

# The Physiological Effect of Color on the Suppression of Human Aggression: Research on Baker-Miller Pink

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## Abstract

*It is hypothesized that a newly discovered color, Baker-Miller Pink, has a measurable and predictable effect on reducing physiological variables associated with aggression in subjects of normal intelligence. Studies at one U.S. Naval correctional facility, two California county correctional centers, and two state and federal psychiatric hospitals confirm these preliminary findings. In several controlled university studies the effect has been found to be significant but the magnitude of effect small. The effect has also been seen in both the non-visually impaired, those color-blind, and some blind subjects, suggesting a physiological mechanism. The possible physiological processes believed to be involved are unknown, however, undetermined neurochemicals in the eye communicating with the hypothalamic center are suspected. A color swatch is available and mixing directions for the color are provided, as it has been found that the precise shade is essential in accurately assessing outcomes. (Int J Biosocial Res., 7(2); 55-64, 1985.)*

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## Introduction

In 1969 I became particularly intrigued with the physiological effects of color on humans while studying psychology at the University of New Mexico. This came after reading segments of a book in German by the Swiss psychiatrist Max Lüscher. After earning my undergraduate degree and during my graduate school training, I carried out several studies, including an assessment of color preferences and personality using five common personality assessment instruments (e.g., MMPI, Thematic Apperception Test, Rorschach Ink Blot Test, etc.). It became apparent that colors could reveal a considerable amount about an individual's personality profile. More interestingly, I noted that a number of subject's choice of color preferences correlated with psychological and physiological changes. Since emotional changes are related to the endocrine system, could colors reflect hormonal changes in humans? I then asked, could colors *cause* hormonal changes?

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I will define *behavioral photobiology* as the scientific study of the relationship between perceptible radiant energy and animal and human behavior.

The word perceptible, versus say "visible", was carefully selected, since I believe that human behavior may be influenced by both the near infrared and long ultraviolet range of the electromagnetic spectrum. The following report of experiments within the visible color spectrum is a part of our on-going studies in behavioral photobiology.

"One aspect of biologic responses to light that seems to deserve immediate study concerns the identification of that portion of the energy spectrum capable of influencing neuro-endocrine function in humans."

Richard J. Wurtman, M.D., Ph.D.  
Massachusetts Institute of Technology  
1969

During 1978, Dr John N. Ott, a noted photobiologist, and I collaborated on a research study at City University (Seattle) on the effects of lighting on rates of deviant behavior among inmates. During our research, he showed me several unrelated experiments that challenged my understanding of the role colors play on endocrine function. He demonstrated a crude kinesiological test of muscle strength, that suggested colors could have a remarkably rapid effect on certain muscles, possibly even the heart, while viewing various monochromatic hues. Knowing his enthusiasm, I asked if his experimental results with me as a subject were due to implicit *in situ* communication concerning the expected outcome of the experiment? Did the lack of uniformity in kinesiological pressure influence each trial? What other confounding variables influenced the compelling results of this demonstration?

I repeated [1] his experiment with numerous subjects under varying conditions while using an adjustable dynamometer. These studies resulted in observed relaxation of the subjects when they stared at a 18 by 24 inch cardboard plate of a certain shade of pink. This response was not observed with any consistency to other colors. I experimented upon myself and noted that my blood pressure, pulse, and heart rate was unaffected by exposure to this shade of pink. However, after intentionally increasing cardiovascular activity through a series of intense physical exercises, I found that this color had a marked effect on *lowering* my heart rate, pulse and respiration as compared to other colors. However, I dismissed these results as experimenter bias.

I awoke one night from a thought that suggested the pink color might have an effect on human aggression. If my heart beat, blood pressure, and pulse, could be reduced by a color, what effect might it have on aggressive behavior? How could the possible beneficial effects of color acting to

mediate aggressive behavior be tested? I searched for a correctional facility to test my theory. But first I had to find a shade of pink that would have the most consistent and reliable effects on aggressive behavior. After experimenting with hundreds of shades of pink, I finally identified a shade of pink, I labelled P-618, that seemingly had a maximal effect on reducing hyperexcitability. This color would later be called "Baker-Miller Pink."

At the same time I was a part-time instructor teaching a course called Innovative Treatment Techniques and Correctional Research for the Washington State Criminal Justice Training Commission. I suggested the possible use of a pink seclusion room at an institution. Obviously, had the color I suggested been any other, resistance might have been minimal. It took the forethought and willingness of two military officers at the U.S. Naval Correctional Center in Seattle: Commander Miller and CWO Gene Baker, to give the study a site. Without our knowing, both Commander Miller and CWO Baker mixed the paint according to our direction and matched the pink hue exactly. They proceeded to paint the entire interior of one admissions cell at the Center with what I now refer to as "Baker-Miller" Pink. Only the cell floor was left with its original brown color. Both CWO Baker and Commander Miller carefully monitored this experiment. Records were kept regarding the rates of assault before and after Baker-Miller Pink. This research continued for 156 consecutive days, beginning on March 1, 1979. After this period of time the Center prepared a report to the U.S. Navy's Bureau of Naval Personnel, Law Enforcement and Corrections Division, Washington, D.C., stating:

"Since initiation of this procedure on March 1, 1979, there have been no incidents of erratic or hostile behavior during the initial phase of confinement."

This memorandum went on to support our theory that the new confines only required a maximum of 15 minutes of exposure to ensure that the potential for violent or aggressive behavior had been reduced. Further, it was surprisingly discovered that the effects of the color linger on for at least another 30 minutes after removal from the cell. This would allow admission's staff enough time to process new inmates to a permanent cell. This procedure is still in operation to this day, with no incidents of hostile or violent behavior reported to date, even though a new administration has taken over command of the base and correctional center. A review of this method for handling inmates was made in late spring of 1980 by the U.S. Naval Office of Research with the assistance of a researcher from Harvard University. Their report, involving three days of intensive interviews of staff and inmates, supports the original memorandum's findings. Therefore, the U.S. Naval Office of Research in Washington, D.C., provided data for further research which was carried out at the Health, Weight and Stress Clinic at John Hopkins University Hospital in Baltimore. The work was supervised by Maria Simonsen, M.D., the Clinic's

Director. Their research over four years on nearly 1,700 subjects revealed a peculiar appetite suppression effect by Baker-Miller Pink, during their studies of its stress-suppressing effect. This effect, of suppressing the desire for food, was confirmed in more than one-third of subjects seeking methods for weight control at the Hospital's Clinic. Further research is on-going.

The actual demonstration of the pink color's dramatic effects on aggression led this researcher to search for another correctional site in the United States to replicate the U.S. Naval Correctional Center's findings. By early summer of 1979, such a site was located in San Jose, California, at the Santa Clara County Jail. This facility holds over 750 inmates and seemed ideal for the replication study. The jail commander, Captain Mike Miller, and the county sheriff, agreed to paint a holding cell at the facility "Baker-Miller." However, the staff was so eager to test the room that several inmates were placed in the experimental holding cell for several hours. This resulted in them scratching the paint off the walls with their finger nails. Otherwise, no aggressive or aberrant behavior was observed. Procedures the following day were instituted limiting an inmates incarceration in the experimental cell to 15 minutes. After several weeks of further experimentation, additional information was learned about the color's utilization and effect. First, it was learned that the color is far more effective in a smaller cell, say 8 by 10 feet, than in a large holding cell, say 10 by 15 feet. It did not affect every inmate in the larger holding cell. Because of poor record keeping it was not possible to scientifically eliminate artifact or expectations. It was found to be more effective when one inmate was held in the cell rather than several. This was due, I believe, to the diffusion effect, in which too many other colors compete with the pink to reduce the monochromatic or malilluminating effect. The site did not answer questions regarding under what conditions the pink effect is aroused or under what circumstances it is produced. Nonetheless, it has worked enough times on enough offenders that the method is still in operation with enthusiastic results. However, another facility was clearly needed to reproduce the U.S. Naval Correctional Center's results.

At a June, 1979, scientific meeting in Houston, Texas, I approached a noted authority on schizophrenia, Humphrey Osmond, M.D., Bryce Hospital, Tuscaloosa, Alabama. Dr. Osmond agreed to attempt a series of more controlled studies on colleagues and patients at the hospital. His enthusiastic confirmation of the color's effects resulted in a call to Adam Coutts, Chief of Management Sciences, Veterans Administration Medical Center, Los Angeles. Coutts is the author of numerous studies and monographs on interior environmental factors affecting health care, including the monograph, *The Physical Environment of the Health Care Facility*, written for the Department of Medicine and Surgery, Veterans Administration. He set up a controlled study involving different colored rooms, including one Baker-Miller Pink room, in a psychiatric ward. After several months of study, he felt enough evidence had been collected to support the

U.S. Naval Correctional Center's findings that he advocated the need for a long term study. This study, yet to begin, will involve three months each of five different phases, during which time data will be gathered on the patient's response to this non-invasive approach to reducing violent and aggressive behavior. The study design should provide answers to many questions concerning what conditions invoke the most positive response. However, the V.A. Hospital's study was not the only such preliminary evaluation begun in the summer of 1979.

With the cooperation of the San Bernadino County Probation Department and the same county's mental health center, a study similar to the U.S. Navy's was conducted under the supervision of Chief Clinical Psychologist, Paul Boccumini, Ph.D., Director of Clinical Services for the San Bernardino County Probation Department in southern California. By assigning a staff nurse to watch the experimental subjects at the Kuiper Youth Center, his staff made some significant findings not previously reported at any of the other sites. The detention center placed 27 obstreperous youths in the pink room. Subjects equally upset were placed in other colored rooms in the same wing. Careful observation revealed that those youth placed in the pink room followed a consistent pattern of behavior. After 2-3 minutes in the room, regardless of the degree of aggressive verbal or physical behavior, each youth would become less verbally aggressive. Approximately 5-6 minutes after placement, each youth would desist from using either physical violence (i.e. kicking the door, hitting or pounding of the walls, etc.) or continue self-mutilative behavior. By the 8-9th minute, each youth would assume a relaxed sitting position or lay on his or her back, spread out on the floor while frequently looking at the ceiling. Within 10 minutes, each youth sufficiently calmed down so that he or she could be returned to the main hall.

This was a dramatic departure for most of the youths who had histories of persistent aggressive behavior. A more recent illustration of this difference is reported by Dr. Boccumini. One particular youth had been placed on numerous occasions into an isolation room for severely aggressive and assaultive behavior. Even after six hours of verbally abusive and physically aggressive behavior during one such incarceration, his behavior did not improve. This youth was placing a considerable strain on the unit's staff. In desperation and complete skepticism, the staff placed the youth in another wing, where the pink seclusion room was located. He was placed in the pink room when in a state of rage. "Within 6 minutes he calmed down, was heard crying, and seen sitting down in the middle of the room," according to the attending staff. More remarkable, one and a half months after this short placement, he never once resumed his previous behavior seen for several months. "He was literally stripped down to his real psychological state, expressing his real underlying frustration and depression," according to clinical psychologist Boccumini's review of the case. In another situation, during a juvenile court hearing, a particularly aggressive youth failed

to desist from his threatening gestures in the court room and was referred to the pink room by the judge. Just a few minutes later after spending less than ten minutes in the pink room, the youth was returned to the hearing and was able to calmly complete the proceedings without any difficulty. This youth had never been found to calm down in less than *hours*.

These preliminary findings were reported by this researcher at the Thirteenth Advanced Seminar for Environmental Medicine in San Diego, California, October 28, 1979. Unfortunately, our preliminary results from this medical meeting were reported in the local press, and eventually through national and international wire services. Within months, facilities and institutions in the fields of geriatrics, psychiatry, education, medicine, dentistry and corrections were reporting similar results. Soon letters were received from overseas supporting our reported findings in the United States. However, I remained skeptical, since so many artifacts could account for these results, not the least of which includes novelty.

Not satisfied with the possibility of artifacts or suggestion, I requested Robert J. Pellegrini, Ph.D., Professor of Psychology and Dean of Research at San Jose State University, California, to conduct a series of controlled laboratory experiments. Our first study involved 72 right-handed undergraduates and was conducted to experimentally test the kinesoid hypothesis that visual stimuli of different hues may differentially affect muscle strength.[2] The results of our 2(sex) by 2(plate color) mixed design factorial ANOVA indicated significantly higher squeeze strength scores: a) for males than for females; and b) in response to the blue (control) as compared with the pink (experimental) plate. Although this was found to be statistically significant, the absolute behavioral magnitude value of this color effect was quite small. One possibility was that exposure to stimuli differing in their electromagnetic properties have differential effects on different muscle groups and organ systems in the body. Obviously more thorough resolution and clarification of this issue required further inquiry. Therefore another study was conducted.

Our second controlled study involved 60 undergraduate subjects. However, rather than using a Lafayette Dynamometer to measure grip strength, we changed to a double-armed goniometer and cable tensiometer to measure quadriceps femoris extension strength differentials. Although, again, the magnitude of effect was small, quadriceps femoris extension strength was found to be significantly ( $p .001$ ) greater for the 60 subjects as they stared at the blue (control), as compared to the pink card. The hypothesized kinesiological effects of the color as thus further indicated.[3]

Are there psychological (e.g. infant gender identity and sex-role stereotypical associations to pink and blue) and/or physiological (e.g. neuroendocrine mechanisms linked to the visual system) processes underlying the observed effects? Such conjectures seem premature until reliability of the presumed effects, and the conditions under which they may be shown most powerfully, have been more unambiguously established.

To test the possible role of organismic state variables associated with body position, we repeated the grip strength test. This study involved 36 undergraduate students in which order effects were balanced by randomly assigning subjects to a pink-blue presentation order condition. However, this time the subjects were tested *standing*. A two-tailed *t*-test for matched samples did not reveal a significant difference thereby failing to support the view that postural status (i.e., sitting vs. standing) may be a factor mediating kinesiological effects of color exposure.[4]

Since each of the above described studies were conducted by Dr. Pellegrini, I did not advise him that blue was not the "opposite" color to the shade of pink (i.e., Baker-Miller Pink) to prevent experimenter bias. The "opposite" color is a shade of green we continue to study. Had we used the "opposite" or strengthening color, the magnitude of effect might not have been so small.

## Discussion

In spite of our preliminary results, scores of programs and institutions have reported instituting the use of Baker-Miller Pink to reduce the incidence of violent or aggressive behaviors of their clients, patients, or inmates. All have reported mixed to dramatic reductions in the rates of recorded aggressive behavior. Numerous well controlled studies are currently under way in the United States and other countries. This includes a study on the effects of Baker-Miller Pink on stress at John Hopkins University Hospital's Health, Weight and Stress Clinic, under the direction of Dr. Maria Simonsen, Professor Emeritus of Pyschiatry.

This is a relatively new field of research. In the past, behavioral photobiology came under the purview of color psychologists or physicists. However, few have conducted studies needed to determine the precise waveband (or visible radiant energy measurement) that would have a precise effect on particular biochemical mechanisms in the human body producing predictable responses. After reviewing thousands of articles, studies and books, on the subject of color, I am sorry to say that too much guesswork has gone into the selection of colors for interior environments. Few studies indicate a systematic evaluation of how certain dominant colors in an environment effect physiology. This probably came from the assumption that colors did not produce a measureable or predictable effect on behavior or physiology. Our studies indicate that serious attention should be given to the possibly that significant effects may be produced by either artificial lighting or interior color selections on human behavior and physiology.

As with any study of humans, certain precautions must be established. This is especially true if any evidence points toward long term effects. To prevent against this, San Bernardino County's Kuiper Youth Center, established procedures regulating the use of the Baker-Miller Pink in seclu-

sion rooms. These procedures outline the length of stay in each pink room by detainees, in addition to post-release strategies. This prevents the possibility of a person being placed into a monochromatic malilluminated environment for extensive periods without supervision. (No color can substitute for the attention that any human asks for while in a state of turmoil.)

From several studies conducted in "quiet rooms" at educational centers that handle emotionally and behaviorally disordered children, and in several correctional facilities, it has become clear that best results, as reported in this article, will be obtained if the room is less than 8 feet by 10 feet wide. Inconclusive or negligible results have been reported in rooms called "fish tanks" (e.g. rooms with several panels of large see through glass), as the amount of pink in the room was minimal. In such environments the observed calming effects by subjects may initially be due to 'novelty'.

The American Institute for Biosocial Research, Inc., is currently in the initial stages of studying metabolic changes (e.g. MHPG; serotonin, norepinephrine, and melatonin) associated with the pink-relaxation-control response anecdotally reported herein. Other scientists are studying the possible pathways through which this physiological response occurs. One possibility includes the existence of a hormone (e.g. thyrotropin-releasing hormones, TRH, thyroliberin) acting as a neurotransmitter to the hypothalamus or pineal gland. This could in turn effect other cells in the adrenal medulla, supraoptic nucleus of the hypothalamus, the hypothalamo-hypophyseal portal system, and the tuberoinfundibular cells of the hypothalamus. Investigators are welcome to communicate with the Institute for supportive assistance or collaborative involvement in related behavioral photobiological studies.

The Institute has available a *Selected Bibliography on Color and Light Research* (check payable to: A.I.B.R-Life Sciences Division, \$5.00US, postage-paid) for those seeking a list of related research. We might also suggest the National Bureau of Standard's Special Publication 545, *Contributions to Color Science*, (Washington, D.C., 1979) honoring the excellent contributions of Dr. Deane Brewster Judd.

## Conclusion

Further study of this field of research is clearly warranted and indicated in the light of our research. Those wishing to replicate our studies need to remember that one must create as great a condition of malillumination as possible for the effect to occur with any consistency. Simply, have as much of the room painted Baker-Miller Pink as possible. The best floor colors are neutral gray or dark brown. It is not necessary that white enamel objects (e.g. wash-basin, toilet, etc.) be painted pink. This has been proven in several sites. Lighting should be at least 30 watts, preferably 100 watts or more. Cool white or warm white fluorescent lights are best,

since they give off a milder form of malillumination with their color rendering distortion peaking in the red-orange range. Further inquiries by serious investigators, research facilities, or institutions, should be addressed to the Institute.

The use of color in tranquilizing aggression and potential violence has many implications. Behavioral photobiological research is opening a new frontier of behavioral technology heretofore not seriously considered.

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### Notes

Parts of this paper are reprinted from the the original report of this study that appeared in Volume 2, 1981, of the *International Journal of Biosocial Research*, which is out of print.

A fine selected bibliography of research studies through 1979 is available From AIBR Life Sciences Division, P.O. Box 1174 Tacoma, WA 98401 USA (206-272-0728), for \$5.00US.