pops out” of a display of up to twelve words. On the other hand, Bundesen et al. found that when people attempted to filter a four-word display by color, their own name was not an unusually troublesome or potent distractor.

To shed new light on the relation of attention to high priority lexical stimuli, the studies reported here examined how a subject’s own name and emotionally charged words might be special in visual search. Visual search was chosen as a starting point because with this task is possible to examine how high-priority stimuli may differ from processing of other stimuli in a relatively analytic fashion, although naturally the results may or may not generalize to other types of stimuli or other kinds of divided attention tasks. In the studies described below, high-priority stimuli were independently placed in the roles of target and distractor, using both speeded and tachistoscopic search designs. The first seven experiments involved speeded visual search tasks with words, examining the effects of number of words in the display (display set size) on RTs to detect the presence or absence of a specified target word or words. In Experiments 1 and 4, the target was either the subject’s own name or a control name, and ordinary words served as distractors. In Experiment 3, the subject’s name and a control name swapped the role of target and distractor between blocks. In Experiments 5 and 6, the target was an ordinary word, and what was varied was wether the subject’s own name versus a control name was used as distractor. Experiments 2 and 7 looked at emotionally charged words rather than names. In Experiment 2, the target was either emotionally charged or neutral, whereas in Experiment 7 it was the distractor that was either emotionally charged or neutral. The final studies (Experiments 8 and 9) again examined word search, but here the primary dependent variable of interest was accuracy rather than reaction time; a comparison of simultaneous versus successive presentations was used to illuminate possible capacity limitations. This method was used in search for the subject’s own name vs. a control name in Experiment 8, and emotionally charged vs. neutral words in Experiment 9.

Experiment 1

In Experiment 1, subjects were required to search for their own name or a control name in a display containing between two and twelve words.

Subjects. Sixty undergraduate students from the University of California, San Diego, participated as subjects for course credit.

Equipment and Stimuli. Displays were presented on 15-inch SONY Trinitron Multiscan 100GS SVGA monitors controlled by Pentium-II PC computers. Timing accuracy was verified with a test keyboard modified so that a digital timing circuit generated key presses at selected intervals.

The experiment was run in sound-attenuated chambers with dim room illumination. Each display contained 2, 6, or 12 words, displayed in black against a light gray background. The 12-word display consisted of four rows of three uppercase words (see Figure 1). The outer dimensions of this array were 20 cm horizontally by 13.7 cm vertically (visual angle 16.0 by 11.1 degrees, based on a typical viewing distance of 70 cm). Six letter words measured 2.5 cm wide by 0.5 cm high (visual angle 2.1 by .41 deg) . The vertical separation between words on adjacent rows was 3.9 cm, and the horizontal separation between words on the same row was 6.5 cm (visual angle 3.19 by 5.31 deg). For the displays with 2 or 6 words, this number of positions were selected randomly without constraint from the total set of 12 positions. Subjects used the keyboard to respond, pressing the M key for target present, and the N key for target absent. They rested the index and middle fingers of their right hands on these response keys throughout the experiment. The target word was either the subject's first name or a "control name", which was the name of another subject who participated in the experiment. Distractors were chosen from a list of 100 words 3 – 6 letters long, of frequency greater than 3 per 100,000 in written English (based on Francis and Kucera, 1982, norms). Distractors were selected randomly from this list without replacement; thus, no display contained any duplicate items, although words used in one trial often reappeared in subsequent trials.

Design. The experiment was divided into ten blocks of trials, each consisting of 48 trials. Three main variables were manipulated: target being searched for (own name vs. control name), display set size (2, 6, or 12 words) and target presence/absence. The target being searched for was manipulated between blocks of trials. Half of the subjects searched for their own name on even-numbered blocks, and half searched for their own name on odd-numbered blocks. Display set size (2, 6, or 12 words) and target presence vs. absence were randomized within the block subject to a constraint of equal numbers of trial per condition. Within each block, half of the displays contained targets and half did not, and there were 8 trials in each of the 6 combinations of presence/absence X display set size.

Procedure. Subjects were given written instructions stating that they should search for the target word, responding as quickly and accurately as possible. At the beginning of each block, the computer displayed the target word for the upcoming block; it remained on the screen for 500 msec. After a delay of 1 sec, the first trial in the block was initiated. Each trial began with the presentation of a cross in the center of the screen. This remained for 500 msec, followed by 500 msec of blank screen, and then the display of words. The display remained present until the subject responded. When the response was detected, the display disappeared and then a 1 second pause was interposed before the presentation of the next fixation cross.

At the end of each block, the computer provided the subject with feedback consisting of mean reaction time and the total number of correct responses in the preceding block.

Results. RTs exceeding three standard deviations above the mean were trimmed (based on simulations by Van selst and Jolicoeur, 1994, this trimming seems appropriate). Figure 2 shows the mean correct RTs for the remaining trials as a function of target type (own name vs. control name), display set size, and target presence/absence. The remarkably linear RT results show the typical search slope (increase in RTs for larger display set sizes) and the usual pattern whereby the slope is steeper for "absent" trials than for "present" trials[3].

A 2 (target type: own name vs. other name) X 2 (target presence vs. absent) X 3 (display set size: 2, 6, or 12) Analysis of Variance was performed. Responses were significantly faster in own name blocks (950 msec) than control name blocks (1039 msec), $F(1, 59) = 13.8$, $p < .001$. The effect of display set size effect was smaller for own-name search compared to control-name search, as reflected in an interaction of display set size X target type, $F(2,118)=10.0$, $p < .001$. Target type did not interact with other variables.

Table 1 shows error rates. Subjects made fewer errors searching for their own name (3.0%) than they did searching for the control name (3.9%), a significant difference, $F(1, 59) = 6.1$, $p < .02$. There were also more misses (5.3%) than false alarms (1.6%), $F(1, 59)=19.1$, $p < .001$. There was no significant interaction between target type and display set size. There was also an effect of display set size, and an interaction between target presence/absence and display set size, $F(2, 118) = 17.3$, $p < .001$, reflecting an increase in the miss rate but not the false alarm rate with increased display set size. There were no other significant effects or interactions.

Discussion

Responses were faster overall when subjects searched for their own name as compared to the control name. This does not appear to reflect a speed-accuracy tradeoff. Slopes for target-present trials were slightly shallower for the own-name target (35.4 msec/item) than the control-name target (47.0 msec/item), as reflected in the significant display set size by target type interaction noted above. Nonetheless, for neither target type does the slope fall in the very low range ordinarily taken to reflect "pop-out" parallel search. Thus, the results provide little support for the proposal of capacity-free search for the subject's own name, as suggested by Mack and Rock (1998).

Experiment 2

The purpose of Experiment 2 was to determine whether search for an emotionally charged word differed from search for other words. The target was either an affectively charged word or an affectively neutral word. Emotionally charged and control words were borrowed from the stimuli used by McKenna and Sharma (1995); their stimulus set produced a robust emotional Stroop effect, often assumed to index putative automatic "grabbing" of attention by affectively charged stimuli.

Subjects. Forty-five undergraduate students from the University of California, San Diego, participated as subjects for course credit. Data from three subjects were discarded because they had overall error rates in excess of 20%.

Design. This was the same as Experiment 1 except that the target type variable reflected emotionally charged versus neutral rather than own name versus control name.

Procedure. Subjects were shown the target word (charged vs. neutral, in different blocks), and pressed the space bar when they were ready to begin the search. When they did so, there was a one second pause, the fixation cross for 500 msec, a 500 msec blank interval, and then the search display.

Results. Analyses were as in Experiment 1. Mean response times (RTs) are shown in Figure 3. Average time taken to search for affectively charged targets (1199 msec) was virtually identical to the time taken to search for neutral targets (1201 msec), F(1, 41) = 0.05, p>.5. Target type did not interact with other variables examined here (p>0.5). The effects of display set size, target presence/absence, and the interaction of these two variables were all highly significant as would be expected.

Error rates are shown in Table 2. There was no effect of target type (charged word vs. neutral), F(1, 41) = 0.9, p>0.3. The interaction between target presence/absence x display set size was significant F(2, 82) = 18.2, p < .001, as in the earlier studies.

Discussion

The results provide no indication that emotionally charged words are detected any more rapidly or efficiently than targets which are emotionally neutral words.

Experiment 3

Experiment 3 compared search for the subject's own name with a single control name as the sole distractor versus search for the control name with the subject's own name as the sole distractor. As described above, Mack and Rock reported that this comparison produced a clear-cut search asymmetry.

Subjects. Thirty-five undergraduate students from the University of California, San Diego, participated as subjects for course credit.

Design. This was the same as Experiment 1, except for target/distractor assignments. In the own-name condition, the target was the subject's own name and all distractors were copies of the same control name. In the control-name condition, the target was the control name and the distractors were all copies of the subject's own name.

Procedure. This was the same as Experiment 1.

Results. One subject was eliminated because this individual made errors on more than 20% of trials. Figure 4 shows mean correct pruned RTs. Subjects responded more quickly when searching for their own name (741 msec) than for the control name (775 msec), F(1, 33) = 10.0, p < .01. Slopes for the subject's name (16.7 msec/item) were not significantly shallower than for the control name (19.7 msec/item), F(2,66)=1.8, p>0.2. The effects of display set size, target presence/absence, and the interaction of these variables were all highly significant (see footnote 3).

Error rates are shown in Table 3. There was no significant effect of the target (own name vs. control), F(1, 33) = .3, p>.6. When the target was absent, larger display set sizes were associated with fewer errors, whereas when the target was present, they were associated with more errors. Reflecting this, the interaction between presence/absence X display set size was significant, F(2, 66) = 18.3, p < .001. As in the other studies, there were more misses than false alarms. Other effects involving errors were nonsignificant.

Discussion

The results were fairly similar to those of Experiment 1. Again, search for the subject's own name was slightly faster than for the control name in terms of overall RTs. However, the slopes in this experiment were not flatter for the own-name target, and again there was nothing to suggest parallel or "pop-out" search for a person's own name. Overall slopes were substantially lower here than in the preceding two studies. This probably reflects the use of fixed distractors; distractor homogeneity seems to facilitate search in all kinds of visual search tasks (Duncan and Humphreys, 1989)

Experiment 4

To further check our conclusion that search for names does not result in parallel search (or even reduce search slopes to any dramatic extent), Experiment 4 examined search for the subject's own name versus the control name when the distractors matched the target in length, thereby precluding a strategy of filtering based on length. In this experiment, the target was either the subject's own name or the control name, and the distractor was a word of the same length as the subject's or control name.

Subjects. Forty-five undergraduate students from the University of California, San Diego, participated as subjects for course credit. All had either a first or last name 3-5 letters in length.

Procedure. This was the same as Experiment 1.

Design. This was the same as Experiment 1, except the target being searched (own name vs. control) was 3-5 letters in length. The distractors were all instances of the same word (CAT if the target was 3 characters, TIME if it was 4 characters and HOUSE if it was 5 characters in length). Words were uppercase.

Results. Mean correct RTs are shown in Figure 5. There was a nonsignificant trend towards faster responses when subjects searched for their own name (777 msec) as compared to the control names (820 msec), F(1,44) = 3.1, p=.09. The slope for own name (15.5 msec/item) was not significantly different from that for the control name, however (17.5 msec/item), F(2, 88) = 1.6, p>0.2. The effect of target presence/absence, display set size, and the interaction of the two were all highly significant, p < .001 (see footnote 3). There were no other significant interactions.

Error rates are shown in Table 4. There was no significant effect of target type on error rates, F(1,44) = 0.8, p>.3. As in the other studies, there were more errors with larger display set sizes and more misses than false alarms. The interaction between the display set size and target presence/absence was again significant, F(2, 88)= 23.9, p < .001, reflecting an increase in the miss rate with display set size and a decline in the false alarm rate.

Discussion

Here, with homogeneous fields of distractors, there was a tendency for the subject's own name to be detected more quickly overall as compared to the control name, but the slope for detecting one's own name was not reliably flatter than that for detecting the control name, and again the search slopes offered no sign of parallel search or pop-out for subjects' own names.

Experiment 5

The purpose of Experiment 5 was to determine whether using the subject's own name as the distractor retards search when the identity of the target is held constant (differentiating this experiment from the target/distractor switch study in Experiment 3).

As noted in the Introduction to this article, Wolford and Morrison (1980) found that inserting the subject's own name as a (centrally presented) distractor in a digit classification task markedly impaired performance in a selective attention task. On the other hand, Bundesen et al. (1997) found that using the subject's own name as a distractor in a color-based partial report task had no effect.

One might try to reconcile these two results by supposing that (i) the name, once identified, does indeed seize and retain visual processing resources more intensely or persistently than would a neutral stimulus (cf Fox, Russo, and Dutton, 2002, for evidence of an analogous effect involving faces). , but (ii) filtering by color causes selection in the Bundesen et al. design to operate so efficiently that the name is not identified in the first place (or at least not before the processing for the parity judgment has progressed sufficiently to be unaffected by any such seizure of resources). How, given these two assumptions, should one explain why distractor type had no effect in Bundesen et al. study, what about the Wolford and Morrison finding? Here, the relevant stimulus was not differentiated from the distractor by color, but rather by location (the relevant digits flanked the centrally presented word), and names produced substantial disruption seemingly reflecting capture of attention. Spatial selection normally seems to be more effective than color-selection, not less effective (e.g., von Wright, 1970; Moore and Egeth, 1998; see Pashler, 1998, for a review). However, this difference has been shown with foveal targets or targets and distractors that are both scattered around parafoveal locations. Spatial selection may not be nearly so efficient when the distractors are foveal and the targets are eccentric (a situation relatively less studied in conventional attention designs).

Putting these points together, one conceivable interpretation (consistent with the two assumptions enumerated above) might be that filtering was not terribly effective in the Wolford and Morrison study because of the particular spatial placement of target and distractor just noted, thereby allowing the names to exert a potent effect upon attentional allocation. By contrast, the color cue in the Bundesen et al. study might have allowed reasonably efficient selection, blunting any effect of the subject's own name.

If this interpretation has merit, what should we expect to observe when the name plays the role of a distractor in a visual search task? Given the relative inefficiency of search with words, it seems virtually certain that distractors in word search will receive more extensive processing than did the distractors in either Bundesen et al. or Wolford and Morrison's studies. More concretely, it seems likely that the name will be identified on many trials well before the search has been completed. (On target-present trials this should often happen before the target is detected, whereas on target-absent trials, it will presumably occur on virtually all trials prior to the termination of search. Note that this would be expected to occur even if, as the experiments presented above have suggested, the name does not cause attention to be drawn to itself any sooner than would a neutral stimulus.) Thus, if the potential reconciliation of the two studies mentioned above is correct, we should expect to find that the subject's own name is an especially potent distractor, whose presence will slow both correct rejections and also detection of neutral targets.

A second alternative account of the results discussed thus far would claim that names, once identified, do not seize hold of visual attention any more intensely than other stimuli. Thus account is obviously fully consistent with the Bundesen et al. finding, but would not be so easily reconciled with Wolford and Morrison's findings of disruption from flanking names. If this alternative is correct, we would expect that placing the subject's own name as a distractor in the present study should have little effect.

We will return to assessing the merits of these two lines of analysis after the results of the present study have been described.

Subjects. Forty-three new undergraduate students from the University of California, San Diego, participated as subjects for course credit.

Design. The target was the same neutral word (Chair) on all trials. The distractors consisted of words randomly selected from the same set as that used in Experiment 1, with one name inserted amongst these words (either the subject's own name or a control name). Words were all uppercase. There were 10 blocks of trials, alternating between own name distractor and control name distractor blocks (half the subjects started with own name). The presence or absence of the target and display set size (2, 6 or 12) were manipulated within the block. There were 48 trials per block, 8 in each of the six (presence/absence X display set size) cells.

Procedure. This was the same as Experiment 1.

Results. Data for two subjects were discarded due to error rates greater than 20%. Figure 6 shows mean latencies of correct responses with outliers trimmed as in Experiment 1. RTs were not detectably different when the subject's own name was a distractor (1169 msec) versus the control name (1171 msec), $F(1, 40) = .1$, $p > 0.5$. There were no interactions between distractor type and other variables ($p>0.20$). The usual effects of display set size, target presence/absence, and the interaction between these two variables were all significant at $p < 0.001$.

As seen in Table 5, error rates were not reliably different for own name distractor (4.9%) than control name distractor (4.7%), $F(1, 40) = 0.3$, $p>0.6$. As usual, the false alarm rate (7.0%) was significantly higher than the miss rate (2.5%), and increasing display set size was accompanied by significantly more errors. There was an interaction between target presence/absence and display set size, $F(2, 80) = 59.6$, $p < .001$, reflecting growth of the miss rate but not the false alarm rate with display set size. There were no other significant effects or interactions.

Discussion

The subject’s own name appears to be no more potent as a distractor than is a control name. There is no evidence that the name draws attention any more quickly, or “holds” it any more effectively or persistently, than a neutral stimulus. Nor does its presence seem to interfere with an ongoing search process in any other way. This seems to contrast rather starkly with the findings of Wolford and Morrison (1980), who found that names seemed to be intrusive distractors in a digit-parity judgment task.

Two possible reconciliations of the Wolford and Morrison (1980) study with the Bundesen et al. (1997) results were discussed in the Introduction to the present experiment. One of these suggested that names seize and retain attentional resources once identified, but specific features of the Bundesen et al. (1997) design (namely exclusion of the names based on location) prevented that initial identification from ever taking place. The second account suggested that names produce no such effect (leaving the explanation for the Wolford and Morrison result unspecified).

The present results clearly favor the second account. The subject’s own name failed to seize and retain attention more successfully than a neutral stimulus even in a design providing ample opportunity for the name to be detected. This in turn suggests that the Wolford and Morrison (1980) effect – interference with an ongoing digit comparison task caused by the occurrence of the subject’s own name in the foveal position – must have some other cause. In recent work in our laboratory (Harris and Pashler, forthcoming), we report the results of follow-up studies closely modeled after Wolford and Morrison, suggesting that the results reflect surprise contingent on the rarity with which the names were presented, rather than any seizure of attention that persists over trials.

Experiment 6

We return now to the processing of emotionally charged stimuli. Experiment 6 was similar to Experiment 5, but it examined the effect of having emotionally charged distractors. Displays either included entirely emotionally charged distractors or entirely emotionally neutral distractors, but each set of distractors were heterogeneous.

Subjects. Thirty-eight undergraduate students from the University of California, San Diego, participated as subjects for course credit.

Design. The target was the same word (Chair) on all trials. The distractors were a random selection of words from one of two lists (emotionally charged vs. neutral) borrowed from McKenna and Sharma (1995), with displays containing heterogeneous distractors.

Procedure. This was the same as Experiment 1.+

Results. Figure 7 shows mean latencies of correct responses with outliers trimmed as in Experiment 1. RTs for emotionally charged distractors (1229 msec) were virtually identical to those for neutral distractors (1226 msec), $F(1, 37) = 0.2$, $p > 0.5$. However, there was a reliable interaction of distractor type and target presence/absence, $F(1, 37) = 6.2$, $p < .05$, reflecting a slightly smaller effect of target absence for the neutral distractors. There was also a significant 3-way interaction between the distractor type, target presence/absence, and display set size $F(2, 74) = 4.4$, $p < .05$. As the reader can verify in the figure, the interaction is very small in magnitude; to the present authors, not interpretable. The main effects of display set size, target presence/absence, and the interaction between these two variables were all significant at $p < .001$ (see footnote 3).

Error rates (Table 6) were not significantly different for charged distractors (5.1%) than neutral distractors (4.8%), $F(1, 37) = 0.4$, $p>0.5$. The miss rate (8.2%) was significantly higher than the false alarm rate (1.7%), $F(1, 37) = 54.1$, $p < .001$. As usual display set size had a significant effect on errors. There was an interaction between target presence/absence and display set size, $F(2, 74) = 38.6$, $p < .001$, reflecting an increase in the miss rate but not the false alarm rate with display set size. There were no other significant effects or interactions.

Discussion

Emotionally charged words proved to be no more effective distractors than neutral words, as assessed with either overall RTs or search slopes. While there were two very small and hard-to-interpret interactions involving distractor type, these do not suggest any substantial processing differences between emotionally charged distractors and neutral stimuli.

Experiment 7

Experiment 7 again examined the effect of using the subject's own name as a distractor. Rather than embedding just a single copy of the name among a larger number of distractors, however, in one condition of this experiment all the distractors were copies of the name.

Subjects. Sixty-three undergraduate students from the University of California, San Diego, participated as subjects for course credit.

Design. The target was the same word (Chair) on all trials. The distractors were homogeneous, consisting either of the subject's own name or of the control name.

Procedure. This was the same as Experiment 1.

Results. Figure 8 shows mean latencies of correct responses with outliers trimmed as in Experiment 1. RTs were not detectably different whether the distractors were copies of the subject's own name or the control name (837 msec for both), $F(1, 62) = 0.0$, $p > 0.5$. There were no interactions between distractor type and other variables ($p > 0.30$ for all). Again, the main effects of display set size, target presence/absence, and the interaction between these two variables were all significant at $p < 0.001$.

Error rates (Table 7) were not reliably different for the own name distractor (3.8%) than the control name distractor (3.4%), $F(1, 62) = 2.3$, $p > 0.1$. As in all the studies described here, the miss rate (4.9%) was higher than the false alarm rate (2.3%), and increases in display set size were accompanied by significantly more errors. There was an interaction between target presence/absence and display set size, $F(2, 124) = 38.0$, $p < .001$, reflecting a rise in the miss rate but not the false alarm rate with increases in display set size. There were no other significant effects or interactions.

Discussion

In line with the results of Experiment 5, there was again no sign that the subject's own name was a more potent distractor than a control name. In this experiment, where many copies of the name appeared in all the distractor positions, there can be no doubt that the own name would be identified early in every trial; thus, the results support the conclusions discussed in connection with Experiment 5 above.

Discussion of Experiments 1 – 7

The results so far can be summarized quite concisely. Whether or not the subject's own name is included among the distractors in a visual search task involving words seems to have no meaningful effect on performance in studies that collected more substantial amounts of data as compared to previous studies, and which examined a variety of different target/distractor combinations. In light of these data, it would be hard to maintain that the subject's own name draws attention involuntarily in any robust way.

When the subject voluntarily searched for his or her own name, on the other hand, there was a noticeable and consistent speedup in response times, accompanied in one case by a statistically significant reduction in search slopes. In no case, however, did slopes in the own-name search tasks approach the range normally associated with "pop-out" or parallel search.

The use of emotionally charged words produced less dramatic effects on attentional processing. Charged targets were not detected any more efficiently than neutral targets. As distractors, there were hints that emotionally charged words produced some reliable changes in performance but such effects were quantitatively very small and qualitatively uninterpretable. Based on studies involving the Emotional Stroop Effect, one might speculate that if more salient effects are there to be observed, they may be restricted to unusually anxious individuals. Given the large amount of data collected here, we can say with some confidence that effects of emotionally charged distractor wordsin visual search are quite negligible for unselected individuals.

Unfortunately, the results described here conflict rather starkly with some of the findings reported by Mack and Rock (1998). These authors presented several fairly small data sets in which search for the subject's own name yielded search slope functions within the "pop-out" range. The source of the difference between the two studies is not easy to determine. Mack and Rock's words were approximately 0.5 to 1.8 degrees visual angle in length -- if anything slightly smaller than the words presented here. The overall extent of their display was not specified, but it appears quite similar based on their schematic illustration (p. 131). Measurement error and random variation between subjects does not seem likely to have caused the discrepancy, given the consistency of the present data. Experiment 1, for example, examined detection of the subject's name among common English words. Slopes averaged 35.4 msec/item, with a standard deviation of 17.4 msec/item. In a corresponding experiment, Mack and Rock (p. 133) reported a mean slope of 5.7 msec/item. Only one of our 59 subjects showed a slope as low as Mack and Rock mean (2.4 msec/item). Similarly, Experiment 3 involved search for the subject's own name as a target with the control name as distractor. Here, our slopes averaged 17 msec per item, with a standard deviation of 9 ms. Mack and Rock reported a mean slope of 6.5 msec/item for a virtually identical task (p. 136); only three of our 34 subjects showed a slope that low. Similar lack of overlap was observed for target-absent slopes.

On the other hand, our results are very congenial to findings of Bundesen et al. (1997), who used a color filtering task in which the subject's own name was sometimes inserted. Our results go beyond those findings, however, in showing that even in visual search tasks where the distractors must be examined as possible targets (and cannot be excluded based on a low-level attribute like color, as in the Bundesen et al. study), the subject's name is no more potent as a distractor than a control name.

As has often been noted, examining slopes for speeded search may not provide an optimal assessment of capacity limitations (e.g., Palmer, 1995; see Pashler, 1998, for a review). One reason is that increasing the display set size would cause the error rate to increase even if subjects are equally effective at identifying each item in a large or small display due to statistical decision noise. Subjects might potentially compensate for this effect by taking more time to process larger displays. A second reason is that the increases in RT with display set size might reflect post-perceptual (e.g., memory comparison operations, rather than perceptual analysis per se. Thus, increases in RTs with display set size do not necessarily reflect perceptual capacity limitations (although of course they may well reflect that). To round out the picture and provide converging tests of the conclusions described in the previous paragraphs, Experiments 8 and 9 used a different, and in some ways more powerful, test for capacity limitations in search involving high-priority stimuli.

Experiment 8

The purpose of Experiment 8 was to examine whether search for an observer's own name is subject to perceptual capacity limitations. For this purpose, we used a design first developed by Shiffrin and Gardner (1972), in which the primary dependent variable is accuracy rather than RT. Search accuracy is compared when subjects search displays with a fixed display set size, differing only according to whether the elements in the array are presented simultaneously or successively. Twelve words were presented on each trial (see Figure 9). Words were presented either one at a time, or two at a time; each was followed by a mask after 47 msec. If perceptual processing of the subject's own name does not require limited capacity, performance should be comparable in the two conditions; this equality of performance is normally found for very simple stimuli like letters, but not for stimuli as complex as words (see Pashler, 1998, for a review).

Subjects. Thirty-nine undergraduate students from the University of California, San Diego, participated as subjects for course credit.

Apparatus and Stimuli. Displays were as in Experiment 1 except as noted. Each display contained a sequence of words and masks displayed in two positions, immediately above or below fixation.

Six-letter words measured 6.5 cm wide by 1.5 cm high. The distance separating the two words was 2.3 cm. Subjects used the keyboard to respond, pressing the M key for target present, and the N key for target absent. The target word was either the subject's first name or a control name (the name of another subject who participated in the experiment). When present, it could appear in any position in any frame. Distractors were chosen from the same list as in Experiment 1.

Design. There were three variables in this experiment. The first was target type (own name target versus control name target). This was manipulated between blocks of trials. The other two variables were target presence/absence and presentation condition (successive versus simultaneous, described below) varied randomly within a block. There were 10 blocks, each consisting of 32 trials. Within a block, there were 8 trials in each of the four combinations of target presence/absence and presentation condition.

Procedure. As seen in Figure 9, words were presented in one of two conditions. In the simultaneous condition, they were presented two at a time. In the successive condition, they were presented one at a time, with the position of each word selected at random. In both conditions, each time a word was presented it was followed by a mask in the same position after 47 msec. One display of words always began 400 msec after the previous display. Subjects were instructed to take their time in deciding whether the target was present. Feedback was provided, with different tones played to signal correct or incorrect responses.

Results. Mean error rates are shown in Table 8 and Figure 10. There were more misses (20.6%) than false alarms (13.6%), as reflected in a significant effect of target presence/absence, $F(1, 38)=12.5$, $p < .01$. Subjects made fewer errors while searching for their own name (15.2%) vs. the control name (19.0%); though the difference was not significant, $F(1,38)=4.0$, $.05 < p < .06$. Error rates were higher in the simultaneous condition (19.3%) than the successive condition (15.0%), $F(1,38)=42.5$, $p < .001$. There was also a significant interaction of sim/succ X presence/absence, $F(1,38)=39.7$, $p>.001$, reflecting the fact the successive advantage was basically confined to target-present trials. Finally, the three-way interaction of target condition, simultaneous vs. successive, and presence/absence was significant, $F(1,38)=6.8$, $p < .02$, seemingly reflecting the fact that when the target was the name, the increase in misses in simultaneous condition was somewhat attenuated.

Not surprisingly in light of the fact that the exposure duration was fixed, there was substantial variation in different subjects' accuracy, reflecting both statistical noise and true differences between subjects. An examination of the simultaneous-successive difference as a function of a subject's overall level of performance disclosed no clear relationship between the two; a substantial successive advantage was observed throughout the performance range.

Discussion

In an unspeeded, tachistoscopic search task, the subject's own name was detected somewhat more accurately than the control name. In addition, there was a substantial advantage for search in sequences where the words were presented one at a time as compared to two at a time, particular for target-present trials (as would be expected if inadequate time and perceptual resources cause misses rather than false alarms). Critically, the advantage for successive presentations occurred both for detection of the control name and for detection of the subject's own name, indicating the existence of capacity limitations in both tasks.

The overall successive advantage was not significantly reduced in search for the subject's own name, but there was a 3-way interaction suggesting some reduction in the successive advantage on target-present trials. This interaction does not allow us to draw any conclusions about the "extent" of capacity limitations in the two search tasks, which is in any case not a well-defined question in the presence of differences in absolute levels of performance as a function of target type[4]. What the results show quite clearly, however, is first, that the better detection of the subject's own name is not restricted to speeded search, and second, that substantial capacity limitations remain even with this type of target.

Experiment 9

Experiment 9 again used the simultaneous vs. successive comparison, but here we examined the effect of having targets that were emotionally charged versus neutral.

Procedure. This was the same as Experiment 8 except as noted.

Subjects. Fifty undergraduate students from the University of California, San Diego, participated as subjects for course credit.

Apparatus and Stimuli. The target word was either a neutral or an emotional word chosen as in Experiment 2.

Design and Procedure. These were the same as Experiment 8 except that the targets varied in emotionality.

Results. Mean error rates are shown in Table 9. There were significantly more errors for emotionally charged targets (26.8%) than for neutral targets (24.2%), $F(1, 49) = 7.1$, $p < .05$. Misses (30.0%) occurred more frequently than false alarms (21.0%), $F(1, 49) = 20.9$, $p < .001$. Error rates were higher in the simultaneous condition (30.3%) than the successive condition (20.7%), $F(1, 49) = 82.1$, $p < .001$. There was no significant interaction between target presence/absence and target type (charged vs. neutral), $F(1, 49) = 1.0$, $p>.3$, or between simultaneous-successive condition and target, $F(1, 49) = 0.82$, $p>.3$. However, there was a reliable interaction between simultaneous-successive condition and target presence/absence, $F(1, 49) = 93.7$, $p < .001$, reflecting a substantial increase in the miss rate in the simultaneous condition as in Experiment 8.

Discussion

There is no sign here that an emotionally charged targets are detected any more readily than other stimuli, or that their detection requires less perceptual capacity. In fact, accuracy was very slightly albeit significantly worse for the emotionally charged targets (the basis for this difference, assuming it is not spurious, remains unclear).

General Discussion

This paper described nine experiments examining visual search tasks with "high-priority stimuli" (the subject's own name or an emotionally charged word) appearing in the role of target or distractor. There were three main findings with respect to names.

First, subjects appear genuinely more efficient in detecting their own name compared to another individual's name. This is apparent in both speeded and unspeeded search tasks. This result supports a previous finding by Bundesen et al. (1997) and extends it from single-item recognition to divided attention.

Second, perceptual capacity limitations are still very much evident when an observer searches for his or her own name. This is reflected both in substantial search slopes in the speeded tasks, and in superior accuracy when searching successively as compared to simultaneously exposed brief displays. This result disputes the findings of Mack and Rock (1998), as noted above.

Third, there is no evidence that a subject's own name is a more potent distractor in a visual search task than is some other individual's name, even though in the difficult search tasks used here (unlike in the partial-report task of Bundesen et al., 1997) there is little doubt that many distractors undergo substantial processing. The results conflict with the commonsense idea that names have the power to seize or retain visual attention more powerfully than do other stimuli.

With respect to emotionally charged stimuli, the results show no advantage for detection of emotionally charged words, and no real indication of enhanced distractor potency for such words. In the word search design, it appears that emotionally charged words have no special power either to grab or hold visual attention.

Interpreting the Results

How should one interpret the observation that a subject's own name is somewhat more readily detected than other comparable stimuli, whereas it is no more potent than comparable stimuli in the role of distractor? The most straightforward interpretation would seem to be that the effects seen here are the consequence of subjects having at least some experience searching for their own name. Many studies have demonstrated that practice makes visual search more efficient. This learning effect is stimulus-specific and long-lasting (Dumais, 1980; Hillstrom and Logan, 1998; Rabbitt, 1978; Schneider and Shiffrin, 1977), and it transfers to tasks where already practiced targets are searched for amongst novel distractors. It seems reasonable to suppose that over the course of many years, most people have had numerous, albeit intermittent, experience searching for their own name. It stands to reason that this may have resulted in their being more proficient in detecting this stimulus as compared to other words. Evidently, this practice has not reduced their ability to reject the name as a distractor or caused an "automatic attention interrupt" for this stimulus (as claims of Schneider and Shiffrin, 1977, might have seemed to imply). Of course, in addition to experience searching for their own names, people would also have encountered these strings of letters with relatively high frequency. By itself, however, word frequency does not seem to have very pronounced effects on visual search (Rayner and Raney, 1996), so we would speculate that mere frequency is probably not sufficient to account for the relatively fast responses to the names.

The results described here echo the findings of Tong and Nakayama (1999) using faces. These investigators found that observers were consistently faster in searching for their own face as compared to the face of strangers (even when given hundreds of exposures to the stranger face). Tong and Nakayama also found that observers had no difficulty rejecting their own face as a distractor.

It is not completely clear from the results described here how one should attempt to reconcile the present findings with the results of Wolford and Morrison (1980). In a forthcoming article (Harris and Pashler, forthcoming) we examine this puzzle in more detail. While the effect of names in the Wolford and Morrison task was found to be highly replicable, it also proved to be confined to the first few trials on which the name was presented. This leads naturally to the view that the critical factor is not the attention-grabbing power of names per se, but rather the surprise evoked by the appearance of something personally relevant in a setting in which it was unexpected, not any enduring tendency for names to draw attention. A precondition for this, of course, is the identification of the word; some of the visual factors mentioned above may help explain why this would likely have occurred in the Wolford and Morrison design.

As mentioned in the introduction, Shapiro and his colleagues (e.g., Arnell, Shapiro, and Sorensen, 1999; Shapiro, Caldwell, and Sorenson, 1997) found reduced attentional blink effect and “repetition blindness” effects for subjects’ own names. The results are certainly consistent with the view that the “blinked” target is actually identified even though it is not reportable, a concept that can reasonably be described as a “late selection” model of the attentional blink effect (Isaak, Shapiro, and Martin, 1999; Shapiro and Terry, 1998). Indeed, there are various compelling pieces of evidence favoring such an account of the blink effect (e.g., Vogel, Luck, and Shapiro, 1998). However, a late selection model of the blink effect need not entail the validity of late-selection theory as a whole (cf. Pashler, 1998). In the attentional blink design, performance is limited by brevity of presentations and the processing of a preceding target, whereas in the present study, it is limited by the simultaneous requirement to identify many other words. It may be that semantic analysis can occur without reaching observers’ conscious awareness in the blink situation, but on the other hand, more basic perceptual capacity limits may prevent the semantic analysis from even occurring in the first place in the experiments described here. The “repetition blindness” phenomenon can also arise in situations where perceptual load at any one moment is modest (Fagot & Pashler, 1995), and it may reflect limitations at the level of working memory storage and retrieval, making the term “blindness” possibly inappropriate.

With respect to emotionally charged words, the present results suggest that these stimuli behave more or less like neutral stimuli. This finding should not be overinterpreted, however. First of all, words are probably relatively weak emotional stimuli. It is conceivable that different results would be obtained with the use of emotionally charged pictures. Emotional pictures have been found to evoke stronger responses than words (Lang, Greenwald, Bradley, and Hamm 1993; De Houwer and Hermans, 1994). Furthermore, some interesting recent studies by Fox and colleagues indicates that people are sometimes slow to disengage attention from pictures of threatening stimuli such as angry faces (Fox, Russo, and Dutton, 2002), especially when they suffer from subclinical anxiety states (Fox, Russo, Bowles, and Dutton, 2001). This would seem to be a profitable area for future research. Second, the population of subjects may be important in modulating any effects of emotionally charged stimuli. As noted above, studies using the emotional Stroop effect have not infrequently found an effect of emotionally charged words confined to anxious subjects. It is conceivable that some relatively small subset of individuals would show such effects in visual search tasks as well. This possibility would seem to merit investigation.

Concluding Remarks

In the beginning of this article it was pointed out that the processing of high-priority affective words in search tasks has relevance to three broad issues. The findings described here are clear-cut enough that the implications for these issues can be stated quite concisely.

First, with respect to the traditional debate between early- and late-selection theories, the present results are consistent with the emerging consensus favoring a modified version of early selection theory, and the belief that late-selection theorists greatly overestimated the capacity for parallel perceptual analysis of complex stimuli. In this respect, the results echo findings of other recent studies of word perception (cf. Pashler, 1998, for a review). To mention just one example, Kahneman and Chajczyk (1983) found that while words people attempt to ignore produce a Stroop effect, this effect is substantially reduced when perceptual processing load of unattended stimuli is increased (see also Besner and Stolz, 1999).

Second, it was noted that the best-known case of apparent bottom-up attentional capture, capture by abrupt visual onsets, now appears to be contingent on task set, suggesting that many phenomena labeled “automatic” may actually be contingently rather than absolutely automatic (Folk, Remington, and Johnston, 1992). The present results (specifically the fact that names and emotional words seem to lack any special potency as distractors) suggest that capture by high-priority affective stimuli is not likely to challenge this interpretation, if in fact automatic capture by such stimuli occurs at all. Ordinary intuitions about attentional capture may, however, reflect phenomena that are not illuminated by visual search tasks. We recently showed that whereas abrupt visual transients do not capture attention when the subject has a task set to ignore transients, nonetheless they do seem to draw attention when people adopt a relaxed “default” set, expecting merely to look at a display of some kind, or to judge its aesthetic character (Pashler and Harris, 2001). It is quite possible that the default set also privileges emotionally charged stimuli.

Finally, it was noted that because contemporary attention research has been devoted almost exclusively to the study of affectively neutral stimuli, some of what has been learned from such studies might not generalize to high-priority affective stimuli. The present results suggest that with respect to emotionally charged words and names in the context of a search task, conclusions derived from studies of neutral stimuli seem to generalize well. Naturally, however, this might not extend beyond words to other, more “intense” kinds of emotionally charged stimuli, such as disturbing pictures or painful stimulation.

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Footnotes

1. The authors suggested that this demonstrated that the effects could not be accounted for by attention shifts; however, attention shifts are not necessarily accompanied by overt eye movements, so this assumption might be doubted.

2. The authors cited above in relation to processing of names appeared unaware of the earlier works on this topic, so they did not provide suggestions about how the various results might be reconciled.

3. To improve readability, we omit F values for certain overall ANOVA tests that collapse over the stimulus priority variables of interest (and thus shed no light on the effects of these variables). The omitted tests simply confirm that RTs were slower and errors more numerous for larger display set sizes and for target-absent trials, and that display set size effects were larger for target-absent as against target-present trials. These findings are found in essentially all speeded visual search tasks involving complex stimuli (and were significant in all of the reaction-time studies reported here).

4. For a discussion of this kind of scaling problem, see Loftus (1978).

Table 1

Mean percent errors for Experiment 1

Own Name		**Present**	**Absent**
display size:	2	3.2	1.9
	6	4.3	1.3
	12	5.5	1.5

Control Name		**Present**	**Absent**
display size:	2	4.2	1.5
	6	6.0	1.5
	12	8.3	1.8

Table 2

Mean percent errors for Experiment 2

Charged Target		**Present**	**Absent**
display size:	2	6.6	5.2
	6	8.3	4.2
	12	12.4	4.5

Neutral Target		**Present**	**Absent**
display size:	2	7.3	3.0
	6	8.5	3.7
	12	12.9	2.8

Table 3

Mean percent errors for Experiment 3

Own Name		**Present**	**Absent**
display size:	2	4.9	3.8
	6	4.3	2.8
	12	8.4	2.1

Control Name		**Present**	**Absent**
display size:	2	4.1	4.0
	6	4.9	2.6
	12	10.4	2.1

Table 4

Mean percent errors for Experiment 4

Own Name		**Present**	**Absent**
display size:	2	3.3	3.4
	6	2.9	2.1
	12	6.0	1.8

Control Name		**Present**	**Absent**
display size:	2	3.6	3.1
	6	4.0	3.0
	12	6.3	1.8

Table 5

Mean percent errors for Experiment 5

Own Name		**Present**	**Absent**
display size:	2	2.9	4.2
	6	6.6	2.3
	12	10.9	2.4

Control Name		**Present**	**Absent**
display size:	2	3.4	3.3
	6	7.2	1.9
	12	11.2	1.1

Table 6

Mean percentage of errors for Experiment 6

Charged Distractor		**Present**	**Absent**
display size:	2	7.4	3.2
	6	5.6	1.5
	12	11.3	1.7

Neutral Distractor		**Present**	**Absent**
display size:	2	5.8	1.9
	6	6.2	1.0
	12	13.2	0.8

Table 7

Mean percentage of errors for Experiment 7

Own Name		**Present**	**Absent**
display size:	2	4.0	3.7
	6	4.8	1.4
	12	7.2	1.5

Control Name		**Present**	**Absent**
display size:	2	2.9	3.1
	6	3.7	2.1
	12	6.6	1.8

Table 8

Mean percentage of errors for Experiment 8

Own Name	**Present**	**Absent**
successive	13.1	14.0
simultaneous	21.2	12.4

Control Name	**Present**	**Absent**
successive	16.9	15.9
simultaneous	31.5	11.9

Table 9

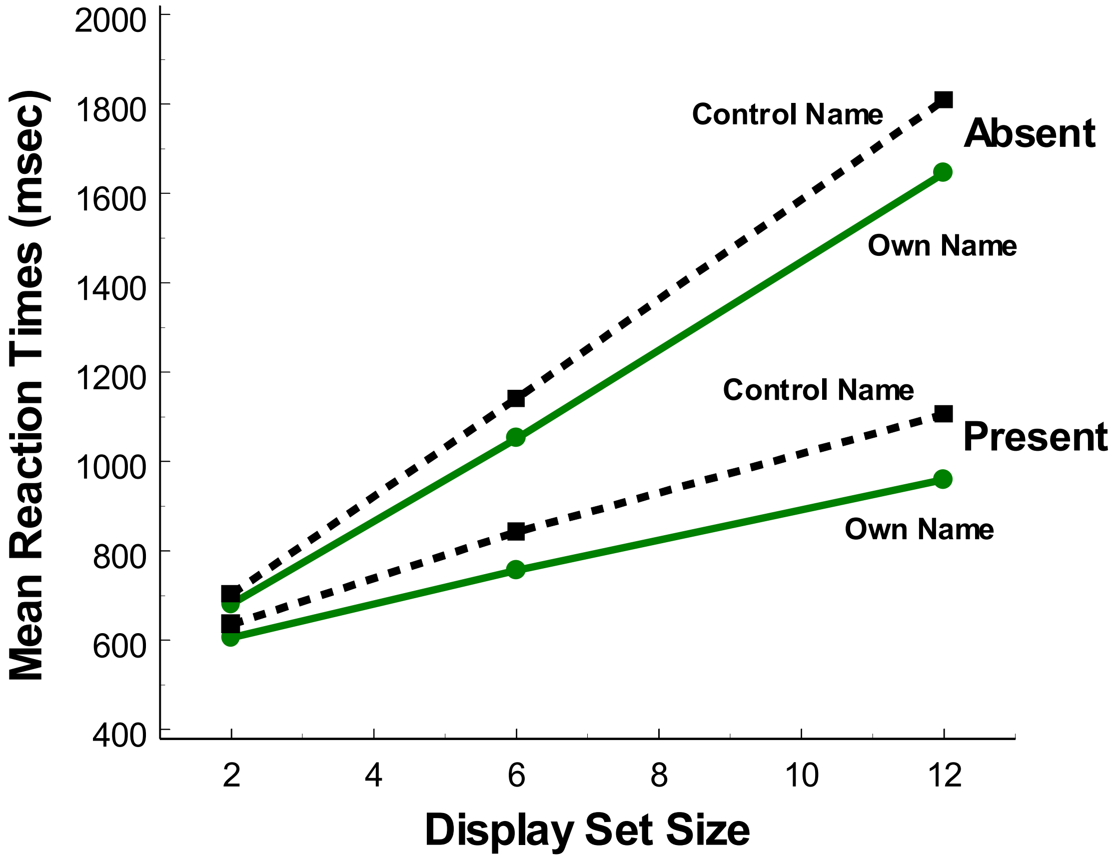
Mean percentage of errors for Experiment 9

Charged Target	**Present**	**Absent**
successive	19.9	23.2
simultaneous	43.5	20.6

Neutral Target	**Present**	**Absent**
successive	18.9	20.7
simultaneous	37.4	19.6

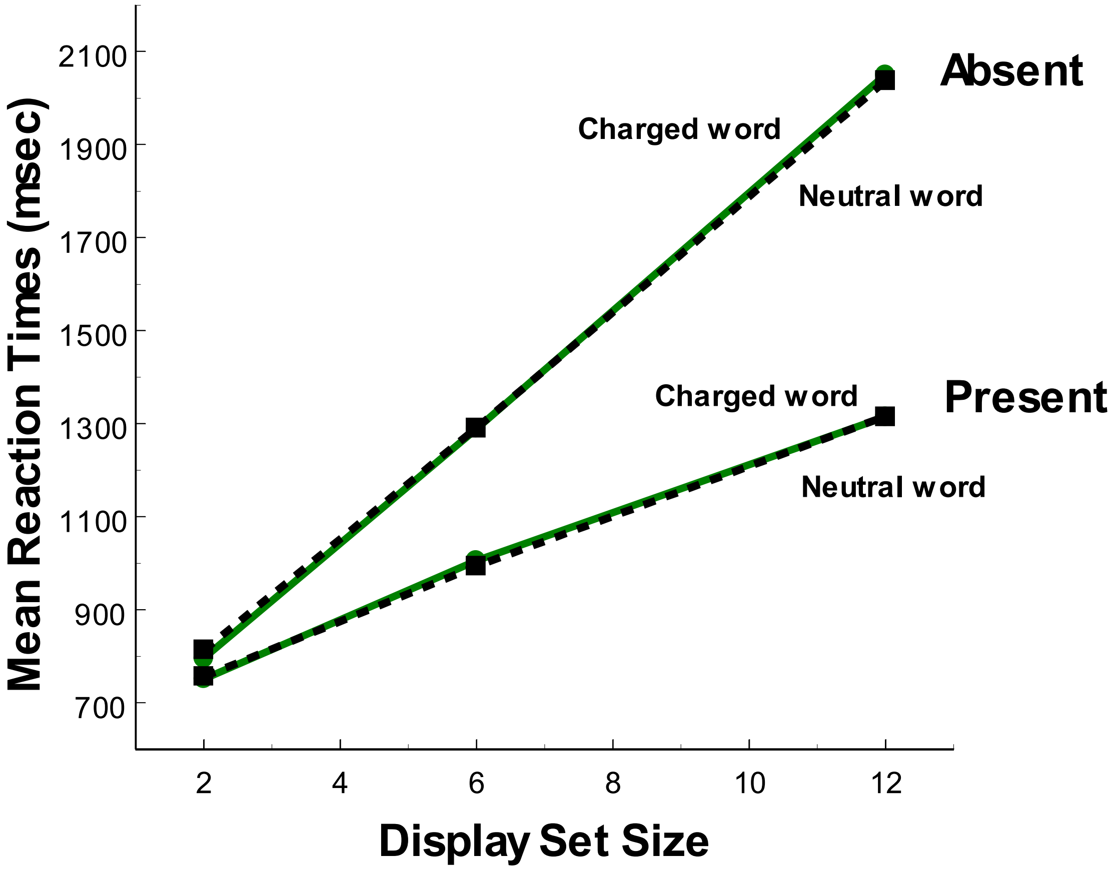
Figure 1

Figure 2



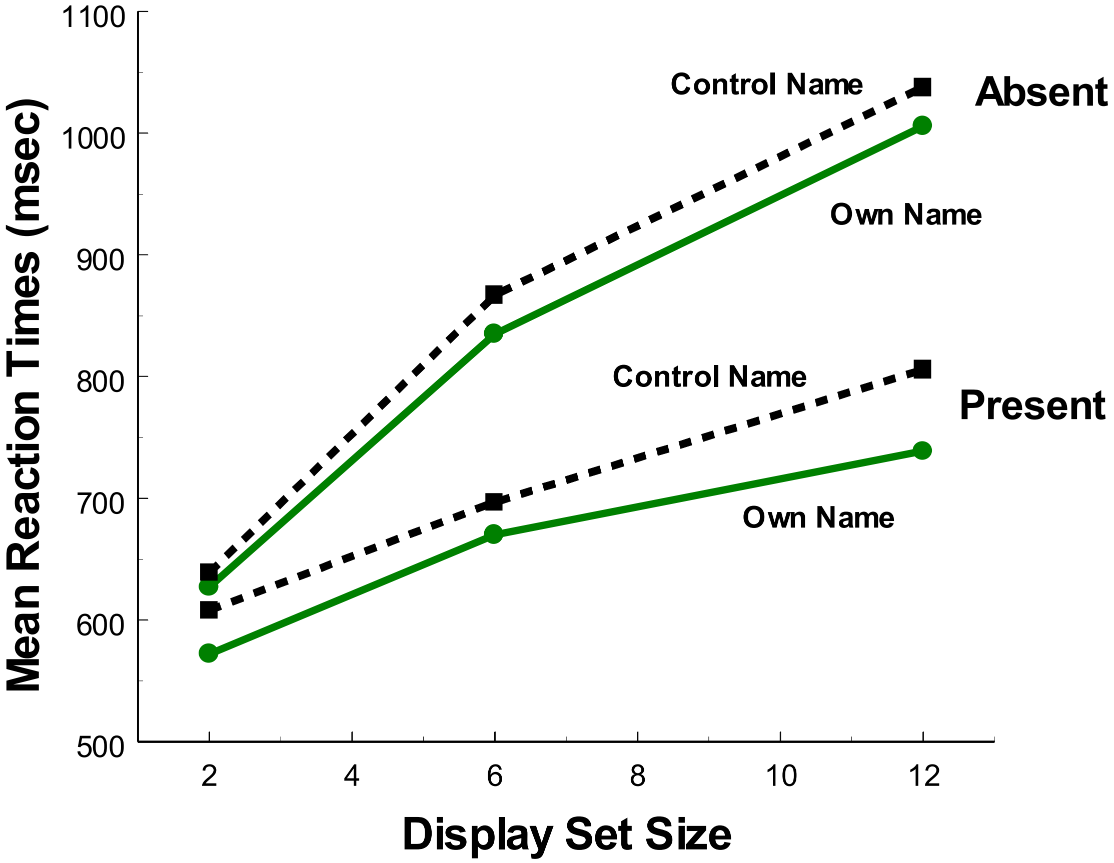
Mackbund1 RT (60 subjects)

Figure 3



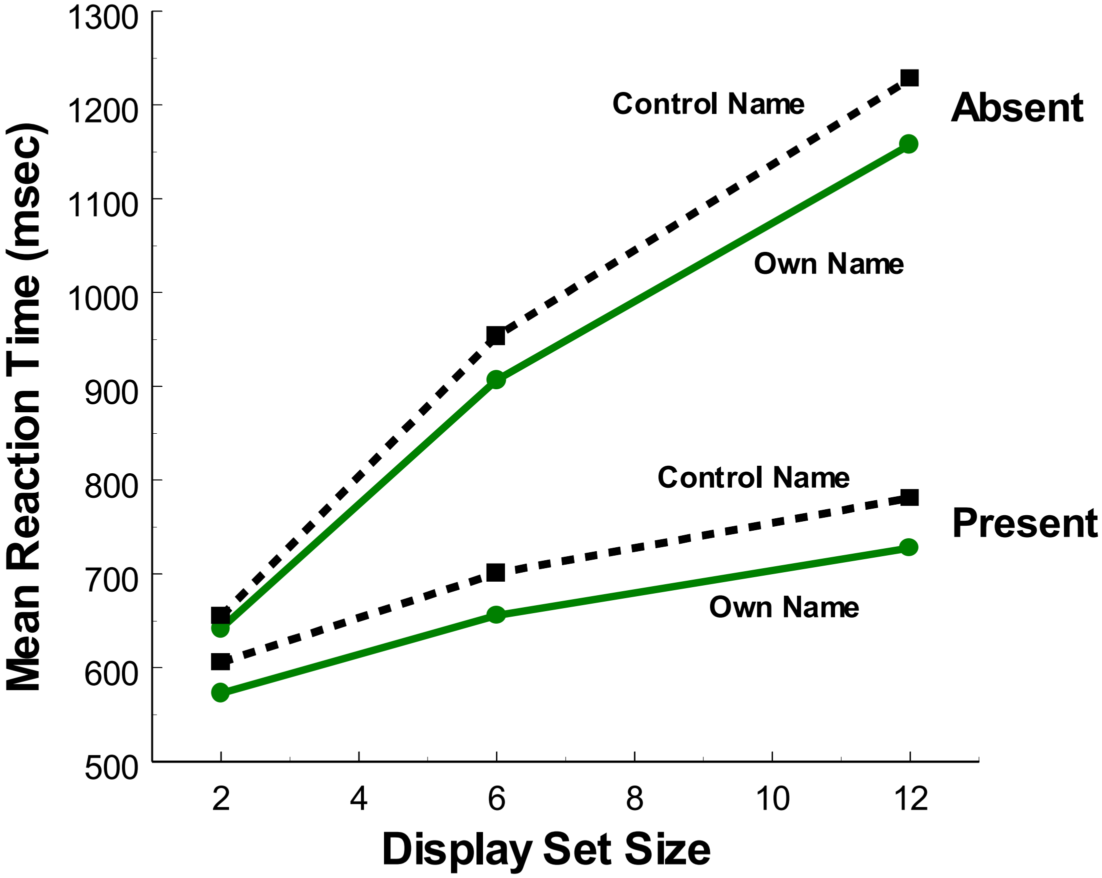
Experiment 5 RT (42 subjects)

Figure 4



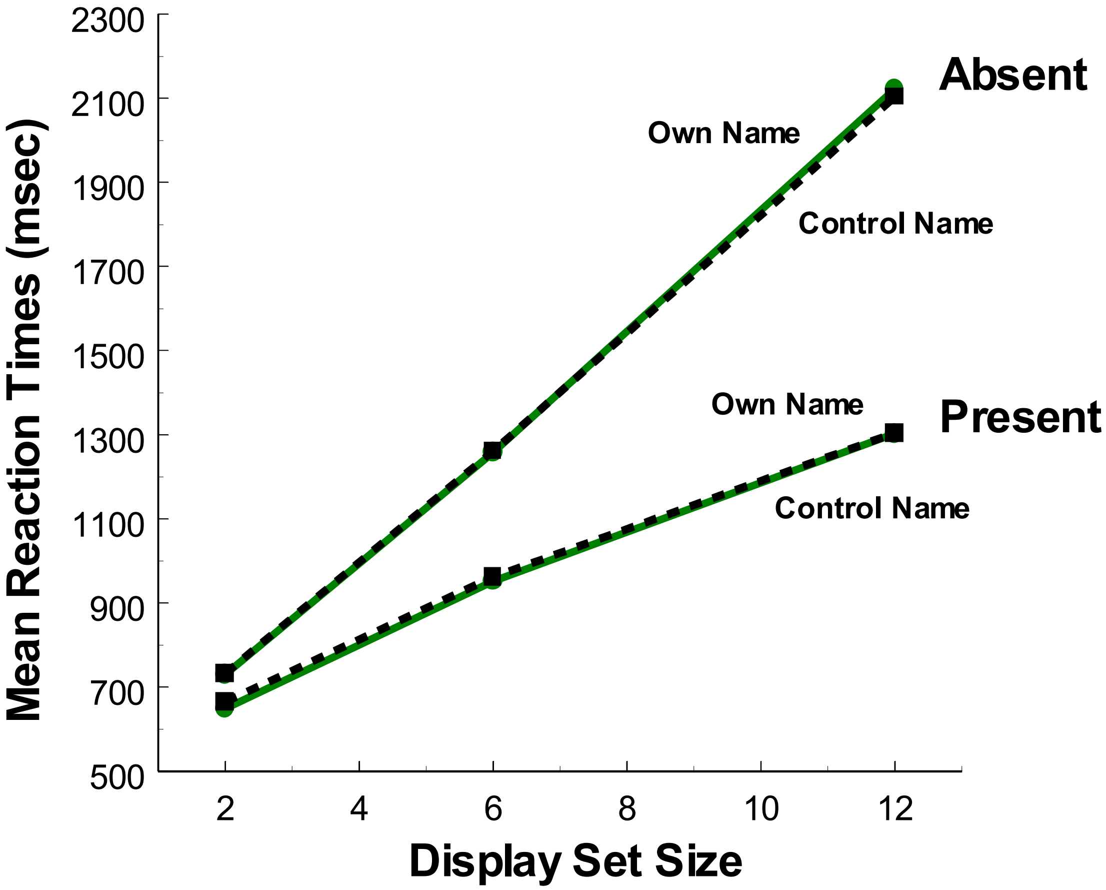
Mackbund4 RT (34 subjects)

Figure 5



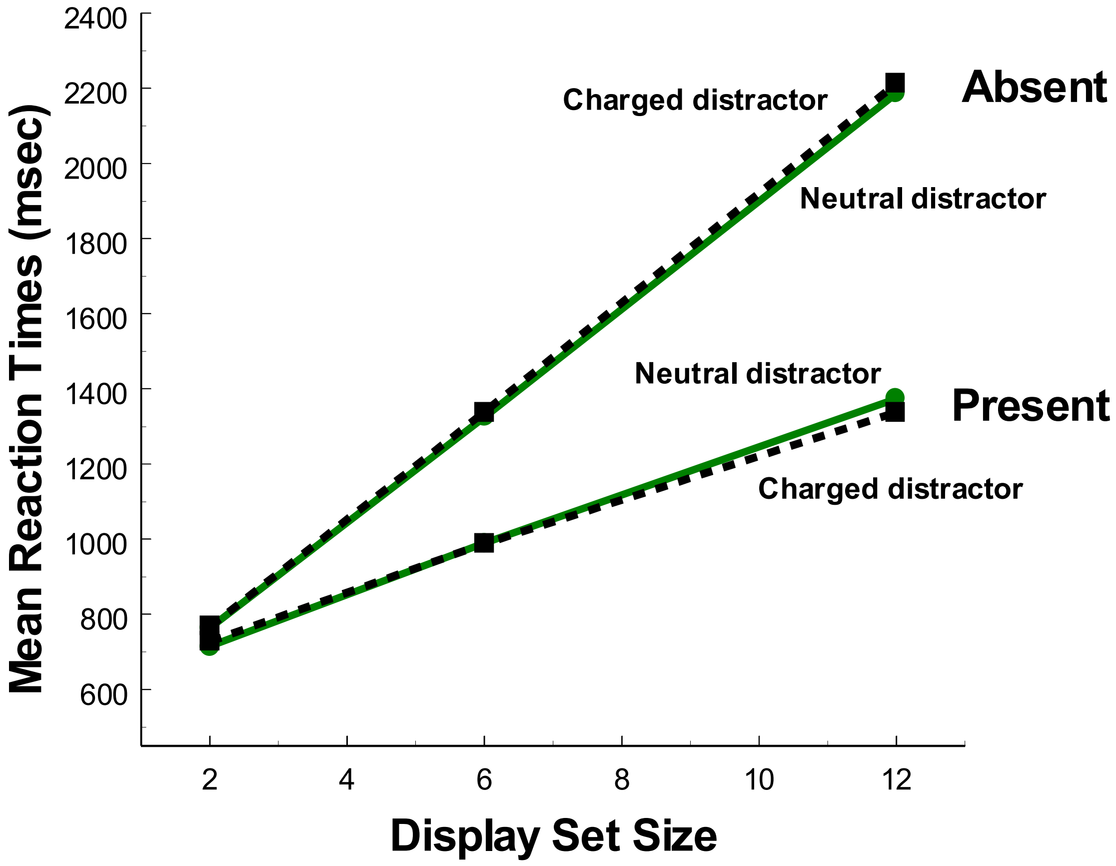
Mackbund3 RT (45 subjects)

Figure 6



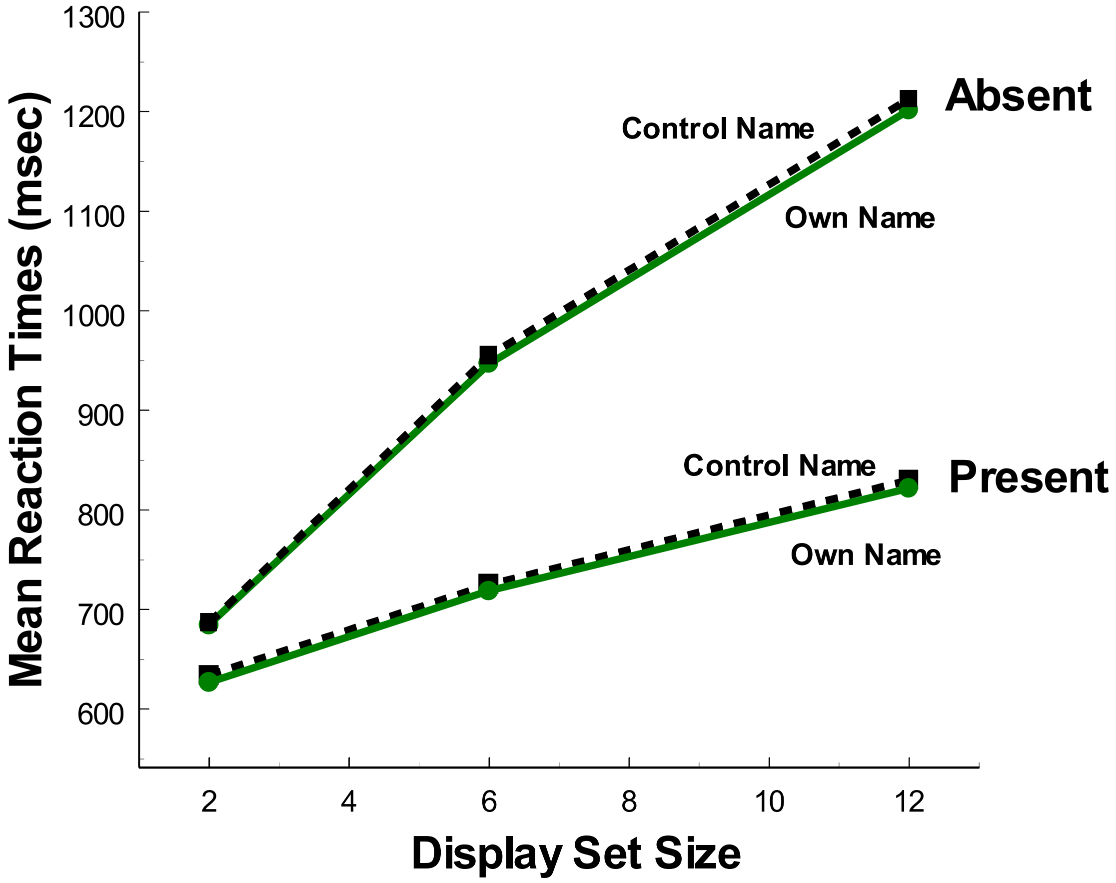
Mackbund2 RTs (n=41)

Figure 7



Mackbund6 RT (38 subjects)

Figure 8



Mackbund7 RT (40 subjects)

Figure 9

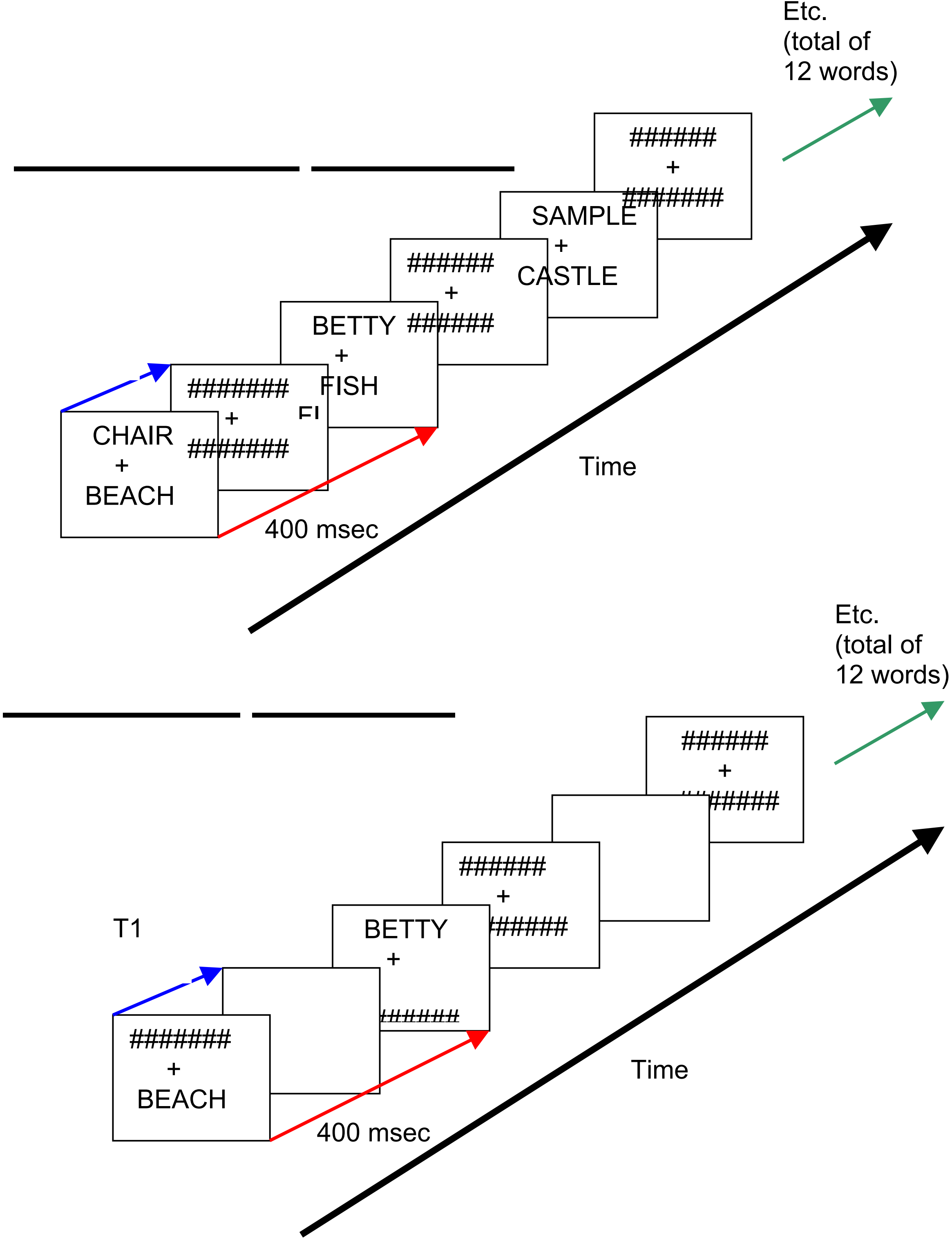

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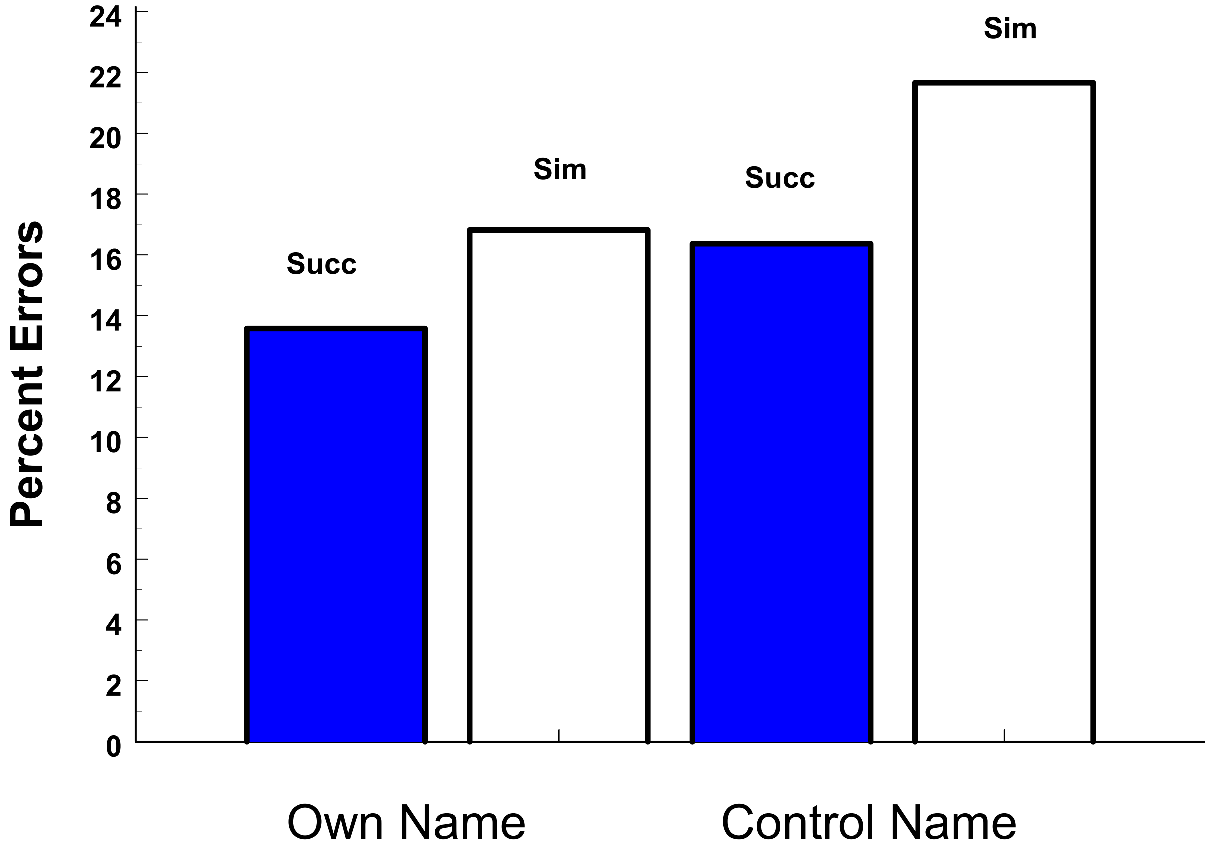
Figure 10


Percent Errors
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Control Name