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Peripheral Vision on Choral Singing: Practical and Didactical Proposals

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Abstract

Humans can focus their attention upon a visual location while capturing information from peripheral involvement. This is particularly important in activities where decisive stimuli appear along our visual field. This is the case of sports, car driving and, as we sustain, choir singing. Singing in a choir implies, frequently, dividing attention for, at least, music sheet and conductor. In fact, despite the ideal situation would be not having to focus on the music sheet, allocating all attentional and perceptive resources to the conductor, not always the music is so well known and decorated that allows this total liberation. Thus, we propose the use of some strategies to maximize the use of peripheral vision. Conductor's position vis-à-vis the choral singers, amplitude and placing of his gestures, color of clothing to wear and positioning of the choral singers' music sheet are some of those. Implications for educational purposes are stated.

Subject Areas

Art

Keywords

Peripheral Vision, Division of Attention, Choral Singing, Conductor, Eye Movement

1. Introduction

The vast majority of daily activities that we perform is sustained, in sensory terms, upon the vision, being decisive for the effectiveness and safety of those actions the visually collected and processed information, like going down un-

even stairs, crossing a busy road, changing a lamp or, like Lee ([1]) pointed out, walk along a crowded place. Also in the field of sports and car driving, for example, the number of studies that proved being decisive the use of perceptive strategies to maximize this collection and respective processing is significant. One of the aspects with which studies dealt was the use of peripheral vision, coupled with the ability to split attention for more than one task or stimulus. We can understand peripheral vision as the ability to detect and react to stimuli located/picked up outside the foveal vision, without moving our eyes or head. The fovea is the most central area of the retina, which, according to some authors [2] [3], only covers one to two degrees of visual angle. [4] widen it up to ten degrees, while [5] and [6] proposed, respectively, twenty and thirty degrees of the visual field. Thus, Itoh and Fukuda [7] state that the determination of central and peripheral vision areas seems to be dependent upon the nature of their experiences and investigation purposes.

Another interesting aspect relates to the differences between these two zones. On the one hand, fovea, rich in receivers called cones, is a specialized area in terms of acuity and colour vision, while the periphery, where the rod cells are in major quantity, is used primarily for detection of motion and vision under low levels of illumination [8] [9].

Speaking of driving and sports, two major domains where peripheral vision use has been widely studied, as well as in general performance, it seems to be less important the role of central vision and more relevant the peripheral vision one. On sports, Applegate and Applegate [10] found that a diminished visual acuity between 6/6 and 6/75, due to introduction of optical blur, did not reduce significantly the performance of basketball launch, contrary to common sense suggestion that a decrease in visual acuity will have a negative effect on this performance. Graybiel, Jokl, and Trapp [11], on a review of several Russian studies of vision and sport, noticed that results showed an increased need of peripheral visual information against foveal one, in a diverse number of activities, including discus and javelin throwing, slalom skiing and ice skating. Laurent, Paul, and Cavallo [12], when trying to establish what types of information will be potentially used to regulate locomotion while approaching to a target, found that the restriction of peripheral vision did not affect the accuracy of placing the foot on target; however, the non-correlated information situation, that is, with a normal field of vision on target but with the peripheral optical flow changed by the effect produced in the external reference, given the movement of the treadmill, significantly affected the performance. The authors concluded that the peripheral visual information, while not essential to the task, is taken into account in stride adjustment when the entire visual field is available. Dichgans and Brandt [13] have also clearly shown that the peripheral vision was very important in the perception self-motion.

On driving, late detection is very often pointed out [14] by drivers as one of the main causes that justify the occurrence of their accidents. One of the causes of this poor detection may be a difficulty with perceptual thresholds, which can

materialized as the inability to discern relevant stimuli in situations where vehicles approach on drivers' peripheral visual field. Ball, Owsley, Sloane, Roenker, and Bruni [15] found that a serious loss of the visual field (less peripheral vision) in both eyes will double the risk of accidents. At the same time, they refer to the high number of studies that show that the higher the deficiency in the useful visual field, a visual information processing measure, the greater the risk of problems in driving performance, including an increased probability of accidents. Lamble, Summala and Hyvarinen [16], investigating the performance of middle-age drivers with problems in their central vision field, but with normal peripheral vision, found no major differences to the performance of subjects with normal vision in driving tasks in city traffic.

2. Peripheral Vision Accuracy in Different Contexts and under Certain Conditions

Our visual field covers the widest visual arc or angle at which we are able to detect a stimulus presented in visual periphery [17]. This visual field, curiously, has not, in its extension, always the same discriminability. The performance on the horizontal meridian is better than in the vertical, just as there is a superiority of the lower regions of the visual field in relation to superiors. This anisotropic behaviour was proven by several researchers [18] [19], being one of the aspects that we will use to sustain one of the proposals which we will do later. For example, [18] found differences in detection capacity in eccentricities of equal value but being one horizontal and the other vertical, with increased difficulty in the later. Additionally, there were some differences between the upper and lower visual fields, results supported by [19], with a higher resolution of attention in the lower visual field, compared with the upper one. In fact, these results led us to state [20] that, in movies or on television, placement of subtitles at the bottom of the screen do not facilitate the task to grasp the details of the film, being preferable the placement upon the top or in areas close to the main action, being assured this does not entail visual occlusion of those same scenes. To this purpose, returning to the issue of driving, [21] suggested that the most critical visual information for drivers, pilots and computer operators, among others, should be put in more sensitive areas of the visual field, avoiding the ones situated in the vertical meridian, where contrast sensitivity and spatial resolution are low and temporal dynamics is slow.

On the other hand, [22] stated that the (useful) visual field is affected by several factors, such as the presence of a secondary task, a distractor stimulus and the similarity between the target and distractor stimuli, among others. With regard to the last two, [23] concluded that the time required to find and identify a target stimulus decreased with increased contrast between it and the background and/or the distractors where that stimulus is presented.

As regards the existence of a secondary task requiring the division of attention for more than one stimulus (which happens when you try to read the music

sheet and pay attention to the conductor), [24] and [25] found that younger individuals and/or with less experience have reduced their effectiveness in catching and/or throwing a ball (considered primary task) when, at the same time, had to detect a peripheral visual signal, with the more skilful and/or the elders, nevertheless, showing fewer detection errors in the secondary task. Going back, once again, to car driving, [26] called our attention to the danger of visual fixations outside the central field. [27], also in this respect, argue that this danger will not be relevant if the remove of the fixation in the central area off the road is brief. However, if it exceeds two seconds, it will, clearly, increase this risk, as well as if we increase the spacing of that location in relation to the front of the road. In the article already mentioned [20], we questioned subtitles' location at the extreme bottom of the screen, due, precisely, to this greater distance from main zone of a movie.

Finally, several authors [28] defend the existence of advantages on using contact lenses compared to the use of glasses. More directly related with what we have been presenting, lenses will allow a better peripheral vision, not only because, in relation to the glasses, will offer less (or no) obstacles to the visual field but, as well, because, at the same time, there will be no solution of continuity, having regard to the adherence of the lens to the eye, unlike the glasses that, due to its distance to the eyes, from a certain eccentricity, do not cover the visual field, decreasing the accuracy of peripheral capture.

3. Practical and Didactical Proposals Applied to Choral Singing

Taking into account the previously mentioned and extrapolating/transferring to choral singing, we think it's reasonable to make some proposals, which will need, obviously, further on, experimental work to confirm the effectiveness of, for now, mere conjectures and inferences. These proposals will apply on formal education settings (where conductor should be read as the students music teacher) as well as on non-formal ones, being the former music schools, Orphean groups, etc.

- It seems to make sense to try to get music sheet and conductor' staring visual lines closer, looking for a facilitation of not only eventual alternation of fixations (decreasing, for example, the risk of a member of a choir to get lost, on the process of returning to the music sheet focusing after conductor observation), as well as increasing the possibility of simultaneous treatment of information (fixation on the music sheet, which requires greater accuracy of reading, and peripheral vision at the conductor and his gestures) Speaking about conductor gestures, it's advised that they be performed following the "rules" mentioned at this proposal and before, that is, mainly in the lower vertical meridian and/or, if possible, in the horizontal one, in order to facilitate singers detection.
- Thus, in line with what we said on the first consideration, having to hold the music sheet in a low position will force singers to use the vertical meridian to

realize, in peripheral vision, indications/gestures of the conductor. This, ultimately, will make them loose information details (e.g., facial expressions, gestures, etc.) that they wouldn't miss if holding the music sheet in a higher position—when possible, due to use of the bottom vertical meridian (this proposal would imply, literally, to hold the music sheet above the conductor visual line, which won't be very practical, obviously); thus, at least, the goal is to place them closer. Higher, only in the case where the conductor takes a lower zone on an amphitheatre, for example, with the chorus a few meters above him, allowing it (the choir) to view the conductor under the music sheet).

- It will be interesting, too, that the conductor concerns himself to wear an outfit that is contrasting with the background (example: dark clothes, when having a white wall behind him, which will constitute the background of the visual fixations of the singers), as well as singers use music sheets which, with the least possible effort, allow a quick reading in order to focus on the conductor as soon as possible—see the analogy with removing the eyes briefly from the road scenario).
- With respect to different levels of ability and experience, it is suggested, if feasible, that the less experienced and/or capable stand a little bit behind of a more experienced colleague, to minimize the eccentricity of this location in the visual field of the first, facilitating the capture of any relevant stimuli, such as opening the mouth and/or a shake of the head from the more experienced, giving a visual clue of the appropriate time to attack a certain area/compass of the piece in question. Still, for a novice singer, with little experience of music sheet reading, read it may require almost all informational resources available, being less available to observe, at the same time and/or in sequence, in a quick and effective way, the gestures of the conductor.
- Attending to advantages mentioned before, particularly in terms of peripheral vision, on the of use contact lenses compared to glasses, we think that this possibility should be considered with the choral singers of different ages and experience, that is, to encourage, if feasible, the use of contact lenses instead of the use of glasses when performing choral music, increasing, thus, the possibility of capture, more effectively, stimuli coming from visual periphery, namely those that come from the conductor.

4. Conclusions

We think that data we presented from past studies, despite not in the specific area of music (mainly on sports and driving domains), are challenging enough to make us reflect, by analogy, about some critical aspects in the relationship choir/conductor. Indeed, and especially by the limitations of the use of peripheral vision in the higher vertical meridian, it would be interesting, in a future study with experimental design, to seek for confirmation of what, by now, we can just predict or speculate. We also think that may be relevant to recall that the visual

search that we perform daily occurs more often in the horizontal plane, which, by itself, can make us think that the task of the choral singers will be, at the very beginning, a little more hampered, especially if they have little experience in this particular domain. In order to read a music sheet it is required, inevitably, to centre the focus of visual attention in it. So, there remains no other possibility but to use peripheral vision (vertical meridian) to figure out what, simultaneously, the conductor is trying to transmit by gestures or body posture or, alternatively, and in a no parallel, but sequential manner, take turns of reading and staring at the conductor.

Given this, we think it may make sense to consider testing present proposals. We are sure that this is an open field of research and that, for example, the use of an eye-tracking system can allow us to correlate data from location, duration and sequence of visual fixations of choral singers with percentage of detection of gestures and orders of the conductor. Some of the other proposals will need no eye-tracker, since, for instance, wearing lenses instead of glasses will allow chorus singers and conductors to evaluate if their performance improves, namely in relation to identification of conductor gestures and/or peers stimuli, especially those that sing in the same voice category. If that is the case, in future we will be capable of enhancing choral singing by advising singers to search for the best way to put themselves and their music sheets taking into account conductor positioning, clothes (colour) that conductor should wear and his placement, given the background where the action (choral performance) is carried out, aiming at the greatest possible effectiveness in this dual task.

Finally, it should be remarked that this article represents an effort to begin to translate and transfer empirical data, mainly from sports and driving domains, to the area of choir singing. Future research should focus to attempt, as we said, on the particular issues we raised here, as well as on others that may lead to an improvement on choir singing performance and efficacy.

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