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ORIGINAL ARTICLE

# Critique of Claims of Improved Visual Acuity after Hypnotic Suggestion

**AMIR RAZ, PhD, DSc, ZOHAR R. ZEPHRANI, BA, HEATHER R. SCHWEIZER, BA, and GERALD P. MARINOFF, MD**

*Magnetic Resonance Imaging Unit in the Department of Psychiatry, Columbia University College of Physicians & Surgeons and New York State Psychiatric Institute, New York, New York (AR), Brain Imaging Division in the Department of Analytical Psychopharmacology, New York State Psychiatric Institute, New York, New York (ZRZ), Department of Human Development, Cornell University, Ithaca, New York (HRS), Department of Ophthalmology, Albert Einstein College of Medicine, Bronx, New York (GPM)*

**ABSTRACT: Psychological approaches to improving vision present an enticing alternative to invasive procedures and corrective lenses; hypnotic suggestion is one such technique. During the past 60 years, multiple studies have documented improvements in the vision of myopic individuals after hypnotic interventions. Given the increasing interest in behavioral and alternative approaches, we have reviewed the pertinent studies to evaluate their validity. We delineate various shortcomings in these reports, including potential methodological caveats, problems with experimental controls, and controversial data interpretation. Overall, the data do not seem to support hypnosis as a viable option for significant long-term improvement of myopia. However, hypnosis can increase one's subjective feeling of enhanced visual acuity by affecting higher cognitive functions, such as attention, memorization, and perceptual learning, which could influence performance on visual tasks. (Optom Vis Sci 2004;81:872–879)**

Key Words: myopia, suggestion, hypnosis, attention, visual acuity

Myopia is a leading cause of visual impairment, affecting 15 to 20% of the adult population[1] and about 25% of young adolescents in industrialized Western societies.[2, 3] Myopic persons have many options for improving their vision.[4] Potential therapies range from corrective lenses and surgery to specialty diets, visual exercises, and behavioral interventions, all the way to complementary medicine. Alternative treatments present the alluring possibility of changing vision through natural techniques. Such approaches are gaining popularity, as shown by the proliferation of programs for preventing and treating poor vision (e.g., http://www.seeclearlymethod.com).[5, 6] Practitioners and visual scientists should be aware of the details and validity of these approaches.

In some cultures, it is common to use alternative techniques such as acupuncture and eye massages to improve vision.[7] The ophthalmologist William Horatio Bates pioneered the field in the U.S. with his controversial behavioral approach to help people out of their glasses.[8] Despite considerable scientific refutation,[9, 10] the Bates method still finds adherents. To improve vision, practitioners have used visual training programs,[11] optical feedback,[12, 13] and behavioral modification.[14] Incorporating hypnosis into their arsenal, some optometrists and hypnotherapists have led efforts purporting to improve vision using behavioral and relaxation methods.[15–17] Evidence supporting the use of hypnosis for enhancing visual acuity often appears in pseudoscientific books and nonrefereed journals. However, seemingly scientific outlets have also published accounts of the effects of suggestion on visual acuity.[18] Evidence-based scientific reports show significant modulations of visual perception after hypnotic and other forms of suggestion.[19] Among lay audiences and some professional circles, these findings have given credibility to the idea of using hypnosis as a remedy for myopia.[6] This new acceptance warrants examination of the supporting evidence. In this article, we review the relevant studies and investigate claims of using hypnosis to improve visual acuity.[20]

## PSYCHOLOGY AND VISION

Evidence shows that psychological and environmental factors can affect visual perception, sensitivity, and acuity. Painful stimuli, vibrational stress, and thermal strain can all decrease visual acuity.[21, 22] Additionally, attentional load and task demands can significantly influence visual processing,[23] as can moderate fatigue and drowsiness.[24] Studies show that a decrease in visual perfor-



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mance after prolonged wakefulness and sleep deprivation correlates with a cumulative strain on many muscles, including perhaps the ciliary body. Visual fatigue induced by continuous engagement in visual tasks also causes a temporary decrease in visual acuity.[25]

Given the evidence for psychological effects on vision, investigators have attempted to use a variety of psychological strategies to improve myopia. Researchers have claimed success using biofeedback (enabling voluntary control by using system monitoring), fading mechanisms (i.e., a variant of reinforcement), and training.[26–31] Other scientists have disputed these findings. For example, some claim that although training may have a positive effect on psychological conditions and subjective visual acuity, it does not measurably reduce myopia.[26, 32–34] After reviewing the literature, prominent researchers argued that more clinical data were needed before operant conditioning and biofeedback qualified as effective treatments of myopia.[35]

Precedents do exist for using operant conditioning to improve myopia. However, they are based on unpublished observations[36] and sparse data.[37, 38] One study reported a significant decrease in refractive error using operant conditioning.[39] Several earlier studies claimed that optometric training could significantly improve visual acuity without using corrective lenses.[40, 41] However, investigators have concluded that these training techniques do not alter the refractive power of the eye.[42] Instead, visual acuity improves when subjects learn to maximize their use of available perceptual cues. It is likely that such perceptual changes form the basis of the effects caused by hypnosis.

## HYPNOSIS AND VISION

Hypnosis is a form of focused concentration.[43] Although clinicians have used hypnosis for hundreds of years, the American Medical Association only certified the technique as a legitimate treatment tool in 1958. In 1996, a National Institutes of Health panel approved hypnosis as an effective intervention for pain regulation. Despite these official recognitions, the scientific community has been slow to accept hypnosis, partly because of misconceptions and folk beliefs and largely because its mechanism has not been adequately explained. With the advent of novel neuroimaging techniques that allow a quantitative analysis of hypnotic phenomena, this bias is changing.[44]

It is possible to classify individuals as either *highly hypnotizable* or *less hypnotizable* based on their susceptibility to hypnotic suggestion as evidenced by performance on standardized scales.[43] Hypnotic procedures change the way highly hypnotizable individuals experience themselves and the environment.[44] Researchers can study these changes using posthypnotic suggestion, a condition after termination of the hypnotic experience wherein a subject is compliant with a suggestion made during the hypnotic episode. Within vision, hypnotic suggestions can induce tunnel vision,[19, 45] color blindness,[46–51] visual hallucinations,[52] alexia,[53] and agnosia.[54] Such phenomena can manifest in other modalities as well.[55]

## HYPNOSIS AND MYOPIA

The scientific literature contains multiple scientific abstracts and reports describing the effects of positive suggestion on the improvement of visual acuity.[56–61] In his doctoral thesis, Kelley investigated the effects of direct suggestion (e.g., hypnosis) and indirect suggestion (e.g., reinforcement) on visual acuity.[62, 63] Using such techniques as cycloplegia and such tools as a haploscope, Kelley determined that suggestion improved visual acuity in waking and hypnotized subjects. These changes involved physiologic correlates relating to the lens or shape of the eyeball rather than accommodative factors. Accordingly, Kelley hypothesized that psychological factors might have reduced the refraction of the eye.[62] Although he did not provide direct evidence that psychological conditioning could affect visual acuity or refractive error, Kelley proposed that behavioral manipulations might have modified visual functions.

In 1971, Graham used a real-time laser technique to investigate the effects of suggestion on myopic visual acuity.[59] He measured changes in relative accommodation in five individuals after hypnotic suggestion[64] and argued that although suggestion could improve acuity, the changes he observed in the refractive power of the eye were neither significant nor consistent enough to explain the result. Graham concluded that the underlying mechanism must have operated at the retinal or higher cerebral level.

Graham and Leibowitz subsequently published a seminal article presenting three experiments on the effect of suggestion on visual acuity in nine myopic subjects.[60] The studies showed that hypnotic and posthypnotic suggestion rapidly and significantly improved the visual acuity of highly hypnotizable subjects. The enhancement was greatest initially, with the hypnotic procedure most effective for those with the poorest acuity and higher suggestibility. This improvement did not involve a change in the refractive power of the eye. Some subjects reportedly maintained their improvement outside of the experimental context.

In the field of hypnosis, other reports support these findings. Several accounts propose that hypnosis can improve visual acuity without changing the refractive power of the eye.[65–67] Studies show that hypnotic age regression, to a time before the subject required corrective lenses, improves myopia and hyperopia.[47, 68] Others report spontaneous improvement in visual acuity while testing hypnotized subjects on unrelated tasks.[69, 70] One study reports transient improvement of visual acuity in nine cases of suppressive amblyopia.[71]

These claims remained neither confirmed nor contested for an entire decade until Sheehan et al.,[61] using a better-controlled experimental design, reported similar findings using a signal detection task.[a] In their study, myopic visual acuity improved after as little as 15 min of listening to suggestions intended to produce relaxation and an improvement in vision.[61] Their study also controlled for potential sampling differences that may have influenced the original results of Graham and Leibowitz.[60] Overall, these investigations concluded that suggestion significantly affected the visual sensitivity of highly hypnotizable subjects. Although the mechanism underlying postsuggestion visual improvement remained unknown, it was presumably a result of the more efficient

[a] In signal detection theory, the detection of a stimulus depends on the observer's sensitivity and on higher decisional and motivational factors. The parameters used are sensitivity (or d', a measure of the average difference perceived by an observer) and criterion (or β, the minimum level of activation an observer needs to claim detection of a target stimulus).



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utilization of available information (e.g., crowding/contour interaction).

In searching for a mechanism to explain this noted improvement, we revisited Graham's initial study in which he inducted subjects into hypnosis and then suggested that they perform a visual vigilance task to the best of their ability.[59] After his suggestion, the less-hypnotizable individuals could better detect stimuli in their flanking visual fields than could the highly hypnotizable subjects. This may suggest that attentional increase at the center is achieved at the expense of peripheral attenuation. Such a process could explain the improved sensory discrimination of highly suggestible individuals at the focal point. Only recently have cognitive neuroscientists been able to investigate this attentional explanation.[20]

## ATTENTION AND VISUAL ACUITY

There is general accord that hypnotic phenomena implicate attention.[72–74] Cognitive scientists draw a distinction between the role of attention in simple detection vs. its ability to enhance visual performance.[20] Although scientists agree that heightened attention may improve performance, there has been great controversy over what orienting attention to a visual stimulus does. However, there is consensus that the attended stimulus receives priority, which decreases reaction time. There also is clear evidence of enhancement of electrical activity over extrastriate visual areas by 90 ms after visual presentation.[75] Conversely, it is also clear that attention to a peripheral stimulus does not compensate for the lack of acuity that would be present for a foveal stimulus. Although stimuli falling on the fovea always have an advantage in detail, the priority for processing the input is elsewhere. Whereas visual acuity requires the resolution of detail, detection thresholds and reaction time can involve the summation of luminance, which may obscure detail. Thus, detection and improved visual acuity are not synonymous. Toward this end, attention can exert its effects as early as the primary visual cortex[76] by either improving discriminability in visual tasks or by increasing the rate of information processing.[77]

## A CRITIQUE

Hypnotic suggestion and other behavioral techniques may improve visual acuity in myopic individuals. However, the published reports on the subject have many shortcomings that bring into question the validity of such claims. These include questionable background data, experimental problems, and controversial interpretation of results.

Graham and Leibowitz's influential study[60] based its claim on largely anecdotal findings. Not only did it reference preliminary case studies[67, 71] but also it cited data using scenarios devoid of suggestion.[65–67, 70] The references included an unrelated report,[69] an unpublished case report using an author's wife as subject,[68] and a reference-free paper based on a brief unpublished thesis[66] with an unclear number of subjects (once reported as 8 and once as 9).

Methodological shortcomings within the experiments also obscure the validity of the results. Memorization effects occur when the same chart is used between left and right eyes or test-retest assessments of the same eye.[78] Increased tolerance of blur can also contribute to an apparent improvement in myopia after a period without refractive correction.[79] Researchers have noted the effect of blur[80] or exposure to unfocused images[81] on visual acuity. Because the ability to detect blur may be altered in adult and child myopia,[82–84] additional research in this area would have to account for the effects of chart memorization and blur adaptation.

Selection of subjects could also influence experimental results. Sheehan et al.[61] point out that Graham and Leibowitz[60] did not use suggestibility-matched controls for the highly hypnotizable experimental group. The controls were almost certainly of lower suggestibility, which alone brings the results into question. Graham and Leibowitz also assessed visual acuity with a single chart of Landolt C characters that subjects viewed multiple times. The subjects may have had sufficient opportunity to view the chart while wearing glasses between measurements. This lax protocol may have introduced an appreciable bias.

Grouping of subjects could also have influenced Graham and Leibowitz's findings. The study contained three subject groups based on degree of refractive error: those with no myopia, those with slight myopia ($-0.75$, $-0.50$, and $-0.25$), and a highly myopic group ($-4$, $-2.25$, and $-1.75$). Most eye care practitioners would probably label the highly myopic group as moderate myopes and reserve the designation "high myopes" for those with refractive errors $> -4$ D or even $> -6$ D.

Under suggestion, the patients with no refractive error showed no increased visual acuity; the patients with slight myopia showed slight improvement; and the patients with the higher myopic errors showed the greatest improvement.[60] This result suggests a statistical regression to the mean effect, in which extreme values tend to improve the most. However, the authors concluded that the hypnosis significantly improved visual acuity and that there was marked improvement over sessions for the highly myopic subjects.

Choice of experimental technique can also affect a study's results. Graham used the "count fingers" method to determine visual acuity when the limits exceeded the size of the letters on the chart.[b] This technique is not a standardized quantifiable method because differences in hand and finger size, spacing between fingers, and movement during testing can affect the outcome. Slight variations in distances and lighting conditions could also alter the data. To analyze these results, we estimated the conversion from count fingers into Snellen letters. Once we express the numbers in Snellen acuity, the results for improvement of myopia after hypnosis are less impressive. Two subjects in the highly myopic group showed slight improvement in one eye only, and the third probably fared worse under suggestion. In the slightly myopic group, only one of three showed a potential improvement in vision under hypnosis. The data simply do not support the claim that the highly myopic subjects significantly improve.

In general, these investigations of the relationship between suggestion and vision reached conclusions that might not have been supported by the data. For example, Graham and Leibowitz ruled out the possibility of relaxation, accommodation, or other causes of a change in refractive power as the mechanism for the alleged improvement caused by suggestion. However, variations in the optical aperture, either by action of the eyelids or changes in the

[b] Count fingers can be useful to assess the degree of visual difficulty a subject is experiencing but should not be used when refractive error is the cause.



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pupil, could explain these changes in visual acuity after suggestion. Myopic individuals are adept at manipulating their eyelids to increase their depth of field. Slight light differences during testing can also introduce substantial variation in performance for those with severe myopia. Last, psychological factors could also have confounded Graham and Leibowitz's original results. For example, the *hold back* effect occurs when one expects to be hypnotized and therefore restricts their prehypnotic performance to allow room for subsequent improvement under hypnosis.[85]

Different methods of statistical analysis can also alter the outcome of these studies. In 1983, Wagstaff challenged the statistics in Sheehan's paper and coherently argued that Sheehan's results might have been premature.[86] Wagstaff claimed that although the experimental group did outperform the control group, the control group might have been marginally better initially. Moreover, he observed that if suggestions did improve visual acuity, then the comparison between the experimental groups before and after treatment should have been significantly different. These differences were not observed.

Wagstaff applied what he believed was a more appropriate statistical model to the data. In doing so, he demonstrated the possibility of concluding that suggestions for improving visual acuity had little to no effect, whereas listening to music (the control condition used by Sheehan et al.) appeared to reduce visual sensitivity. In a courtesy reply, the original authors reapplied the conventional analysis of variance to the original data. This re-evaluation illuminated the inadequacy of their initial conclusions on the effects of suggestion on visual acuity.[87]

Hypnotic, or even monetary, incentives for changing visual threshold may be relatively ineffective when participants operate initially near optimal levels.[88] Studies also suggest that although visual training in myopes does not improve objective measures of visual acuity, training does promote a greater sense of well-being. This feeling can then cause a subjective improvement in vision,[28] although it does not translate into a measurable change in visual acuity. Collectively, it seems that a wealth of unambiguous data dating back >60 years shows no evidence for increased sensitivity in visual acuity under hypnotic suggestion.[89] We compiled a list of the studies typically cited to support the effects of hypnosis and suggestion on visual acuity. Table 1 summarizes the results of our efforts and outlines the shortcomings for each study.

Even if the evidence did support a role for hypnosis in improving vision, the clinical relevance of these techniques would still be questionable. Behavioral training is typically minimal and short lived. Few substantive follow-up data show long-term efficacy with these techniques. It is also unclear whether we can generalize such data across the heterogeneous myopic population. Clinical ophthalmologists, optometrists, and physiologic optics experts have thoroughly reviewed the psychological and behavioral factors in the modification of myopia.[39] Most of these eye care specialists agree that little evidence supports effective behavioral intervention of myopic vision.[90, 91]

## ALTERNATIVE ACCOUNTS

Although psychological approaches may not improve myopia at the level of the eye, differences in visual information processing in the brain can affect vision. When we train the brain to interpret retinal blotches, the cognitive phase of seeing becomes more responsive, causing an improvement in vision. An illustration of this phenomenon is a smudge on an X-ray chart that may be a blur to a novice but highlights a serious medical indication to an experienced radiologist. The retinal images in the eyes of the two observers may be identical in clarity, size, and shape, but the cognitive interpretation and mental contribution of this retinal image are vastly different. In another example, individuals who failed military entrance tests because of color blindness managed to pass the required test after visual training. There was consensus within medical circles that the visual exercises did not cure their color blindness but instead educated the individuals in how to better discern colors. Regardless of whether these individuals were cured or educated, they could distinguish the colored patterns of the test[92, 93] after completing the training exercises. Despite current knowledge of the substrates of color vision, some practitioners still mistakenly interpret these data to mean that those persons had acquired a greater degree of color perception and color discrimination than they had before doing the exercises.

We do not wish to disparage perceptual training to develop a keener ability to interpret blurred images. The improvement of some aspects of visual performance through perceptual learning has been verified.[42] Instead, we stress that there is admissible evidence of improvement in visual acuity not explained by refractive changes.

Graham and Leibowitz[60] showed a slight increase in visual acuity for some subjects under suggestion. The effect was the same for low to moderate myopes and was not related to relaxation of accommodation as would be present in pseudomyopia. Eye practitioners acknowledge that one's vision fares differently on different examination days, either within multiple tests with the same examiner or among independent examiners. The degree to which an examiner pushes the patient to discern the visual objects, colloquially called "whipping the patient," can affect the testing, producing an increase on the order of magnitude equal to that seen in some of the experimental subjects studied under hypnosis. This outcome probably results from increased attentional effort, concentration, motivation, or a willingness to use visual (e.g., contrast) and cognitive (e.g., elimination) clues other than enhanced resolution. To implicate suggestion or hypnosis as the cause of this slight increase in visual acuity may be overreaching.

Negative accommodation could also possibly explain this occasional improvement in visual acuity in uncorrected myopes.[94] Sparsely documented in rare individuals, the baffling phenomenon of negative accommodation involves evanescent increases in vision (i.e., *flashes* of clear vision) accompanied by a decrease in the overall plus power of the eye. It is thought that there is a base tonus for the accommodative mechanism[95–97] that, combined with the dioptric power of the lens/cornea and the axial length of the eye, produces the total refractive state. Actively reducing the base accommodative tonus would reduce the plus power of the eye, enabling myopes to see better.[98] However, negative accommodation, if it does exist, is extremely rare. In our search, we have found only a few personal communications from prominent clinicians who report having assessed negative accommodation objectively (e.g., by retinoscopy).[94] However, these accounts are not consistent with the descrip-



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**TABLE 1.**
Chronological summary of the primary evidence (since 1950) typically cited in favor of the effects of hypnosis and suggestion on visual acuity

| Author(s) | Sample Size | Method | Effect Reported | Comments |
|---|---|---|---|---|
| Weitzenhoffer[69] | N = 6 | Hypnotic suggestions for improved differential recognition | Superior performance level compared to the waking state | Visual acuity was not formally tested. |
| LeCron[68] | N = 1 | Hypnotic age-regression; no suggestion | Improved vision in a myopic patient | Based on unpublished data collected from a cited authors' wife. |
| Kline[70] | N = 1 | A test of visual discrimination in both the waking and hypnotic states | Hypnotic transcendence of waking visual capacities | Controversial and preliminary case report. |
| Browning and Crasilneck[71] | N = 9 | Exploring the effects of positive hypnotic suggestion on visual acuity in patients with suppression amblyopia (amblyopia ex anopsia) | Visual improvement in some cases | Inconclusive results; preliminary report; pilot study. |
| Kelley[62,63] | N = 4–14 | Hypnotic suggestion accompanied by optometric assessments using such manipulations as cycloplegia and a haploscope. | Significant improved vision in myopes following both direct and indirect suggestions proposing reduced refractive error. | Unpublished data or published in non–peer-reviewed journal; strong bias towards the "Bates method;" failure to measure refractive changes during the actual training sessions; doctoral dissertation. |
| Kliman and Goldberg[100] | N = 10 | Studying visual recognition thresholds of words seen in hypnotic and control waking states, compared with a baseline waking state. | Visual recognition at lower illumination under hypnosis. | Does not address visual acuity. |
| Copeland[65,66] | N = 8 or 9 | Hypnosis without suggestion | Improved visual acuity following hypnosis | Unpublished data; doctoral dissertation. |
| Davison and Singleton[67] | N = 1 | A glasses-wearing subject induced to have positive and negative hallucinations under hypnosis with and without cycloplegia | Improved visual acuity with and without cycloplegia. | Preliminary report; accidental finding. |
| Graham[59] | N = 5 | Hypnotic suggestion to improve vision. | Improved vision with some myopes. | Inconclusive results. |
| Graham and Leibowitz[60] | N = 9 | Three experiments to explore whether hypnotic suggestion could improve vision in myopes while refraction and acuity were measured simultaneously. | Improved vision following hypnotic suggestion both 'within' and 'between' sessions. | The gist of the present paper. |
| Sheehan et al.[61] | N = 16 | Signal detection method to assess monocular spatial discrimination while listening to either taped hypnotic suggestion or taped music. | Visual acuity can be improved by suggestion. | Critiqued[85] and rebutted[86]; questionable conclusions. |
| Kay[101] | N = 75 | Compares hypnosis with suggestion for improved vision, neutral hypnosis, progressive relaxation, and control conditions across myopes | Improved vision with some myopes under hypnotic suggestion. | Methodological issues; unpublished data; doctoral dissertation. |



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tion of increased visual acuity that allegedly occurs as a result of suggestion.

## CONCLUSION

We have presented thorough evidence challenging the original premise that hypnotic suggestion improves visual acuity in myopes. Early studies supporting this use of hypnosis have many shortcomings, including small sample sizes, weak procedures, and disputable interpretation of results. Based on results from these studies, the effect of suggestion on myopes' visual acuity is not likely to be significant or long lived.

Reports of temporary changes in subjective acuity and refractive error as a function of behavioral interventions seem to support a psychological component to vision. Psychological factors may play a progressively more important role in our understanding of myopia. Whereas the correlation between suggestion and myopic visual improvement remains uncertain, evidence relating hypnotic suggestion to attentional mechanisms is mounting.[53] Hypnotic suggestion can affect visual attention, which in turn could influence performance on visual tasks. These findings, together with data illuminating visual attention and acuity,[99] provide the likely mechanism of how suggestion can influence visual acuity.

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**Amir Raz**
*Magnetic Resonance Imaging Unit in the Department of Psychiatry*
*Division of Child and Adolescent Psychiatry*
*Columbia University College of Physicians & Surgeons*
*New York State Psychiatric Institute*
*1051 Riverside Drive, Unit 74*
*New York, NY 10032*
*e-mail: ar2241@columbia.edu*



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