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SEE CLEARLY: *Suggestion, Hypnosis, Attention, and Visual Acuity*

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Abstract: Some reports claim that positive suggestion (e.g., using hypnosis) can significantly improve visual acuity (e.g., in myopes). Based on behavioral, neurocognitive, and ophthalmological findings, the authors provide a critical account to review and challenge some of these data. While acknowledging the relative merits of hypnosis for investigating visual phenomena, an array of arguments converges to propose caveats to the apparent influence suggestion can exert on visual acuity. The authors argue that neither suggestion nor hypnotic

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phenomena are likely to significantly improve myopic vision and contend that a responsible scientific attitude should carefully outline what hypnosis and suggestion *cannot* do in addition to what they can. It seems likely that the small apparent influence of suggestion on visual acuity is mediated by changes in attention. The authors outline how attention can affect visual acuity.

Humans are largely visual animals, perhaps due to a common adaptation to visual predation generally found in primates. Visual problems have plagued human society from time immemorial. In 450 B.C., nearsighted slaves were sold at a discount; with no way to correct it, the vision defect reduced their value. Trying to enhance vision has a long history dating to the use of crystals as crude magnifying glasses. Contemporary efforts to improve visual acuity rely on technological innovations such as surgical laser procedures, which are available to moderate some individuals' dependence on glasses or contact lenses. These procedures are relatively new, however, and not without risks. Consequently, efforts to foster natural and safer alternatives to either concave lenses or surgery have rekindled interest in older psychological approaches to improving eyesight. The resurgence of these behavioral training and relaxation methods has been recently promulgated in commercial, prevention, and treatment contexts (e.g., http://www.seeclearlymethod.com; Kaplan, 1994; cf. Kemery, 2000). The greater psychological society in general and the hypnosis community in particular need to worry about the proliferation of these approaches, not as means to extirpate quackery, but mostly because their revival relegitimizes scientific accounts tainted by time and shrouded in myth.

Researchers and clinicians have studied the optics, anatomy, development, pathology, and underlying neural processes of the visual system making it the most widely studied perceptual system. Some people (e.g., highly hypnotizable individuals) may experience attentional and perceptual changes that may not typically occur during common awareness following particular suggestions (e.g., Spiegel, Bierre, & Rootenberg, 1989; Spiegel, Cutcomb, Ren, & Pribram, 1985). Similar phenomena can occur in certain patient populations (e.g., conversion hysteria, Oakley, 1999; cf. Halligan, Athwal, Oakley, & Frackowiak, 2000). Within vision, for example, hypnotic suggestions have been demonstrated to induce tunnel vision (e.g., Blum, 1975; Leibowitz, Post, Rodemer, Wadlington, & Lundy, 1980), color-blindness (e.g., Erickson, 1939, 1943; Harriman, 1942; Harvey & Sipprelle, 1978; cf. Grether, 1940; Mallard & Bryant, 2001) visual hallucination (e.g., Kosslyn, Thompson, Costantini-Ferrando, Alpert, & Spiegel, 2000), alexia (Raz, Shapiro, Fan, & Posner, 2002b), and agnosia (e.g., Blum & Wiess, 1986). Such phenomena can manifest in other modalities as well (e.g., Szechtman, Woody, Bowers, & Nahmias, 1998).

The past 2 decades have ushered in a number of alternative therapeutic methods as viable adjuncts to treatment. Fewer scientists currently repudiate some of these integrative techniques as cumulative data begin to endorse their efficacy and ability to complement modern remedies. Ophthalmology is no exception to this trend. In some cultures, the use of alternative techniques to improve vision (e.g., acupuncture and eye massages) is common (Peking Review, 1977). In the U.S., similarly motivated attempts probably began with variations of the account originated by the ophthalmologist William Horatio Bates. Bates had become increasingly dissatisfied with conventional ophthalmological practice before the turn of the previous century and consequently developed what became known as the Bates Method—a controversial behavioral approach to help people out of their glasses (Bates, 1912)—which, despite considerable scientific refutation (e.g., Pollack, 1956; Worrall, Nevyas, & Barrett, 2002), still finds adherents. The Bates Method was further fueled by the evolution of training programs as treatment alternatives to corrective lenses (Friedman, 1981) as well as by innovations introduced by optical engineering (e.g., Cornsweet & Crane, 1970; Perkins, Hammond, & Milliken, 1976) and behavioral modification (e.g., Rotberg & Surwit, 1981). Some optometrists as well as hypnotherapists (adorning themselves with such appellations as "behavioral optometrists" and "vision therapists" (e.g., Collier-Vanhimbeeck, 1997) have led commercial efforts purporting to improve vision using behavioral and relaxation methods, incorporating hypnosis into their arsenal (e.g., Scholl, 1978, 1990, 1997). Although some individuals who promote using hypnotic phenomena to enhance visual acuity publish their theories in pseudoscientific books[3] and nonrefereed journals (e.g., Gienke, 1957), accounts of the effects of suggestion on visual acuity found their way into seemingly scientific outlets (e.g., Kroger, 1977, p. 270) and thereby gain acceptance within lay as well as professional circles (Kemery, 2000).

Scientifically appraising hypnotic phenomena in the context of vision can be a delicate balancing act. A visual scientist unfamiliar with hypnotic phenomena may find these accounts exaggerated, dubious, or downright impossible—thereby calling into question their plausibility. On the other hand, there are scientific data published regarding the significant modulation of visual perception following hypnotic as well as other forms of suggestion (e.g., Leibowitz et al., 1980). Thus, unreliable reports aside, while most cognitive neuro-

[3]Examples of these fads are copious—Scholl (1990) writes: "Good vision is not something we are born with or without, it's a subconsciously learned skill that develops in accordance with our personality and our attitudes" (p. xi); "Hypnosis accesses the subconscious, which is why it is so effective for everything from pain relief to weight control and vision improvement" (p. 2). Liberman (1995) reports that he has taken people with 20/600 vision and transformed them to 20/20 in a matter of days.

scientists and eye-care specialists are unfamiliar with the scientific hypnosis literature, typical discussions of the visual system in cognitive neuroscience or clinical ophthalmology rarely consider hypnosis theories and seldom ponder data involving the role of suggestion. Toward this end, the crux of the present piece—whether (hypnotic) suggestion can significantly enhance visual acuity—receives conflicting answers based on the (scientific) literature one chooses to read.

Science has not fully fostered hypnosis as a viable experimental manipulation (Raz & Shapiro, 2002; Raz, Shapiro, Fan, & Posner, 2002b). Plagued by a checkered history, hypnosis suffers from a reputation stained by myths and folklore belying its promise in mainstream research. Nonetheless, the scientific literature contains multiple abstracts (e.g., Harwood, 1970; Harwood & Ward, 1972; Leibowitz, Graham, & Stein, 1972) and reports describing the effects of positive suggestion on the improvement of visual acuity (e.g., Graham, 1971; Graham & Leibowitz, 1972; Sheehan, Smith, & Forrest, 1982). A scrutiny of these reports reveals that a report by Graham and Leibowitz was probably the cornerstone of these data, especially considering the important work Herschel Leibowitz carried out in visual science (e.g., Leibowitz, Brislin, Perlmutt, & Hennessy, 1969).

Following our recent interest in the top-down modulation exerted by posthypnotic suggestion (e.g., Raz, Shapiro, Fan, & Posner, 2002b), we decided to reexamine the findings of Graham and Leibowitz (1972) and the derivative studies based upon their findings. We try to provide a critical examination of hypnotic phenomena in the context of visual acuity and demonstrate why some of the earlier claims concerning the role of suggestion in enhancing visual acuity of nearsighted individuals may have been overstated.

Visual Acuity

It is possible to measure visual acuity by several methods. The most common and clinically used, designed to measure acuity in angular terms, is the Snellen method where a fraction represents the visual acuity: the numerator indicating the testing distance and the denominator indicating the distance at which that test letter subtends 5 minutes of arc at the nodal point of the eye. Alphabet letters from the 20/20 line subtend five minutes of arc at 20 feet. Accurate identification of the Snellen letters results from distinguishing gaps in the spacing between solid black components of the test object. Although commonly used by eye practitioners, the Snellen method is not ideal for research purposes (e.g., Duke-Elder, 1942), where the use of other tests (e.g., Landolt C or illiterate E) is often more appropriate. In the case of the Landolt C visual acuity test, the subject attempts to identify the orientation of the gap in the letter "C" when rotated in four to eight directions.

The limit of resolution of the human eye is 5 seconds of arc to 1 minute of arc depending on the method used (e.g., Vernier or Snellen acuity). Factors such as contrast, pupil size, luminance, exposure duration, cell distribution, tilting of receptors, and neural processing affect an individual's ability to distinguish Snellen letters, but, once pupil size and accommodation are controlled, the ability to distinguish letters at a given luminance is largely determined by the refractive power of the eye and the size and spacing of cones in the foveal region of the retina. The size and separation of the cones is the limiting factor in visual acuity. Anatomic variation in this size and spacing would account for the variability of the limit of resolution.

Behavioral and Environmental Effects

There is evidence that psychological and environmental factors may affect visual perception, sensitivity, and acuity. For example, visual acuity decrements are associated with vibrational stress (O'Briant & Ohlbaum, 1970), and decreases in visual sensitivity are found both during and for a few minutes following painful stimulation (Clark, Yang, & Janal, 1986). Environmentally, to give one example, a significant loss of visual acuity was linearly correlated with thermal strain (Hohnsbein, Piekarski, Kampman, & Noack, 1984). In addition, attentional manipulations can significantly influence visual processing (e.g., Rees, Russell, Frith, & Driver, 1999), as can moderate fatigue and drowsiness (e.g., Raz, 1999). Experimental assays examining decreases in visual performance following prolonged wakefulness and sleep deprivation suggest cumulative strain on many muscles of the body, including perhaps the hyperopic eye (e.g., Corsi-Cabrera, Arce, Del Rio-Portilla, Perez-Garci, & Guevara, 1999). Also, there is evidence that visual fatigue, induced by having subjects engage in continuous eye tasks, causes a temporary decrease in visual acuity (e.g., Watten & Lie, 1992).

A Seminal Report and its Consequences

Myopia, or nearsightedness, is an optical condition in which only rays from a finite distance from the eye focus on the retina. Myopes—who constitute about 15–20% of the adult population (Safir, 1979)—suffer from a refractive state in which the image from distant objects falls in front of the retina. Thus, myopes can only see near objects clearly, because their visual condition precludes distant objects from coming into proper focus. Using a real-time laser technique that allowed him to measure changes in relative accommodation (Hennessy & Leibowitz, 1970), Graham (1971) carried out an investigation of the positive effects of suggestion on myopic visual acuity. Based on

measurements from 5 subjects, he interpreted his data to imply that whereas in some cases acuity improved through hypnotic suggestions, the changes observed in the refractive power of the eye were neither large nor sufficiently consistent to provide an adequate explanation of the result. Accordingly, Graham concluded that the underlying mechanism must operate at the retinal or higher cerebral level.

A seminal subsequent paper by Graham and Leibowitz (1972) presented results from three experiments examining the effect of suggestion on visual acuity. Interpretation of the data, collected from 9 subjects, proposed that the visual acuity of highly suggestible myopes significantly improved following both hypnotic and posthypnotic suggestions to rectify their myopia. The enhancement was greatest initially, with the hypnotic procedure most effective for those myopes with the poorest acuity. Further, Graham and Leibowitz reported that in some instances myopic individuals were able to carry over and demonstrate the improvement outside of the experimental context.

These claims were apparently in line with other reports that hypnotic age regression, to a time before the subject required corrective lenses, improved both myopia and hyperopia (Erickson, 1943; LeCron, 1952); accounts advising that hypnosis was capable of improving visual acuity without changing the refractive power of the eye (Copeland, 1967a, 1967b; Davison & Singleton, 1967); reports of spontaneous improvement in visual acuity while testing subjects on unrelated tasks (Kline, 1952/1953; Weitzenhoffer, 1951); and data from a tangential assay reporting transient improvement of visual acuity in nine cases of another visual disturbance (Browning & Crasilneck, 1957). Graham and Leibowitz (1972) proposed that their findings together with these background data collectively supported the claim that improvement of binocular visual acuity in highly suggestible myopes could take place rapidly as a function of hypnotic as well as nonhypnotic suggestion and that the improvement did not involve a change in the refractive power of the eye. Moreover, they proposed that subjects with poorer acuity and those with higher suggestibility showed greater improvement due to positive suggestion.

These claims remained neither contested nor confirmed for a whole decade until Sheehan et al. (1982), employing a better-controlled experimental design, reported similar findings using a signal detection task.[4] Presenting d' scores (i.e., measuring how accurately an observer identifies a stimulus) and controlling for potential sampling differences

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

that may have tipped the original results of Graham and Leibowitz (1972), Sheehan et al. reported improvement in myopic visual acuity following as little as 15 minutes of listening to suggestions intended to produce relaxation and an improvement in vision. The general conclusion of these combined investigations was that suggestion significantly affected the visual sensitivity of highly suggestible subjects. Although the mechanism for "visual-transcendence-following-suggestion" remained unknown, it was presumably a result of the more efficient utilization of available information following enhanced attention.

That highly suggestible subjects under hypnosis become less attentive to environmental stimuli while highly focused on central ones is a notion deeply embedded in the clinical lore and found in various theoretical guises (e.g., Spiegel & Spiegel, 1978). The implicit rationale, often offered by way of intuition rather than data, refers to the exceptional mastery of attentional faculties that highly suggestible individuals purportedly possess (Crasilneck & Hall, 1959; Hull, 1938; Kline, 1952/1953; cf. Raz, Fossella, McGuiness, Zephrani, & Posner, in press-a; Raz, Fossella, McGuiness, Zephrani, & Posner, in press-b; Raz, Fossella, McGuinness, Sommer, & Posner, 2003). Graham himself (1971) reported that highly suggestible individuals were not as able to detect stimuli in their flanking visual fields as were less suggestible subjects after they had been exposed to a hypnotic induction and suggestions to perform a visual vigilance task to the best of their ability. Some researchers interpreted these data to mean that peripheral attenuation accompanied a proportional attentional increase at the center—paving the way for an explanation of improved sensory discrimination at the focal point. Only recently have cognitive neuroscientists been able to collect viable data to shed light on some aspects of this "attentional explanation."

Attention and Visual Acuity

There is general accord that hypnotic phenomena implicate attention (e.g., Fan, Raz, & Posner, in press; Karlin, 1979; Spiegel & Spiegel, 1978) and relate to self-regulation (e.g., Posner & Rothbart, 1998). A number of investigators have hypothesized that hypnotizability correlates with underlying differences in individual patterns of waking attention (e.g., Tellegen & Atkinson, 1974), though theories of hypnotic responding differ regarding attentional processes (e.g., Kirsch, Burgess, & Braffman, 1999). The marriage of attention and hypnosis has culminated in a new prospective research direction (Raz & Shapiro, 2002) fostering hypnosis to probe attentional networks (Fan, McCandliss, Sommer, Raz, & Posner, 2002). This research program recently produced converging data (e.g., behavioral, Raz et al., 2002b; optical, Raz, Landzberg et al., 2003; and functional magnetic resonance imaging,

Raz, Fan, Shapiro, & Posner, 2002; Raz, Shapiro, Fan, & Posner, 2002a; Raz, Shapiro, Fan, & Posner, 2002c) demonstrating that hypnotic suggestion can modulate the Stroop interference effect (Stroop, 1935).

Recent studies reported evidence that attention improves performance in spatial resolution tasks (Yeshurun & Carrasco, 1998, 1999). Cognitive scientists draw a distinction between how attention may be useful for simple detection of events versus how performance can improve on those events. Although performance may improve upon increased attentional investment, there has been great controversy over what orienting attention to a visual stimulus actually does. There is general agreement that the attended stimulus receives priority, so that reaction time to it is usually faster. There is also clear evidence of enhancement of electrical activity over extrastriate visual areas (by about 90 milliseconds after visual presentation). On the other hand, 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. Stimuli in the fovea always have an advantage in detail, albeit the priority for processing the input has been placed elsewhere.

Hence, attention is not a panacea to perception; there is a great deal attention cannot do. For example, while orienting to a location, attention can give priority to that location (i.e., targets that appear there will be perceived more rapidly and with lower thresholds), but it cannot substitute for the acuity provided by the fovea. Although the fovea is critical for acuity, the costs in reaction time for an unexpected foveal stimulus are just as great as for an unexpected peripheral event. Thus, visual attention influences priority or processing preference.

There are older descriptions of alteration in perceptual thresholds as a function of attentional investment in both the visual (Grindlye & Townsend, 1968; Kliman & Goldberg, 1962) and auditory (e.g., Durrant & Shallop, 1969) modalities. In this respect, the psychophysics literature has grown considerably and now provides good accounts of how visual thresholds correlate with attentional investment. Improvement in "visual acuity," however, is not synonymous with altered thresholds for detection, better performance, or faster reaction times. Acuity requires the resolution of detail, whereas detection thresholds and reaction time can involve the summation of luminance, which might obscure detail.

Whereas investing attention is frequently associated with looking directly at the scene of interest, covert attention is the ability to select visual information at a cued location, without eye movements, and to grant such information priority in processing. Yeshurun and Carrasco (1999) reported data to support the idea that the performance improvement at attended locations resulted, to some extent, from an enhanced spatial resolution at the cued location. These results illustrated that enhancement of spatial resolution indeed occurred at the attended

location (cf. Yeshurun & Carrasco, 1998). Findings from further psychophysical studies supported the hypothesis that attention increased resolution at the attended location and were consistent with the idea that attention could exert its effects as early as the primary visual cortex (Yeshurun & Carrasco, 2000). Later visual studies explored the relationship between visual attention and contrast sensitivity (Carrasco, Penpeci-Talgar, & Eckstein, 2000). There are data that covert attention not only improves discriminability in a wide variety of visual tasks but could also speed up the rate at which information was processed (Carrasco & McElree, 2001). Moreover, this observed attentional advantage was consistent with signal enhancement (Cameron, Tai, & Carrasco, 2002).

Thus, data from studies employing transient attention, which is a reflexive, stimulus-driven type of attention, indicate enhanced spatial resolution at the attended location (Yeshurun & Carrasco, 1998, 1999, 2000). It is plausible that the effect would be the same with central (i.e., sustained) attention, but such data are currently unavailable. Nonetheless, there are findings indicating that one's contrast sensitivity is greater in the lower (versus higher) visual meridian (Carrasco, Talgar, & Cameron, 2001). Moreover, recent data demonstrate that spatial resolution is higher in the lower half with a constant degree of resolution enhancement along the vertical meridian (Talgar & Carrasco, 2002). The bulk of the evidence sets limits to the effects of attention on spatial resolution and specifies that certain visual—*not attentional*—constraints determine aspects of spatial resolution.

Last, because some scholars maintain that highly suggestible people can respond to suggestions even without hypnosis (Braffman, 2001; Braffman & Kirsch, 1999; Kirsch & Braffman, 2001), it is not clear whether a hypnotic context is essential in order for suggestions to be practicable. Toward this end, findings from studies concerning the effects of suggestion on visual processing outside of hypnosis are highly relevant (cf. Pollard, Raz, & Kirsch, 2003).

Psychological Approaches to Myopia

Most eye-care practitioners generally view myopia as resulting from the refractive elements of the eye being too high (refractive myopia) or from an elongated eye (axial myopia) and usually a result of a combination of both. In general, these effects are explainable by the mechanical arrangements of the human eye and are therefore governed by the laws of physics (i.e., optics). In harmony with this approach, most eye practitioners do not typically consider psychological factors as pertinent to myopia and frequently prescribe concave lenses for its correction. Nonetheless, there has been significant interest in the use of behavioral training and adjunctive treatment in the improvement of

vision in general, and modification of myopia in particular (Lanyon & Giddings, 1974; Rosen, Schiffman, & Cohen, 1984).

An exhaustive review of the field of visual training is beyond the scope of this paper, however, in order to give a flavor of some relevant studies, we wish to briefly mention studies concerning operant conditioning and biofeedback as complements to the efforts of recruiting hypnosis to the modification of myopia.

Based on informal observations, unpublished theses (e.g., Bell, 1956), and little published research (e.g., Giddings, 1971; Giddings & Lanyon, 1971), some precedents exist for exploring the relevance of conditioning for altering visual acuity. Accounts of psychological factors in myopia were frequently studied in doctoral dissertations (e.g., Brandt, 1977; Gil, 1984; Rosanes, 1966; Seitler, 1982; Zeiger, 1977), albeit the majority of these data typically remained unpublished. Although later reports exhibited a nonsignificant increase in acuity with only one study reporting a significant decrease in refractive error (Giddings & Lanyon, 1974), several earlier studies claimed that myopes' visual acuity can be significantly improved without corrective lenses, via optometric training (e.g., Hildreth, Meinberg, Milder, Post, & Sanders, 1947). Sells and Fixott (1957) concluded that these training techniques do not alter the refractive power of the eye and that visual acuity improved when subjects learned to maximize their use of available perceptual cues.

In a line of optometric studies as part of his doctoral thesis, Kelley (1958, 1962) investigated in several ways the effects of indirect (e.g., reinforcement) and direct (e.g., hypnotic) suggestion on visual acuity. Using such techniques as cycloplegia—a temporary paralysis of the accommodative apparatus of the eye—and such tools as a haploscope—an instrument that provides different displays to the two eyes, usually for the testing of fusion or stereopsis—Kelley determined that both waking and hypnotized subjects were able to improve their visual acuity through suggestion and that those changes probably involved the lens or eyeball shape and more than accommodative factors. Accordingly, Kelley (1958) hypothesized that psychological factors might act to reduce the refraction of the eye. While not lending direct evidence for the conditionability of visual acuity or refractive error, Kelley proposed that some visual functions might be modifiable by behavioral manipulations. Several researchers have subsequently investigated these claims.

The treatment of myopia through biofeedback and fading mechanisms has been widely studied (e.g., Angi et al., 1996; Collins, Epstein, & Hannay, 1979; Rupolo, Angi, Silvestri, & de Bertolini, 1990; Rupolo et al., 1997). Investigating these effects on enhancing visual acuity, some investigators (e.g., Epstein, Greenwald, Hennon, & Hiedorn, 1981) also claimed training to be effective, and there have been claims that visual acuity could be improved using fading procedures even without

feedback (Collins, Epstein, & Hannay, 1981). However, more recent studies investigating visual (Angi et al.) and acoustic (Rupolo et al., 1997) biofeedback in the treatment of myopia and improvement of visual acuity found that the training had a positive effect on psychological condition and subjective visual acuity but failed to reduce the existing myopia or show improvement on objective measurements. These behavioral assays demonstrate that although feedback training boosted improvement in visual acuity in terms of subjective measures and promoted a global sense of welfare, it did not affect acuity as tested objectively.

More recent data to support the involvement of behavioral factors in the improvement of visual acuity in myopia came from the doctoral dissertation of Kay (1992), who explored the visual acuity changes resulting from hypnosis with specific suggestions, neutral hypnosis, progressive relaxation, and nonhypnotic suggestion, employing an independent group design in which the dependent variable was the change in visual acuity. Kay found that subjects exposed to hypnotic induction with appropriate suggestions demonstrated an improvement over their own pretest scores. Further, their posttest scores were significantly better than those obtained for subjects in the progressive relaxation condition. Whereas data compiled from the nonhypnotic suggestion group demonstrated a slight (nonsignificant) trend, no change was found for any of the other conditions (Kay). A detailed examination of these unpublished findings raises a number of reservations concerning the experimental design and hypnotic procedures employed.

Any correlation found between psychological condition and myopia may result from the effect of social constraints of the myopic condition rather than the reverse causation. It has been reported that myopia is correlated with such psychological factors as introversion (e.g., Mull, 1948), intelligence (e.g., Miller, 1992), academic achievement and individual creative performance (e.g., Young, Singer, & Foster, 1975), and other personality factors and psychological stressors (Rupolo et al., 1990, 1997). However, many of the reported correlations were small and they all appear to relate to academic contexts and the stereotypical high-achieving student. Although there is no established cause-and-effect relationship, there is an association between excessive visual near-work behavior and myopia (Angle & Wissmann, 1980; Rose, Yinon, & Belkin, 1974; Wallman, Turkel, & Trachtman, 1978; Young, 1961, 1967; Young et al., 1970). Therefore, a student who reads a lot and undertakes excessive schoolwork is more likely to develop or aggravate mild myopia. These behavioral aspects probably complement a genetic predisposition as heredity also plays a role in myopia (e.g., Mutti, Mitchell, Moeschberger, Jones, & Zadnik, 2002; Mutti, Semina, et al., 2002). Clinically, assuming coincidence with key psychological crises in

one's development, a few practitioners even attempted psychoanalysis as a therapeutic technique to improve myopia (e.g., Kaufman, 1963). Curiously, the official publication of the Academy of Scientific Hypnotherapy recently revived a similar account by optometrist Erwin L. Gienke (Kemery, 2000; cf. Gienke, 1957). This report draws on the descriptions of LeCron (1952, p. 160) and Dunbar (1947, p. 37), who speak of a myopic person showing marked improvement in visual acuity under hypnosis and suggest that myopia may be a defense mechanism adopted to protect oneself from external strife, respectively.

In general, the preponderance of the admissible evidence suggests that although perceptual learning may improve vision to some degree, it is important to realize the shortcomings of these behavioral techniques. Most data collected thus far are limited to demonstrations that minimal and temporary improvements can occur following such interventions as reinforcement and hypnosis. Chiefly, these changes appear to involve alterations in subjectively assessed acuity. Further, "in view of the lack of concrete evidence regarding potential correlated physiological changes in the visual system, ethical considerations call into question experimental treatments producing more than minimally significant effects" (Giddings & Lanyon, 1974, p. 279). Uncertainty regarding the clinical worth of these investigations lingers because behavioral training is typically short-lived, resulting in meek effects with little substantive follow-up data. It is unclear whether generalizing such data across all, or even most, myopes is possible. Clinical ophthalmologists as well as optometrists and physiological optics experts have thoroughly reviewed the psychological and behavioral factors in the modification of myopia (e.g., Giddings & Lanyon, 1974). Among those eye-care specialists, there is consensus that there is a dearth of evidence to support effective behavioral mediation of myopic vision (e.g., Rosen et al., 1984; Woods, 1946).

A Meticulous Evaluation

Graham and Leibowitz (1972) anchor the claim that hypnotic suggestion can improve visual acuity around largely anecdotal findings. Not only does some of their substantiation rely on preliminary case studies (Browning & Crasilneck, 1957; Davison & Singleton, 1967), some of these data actually present scenarios devoid of suggestion (Copeland, 1967a, 1967b; Davison & Singleton; Kline, 1952/1953). Additionally, the authors cite data from unrelated domains (Weitzenhoffer, 1951), an unpublished case report using the wife of one of the authors as subject (LeCron, 1952), and a short, reference-free report based on an unpublished five-page thesis (Copeland, 1967b) where the number of subjects is unclear (once reported as 8 and once as

9). While intriguing, these sparse reports are at odds with what seems to be a large corpus of dependable data. As a case in point, the meandering accounts of age-regressed vision do not accord with data from modern studies into the development of visual acuity (e.g., Maurer & Lewis, 2001a, 2001b; cf. Harwood & Ward, 1972) and are particularly problematic in light of evidence showing that visual acuity is not adult-like until age 7 (Ellemberg, Lewis, Liu, & Maurer, 1999).

Methodologically, there also are a number of caveats to keep in mind. As Sheehan et al. (1982) pointed out, in their first experiment, Graham and Leibowitz (1972) did not match their control groups: control subjects were not suggestibility-matched with the highly suggestible experimental group and were thus almost certainly of lower suggestibility. This alone can explain the results of Experiment 1 (i.e., the effect measured may have resulted not from the presence or absence of suggestions but from the inequality of the groups compared). In addition, Experiment 1 assessed visual acuity by means of a single chart of Landolt C characters, which subjects were able to view multiple times. Testing subjects without their glasses and comparing two measurements separated in time decided the visual acuity gradient. However, subjects may have had sufficient opportunity to view the chart in between these occasions while wearing their glasses. This lax protocol may have introduced an appreciable bias.

Further, in the first study, 9 patients with varying degrees of refractive error (from 0 to −4) were tested in the waking state and then while hypnotized. The experimental design separated the subjects into three groups: those with no myopia, those with slight myopia (−.75, −.50, and −.25), and a group dubbed as highly myopic (−4, −2.25, and −1.75). The authors state that 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 "marked improvement" (Graham & Leibowitz, 1972, p. 174). Although this result is highly reminiscent of a statistical "regression to the mean" effect (i.e., extreme values tend to improve the most), the authors concluded, based on the experiment, that myopic visual acuity was significantly improved through the use of hypnosis and that there was "marked improvement" over sessions for the highly myopic subjects.[5] In Experiment 2 the examiners concluded that visual acuity for myopes who were hypnotically susceptible significantly improved with suggestion absent hypnosis and that

[5]These changes can be obtained by a very small change in the optical aperture, by action of the eyelids or small changes in the pupil. Myopes are very adept at manipulating their eyelids to gain an increase in their depth of field. A small change in pupil size promoted by slight light difference can introduce substantial variation in performance in high myopia or when the pupil was initially large.

the improvement did not transfer to outside the experimental situation. No data were presented for the individual subjects, but the method of assessing visual acuity was the same as for Experiment 1. In Experiment 3, the authors eliminated the possibility of relaxation, accommodation, or other causes of a change in refractive power as the mechanism for the alleged improvement mediated by suggestion. In this experiment, 5 patients were tested and the authors again state that the effect of suggestion was more effective for the more myopic.

Close inspection of the data presented in the three experiments does not support most of the conclusions. For example, data from Experiment 1 purports to show slight improvement in the low myopes and marked improvement in what the authors call high myopes (most eye practitioners would label this latter group moderate myopes and reserve the appellation high myopes for individuals with refractive errors greater than −4 or even −6). In the slightly myopic group, only 1 patient (No. 5) showed improvement under hypnosis with visual acuity changing in the right eye from 20/200 to 20/80 and in the left eye from 20/300 to 20/100. One patient in this group showed minimal improvement in only one eye, and 1 patient was minimally worse in one eye. In their "highly" myopic group, there was minimal to no change in any of the 3 in spite of claims to the contrary. A method of determining visual acuity, "count fingers," was utilized when the limits exceeded the size of the letters on the chart, rendering the report of the results unreliable.[6] "Count fingers" is not a standardized quantifiable method for determining visual acuity and is undependable. Different examiners have different hand and finger size, space in between the fingers is not controlled, nor is the possibility that there will be slight hand movement during the testing. Distances are usually estimated and are not accurately measured. Lighting differs, as does the luminance of the background between the fingers. It is estimated that three fingers subtend approximately the same visual angle as the 100 or 200 Snellen letters and therefore "count fingers" at five feet is the equivalent of between 5/100 and 5/200 vision (equivalent to 20/400 to 20/800). "Count fingers" at nine feet is equivalent to 9/100 to 9/200 Snellen acuity (approximately 20/200 to 20/400). "Count fingers" at seven feet is approximately equivalent to 20/300. That means that the first 2 subjects in the highly myopic group showed very slight improvement in one eye only and that the 3rd patient probably fared worse under suggestion. At best, Experiment 1 showed that 1 slightly myopic patient, out of 3, showed improvement in vision under hypnosis and that in the highly myopic group 2 patients showed slight improvement in one eye, and 1 patient was probably worse in both

[6]This technique is useful to assess the degree of visual difficulty the subject is experiencing and is not used where refractive error is the cause.

eyes. The claim that the highly myopic subjects showed significant improvement is simply not borne out by the data.

Experiment 3 does show improvement in visual acuity of myopes under hypnotic conditions, but the conclusion that the procedure is more effective for the more myopic requires clarification. While the higher myopes did achieve a larger improvement in resolution angle in absolute terms (e.g., visual angle 6.18 down to 4.08 and 4.08 down to 2.99), in relative terms the greatest improvements occurred in Patients 3 and 4, the low myopes. In addition, no explanation was offered for the fact that between Sessions 2 and 3 the visual acuity improved in 4 out of 5 subjects absent the hypnotic state.

In a short paper challenging their statistical analyses, Wagstaff (1983) questioned the conclusions of the follow-up study by Sheehan et al. (1982) and provided a coherent account showing why their results might have been premature. Although the experimental group performed better than the control group, Wagstaff noted that this might have been because the control group was marginally better initially. Moreover, he observed that if suggestions do improve visual acuity, then the comparison between the experimental group before and after treatment should be significantly different, which was not the case. Finally, applying what he deemed to be a more appropriate statistical model to Sheehan et al.'s data, Wagstaff demonstrated that it was possible to conclude that suggestions for improving visual acuity had little to no effect whereas listening to music (i.e., the control condition employed by Sheehan et al.) appeared to reduce visual sensitivity. A courtesy reply from the original authors (Smith, Forrest, & Sheehan, 1983), where they reapplied the conventional analysis of variance to the original data, illuminated the inadequacy of their initial conclusions (i.e., that suggestion improved visual acuity) and considerably weakened the results' viability.

It has been established that hypnotic (or even monetary) incentives for changing visual threshold may be relatively ineffective when participants operate initially near optimal levels (e.g., Zamansky & Brightbill, 1964). In addition, there are studies suggesting that whereas visual training techniques with myopes lead to no improvement in objective measures of visual acuity, they do promote an improvement in relatively subjective measures of visual acuity and a parallel enhancement in psychological conditions (Rupolo et al., 1997). In other words, myopes who were treated consequently developed a greater sense of general well being, although their visual acuity remained unchanged. To this end, the "hold back" effect (i.e., when one expects to be hypnotized and as a result restricts the prehypnotic performance in order to allow room for subsequent improvement under hypnosis) may have further confounded Graham and Leibowitz's original results (e.g., Zamansky, Scharf, & Brightbill, 1964). Altogether, it seems that

Table 1
A Chronological Summary of the Chief 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, 1951	N = 6	Hypnotic suggestions for improved differential recognition	Superior performance level compared to the waking state	Visual acuity was not formally tested.
LeCron, 1952	N = 1	Hypnotic age-regression; no suggestion	Improved vision in a myopic patient	Based on unpublished data collected from one of the cited authors' wife.
Kline, 1952/1953	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 & Crasilneck, 1957	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, 1958[¥], 1962[§]	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; strong bias towards the "Bates method" throughout the exposition; failure to measure refractive changes during the actual training sessions.

Kliman & Goldberg, 1962	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, 1967a[§]; Copeland, 1967b[¥]	N = 8 or 9	Hypnosis without suggestion	Improved visual acuity following hypnosis	Unpublished data.
Davison & Singleton, 1967	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, 1971	N = 5	Hypnotic suggestion to improve vision	Improved vision with some myopes	Inconclusive results.
Graham & Leibowitz, 1972	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, Smith, & Forrest, 1982	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 (Wagstaff, 1983) and rebutted (Smith, Forrest, & Sheehan, 1983); questionable conclusions.

Table 1
(continued)

Author(s)	Sample size	Method	Effect reported	Comments
Kay, 1992[¥]	N = 75	Comparison of hypnosis with suggestion for improved vision, neutral hypnosis, progressive relaxation, non-hypnotic suggestion, and control conditions across myopes	Improved vision with some myopes under hypnotic suggestion	Methodological issues; unpublished data.

[¥]Doctoral dissertation.
[§]Not a peer-reviewed journal at the time of publication.

there are copious unambiguous data that date back more than 60 years showing no evidence for increased sensitivity in visual acuity under hypnotic suggestion (Sterling & Miller, 1940).

"Extraordinary claims require extraordinary evidence" is an adage attributed to the late Carl Edward Sagan. However, Graham and Leibowitz (1972) provide inadequate evidence that suggestion advances visual acuity in myopes. Toward this end, we have attempted to compile a list of the studies typically cited in favor of the effects of hypnosis and suggestion on visual acuity. Table 1 summarizes the results of our efforts and outlines a sketch of some salient shortcomings for each.

Perceptual Learning and Beyond

The process of seeing is "only half ocular—the other half is cerebral" (Lancaster, 1944). Indeed, it is possible to train the brain to interpret retinal blotches. The improvement in vision, in such a case, will be due to a better response in the psychological phase of seeing. Clearly, some practitioners have overexploited this facet. However, this phenomenon is no stranger than what one normally encounters in the course of everyday life. For example, a smudge on an X-ray chart may be a blur to the uninitiated novice but a serious medical indication to the 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. Moreover, there are data demonstrating that visual training holds no improvement in objective measures of visual acuity, but does lead to an improvement in one's subjective measure of visual acuity alongside a general growth in psychological well-being (Rupolo et al., 1997).

As a case in point—related to an acrimonious controversy in the early 1940s concerning claims for the rehabilitation of color blindness by means of visual exercises—a number of individuals rejected by the military because of color blindness managed to pass the required test after training. There was consensus within medical circles that the exercises they undertook did not "cure" their color blindness but merely "educated" them to better discern colors. However, regardless of whether these individuals were "cured" or "educated," they could distinguish the colored patterns of the Ishihara (Ishihara, 1951, 1994) or other similar tests, following a series of exercises—something they could not do before training.[7] Subsequently, some practitioners chose

[7]To test this scientifically, one would have to use an anomoloscope.

to interpret these data to mean that these persons had acquired a greater degree of color perception and color discrimination than they had had before taking the exercises.

We do not wish to disparage perceptual training (i.e., developing a keen ability to interpret blurred images) or in any way deprecate the significance of such learning. Instead, we wish to stress that there is admissible evidence of improvement in visual acuity that is not explained by refractive changes. Indeed, the improvement of some aspects of visual performance through perceptual learning is a fact (Sells & Fixott, 1957).

Graham and Leibowitz (1972) showed a slight increase in visual acuity for some subjects under suggestion. The effect was the same for low to moderate myopes (no truly high myopes were tested) 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 have an effect on the testing, producing an increase on the order of magnitude equal to that seen in some of the experimental subjects studied in the hypnosis assays. 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. Thus, to implicate suggestion or hypnosis as the cause of this slight increase in visual acuity may be overreaching.

The baffling phenomenon of negative accommodation, sparsely documented in rare individuals, can also possibly explain better visual acuity in uncorrected myopes on occasion (LeGrand, 1950, 1952; Maddock, Millodot, Leat, & Johnson, 1981; Marg, 1952; Morgan & Olmstead, 1939; cf. Otero, 1951). It is thought that there is a base tonus for the accommodative mechanism (Gilmartin & Hogan, 1985a, 1985b), which 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 and enable myopes to see better. Negative accommodation, however, even if it exists, is extremely rare. It results in evanescent increases in vision (described as flashes of clear vision) and is accompanied by a decrease in the overall plus power in the eye. We have been able to gather less than a handful of personal communications from prominent clinicians who report having assessed negative accommodation objectively (e.g., by retinoscopy). These features are not consistent with the description of increased visual acuity that allegedly occurs as a result of suggestion.

CONCLUSION

We present an abundance of evidence to challenge the original premise concerning the favorable effect of (hypnotic) suggestion on visual acuity in myopes (e.g., Graham, 1971; Graham & Leibowitz, 1972). We outline multiple shortcomings to the evidentiary foundation on which Graham and Leibowitz built their claims. In particular, we point out that their samples were too small and their procedures too weak to afford any long-term conclusions. We provide arguments to suggest that the effect of suggestion on myopes' visual acuity is not likely to be significant. These arguments invariably apply to other studies emanating from Graham and Leibowitz's original work (e.g., Sheehan et al., 1982).

Although some reports of temporary changes in subjective acuity and refractive error by behavioral means seem to support the view that myopia may be operationalized as a behavioral disorder and that psychological factors may play a progressively more important role in its understanding, further research is required to establish a viable correlation between suggestion and veridical visual acuity improvement in myopes.

Finally, we believe that these 30-year-old findings should be recast as an example of the limits of what (hypnotic) suggestion can achieve rather than serve as grist for the skeptics' mill. When left uncontested the passage of time does not necessarily negate—indeed it may even endorse—the impact of old data. We believe that a responsible scientific stance should examine what hypnosis and suggestion *cannot* do as well as what they can. Evidence relating hypnotic suggestion to attentional mechanisms is mounting (e.g., Raz et al., 2002b). Together with data illuminating visual attention and acuity (e.g., Yeshurun & Carrasco, 1999), these collective findings provide the likely limits suggestion can impart to visual acuity. We plan to soon report empirical data from a series of experiments to corroborate this notion.

REFERENCES

Angi, M.R., Caucci, S., Pilotto, E., Racano, E., Rupolo, G., & Sabbadin, E. (1996). Changes in myopia, visual acuity, and psychological distress after biofeedback visual training. *Optometry and Vision Science, 73*(1), 35–42.

Angle, J., & Wissmann, D.A. (1980). The epidemiology of myopia. *American Journal of Epidemiology, 111*, 220–228.

Bates, W.H. (1912). Eye training for the cure of functional myopia. *The British Psychological Society, 78*(2), 1029–1032.

Bell, G.K. (1956). *Conditioning visual acuity: Increased perceptual responses as a function of myopia and manifest anxiety.* Doctoral dissertation, University of Tennessee.

Blum, G.S. (1975). A case study of hypnotically induced tubular vision. *International Journal of Clinical and Experimental Hypnosis, 23*, 111–119.

Blum, G.S., & Wiess, F. (1986). Attenuation of symbol/word interference by posthypnotic negative hallucination and agnosia. *Experimentelle und Klinische Hypnose, 2*, 58–62.

Braffman, W. (2001). Reaction time as a predictor of imaginative suggestibility and hypnotizability. *Contemporary Hypnosis, 18*, 107–119.

Braffman, W., & Kirsch, I. (1999). Imaginative suggestibility and hypnotizability: An empirical analysis. *Journal of Personality and Social Psychology, 77*, 578–587.

Brandt, R. (1977). The visual anomalies of myopia and hyperopia related to psychological factors [Abstract]. *Dissertation Abstracts International, 38*(6B), 2845.

Browning, C.W., & Crasilneck, H.B. (1957). The experimental use of hypnosis in suppressive amblyopia. *American Journal of Ophthalmology, 44*(4, Part I), 468–477.

Cameron, E.L., Tai, J.C., & Carrasco, M. (2002). Covert attention affects the psychometric function of contrast sensitivity. *Vision Research, 42*(8), 949–967.

Carrasco, M., & McElree, B. (2001). Covert attention accelerates the rate of visual information processing. *Proceedings of the National Academy of Science USA, 98*(9), 5363–5367.

Carrasco, M., Penpeci-Talgar, C., & Eckstein, M. (2000). Spatial covert attention increases contrast sensitivity across the CSF: Support for signal enhancement. *Vision Research, 40*(10–12), 1203–1215.

Carrasco, M., Talgar, C.P., & Cameron, E.L. (2001). Characterizing visual performance fields: Effects of transient covert attention, spatial frequency, eccentricity, task and set size. *Spatial Vision, 15*, 61–75.

Clark, W.C., Yang, J.C., & Janal, M.N. (1986). Altered pain and visual sensitivity in humans: the effects of acute and chronic stress. *Annals of the New York Academy of Sciences, 467*, 116–129.

Collier-Vanhimbeeck, S. (1997). *A guide to the optemetric training of myopia control*. Sanra Ana, CA: Optometric Extension Program Foundation.

Collins, F.L., Epstein, L.H., & Hannay, H.J. (1979). Modification of myopia using fading and feedback: A case study. *Behavior Therapist, 2*(5), 28–29.

Collins, F.L., Epstein, L.H., & Hannay, H.J. (1981). A component analysis of an operant training program for improving visual acuity in myopic students. *Behavior Therapy, 12*, 692–701.

Copeland, V.L. (1967a). Increased visual acuity of myopes while in hypnosis. *Journal of the American Optometric Association, 38*(8), 663–664.

Copeland, V.L. (1967b). *Increased visual acuity of myopes while in hypnosis*. Fifth-year thesis, Pacific University.

Cornsweet, T.N., & Crane, H.D. (1970). Servo-controlled infrared optometer. *Journal of the American Optometric Association, 60*, 548–554.

Corsi-Cabrera, M., Arce, C., Del Rio-Portilla, I.Y., Perez-Garci, E., & Guevara, M.A. (1999). Amplitude reduction in visual event-related potentials as a function of sleep deprivation. *Sleep, 22*, 181–189.

Crasilneck, H.B., & Hall, J.A. (1959). Physiological changes associated with hypnosis: A review of the literature since 1948. *International Journal of Clinical and Experimental Hypnosis, 7*, 9–50.

Davison, G.C., & Singleton, L. (1967). A preliminary report of improved vision under hypnosis. *International Journal of Clinical and Experimental Hypnosis, 15*, 57–62.

Duke-Elder, W.S. (1942). *Text-book of ophthalmology* (Vol. 1). London: Henry Klimpton.

Dunbar, F. (1947). *Mind and body: Psychosomatic medicine*. New York: Random House.

Durrant, J.D., & Shallop, J.K. (1969). Effects of differing states of attention on acoustic reflex activity and temporary threshold shift. *Journal of the Acoustical Society of America, 46*(4), 907–913.

Ellemberg, D., Lewis, T.L., Liu, C.H., & Maurer, D. (1999). Development of spatial and temporal vision during childhood. *Vision Research, 39*(14), 2325–2333.

Epstein, L.H., Greenwald, D.J., Hennon, D., & Hiedorn, B. (1981). Monocular fading and feedback: Effects on vision changes in the trained and untrained eye. *Behavior Modification, 5*(2), 171–186.

Erickson, M.H. (1939). The induction of color blindness by a technique of hypnotic suggestion. *Journal of General Psychology, 20*, 61–89.

Erickson, M.H. (1943). Hypnotic investigation of psychosomatic phenomena: I. Psychosomatic interrelationships studied by experimental hypnosis. *Psychosomatic Medicine, 5*, 51–58.

Eyesight protection massage in Japan. (1977). *Peking Review* (pp. 27–28).

Fan, J., McCandliss, B.D., Sommer, T., Raz, A., & Posner, M.I. (2002). Testing the efficiency and independence of attentional networks. *Journal of Cognitive Neuroscience, 14*(3), 340–347.

Fan, J., Raz, A., & Posner, M.I. (in press). Attentional mechanisms. In M.J. Aminoff & R.B. Deroff (Eds.), *Encyclopedia of neurological sciences.*

Friedman, E. (1981). Vision training program for myopia management. *American Journal of Optometry and Physiological Optics, 58*(7), 546–553.

Giddings, J.W. (1971). Operant conditioning of visual acuity [Abstract]. *Dissertation Abstracts International, 32*(3B), 1841–1842.

Giddings, J.W., & Lanyon, R.I. (1971). Modification of refractive error through conditioning: An exploratory study. *Behavior Therapy, 2*, 538–542.

Giddings, J.W., & Lanyon, R.I. (1974). Effect of reinforcement of visual acuity in myopic adults. *American Journal of Optometry and Physiological Optics, 51*(3), 181–188.

Gienke, E.L. (1957). Use of hypnosis in visual corrections. *The Optometric Weekly, 48*, 1797–1800.

Gil, K.M. (1984). Behavioral factors in myopia: The effects of fading and feedback training on multiple aspects of visual behavior [Abstract]. *Dissertation Abstracts International, 45*(5B), 1585.

Gilmartin, B., & Hogan, R.E. (1985a). The relationship between tonic accommodation and ciliary muscle innervation. *Investigative Ophthalmology and Visual Science, 26*(7), 1024–1028.

Gilmartin, B., & Hogan, R.E. (1985b). The role of the sympathetic nervous system in ocular accommodation and ametropia. *Ophthalmic Physiology Optics, 5*, 91–93.

Graham, C. (1971). On the mechanism of suggested suppression of myopia: Relationship to relative accommodation. *Proceedings of the Annual Convention of the American Psychological Association, 6*(Pt. 2), 779–780.

Graham, C., & Leibowitz, H.W. (1972). The effect of suggestion on visual acuity. *International Journal of Clinical and Experimental Hypnosis, 20*(3), 169–186.

Grether, W.F. (1940). A comment on "The induction of color blindness by a technique of hypnotic suggestion". *Journal of General Psychology, 23*, 207–210.

Grindlye, G.C., & Townsend, V. (1968). Voluntary attention in peripheral vision and its effects on acuity and differential thresholds. *Quarterly Journal of Experimental Psychology Section A-Human Experimental Psychology, 20*(1), 11–19.

Halligan, P.W., Athwal, B.S., Oakley, D.A., & Frackowiak, R.S. (2000). Imaging hypnotic paralysis: Implications for conversion hysteria [see comments]. *Lancet, 355*(9208), 986–987.

Harriman, P.L. (1942). Hypnotic induction of color vision anomalies: I. The use of the Ishihara and the Jensen tests to verify the acceptance of suggested color blindness. *Journal of General Psychology, 26*, 289–298.

Harvey, M.A., & Sipprelle, C.N. (1978). Color blindness, perceptual interference, and hypnosis. *American Journal of Clinical Hypnosis, 20*(3), 189–193.

Harwood, L.W. (1970). *Changes in visual acuity in myopic subjects during hypnosis.* Paper presented at the American Journal of Optometry and Archives of American Academy of Optometry.

Harwood, L.W., & Ward, L. (1972). *Visual acuity changes in subjects experiencing age regression during hypnosis.* Paper presented at the American Journal of Optometry and Archives of American Academy of Optometry.

Hennessy, R.T., & Leibowitz, H. (1970). Subjective measurement of accommodation with laser light. *Journal of the Optical Society of America, 60*(12), 1700–1701.

Hildreth, H.R., Meinberg, W.H., Milder, B., Post, L.T., & Sanders, T.E. (1947). The effect of visual training on existing myopia. *American Journal of Ophthalmology, 30*, 1563–1576.

Hohnsbein, J., Piekarski, C., Kampman, B., & Noack, T. (1984). Effects of heat on visual acuity. *Ergonomics, 27*(12), 1239–1246.

Hull, C.L. (1938). *Hypnosis and suggestibility: An experimental approach.* New York: Appleton-Century-Crofts.

Ishihara, S. (1951). *Tests for color blindness.* Japan: S. Kanehara.

Ishihara, S. (1994). *Ishihara tests for colour-blindness.* Tokyo Japan: Kanehara Shuppan.

Kaplan, R.M. (1994). *Seeing without glasses: Improving your vision naturally.* Hillsboro, OR: Beyond Words.

Karlin, R.A. (1979). Hypnotizability and attention. *Journal of Abnormal Psychology, 88*, 92–95.

Kaufman, F. (1963). Myopia seen psychoanalytically. *Psychoanalytic Review, 50*, 24–49.

Kay, L.M. (1992). *The effects of hypnosis, relaxation, and suggestion on visual acuity.* Doctoral dissertation, California School of Professional Psychology.

Kelley, C.R. (1958). *Psychological factors in myopia.* Doctoral dissertation, New School for Social Research.

Kelley, C.R. (1962). Psychological factors in myopia. *Journal of the American Optometry Association, 33*(11), 833–837.

Kemery, W.E. (2000, October). Hypnosis may help visual problems. *Hypnotherapy in Review*, 2–3.

Kirsch, I., & Braffman, W. (2001). Imaginative suggestibility and hypnotizability. *Current Directions in Psychological Science, 10*(2), 57–61.

Kirsch, I., Burgess, C.A., & Braffman, W. (1999). Attentional resources in hypnotic responding. *International Journal of Clinical and Experimental Hypnosis, 47*, 175–191.

Kliman, G., & Goldberg, E.L. (1962). Improved visual recognition during hypnosis. *Archives of General Psychiatry, 7*, 155–162.

Kline, M.V. (1952/1953). The transcendence of waking visual discrimination capacity with hypnosis: A preliminary case report. *British Journal of Medical Hypnotism, 4*, 32–33.

Kosslyn, S.M., Thompson, W.L., Costantini-Ferrando, M.F., Alpert, N.M., & Spiegel, D. (2000). Hypnotic visual illusion alters color processing in the brain. *American Journal of Psychiatry, 157*(8), 1279–1284.

Kroger, W.S. (1977). *Clinical and experimental hypnosis in medicine, dentistry, and psychology* (2nd ed.). Philadelphia: J.B. Lippincott.

Lancaster, W.B. (1944). Present status of eye exercises for improvement of visual function. *Archives of Ophthalmology*, 32, 167.

Lanyon, R., & Giddings, J.W. (1974). Psychological approaches to myopia: A review. *American Journal of Optometry and Physiological Optics, 51*(4), 271–281.

LeCron, L.M. (Ed.). (1952). *Experimental hypnosis.* New York: Macmillan.

LeGrand, Y. (1950). Sur lexistemce chez certains sujets dune accommodation negative [The presence of negative accommodation in certain subjects]. *Comptes Rendus Hebdomadaires Des Séances De l'Academie Des Sciences, 230*(15), 1422–1424.

LeGrand, Y. (1952). The presence of negative accommodation in certain subjects. *American Journal of Optometry and Archives of American Academy of Optometry*, 134–136.

Leibowitz, H., Brislin, R., Perlmutt, L., & Hennessy, R.T. (1969). Ponzo perspective illusion as a manifestation of space perception. *Science, 166*(3909), 1174.

Leibowitz, H.W., Graham, C., & Stein, G.B. (1972). *The effect of suggestion on visual acuity.* Paper presented at the American Journal of Optometry and Archives of American Academy of Optometry.

Leibowitz, H.W., Post, R.B., Rodemer, C.S., Wadlington, W.L., & Lundy, R.M. (1980). Roll vection analysis of suggestion-induced visual field narrowing. *Perception and Psychophysics, 28*(2), 173–176.

Liberman, J. (1995). *Take off your glasses and see*. New York: Three Rivers Press.

Maddock, R.J., Millodot, M., Leat, S., & Johnson, C.A. (1981). Accommodation responses and refractive error. *Investigative Ophthalmology and Visual Science, 20*(3), 387–391.

Mallard, D., & Bryant, R.A. (2001). Hypnotic color blindness and performance on the Stroop test. *International Journal of Clinical and Experimental Hypnosis, 49*, 330–338.

Marg, E. (1952). "Flashes" of clear vision and negative accommodation with reference to the Bates method of visual training. *American Journal of Optometry and Archives of American Academy of Optometry, 29*(4), 167–184.

Maurer, D., & Lewis, T. (2001a). Visual acuity and spatial contrast sensitivity: Normal development and underlying mechanisms. In C. Nelson & M. Luciana (Eds.), *Handbook of developmental cognitive neuroscience* (pp. 237–251). New York: Bradford Books.

Maurer, D., & Lewis, T. (2001b). Visual acuity: The role of visual input in inducing postnatal change. *Clinical Neurosciene Research, 1*, 239–247.

Miller, E.M. (1992). On the correlation of myopia and intelligence. *Genetic, Social, and General Psychology Monographs, 118*(4), 361–383.

Morgan, M.W., & Olmstead, J.M.D. (1939). Response of the human lens to a sudden startling stimulus. *Proceedings of the Society for Experimental Biology and Medicine, 42*, 612.

Mull, H.K. (1948). Myopia and introversion. *American Journal of Psychology, 61*, 575–576.

Mutti, D.O., Mitchell, G.L., Moeschberger, M.L., Jones, L.A., & Zadnik, K. (2002). Parental myopia, near work, school achievement, and children's refractive error. *Investigative Ophthalmology and Visual Science, 43*(12), 3633–3640.

Mutti, D.O., Semina, E., Marazita, M., Cooper, M., Murray, J.C., & Zadnik, K. (2002). Genetic loci for pathological myopia are not associated with juvenile myopia. *American Journal of Medical Genetics, 112*(4), 355–360.

Oakley, D. (1999). Hypnosis and conversion hysteria: A unifying model. *Cognitive Neuropsychiatry, 4*, 243–265.

O'Briant, C.R., & Ohlbaum, M.K. (1970). Visual acuity decrements associated with whole body plus or minus Gz vibration stress. *Aerospace Medicine, 41*(1), 79–82.

Otero, J.M. (1951). Influence of the state of accommodation on the visual performance of the human eye. *Journal of the Optical Society of America, 41*(12), 942–948.

Perkins, E.S., Hammond, B., & Milliken, A.B. (1976). Simple method of determining the axial length of the eye. *British Journal of Ophthalmology, 60*(4), 266–270.

Pollack, P. (1956). Fallacies of the Bates System. In P. Pollack (Ed.), *The truth about eye exercises*. Philadelphia, PA: Chilton.

Pollard, J., Raz, A., & Kirsch, I. (2003, July). *The effect of suggestion on Stroop performance*. Paper presented at the the Fifth Biennial Meeting of the Society for Applied Research in Memory and Cognition (SARMAC), Aberdeen University, Scotland.

Posner, M.I., & Rothbart, M.K. (1998). Attention, self-regulation and consciousness. *Philosophical Transactions of the Royal Society of London – Series B: Biological Sciences, 353*(1377), 1915–1927.

Raz, A. (1999). *The Effects of total sleep deprivation on the spotlight of visual attention and on pre-attentional processing*. Doctoral dissertation, Hebrew University.

Raz, A., Fan, J., Shapiro, T., & Posner, M.I. (2002, November). *fMRI of posthypnotic suggestion to modulate reading Stroop words*. Paper presented at the Annual Meeting of the Society for Neuroscience, Orlando, Florida.

Raz, A., Fossella, J.A., McGuinness, P., Sommer, T., & Posner, M.I. (2003, April). *Using genetic association assays to assess the role of dopaminergic neuromodulation in attentional and hypnotic phenomena*. Paper presented at the Cognitive Neuroscience Society, New York.

Raz, A., Fossella, J.A., McGuiness, P., Zephrani, Z.R., & Posner, M.I. (in press-a). Neural correlates and exploratory genetic associations of attentional and hypnotic phenomena. *Hypnose und Kognition – The official Journal of the Milton Erickson Society for Clinical Hypnosis in Germany*.

Raz, A., Fossella, J.A., McGuiness, P., Zephrani, Z.R., & Posner, M.I. (in press-b). Neuroimaging and genetic associations of attentional and hypnotic processes. In U. Halsband (Ed.), *Brain imaging in the neurosciences – an interdisciplinary approach*. Frankfurt am Main: Peter Lang GmbH – Europäischer Verlag der Wissenschaften.

Raz, A., Landzberg, K.S., Schweizer, H.R., Zephrani, Z.R., Shapiro, T., Fan, J., & Posner, M.I. (2003). Posthypnotic suggestion and the modulation of Stroop interference under cycloplegia. *Consciousness and Cognition, 12*(3), 332–346.

Raz, A., & Shapiro, T. (2002). Hypnosis and neuroscience: A cross talk between clinical and cognitive research. *Archives of General Psychiatry, 59*(1), 85–90.

Raz, A., Shapiro, T., Fan, J., & Posner, M.I. (2002a). Hypnotic modulation of Stroop interference: Behavioral and neuroimaging accounts. *Journal of Cognitive Neuroscience, A34*(Suppl.).

Raz, A., Shapiro, T., Fan, J., & Posner, M.I. (2002b). Hypnotic suggestion and the modulation of Stroop interference. *Archives of General Psychiatry, 59*(12), 1155–1161.

Raz, A., Shapiro, T., Fan, J., & Posner, M.I. (2002c, November). *Top-down modulation of Stroop interference by posthypnotic suggestion: Behavioral, optical, and neuroimaging accounts*. Paper presented at the 53rd Annual Meeting of the Society for Clinical and Experimental Hypnosis, Boston, MA.

Rees, G., Russell, C., Frith, C.D., & Driver, J. (1999). Inattentional blindness versus inattentional amnesia for fixated but ignored words. *Science, 286*(5449), 2504–2507.

Rosanes, M.B. (1966). Psychological correlates to myopia compared to hyperopia and emmetropia [Abstract]. *Dissertation Abstracts International, 27*(6B), 2125.

Rose, L., Yinon, U., & Belkin, M. (1974). Myopia induced in cats deprived of distance vision during development. *Vision Research, 14*(10), 1029–1032.

Rosen, R.C., Schiffman, H.R., & Cohen, A.S. (1984). Behavior modification and the treatment of myopia. *Behavior Modification, 8*(2), 131–154.

Rotberg, M.H., & Surwit, R.S. (1981). Biofeedback techniques in the treatment of visual and ophthalmologic disorders: A review of the literature. *Biofeedback and Self Regulation, 6*(3), 375–388.

Rupolo, G., Angi, M., Sabbadin, E., Caucci, S., Pilotto, E., Racano, E., & de Bertolini, C. (1997). Treating myopia with acoustic biofeedback: A prospective study on the evolution of visual acuity and psychological distress. *Psychosomatic Medicine, 59*(3), 313–317.

Rupolo, G., Angi, M., Silvestri, A., & de Bertolini, C. (1990). Variazioni della refrazione, struttura di personalita e sofferenza psicologica: Studio preliminare [Myopia, personality structure, and psychological suffering: Preliminary reports]. *Rivista di Psichiatria, 25*(1), 31–41.

Safir, A. (1979). Symposium: Clinical management of physiologic myopia. Introduction. *Ophthalmology, 86*(5), 679–680.

Scholl, L. (1978). *Visionetics: The holistic way to better eyesight* (1st ed.). New York: Doubleday.

Scholl, L. (1990). *Hypnovision: The new natural way to vision improvement* (1st ed.). New York: Henry Holt.

Scholl, L. (1997). *Hypnovision: the new natural way to vision improvement* (Paperback ed.). New York: Westwood.

Seitler, B.N. (1982). Psychological characteristics of boys with myopia [Abstract]. *Dissertation Abstracts International, 42*(12B, Pt 1), 4942.

Sells, S.B., & Fixott, R.S. (1957). Evaluation of research on effects of visual training on visual functions. *American Journal of Ophthalmology, 44*, 230–236.

Sheehan, E.P., Smith, H.V., & Forrest, D.W. (1982). A signal detection study of the effects of suggested improvement on the monocular visual acuity of myopes. *International Journal of Clinical and Experimental Hypnosis, 30*, 138–146.

Smith, H.V., Forrest, D.W., & Sheehan, E.P. (1983). Suggested improvement, music, and the visual acuity of myopes: A reply. *International Journal of Clinical and Experimental Hypnosis, 31*(4), 241–242.

Spiegel, D., Bierre, P., & Rootenberg, J. (1989). Hypnotic alteration of somatosensory perception. *American Journal of Psychiatry, 146(6),* 749–754.

Spiegel, D., Cutcomb, S., Ren, C., & Pribram, K. (1985). Hypnotic hallucination alters evoked potentials. *Journal of Abnormal Psychology, 94,* 249–255.

Spiegel, H., & Spiegel, D. (1978). *Trance and treatment: Clinical uses of hypnosis.* New York: Basic Books.

Sterling, K., & Miller, J.G. (1940). The effect of hypnosis upon visual and auditory acuity. *American Journal of Psychology, 53,* 269–276.

Stroop, J.R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18,* 643–661.

Szechtman, H., Woody, E., Bowers, K.S., & Nahmias, C. (1998). Where the imaginal appears real: A positron emission tomography study of auditory hallucinations. *Proceedings of the National Academy of Science USA, 95*(4), 1956–1960.

Talgar, C.P., & Carrasco, M. (2002). Vertical meridian asymmetry in spatial resolution: Visual and attentional factors. *Psychonomic Bulletin & Review, 9*(4), 714–722.

Tellegen, A., & Atkinson, G. (1974). Openness to absorbing and self-altering experiences ("absorption"), a trait related to hypnotic susceptibility. *Journal of Abnormal Psychology, 83,* 268–277.

Wagstaff, G.F. (1983). Suggested improvement of visual acuity: A statistical reevaluation. *International Journal of Clinical and Experimental Hypnosis, 31,* 239–240.

Wallman, J., Turkel, J., & Trachtman, J. (1978). Extreme myopia produced by modest change in early visual experience. *Science, 201*(4362), 1249–1251.

Watten, R.G., & Lie, I. (1992). Time factors in VDT-induced myopia and visual fatigue: An experimental study. *Journal of Human Ergology, 21,* 13–20.

Weitzenhoffer, A.M. (1951). The discriminatory recognition of visual patterns under hypnosis. *Journal of Abnormal and Social Psychology, 46,* 388–397.

Woods, A.C. (1946). Report from the Wilmer Institute on the results obtained in the treatment of myopia by visual training. *American Journal of Ophthalmology, 29,* 28–32.

Worrall, R.S., Nevyas, J., & Barrett, S. (2002). *Eye-Related Quackery.* http://www.quackwatch.com/01QuackeryRelatedTopics/eyequack.html (Vol. 2002).

Yeshurun, Y., & Carrasco, M. (1998). Attention improves or impairs visual performance by enhancing spatial resolution. *Nature, 396*(6706), 72–75.

Yeshurun, Y., & Carrasco, M. (1999). Spatial attention improves performance in spatial resolution tasks. *Vision Research, 39*(2), 293–306.

Yeshurun, Y., & Carrasco, M. (2000). The locus of attentional effects in texture segmentation. *Natural Neuroscience, 3*(6), 622–627.

Young, F.A. (1961). The effect of restricted visual space in the primate eye. *American Journal of Ophthalmology, 52,* 799–806.

Young, F.A. (1967). Myopia and personality. *American Journal of Optometry and Archives of the American Academy of Optometry, 44*(3), 192–201.

Young, F.A., Leary, G.A., Baldwin, W.R., West, D.C., Box, R.A., Goo, F.J., Harris, E., & Johnson, C. (1970). Refractive errors, reading performance, and school achievement among Eskimo children. *American Journal of Optometry and Archives of the American Academy of Optometry, 47*(5), 384–390.

Young, F.A., Singer, R.M., & Foster, D. (1975). The psychological differentiation of male myopes and nonmyopes. *American Journal of Optometry and Physiological Optics, 52*(10), 679–686.

Zamansky, H.S., & Brightbill, R. (1964). Modification of the word-recognition threshold by hypnotic suggestion and monetary reward. *Perceptual and Motor Skills, 18,* 805–812.

Zamansky, H.S., Scharf, B., & Brightbill, R. (1964). The effect of expectancy for hypnosis on prehypnotic performance. *Journal of Personality, 32*(2), 236–248.

Zeiger, C.A. (1977). A psychological approach to the improvement of myopia [Abstract]. *Dissertation Abstracts International, 37*(12B, Pt 1), 6359.

Vier Jahrzehnte Gruppen-Hypnose-Skalen: Was sagt die Item-Response-Theorie darüber aus, was wir gemessen haben?

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Zusammenfassung: Um die Schwierigkeiten früherer psychometrischer Ansätze mit Hypnose-Skalen zu überwinden, führten die Autoren eine Faktorenanalyse (Methode mit voller Information), basierend auf multidimensionaler Item-Response-Theorie (IRT), mit einer sich über 39 Jahre erstreckenden Stichprobe von 11.517 Datensätzen der Harvard Group Scale of Hypnotic Susceptibility, Form A (HGSHS:A) durch. Ebenfalls wurde eine vergleichbare Analyse mit der Standardisierungsstichprobe der Waterloo-Stanford Group C Scale (WSGC) berechnet. Die HGSHS:A stellte sich als zweifaktoriell heraus, während die WSGC eher Eindimensionalität erreicht. Faktorstruktur und Mittelwerte der HGSHS:A weisen nur geringfügige Veränderungen über die letzten vier Jahrzehnte hinweg auf. Eine auf der IRT basierende Analyse der HGSHS:A deutet jedoch darauf hin, dass Probleme wie etwa „Pseudo-Raten" bei zwei Items die Güte des Item-Satzes begrenzen. Die Autoren stellen alternative, substantielle Interpretationen der Traits vor, welche der 2-Faktoren-Struktur zugrunde liegen könnten.

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Voir clairement: Suggestion, hypnose, attention et acuité visuelle

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Résumé: Certaines études prétendent qu'une suggestion positive (e.g., utilisant l'hypnose) peut significativement améliorer l'acuité visuelle (e.g., chez les myopes). En se basant sur des résultats comportementaux, neurocognitifs et ophtalmologiques, les auteurs fournissent un rapport critique passant en revue et remettant en question certaines de ces données. Tout en reconnaissant les mérites relatifs de l'hypnose dans l'étude des phénomènes visuels, une série d'arguments se rejoignent pour s'opposer à l'influence apparente que la suggestion peut avoir sur l'acuité visuelle. Les auteurs soutiennent que ni la suggestion, ni le phénomène hypnotique ont des chances d'améliorer la myopie de manière significative et plaident en faveur d'une attitude scientifique responsable qui devrait indiquer soigneusement ce que l'hypnose et la suggestion ne peuvent pas faire en plus de ce qu'elles peuvent faire. Il est probable que la faible action apparente de la suggestion sur l'acuité visuelle est possible grâce au changement dans l'attention. Les auteurs exposent comment l'attention peut modifier l'acuité visuelle.

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Vea claramente: Sugestión, hipnosis, atención, y agudeza visual

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Resumen: Algunos artículos mencionan que sugestiones positivas (p. ej., hipnóticas) pueden mejorar significativamente la agudeza visual (p. ej., en miopes). Basándonos en investigaciones conductuales, neurocognitivas, y oftalmológicas, los autores proveen una revisión y crítica de algunos de estos datos. Aunque reconocemos los méritos relativos de la hipnosis para investigar fenómenos visuales, un conjunto de argumentos sugieren limitaciones en la influencia que la sugestión puede ejercer sobre la agudeza visual. Los autores argumentan que no es probable que la sugestión o los fenómenos hipnóticos puedan mejorar significativamente la visión miope y mantienen que una actitud científica responsable debería delinear cuidadosamente lo que la hipnosis y la sugestión no pueden conseguir, junto con lo que sí pueden. Parece probable que la pequeña influencia aparente de la sugestión en la agudeza visual está mediada por cambios en la atención. Los autores describen cómo la atención puede afectar a la agudeza visual.

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