# The Effect of Thermal Suggestion on Skin Temperature Under Hypnosis

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**Abstract**

Since the application of hypnosis, there has been a controversial question of whether hypnosis is a cognitive state or a physiological phenomenon. Here we tested the impact of thermal suggestion on perception and skin temperature of 30 participants. To achieve this goal we compared the temperature of individuals' hand skin in a pretest-posttest design. In order to assess the thermal perception, a likert scale was conducted immediately after dehypnotizing. Findings show that hands temperature during the hypnotic cold suggestion decrease by 2.26 centigrade in comparison with pre-test. Furthermore, during hypnotic warmth suggestion 1.13 centigrade increase is observed after hypnosis. In conclusion, findings suggest that hypnotic suggestions can influence not only the perception of individuals but also their physiology.

**Keywords:** Hypnosis; Cognition; Physiology.

## 1. Introduction

Hypnosis is a consciousness state, which leads to changing memory, perception, and the voluntary control of action (Kihlstrom, 2013). In hypnosis, the subject accepts suggestion without having critical thinking or analytical pondering (Gemignani, et al., 2000). Sometimes, hypnosis is considered identical to suggestibility, but they are different because suggestibility is said to increase with hypnosis (Diense, 2012). The majority of hypnotic studies have focused on behaviorism and also have included hypnotic suggestion, cognitive and social processes (Nash & Barnier, 2007). However, hypnosis has recently revolutionized the scope of cognitive science and aroused interest in investigating the unconscious mental life (Kihlstrom, 2007). Clinical hypnosis has provided a wide range of literature concerning behavioral and physical changes. During hypnosis, individuals' perception and feeling alter in comparison with the other states of consciousness (Kihlstrom, 2014). The studies carried out about brain signals have proven that these waves change in hypnotic states (Sebastiani and et al., 2003). Consequently, it can be concluded that hypnosis causes not only a deep relaxation in the hypnotized individuals but also affects perception and the consciousness level

(Williamson and et al., 2002). Generally, the best way to find out about such changes requires four factors: suggestion approach, the alterations following the subject's mental experiences, changes in the subject's behaviors and the physiological changes (Kihlstrom, 2005). Changes that hypnosis causes in our body are extensive and all-inclusive. These changes include voluntary muscle behavior, the function of involuntary muscles, glands and body organs, and five different senses. Moreover, hypnosis influences the changes of immunity system, cardiovascular system, breathing and other activities of mind such as brain blood circulation and brain waves, which can be observed in all individuals (Roure and et al., 1999). One of the most critical issues about hypnosis is whether the observed alterations are induced by cognitive aspects or by physiological events. Tebecis and Provins (1976) showed in their research that an average difference could be found in the physiological parameters of every individual. Although noticeable changes could be observed in the skin temperature, heart rate, and palmar skin resistance between two groups.

Another research indicated that the temperature of fingertip skin changed when pictures showing temperature experiences, mental pressure and relaxation were presented to the subjects. The study eventually showed that cognitive content of pictures triggered automatic responses (Kistler et al, 1999).

In other study, picture suggestion and hypnosis were more effective in relieving pain than no treatment. Furthermore, placebo did not differ from the suggestion of no pain in this study. (Milling et al, 2005). Another study showed that painlessness suggestion can modulate pain experience differentially in healthy individuals with high and low hypnotizability (Santarcangelo et al., 2013). Consequently, they conclude that suggestion moderated different levels of pain more effectively in high hypnotizability group, whereas it was less effective on the group with less hypnotizability. Raynaud et al. (1984) also found out that rectal temperature in males increased in response to hypnotic suggestion whereas the temperature of their body and skin gently returned to normal state when warmth suggestion was stopped. Moreover, Piedmont (1981) also studied the effect of hypnosis and biofeedback on the adapting skin temperature and found out that hypnosis influenced skin temperature significantly, while cognitive variables were effective to some extent. In another study, the researchers assessed the effects of hypnotic suggestion on the participants' control over the increase and decrease of skin temperature. They proved that the ability of the examinee to adjust his skin temperature was affected by the kind of applied suggestion (Bregman & Mc Allister, 1981).

Finally, Grabert, Bregman and Mc Allister (1980) studied the suggestion effect and the response of skin temperature. They concluded that there was a significant difference in the skin temperature increase of the experiment group in comparison with the control group. As a result, they stated that the capacity of skin temperature increase might had been due to simultaneous application of suggestion and reaction.

The aim of this study was specifically to determine the level of cognitive dimensions and physiological aspects of hypnosis by applying warm and cold suggestion to the hands of the individuals under hypnotic suggestion.

## 2. Method

### 2.1. Design

This study was carried out experimentally by applying a per-test and a post-test besides having a control group in both phases. The statistical subjects of the study included students from Payam Noor University of Mashhad.

### 2.2. Participants

Thirty students were chosen as the experimental group, who were also in our control group. Therefore, we used the available sampling method to select this group. The average age of participants was 24.8. They included 10 males and 20 females.

### 2.3. Performance Method

Participants were invited to the Psychology Laboratory of Payam Noor University of Mashhad individually. After the population's cognitive data had been gathered, the temperature of their hands was measured and recorded using an infra-red thermometer (Fluke 62 mini). Then the hypnotist started to apply a specific hypnotic induction, which had been written by the researcher, from the instruction in order to being exactly similar for all the participants. The hypnotized person was induced that one of his hands was in a mass of snow and was gradually getting cold (the cold-experiment stage). The second stage was allocated to heat induction. The hypnotized person who was still in a deep ecstasy was induced that his hand was in a warm water container. The left or right hand was selected randomly, and one hand was selected for the examined group while the other hand one obviously in the control group. Before the hypnosis procedures, temperatures of the both hands of subjects were measured and recorded. Both hands' temperatures were measured and recorded before hypnosis procedures came to an end as well. The hypnotized subjects were gradually relieved from ecstasy. After the subjects had come out of the hypnosis state, they were asked the following question: "How much heat or cold did you feel when you underwent the induction?" Participants had to answer this question on a likert scale ranging from never to very much. The answers given to this question show to what extent temperature changes in hypnosis are related to cognitive procedure (Table 1). After informing participants about the procedure of the study, the hypnotist started hypnotic deepening. When participants were experiencing a deep trance, the temperature suggestions were proposed. All the procedures in both deepening trance

In this study, environmental temperature, considered as disturbing, was kept constant in the experimental condition. The thermometer showed the average temperature of 21.2 °C for induced cold hypnotically and 22.9 °C for the induced warmth hypnotically (the average range of changes was 1.2 °C).

As the control group was responsible for both pre-test and post-test in this study, the Dependent T test and Independent T test were applied to interpret test results. To do so, SPSS 17 software was used and the results and purposes were analyzed by using descriptive and perceptive tables.

### 3. Results

The data indicated that 60% of participants perceived the suggested cold and 10% did not perceive any temperature change. Considering the warmth suggestion, as we can see in table 1, 6.7% of participants did not perceive any temperature change, 70%, however, distinguished the suggested warmth.

Table 1. The rate of participants' temperature perception

| | Cold Induction | | Heat Induction | |
|---|---|---|---|---|
| Undergoing subject's sense of the rate of temperature change | P | f | P | f |
| Never | 10 | 3 | 6.7 | 2 |
| A little | 13/3 | 4 | 16/7 | 5 |
| Low | 16/7 | 5 | 6.7 | 2 |
| So-so | 23/3 | 7 | 46.7 | 14 |
| Lot | 30 | 9 | 13.3 | 4 |
| Too much | 6/7 | 2 | 10 | 3 |
| N | 100 | 30 | 100 | 30 |

Data presented in table 2 shows the subjects' hand temperature before undergoing hypnosis in comparison with the time when the warmth and cold were suggested hypnotically. Data analysis in cold phase experiment, by applying T-dependent test ($t = 3.31$) and the significance level of 0.0001 ($p<0.01$), indicates that the average hand temperature decreased by 2.26 °C after hypnosis.

Of course, this reduction rate is significant when we refer to the next table even with 0.05 Alpha (0.95 certainties). This decrease accounts for the rejection of zero hypothesis; equality between average temperature of the hands in the pre-test and post-test stage, whereas it confirms the opposite or investigative hypnosis, which believes in the inequality of average temperature measured or recorded in both stages. In other words, the independent variable, which is hypnosis, has had statistically significant effects on the dependent variable, that of the change of hand temperature.

As well, the data analysis in warmth suggestion experiment, by applying T-dependent test ($t = 4.75$) and the significance level of 0.001 ($p<0.01$), indicates that the average hand temperature increased by 1.13 °C. In other words, the independent variable, which is hypnosis, has had statistically significant effects on the dependent variable, which is hand temperature.

Table 2. The comparison of hand temperature before and after hypnotic suggestion in warmth and cold phase

| situation | N | M | S | SD | M | S | SD | T | Df | Sig |
|---|---|---|---|---|---|---|---|---|---|---|
| Hand temperature before cold induction | 30 | 26/03 | 3/69 | 0/674 | 2/267 | 3/741 | 0/683 | 3/319 | 29 | 0/001 |
| Hand temperature after cold induction | 30 | 23/77 | 3/70 | 0/676 | | | | | | |
| Hand temperature before hot induction | 30 | 26/17 | 3/20 | 0/585 | -1/133 | 1/306 | 0/238 | -4/753 | 29 | 0/001 |
| Hand temperature after hot induction | 30 | 27/30 | 3/42 | 0/625 | | | | | | |

Table 3. The temperature comparison between the heat and cold induced hand and also the hand temperature of the control group

| situation | N | M | S | SD |
|---|---|---|---|---|
| Cold induction to experimental hand | 30 | 23/77 | 3/702 | 0/676 |
| Control hand in cold induction | 30 | 27/04 | 3/568 | 0/651 |
| Hot induction to experimental hand | 30 | 27/30 | 3/426 | 0/625 |
| Control hand in hot induction | 30 | 25/07 | 3/562 | 0/650 |

Data analysis, by using Dependent T test, implies that, in the heat induction experiment, average temperature of the induced hand increased in hypnotic process compared to its temperature before induction. Those amounts of temperature increase were significant with regard to table 4 ($p<0.0001$). Therefore, it rejects the zero hypotheses believing in the equality of average temperature of the hand induced with heat in the pre-test and post-test stage. In other words, the independent variable, hypnosis, had a statistically significant influence on the temperature change of the induced hand. In fact, the temperature of the induced hand increased.

The data presented in table 4 illustrates that the average temperature of the cold induced hands and average Temperature of the controlled hands after hypnosis had a difference of 3.27 °C.

Table 4. The state analysis of hands in the experimental and control group in the temperature induction

| Test Situation | | F | Sig | T | Df | Sig |
|---|---|---|---|---|---|---|
| The comparison of the cold induction hand and the control hand | Equality of variances is assumed | 0/12 | 0/95 | -7/733 | 58 | 0/001 |
| | Equality of variances is not assumed | | | | 56/73 | 0/001 |
| The comparison of the heat induction hand and the control hand | Equality of variances is assumed | 0/063 | 0/802 | 4/751 | 58 | 0/001 |
| | Equality of variances is assumed | | | | 55/97 | 0/001 |

In other words, the average of the controlled hand temperature was higher after the performance of the experiment. By applying Loin test and variance acceptability, with the score of T= -7.73 and significant level of 0.01 ($p< 0.01$), we indicated the temperature difference between the hands of the cold induction group and the control group. Furthermore, there was a 2.23 °C average difference between the hands of heat induction group and those of the control group after the hypnotic induction. It means that the temperature of the heat induction hand was higher than the average heat of the control group after the experiment had been carried out. After Loin test and equal variance acceptability had been performed, the score t = 4.75 and significant level of 0.001 at the level of ($p<0.01$) were obtained indicating the difference between the temperature of heat induced hands and control group. Since the significant level (sig= 0.000) was lower than 0.05, it was implied that the average hand temperatures of both groups were not equal. Consequently, we concluded that the difference is statistically considerable, which in turn rejects the zero hypothesis and confirms the opposite hypothesis.

**4. Discussion**

Reid and Curtsinger (1988) investigated hypnosis impact on physiological changes of skin temperature and showed that temperature increase of the mouth and skin was generally observed simultaneously, whereas the control group who were in a relaxation state did not show any significant changes in their skin temperature. Their findings were convergent with the findings of the present study.

The convergence of the findings of this study with findings of other researches indicates the importance of temperature difference of both hands in the experiment of warmth suggestion, before and after hypnotic suggestion, and makes it clear that hypnosis affects physiology. These findings may change the current ambiguity in regard to the effect of hypnosis on body and physiology.

In the present study, first cold and then warmth suggestion experiments were carried out. Consequently, this issue caused the ones under hypnosis with cold suggestion to show more inductivity while induced with warmth. Moreover, warmth and cold felt by the high percentage of the subjects indicates the cognitive dimension of the experiment. The fact that 90% of experimented subjects, in both conditions of suggestion, felt warmth and cold is a noticeable issue even if it did not have a significant physiological effect. This issue indicates that the mind can truly process what is imaginarily being made. In the same way, the study done on the group clinically diagnosed with depression showed the fact that if one is experiencing self-generated feeling of happiness we can observe almost the same brain oscillations as an individual who is experiencing the real feeling of happiness (Soukhtanlou et al, 2019).

Accordingly, as psychological factors play an important role in experiencing pain, this viewpoint shows that hypnosis can play a significant role in pain reduction. The hypnotic situation

allows the subject, responding to the advice of hypnotizer, to control the physiological process which is impossible in a normal conscious state. Consequently, hypnosis provides us with a very effective clinical tool which can help control pain. Hence, individuals who have more hypnotizability will benefit more from hypnosis. Considering its natural essence or from its effects point of view, hypnosis causes the relief of pain which is an unquestionable issue. Van der Does and Van Dyke (1989) applied hypnosis to 28 patients suffering from burn. They concluded that hypnosis could be an effective way to decrease the pain related to burning. The subjects in our research asserted that they did not feel pain. Consequently, the findings of the present study can be used to treat different kinds of physiological sufferings.

From the results indicated in table 2 we can infer that although there was no environmental temperature change most of the participants experienced warmth and cold in their hand. This was due to the hypnosis and self-generated inductions. Also the results of table 1 indicate that about 2:3 of participants reported perception of cold and warmth during hypnosis even though statistical data confirmed that the temperature change was just about 1to 2°C. Statistically, it is obvious that this rang of change is not conceivable by human being. As our results consisted with previous studies and former explanations, we can infer that hypnosis can influence both our physiology and perception.

## Recommendations and Limitations

It is a fact that the previous studies and ours have extended the border of science in this area, but there are lots of ambiguous concepts about the hypnosis and our conceptions. Future studies can focus on the relationship between human perception and emotion during hypnosis using neuroscientific tools such as EEG, fMRI, SPECT etc.

Accessing to a sample with previous hypnosis experiences was the main limitation of this study. Apparently, this kind of experience would influence any hypnotic inductions. In any further research it would be better to test the samples by hypnotic scales to handle this limitation.

## Acknowledgments

This research was partially supported by both College of Alborz And Payame Noor University. We also thank our colleagues from Iranian scientific society of clinical hypnosis that provided insight and expertise that greatly assisted the research.

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