Visual Attention in Deaf and Normal Hearing Adults: Effects of Stimulus Compatibility

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Visual perceptual skills of deaf and normal hearing adults were measured using the Eriksen flanker task. Participants were seated in front of a computer screen while a series of target letters flanked by similar or dissimilar letters was flashed in front of them. Participants were instructed to press one button when they saw an H, and another button when they saw an N. Targets H and N were flashed with flanking letters that were either H or N, creating response-compatible and response-incompatible arrays. Flankers were presented at different distances from the targets and reaction times were measured. In the present study, reaction times were significantly faster for the hearing group than for the deaf group. However, the hearing group had significantly more errors on this task than the deaf group, suggesting that the deaf participants may have been more deliberate in their responses. In addition, the deaf group revealed a significantly greater interference effect than the hearing group at a parafoveal (i.e., 1.0°) eccentricity. These findings suggest that deaf individuals may allocate their visual resources over a wider range than those with normal hearing.

KEY WORDS: visual attention, congenital deafness, flanker compatibility effect

Although the majority of neural connections in humans are patterned during fetal development, refinement of neural organization depends on sensory information received from the world around us during childhood as a product of neural activity and synaptic transmission (Baer, Conners, & Parasido, 2001). Accordingly, congenital sensory impairment in one modality may lead to a reorganization of neural connections and, consequently, perceptual differences. The maturing nervous system is remarkably plastic and, in the presence of a sensory impairment, it is reasonable to expect some degree of reorganization within one or multiple sensory modalities.

Visual perceptual differences between individuals with severe-to-profound deafness and individuals with normal hearing may be experiential in nature simply because the life experiences of congenitally deaf individuals place large demands on the visual system. From infancy, deaf individuals must rely on visual input for communication, by supplementing oral communication with lipreading or, in most cases, learning a manual mode of communication such as American Sign Language. One could argue that using a visual form of communication would demand that visual attention be allocated to both central and peripheral fields because signed communication requires the receiver to fixate on the face or lips of the signer while maintaining some degree of attention to events.
in the periphery (Siple, 1978). The space in which a signer communicates typically extends beyond the central visual space of the person with whom they are communicating. Moreover, the motions of sign vary dynamically, placing demands on the receiver to allocate attention to various spatial positions in a short amount of time (Parasnis & Samar, 1985). These demands on the visual system are increased further because the deaf individual must also use visual input to monitor events in the periphery. Whereas individuals with normal hearing use both audition and vision to pick up environmental cues around them, such as people entering a room or objects moving from one place to another, deaf individuals, even those who do not use sign language, are required to rely on visual input to monitor ongoing peripheral events. For deaf individuals, it may be the case that allocating visual resources to both the central and the peripheral fields leads to perceptual differences from their normal hearing peers. Therefore, cases of congenital deafness provide an exceptional opportunity to examine the perceptual consequences of altered sensory experience.

Two theories address how the remaining sensory systems might adjust in the presence of a sensory impairment (Hoenig, 1978; Parasnis, 1983; Reynolds, 1978). The perceptual deficit theory operates on the premise that sensory systems complement each other and work best when they are all intact. Therefore, a deficit in one sensory system will negatively affect the development of the remaining systems. Conversely, the perceptual compensation theory states that impairment in one sensory system may cause compensatory proficiency in other sensory systems (Parasnis, 1983). Reynolds (1993) proposed two forms of neural reorganization that might account for such sensory compensation. First, areas of the brain normally associated with the impaired sensory modality might develop the ability to process information from one or more of the intact sensory systems. Second, neural areas for these remaining senses may acquire enhanced functional and processing capabilities.

Within the body of literature examining visual perceptual skills of deaf and normal hearing individuals, some studies support the perceptual deficit theory (e.g., Quittner, Smith, Osberger, Mitchell, & Katz, 1994; Rothpletz, Ashmead, & Tharpe, 2003, and others show evidence for the perceptual compensation theory (e.g., Loke & Song, 1991; Parasnis, 1983). In addition, there is some evidence that there are no differences at all between deaf and normal hearing individuals on some visual attention tasks (Loke & Song, 1991; Tharpe, Ashmead, & Rothpletz, 2002). Given that a consistent pattern of superior, inferior, or equivalent visual performance has not been established, it has been suggested that visual differences between deaf and normal hearing individuals are task specific and largely experiential in nature (Parasnis, 1983; Parasnis & Samar, 1985; Stivala, Moreno, Richard, Barraud, & Raphael, 1998).

Recently, Proksch and Bavelier (2002) examined the gradient of visual attention of deaf and normal hearing participants. The authors used a paradigm developed by Lavie and colleagues (Lavie, 1995; Lavie & Cox, 1997; Rees, Frith, & Lavie, 1997). In this experiment, participants were asked to identify a shape as quickly as possible in one of six circular frames arranged in a ring around a fixation point. A distracting shape was presented in either the center of the ring (central condition: 0.5° from the fixation to the left or right) or outside of the ring (peripheral condition: 4.2° from fixation to the left or right). The distracter was either an element from the target set or a neutral shape and was, therefore, compatible, incompatible, or neutral relative to the target. Participants were asked to ignore the distracting shape and focus on the target task. The authors hypothesized that deafness would lead to an altered gradient of attention across the visual field, such that attentional resources would be equally distributed across the visual field. The authors found that as load increased, the deaf population exhausted their central resources at a lower load than the hearing participants. In the peripheral condition, the hearing population exhausted their peripheral resources at a lower load than the deaf population. The authors suggested that the expanded resources in the periphery demonstrated by the deaf participants were drawing away resources that would normally be used for central attention.

The aforementioned studies used various measures of visual attention, such as visual search tasks, to assess participants. Visual search tasks are often used to study visual perception and require participants to recognize targets embedded among a display of noise (Eriksen & Schultz, 1979). One variation of a visual search task, first described by Eriksen and Eriksen (1974), has proven to be a popular method of evaluating central visual filtering. Referred to as the flanker task, this paradigm eliminates the search element and requires the participant to make a judgment about a target stimulus in a fixed location when it is flanked by similar or dissimilar elements. The flankers are controlled to appear in varying proximity to the targets. Eriksen and Eriksen observed that reaction time on this task was dependent on the distance between the target and the flankers and whether the flankers were response compatible or response incompatible with the target; that is, whether the flankers were the same as or different from the targets. In Eriksen and Eriksen’s original description, participants were asked to press a lever to the left when the target was an H or R and to the right when it was an S or C. Three letters on either side of the target served as the flankers. The letters were either response
compatible (i.e., $HHHHHHH$) or response incompatible (i.e., $SSSHSSS$). Eriksen and Eriksen proposed that the visual system has a minimal channel capacity that is larger than that required for selecting a single letter. As a result, if other letters are present in close proximity, they are processed along with the target letter. If the letters surrounding the target are response incompatible, the participant must choose which way to move the lever, since they cannot choose both. The time needed to execute this selection process adds to the reaction time and is called the flanker compatibility effect.

The present study used the Eriksen flanker task to examine further the visual perception skills of deaf and normal hearing adults. Given that deaf individuals rely on visual information to communicate and monitor the world around them, it is reasonable to propose that they allocate their visual resources over a wider area than hearing individuals. In this context, it is possible that deaf adults will show more interference from incompatible flankers than normal hearing adults, even when the flankers are spaced far from the target letter. Differences in performance on the Eriksen flanker task between groups of deaf and normal hearing individuals may reflect a broader distinction between the two populations related to allocation of visual resources in social situations or, perhaps, in more centralized tasks such as reading.

The specific purposes of this investigation were (a) to replicate findings from previous studies suggesting that reaction time varies within participants when the flankers are compatible or incompatible, and when the flankers vary in distance from the target, and (b) to assess if the flanker compatibility effect is different between deaf and normal hearing participants.

## Method

### Participants

Participants included 20 adults (8 men and 12 women) divided into two groups: those with normal hearing and those with severe-to-profound deafness. The deaf group comprised 4 women and 6 men, and the hearing group was made up of 8 women and 2 men. The participants ranged in age between 21 and 45 years, with a mean age of 29.7 years for the deaf group and 29.9 years for the hearing group. Hearing was evaluated using standard audiometric techniques. Those in the normal hearing group ($n=10$) demonstrated thresholds better than or equal to 20 dBHL for frequencies at octave intervals 500 to 4000 Hz bilaterally. Those in the deaf group ($n=10$) demonstrated a pure tone average for frequencies 500, 1000, and 2000 Hz that exceeded 80 dBHL for each ear. Participants in the deaf group experienced onset of hearing loss in both ears prior to 2 years of age. In addition, participants in the deaf group used sign language as their primary form of communication and were educated in programs using manual communication. The two groups were matched by age (within $\pm 24$ months) and IQ (within one standard deviation).

Three participants in the deaf group reported intermittent use of a hearing aid, 1 participant reported part time use but no benefit from a multichannel cochlear implant for the past 5 years, and 6 participants reported no use of any amplification system. Table 1 outlines the pertinent demographic information for each participant.

### Cognitive Evaluation

Previous research has suggested a strong relationship between IQ and reaction time (Deary, Der, & Ford, 2001; Luciano et al., 2001; Posthuma, Mulder, Boomsma, & de Geus, 2002). Therefore, participants were evaluated using the Test of Nonverbal Intelligence (3rd ed., TONI-3; Brown, Sherbenou, & Johnson, 1998). The TONI-3 is a nationally recognized, standardized test designed to measure intelligence, aptitude, abstract reasoning, and

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Note. TONI-3 = Test of Nonverbal Intelligence—Third Edition; Cl = cochlear implant; HA = hearing aid; M = man; W = woman.
problem-solving ability. The normative mean is 100 with a standard deviation of 15. To control for the potential effects of IQ, all participants had to demonstrate an IQ score that fell within normal limits (i.e., 2 standard deviations of the normative mean). Actual scores for each participant are specified in Table 1. As mentioned previously, the deaf and normal hearing participants were also matched so that their IQ scores fell within 1 standard deviation of each other.

The decision to use IQ as a between-subjects matching criterion was an effort to control for the potential influence of differences in intelligence between groups on reaction times. The mean IQ scores for the deaf and hearing groups were 82 and 86, respectively. An independent-sample, two-tailed t test revealed no significant difference in IQ between groups.

**Vision Screening**

Central visual acuity was screened for all participants using the Snellen Vision Chart (Strouge-Watt, 2004). The screening followed the recommended procedure for the Snellen chart. Specifically, each participant was asked to read a line representing normal vision at a distance of 20 feet using both eyes, and then each eye separately. All participants demonstrated normal or corrected-to-normal visual acuity.

**Apparatus and Procedures**

Stimuli were presented and the responses recorded using a Dell Pentium 3 computer with a Dell Trinitron 18-in. display monitor. Stimulus and collection parameters were programmed using MATLAB 6.0 and Psych-toolbox freeware. Participants sat directly in front of the monitor with their chins resting firmly in a chin rest at a distance of 18 in. The height of the chin rest was set 10 in. above the table so that the eyes of each participant would be directly in front of the computer screen. The height of the chin rest was held constant across participants. However, participants were able to adjust the height of the chair if they desired.

Participants were instructed to respond as quickly as possible to the target stimuli while keeping errors to a minimum. An external button box with two response buttons was used to indicate participant responses. Each response button was clearly labeled H or N. One half of the participants were instructed to press the keypad with their left index finger on the letter H and with their right index finger on the letter N. Opposite directions were given to the remaining half of the participants. Target letters H and N were selected because of their high feature overlap, making the task more difficult. The target stimuli were flanked by four (two on either side) response-compatible letters (i.e., HHHHH/NNNNN) or response-incompatible letters (i.e., HHHNH/NNHHN). To evaluate the effect of spacing, the letters were presented 0.05°, 1.0°, and 3.0° apart from each other, edge to edge, horizontally for both compatible and incompatible arrays. Control trials consisted of a target letter presented in isolation. The control trials were presented randomly among the test trials.

A single underscore character served as a fixation point on the monitor for the target stimulus. The fixation point appeared in the absence of the stimulus and disappeared simultaneously with the onset of the stimulus. In all conditions, the stimulus arrays were presented for 100 ms. Once the participant responded, the fixation point would reappear. This test arrangement was in agreement with the original description of the Flanker task (Eriksen & Eriksen, 1974).

Participants were instructed using written, signed, or oral communication. Instructions were first provided in a clear written format. Then, the task was explained verbally or in sign language according to the participant’s primary mode of communication. The deaf participants were shown an instructional video clip of a certified sign language interpreter signing the instructions.

Each of the 14 conditions (two target letters with compatible and incompatible flankers at each of three spacing conditions plus the two control conditions (i.e., H and N in isolation) was presented five times in a block of 70 trials. Each participant completed six blocks of 70 trials for a total of 30 trials per condition per participant. Therefore, a total of 420 data points was collected per participant. A practice block of 70 trials was given to each participant prior to initiating the test session. Similar to the experimental blocks, the practice block comprised a mixture of control trials and experimental trials.

**Results**

To avoid accidental responses or outliers, button responses were included in the analysis only if the response occurred between 200 and 1,200 ms following the onset of the array. In addition, responses were excluded if the participant pressed the incorrect key. Another type of error occurred if the participant did not press either button. In this case, the program timed out, automatically started the next trial, and the trial was not included in the analysis.

As is typical with reaction time data, median reaction times were computed. As there were no significant differences between the median reaction times for the target N or the target H for either group, the N and H reaction times were collapsed for both groups. The median reaction times for each participant for each
condition were averaged. The mean median reaction times for the deaf and hearing groups for response-compatible and response-incompatible arrays at each of the three spacing conditions are presented in Figure 1. On average, deaf participants demonstrated longer median reaction times than their normal hearing peers. All participants (deaf and hearing) demonstrated interference effects from response-incompatible flankers when they were in close proximity (i.e., 0.05° of separation), yet this effect diminished as the distance between flanks and targets increased.

The data were analyzed using a three-factor mixed model analysis of variance (ANOVA). The between-groups factor was hearing status. The repeated measures factors were target–flanker distance (i.e., 0.05°, 1.0°, and 3.0°) and response compatibility (i.e., response compatible and response incompatible). The dependent variable was median reaction times in milliseconds.

A significant main effect of compatibility was observed, indicating that participants were slower to respond when the surrounding elements were response incompatible, \( F(1, 36) = 57.09, p < .01 \). In addition, a significant main effect of distance, \( F(2, 36) = 105.60, p < .01 \), suggests that reaction times were faster when the spacing between the noise elements and the target was increased. Finally, a significant main effect of group was observed, \( F(1, 18) = 9.88, p < .01 \), demonstrating that reaction times were faster for the hearing group than the deaf group. These main effects were qualified by a significant interaction between compatibility and distance, \( F(2, 36) = 58.45, p < .01 \), suggesting that compatibility of the flankers created more interference when the flankers were close to the target than when distance from the target increased. In addition, there was a significant interaction between compatibility, distance, and group, \( F(2, 36) = 4.10, p < .05 \), which suggests the flanker compatibility effect varies between deaf and hearing participants, depending on the spacing distance between the target and the flankers.

To follow up on these significant interactions, planned analytical comparisons were completed between groups at each of the spacing conditions. There was a significant effect of compatibility, \( F(1, 18) = 74.89, p < .01 \), and group, \( F(1, 18) = 6.67, p < .05 \), for the 0.05° of spacing condition but no significant Group \( \times \) Compatibility interaction, suggesting that the flanker compatibility effect was similar for both groups at this eccentricity. At 1.0° of eccentricity, there was a significant effect of compatibility, \( F(1, 18) = 74.77, p < .01 \), and group, \( F(1, 18) = 12.95, p < .01 \), and a significant Compatibility \( \times \) Group interaction, \( F(1, 18) = 9.54, p < .01 \), indicating that the flanker compatibility effect was larger for the deaf group. Finally, for the 3.0° spacing condition, there was a significant effect of group, \( F(1, 18) = 8.86, p < .01 \), but no significant effect of compatibility or Compatibility \( \times \) Group interaction, suggesting a lack of compatibility effect for either group at this spacing condition.

As a further evaluation of group reaction time differences, the median reaction times associated with control trials were analyzed separately using a one-way ANOVA. The group median reaction times for control trials are shown in Figure 1. This analysis showed a significant effect of group, \( F(1, 19) = 5.72, p < .05 \), revealing longer reaction times for the deaf participants than normal hearing participants, even when no flankers were present.

**Figure 1.** Mean of the median reaction times (±1 standard error) for the deaf and hearing groups as a function of compatibility and target-flanker spacing. Error bars represent standard error of the mean.

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Recall that half the participants in each group were instructed to press the left button when the target letter was an H and the right button when the target button was an N. The other half of each group was given the opposite instructions. Theoretically, this method of balancing should control for any right- or left-handed dominance effects. An ANOVA was completed with the hand as the between-groups factor. The repeated measures factors were target-flanker distance (i.e., 0.05°, 1.0°, and 3.0°) and response compatibility (i.e., response compatible and response incompatible). The dependent variable was reaction time in milliseconds with the target letter H and then the target letter N. No significant effect was observed, indicating that it did not matter if the participant used his or her left hand or right hand to respond to the target letters H or N.

**Error Analyses**

The number of response errors was coded and analyzed for each condition. There were a total of 8,400 possible responses, of which 256 (3%) resulted in one of four types of errors. Recall that response errors included those that occurred when the participant (a) hit the wrong button, (b) hit the response button too soon (i.e., <200 ms), (c) waited too long to respond (i.e., >1,200 ms), and (d) did not hit a response button before the program timed out and started the next trial. The total number of errors that occurred because the participant hit the wrong button equaled 199 and accounted for the vast majority of the errors (77%). Therefore, the other error types (i.e., responding too slow, too late, or not at all) were not included in this analysis.

Despite the small number of errors recorded from hitting the wrong key, interference effects from irrelevant flanks were noted. The highest percentage of errors occurred when the flanks were in close proximity and decreased as the target-flanker spacing distance increased. When separated by group, compatibility, and distance, as seen in Figure 2, the percentage of errors is highest for the hearing group when presented with incompatible flanks in close proximity.

The percentage of errors as a result of hitting the wrong key was subjected to an ANOVA. Again, the between-groups factor was hearing status. The repeated measures factors were target-flanker distance (i.e., 0.05°, 1.0°, and 3.0°) and response compatibility (i.e., response compatible and response incompatible).

Results revealed a significant main effect of compatibility, *F*(1, 17) = 3.40, *p* < .05, which demonstrated that for the most part, the percentage of errors was greatest when the stimulus arrays were response incompatible. This main effect was accompanied by a significant interaction between compatibility and group, *F*(1, 17) = 8.50, *p* < .05, suggesting that when the flanks were incompatible, there was a larger percentage of errors for the hearing group. In addition, a significant main effect of distance was found, *F*(1, 17) = 7.50, *p* < .01, demonstrating that the percentage of errors decreased as the target-flanker spacing increased.

It was also of interest to determine if either group was responding significantly faster when participants committed an error as compared with the trials when they responded correctly. The median reaction times of the errors and the nonerrors for each group were analyzed using two separate ANOVAs. In the first ANOVA, the median reaction times for hearing participants' error- and nonerror responses were analyzed. The results showed a significant main effect of response

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*Figure 2. Percentage of wrong-key errors for the deaf and hearing groups as a function of compatibility and target-flanker spacing.*
type, $F(1, 18) = 16.61, p < .01$, suggesting that for trials in which the hearing participants did commit an error, the reaction time was significantly faster than for trials where no error was committed. In contrast, an ANOVA of the error and nonerror responses for the deaf participants did not yield a significant difference, suggesting that increased reaction time was not responsible for an increase in the number of wrong-button presses for the deaf group.

**Discussion**

Previous studies comparing visual perceptual abilities of deaf and hearing participants have reported a variety of findings using peripheral and central stimuli. Some studies have demonstrated superior visual perception skills by deaf individuals compared with their normal hearing peers, some have found equivalent performance, and others have shown poorer performance.

The results of the current investigation support previous findings of the flanker compatibility effect. Specifically, it was found that the flanker compatibility effect decreased with increased spacing between the target letter and the irrelevant flankers for all participants, deaf and normal hearing alike. It should be noted that median reaction times observed in this study are comparable to those reported by Eriksen and Eriksen (1974) in their original description of the task. For example, in their control condition, when the target letter was presented without flankers, Eriksen and Eriksen reported a reaction time of approximately 433 ms. In the present study, the median reaction time for normal hearing individuals in the control trial was 431 ms.

A notable finding of the current study was the overall difference in reaction time between deaf and normal hearing participants. In general, the hearing participants were faster than the deaf participants for each of the experimental conditions as well as for the control condition. One explanation for the difference in reaction time between deaf and hearing groups may be the use of letters in the stimulus arrays. There is some evidence suggesting that deaf and hearing individuals differ in their ability to process English letters (Doehring & Rosenstein, 1974; Marschark, 1993). Specifically, some studies suggest that deaf and hearing individuals use different mechanisms to process print. For example, Ross (1983) postulated that deaf individuals process letters on a configurational basis. This is in contrast to hearing individuals who process letters on a phonological basis. Proksch and Bavelier (2002) argued that for letters, hearing individuals have auditory associations and phonological representations that are not readily available to deaf individuals and may impact processing of letters. To support this claim, Proksch and Bavelier examined reaction times for deaf and hearing individuals with a task involving the visual processing of letters and geometric shapes. The results demonstrated that the reaction time for processing geometric shapes was equivalent for the deaf and normal hearing groups. However, hearing individuals were significantly faster than their deaf counterparts when processing letters.

In contrast to the Proksch and Bavelier findings (2002), a recent study by Rothpletz et al. (2003) revealed differences in reaction times between deaf and hearing participants on a visual attention task, even though they used nonlinguistic elements. In that study, participants were asked to turn their heads to a light in a distracter and a nondistracter condition. In the distracter condition, participants were required to ignore the distracters and respond only to the target stimuli, similar to the present study. The target stimuli were located at 10°, 40°, and 65° of eccentricity. For each target location, the hearing participants were faster than the deaf participants. In other words, even when nonlinguistic target stimuli were used, there was still a difference in reaction time between the deaf and hearing groups. Rothpletz et al. reported that the difference in reaction time between deaf and hearing groups ranged between 42 and 65 ms. Similarly, in the present study, the difference in reaction time between the deaf and hearing participants for incompatible stimuli ranged between 50 and 81 ms. Therefore, it is unlikely that hearing participants in the current study were faster than the deaf participants simply because the stimulus arrays contained linguistic, as opposed to nonlinguistic, elements.

Rothpletz et al. (2003) offered that differences in reaction time between deaf and hearing groups in their study may have occurred because deaf individuals are more deliberate with their responses; that is, they tend to emphasize accuracy of response at the cost of responding more slowly. This explanation can also be applied to the current study. Specifically, evidence for the deliberate tendency of deaf individuals can be found in the error rates in the present experimental procedure. Overall, the hearing participants made a significantly greater number of errors than the deaf participants. Moreover, the reaction times during the commission errors by the hearing group were faster than the reaction times during nonerror responses. This finding suggests a certain level of impulsivity by the normal hearing participants that was not observed in the deaf participants. Put another way, the deaf participants had a lower number of errors than the normal hearing participants, and their reaction times during the commission of errors were equivalent to their reaction times during nonerror responses. Insomuch as deaf individuals have input from only one sensory system available for
monitoring their environment as opposed to two available to hearing persons, one could argue that deaf individuals are more careful overall with their visual resources, resulting in slower reaction times and fewer errors on a visual attention task such as the flanker paradigm.

Perhaps the most compelling finding of the current study can be seen in the interaction between spacing, compatibility, and group. The locus of this interaction exists at the 1.0° of spacing condition. Eriksen and Eriksen (1974) previously reported that when the display letters were separated by 1.0°, reaction times of typical adults for response-compatible and response-incompatible arrays were essentially the same. However, in the present study, with 1.0° of spacing between the target and flanks, the flanker compatibility effect existed for both groups, but was significantly larger for the deaf group. In other words, response-incompatible flankers caused less of an interference effect for the normal hearing group at 1.0° of spacing than they did for the deaf group. Again, this finding might be explained by the visual demands placed on deaf individuals. Recall that one implication of deafness is a need to monitor the events in the periphery using the visual system. At the same time, deaf individuals must focus centrally on the lips and face of the person with whom they are communicating. To look away at an event in the periphery may come at a cost of missing an important piece of dialogue. Therefore, one could speculate that deaf individuals learn from an early age to focus their visual attention in front of them in addition to keeping visual resources allocated further out in the periphery. In this context, one might expect deaf individuals to allocate visual resources over a wider area, explaining why, in the present study, deaf participants demonstrated a greater flanker compatibility effect for the 1.0° target–flanker spacing condition than the normal hearing participants. This explanation is in agreement with work by Proksch and Bavelier (2002) who speculated that deafness might lead to compensation in the mechanisms that allocate visual attention across the visual field. Specifically, they suggested that deficits in hearing might result in a redistribution of visual attention toward peripheral locations in order to monitor the peripheral field.

In summary, there is reason to expect that a sensory impairment in one modality might lead to perceptual differences in one or more of the remaining intact senses. The present study examined differences in visual perception across different target–flanker spacing conditions and found that deaf adults showed a significantly greater flanker compatibility effect farther out in the periphery than normal hearing adults. It would be of interest to examine the source of this difference in future work; that is, whether this finding also holds true for deaf individuals who are oral communicators or if it is specific to the perceptual experience of deaf individuals who use sign language.

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