SIMULTANEOUS SENSORY STIMULATION, OVERINCLUSIVE AND CREATIVE THINKING.

BY

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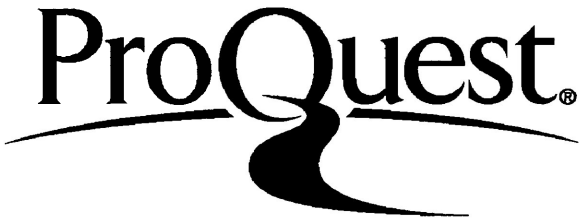

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ABSTRACT

The purpose of this study was to examine the relationship between overinclusive thinking and creativity, and to observe the effects of simultaneous sensory stimulation (SSS) on these processes. The hypotheses were: 1) subjects scoring high on tests of creativity will also score high on tests of overinclusive thinking. 2) simultaneous sensory stimulation will significantly increase post-test scores on creativity, and 3) simultaneous sensory stimulation will significantly increase post-test scores on overinclusiveness. The sample consisted of fifty-four Lakehead University students, half males and half females. The subjects were randomly divided into three groups of eighteen containing nine males and nine females in each group. Group 1, the experimental group, received SSS for fifteen minutes. Group 2, the quasi-experimental control group, received the same treatment as the experimental but only for three minutes; and Group 3, the control group, received neutral stimulation (NS) for fifteen minutes. Subjects were tested both pre- and post-treatment on the Goldstein-Scheerer Object Sorting Test (O.S.T.) for overinclusiveness and Guilford's Test of Consequences (G.T.C) for Creativity . No evidence for a relationship between overinclusiveness and creativity was found. Also, SSS had

no significant effect on creativity. However, the findings did show a partial trend in the predicted direction. No significant effect of SSS on overinclusive thinking was found by parametric analysis, though a non-parametric analysis did indicate that SSS had a significant effect on increasing behavioral overinclusion. Thus, the third hypothesis was partially supported.

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THIS THESIS IS DEDICATED TO MOM AND DAD WITH GREAT RESPECT AND AFFECTION.

Creativity

Creativity has been a fashionable topic of inquiry among psychologists for over twenty years. Yet, it was only in the mid-sixties that psychologists began applying scientific research to the creative dimension of the human potential.

Morgan (1953) listed 25 definitions of creativity which he extracted from the literature. Most of these definitions imply that creativity involved the development of something new and unique. Spearman (1931) had generated interest in this area with his book, Creative Mind. There he defined creativity as "the power of the human mind to create new content - by transferring relations and thereby generating new correlates -- extends its sphere not only to representation in ideas, but also to fully sensuous presentations" (p. 148). Freud (1932) suggested that easy accessibility of both primary and secondary thought processes was an important feature of the original thinker. Kris (1952) elaborated on this speculation to postulate that the "effectively original person can regress temporarily, but could rapidly return to rationality, bringing with him the primitive and fantastic modes of thought characteristics of the primary processes." This he called "Regression in the service of the Ego." (cited from Dykes, 1972, p. 3).

Later investigations of artist's and children (e.g., Dudek, 1971, and 1975) Dudek (1971) inferred that the artist has a greater capacity to regress in the service of the ego than the non artists. To regress in this sense means to

retreat, or dive into earlier often repressed thoughts, smells, feelings, experiences, sensations and to insert them into the artifact one is working on.

The Gestalt psychologists defined creativity as an action that produces a new idea or insight through imagination rather than through reason or logic. Thurstone (1962) similarly assumed "that the creative act is characterized by the moment of insight which is often preceded by nonverbalized prefocal thinking," and that creative thinking "is normally followed by implicit and deductive thinking in testing the new idea" (p. 52). These early definitions tended to be unitary in nature and they frequently indicated origins of creativity, such as vitalism, emergentism, serendipity, culture, interpersonal relations and personal. Barron (1969) believes that creative individuals appear to be both sicker and healthier, psychologically, than people in general; or stated differently, they are much more troubled psychologically, but they also have far greater resources with which to deal with their troubles.

Psychologists such as Guilford (1967a), view creativity as inherent in all persons, qualitatively similar at all levels, and, therefore, their concern is with quantitative differences relative to the general population norms. Other researchers such as Ghiselin (1958), have postulated two kinds of creativity: creativity manifested by those who devote their lives to creative ends, and the creativity manifested by the general population. Ghiselin's distinction indicates a qualitative difference between the general population and people in the creative fields. (cited from Taylor and Getzel's, 1975, p. 2).

Roe (1953), states that, creativity in both artists and scientists, does not come from any sudden inspiration invading an idle mind and idle hands, but from the labor of a driven person.

Since there is a great diversity of interests and approaches in the research of creativity, investigators have tried to categorize creativity into various areas. Golann (1963) proposed that most of the literature could be organized under four basic emphases: products, process, measurement and personality.

Dellas and Gaier (1970) similarly suggest that most economically the literature on creativity can be classified into four major areas: the nature and quality of the product created; the actual expression of the creative acts and the continuing process during the creation; the nature of the individual; and the environmental factors that tend to initiate and foster creativity. Mackinnon (1970) very aptly stated that creativity is a multifaceted phenomenon rather than a theoretical concept to be precisely defined. One advantage of considering creativity in this way is that a complex phenomenon is analyzed into its distinguishable aspects or facets, each of which is more manageable and more amenable to research than is a global concept of creativity.

Considered in this manner, according to Mackinnon (1970), there are four major facets of creativity: (1) the creative product, (2) the creative process, (3) the creative person, and (4) the creative situation.

The theory of creativity as propounded by Taylor (1972)

extends Mackinnon's areas into five fields of investigation. These include the creative person, creative problem formulation, creative process, creative product, and the creative environment.

Taylor (1972a) describes the creative person as transactive, creative problems as generic, creative processes as involving transformations of perceptions and communications, the resulting creative product as being generative, and finally the environment which facilitates creativity as being stimulating.

N. O'Neill and G. O'Neill (1974), in their book Shifting Gears review the conditions for creativity. They conclude that while most of the conditions for creativity require a suspension of control, an openess to the inner areas of the self, the last and the most important is using our will to put what we have discovered into action -- just as in the shifting gears it is not enough to focus and center and make the decision. Without the commitment to action, our creativity may never emerge.

Creativity and Stimulation

Experimental efforts to stimulate creativity have been made both in group and individual activities. The most commonly used techniques include Brainstorming (Osborn, 1963); Synectics (Gordon, 1961); Creative problem solving (Parnes, 1967); Stimulation induced by biofeedback techniques in facilitating creativity (Green & Walters, 1971); and most

directly through the use of simultaneous sensory stimulation (Taylor, 1972b).

But what constitutes a creative climate? What conditions stimulate creativity. Torrance (1967) suggested that a situation should provide the following as important factors in increasing a person's productivity, largely in an educational setting: respect unusual questions, respect unusual ideas, show that ideas have value, provide opportunities and credit for self-initiated learning, and allow performance to occur without constant threat of evaluation. Maddi (1965) assumes an opposing view and suggests that creativity will occur regardless of climate or setting. Sensory stimulation is another important variable related to facilitating creativity. Ludwig (1971) points out that in contrast to the abundance of research on sensory deprivation, research on sensory overload, which appears to be the opposite is essentially non-existent. Taylor (1972a) found that exposure to intensive SSS over a short period of time can facilitate openess and creative divergent production. Schachtel (1959) has noted the impact of sensory stimuli on the individual, and Murphy (1947) has indicated the importance of sensory stimulation and enrichment in providing impetus for creative growth.

Taylor (1975) has made the following observations:

> The effects of sensory stimulation (Taylor 1970a, 1972a) can be contrasted with those of sensory deprivation (Zubek, 1969) which have been extensively studied. One of the effects of a creative product is to produce stimulation in the environment. Such motion or stimulation produces an attraction or novelty for others and facilitates their creativity. Stimulation is not as necessary

> for creative transactualization as transaction, generics, transformation and generation, but it facilitates these processes. There are several reasons why transactualization occurs best in an environment which is stimulating. First, it is easier to redesign an environment that is in motion. Second, such an environment allows transformations to occur, and finally, stimulation is congruent with change. (p. 316).

Studies by Taylor and Knapp (1971) and Taylor (1972b) indicate that SSS did improve artistic abilities of schizophrenics, and divergent thinking was increased for a normal college group.

Empirically, therefore, there is justification for thinking that SSS can enhance creativity, divergent thinking and artistic production, and can be an effective means of inducing openess which is a very important aspect of creativity. Rogers (1961) describes openess as the opposite of psychological defensiveness with each stimulus being freely relayed through the nervous system without being distorted by defensive processes.

Overinclusive thinking

The concept of overinclusive thinking is the outgrowth of studies in the field of schizophrenic thought disorder, and therefore, it has been seen as a negative attribute by many investigators (Cameron, 1938a, 1938b, 1939a, 1939b; Payne or Friedlander, 1962; Payne, Mattussek, and George, 1959; Payne & Caird, 1967; and Broadbent, 1958).

Among the different viewpoints about schizophrenic thinking, Cameron's concept of "overinclusion" (Cameron, 1939; Cameron and Margaret, 1951) has been one of the most promising from a theoretical standpoint and has also been subjected to a number of empirical studies.

Cameron (1938a) referred to overinclusive thinking as an inability to preserve conceptual boundaries, which results in the incorporation of irrelevant ideas, making thinking more abstract and lucid." (p. 213) It has also been described as the patient's difficulty in maintaining the usual conceptual boundaries and a tendency to include in one's concept elements which are not essential but irrelevant (Harrow, Himmelhoch, Tucker, Hersh and Quinlan, 1972). Some researchers and clinical psychologists emphasize the fact that overinclusive thinking is also exhibited by obsessionals and depressives (Reed, 1969). Payne, et al., (1959), Payne and Hewlett (1960), and Payne (1961), have extended the definition regarding overinclusiveness essentially as an attention defect:

> the breakdown in a hypothetical filter mechamism which normally screens out the stimuli, both internal and external which are irrelevant to the task in hand, to allow the most efficient processing of incoming information. (p. 213)

Since Cameron (1938) first introduced the concept of overinclusion, many studies have been performed by psychologists to investigate the concept of overinclusive thinking in schizophrenics. Lovibond (1954) using the Goldstein-Scheerer

Object Sorting Test, found that schizophrenics were rated as more overinclusive, and Chapman (1956), and Chapman and Taylor (1957) report a series of interesting experiments which have also confirmed the theory of overinclusive thinking.

Studies by Rashkis, Cushman and Landies (1946), Fisher (1950), and McGaughran and Morgan (1956), as cited in Payne, et. al. (1959), indicate that studies using sorting tests of concept formation have produced similar results. Schizophrenics cannot be regarded as exhibiting concrete thinking in the sense of being unable to generalize at all, rather they tend to produce unusual generalizations.

Such findings prompted questions as to what types of schizophrenics were more overinclusive. Payne (1964) found that overinclusiveness is typical of the acute phase of illness rather than the chronic phase, and that it was clinically associated with delusional thinking. Bauman (1965) reports that even normals are overinclusive in thinking, suggesting that overinclusive thought is not an abnormality found only in the schizophrenics.

Broen (1968) has differentiated two classes of overinclusion tests, possibly indicating aspects of schizophrenic deficits. Payne's tests were designed to examine the subject's ability to selectively respond to certain stimuli, whereas, the test devised by Chapman (1958), and used by Hawks & Marshall (1971a), is seen as a measure of the appropriateness of the

response made to one stimulus.

Other writers, e.g., Harrow, Himmelhoch, Tucker, Hersh and Quinlan (1972), have described three types of overinclusion. The first type of overinclusion, which they labelled "behavioral overinclusion," has been studied extensively by Payne, et al. (1960, 1962a, 1964). The major test used by Harrow, et al. (1972) was the Goldstein-Scheerer Test, and they found that the results on conceptual overinclusion accounted for twice the percentage of variance that was accounted for by behavioral overinclusion in a non-schizophrenic group as compared to a schizophrenic group.

In these studies it should be noted that overinclusion was seen as an essential characteristic of normal ordered thought. The empirical evidence does not confirm the position that over-inclusive thought in itself is pathological.

A study by Payne, Ancevich and Laverty (1963), showed that formerly deluded schizophrenics were not significantly more overinclusive in their performances on the object sorting test than normals. It was inferred from these results that overinclusion was a symptom of schizophrenia and that remission of overinclusive thinking was a sign of good prognosis.

More recently the utility of the concept of overinclusive-ness has been criticized by several theorists and investigators on both methodological and theoretical grounds.

Bauman & Murray (1968) and Andreasen and Powers (1975) suggest that overinclusiveness can also be studied in relation

to healthy processes. Based on Bauman's (1965) research, "overinclusive thinking is the ability to make new and unusual associations, rather than a pathological inability to filter out irrelevant associations" (p. 56).

The question arises: Does overinclusion define a abnormal cognitive style? Rawling (1975) states:

> If overinclusion is to be proposed as describing the essential nature of the schizophrenic thought disorder, then it must be shown that overinclusion does not characterize normal, ordered thought.
>
> To establish this requires some knowledge of hypothesis of the form that normal thought takes. However, as Rodnick (1967) has pointed out, nominalist definitions of the symptomatic behaviour of schizophrenics have tended to appear where a knowledge of the form of normal behaviour is lacking.
>
> 'In the absence of a satisfactory theoretical model (of behaviour), the empirical investigator of psychopathology of schizophrenia is usually forced to confine his inquiry to one particular facet or attribute of psychological functioning, with insufficient regard for other attributes. He is not sure whether what he is describing is of primary significance to the disorder, or only of secondary import as a derivative of other, more basic attributes.' (p. 175).
>
> 'Little research has been carried out by Payne and his colleagues to establish whether overinclusive thought is in fact, pathological. The only study directed towards this is one by Payne, Anchevich and Laverty (1963), in which it was found that formerly deluded schizophrenics were not significantly more overinclusive in their performance on an object sorting test than normals. It was inferred from this result that overinclusion was a symptom of schizophrenia and that remission of overinclusive thinking was a sign of good prognosis. However, firm support for this inference can only come from a study that shows that the now-recovered schizophrenics were significantly more overinclusive during their illness.'

"If this was not the case, then it is possible that overinclusion describes a relatively normal (in the statistical sense) cognitive style. A series of studies by McConaghy (1959) suggests that this is the case. He found that, even in recovered schizophrenics, a characteristic "looseness" of thinking remained, but this type of thinking did not preclude assimilation into normal society. McConaghy, apparently realizing that it may be unwise to assume that the formal laws of logic characterize the thinking of normal people, suggested that the looseness summarized by the concept of overinclusion may relate to a non-pathological cognitive style. In support of this hypothesis, McConaghy and Clancy (1968) found no evidence of schizophrenia in university students whose thinking, as rated on an Object Sorting Test (Lovibond, 1954), was characteristically loose." (p. 66-67).

The assumption behind the present study was to test the prediction that overinclusion is a particuler kind of cognitive style, which could be observed in creative people. The purpose of this research was to investigate the effects of Simultaneous Sensory Stimulation on overinclusiveness and creativity.

From the perspective of overinclusiveness as a positive process, the following three hypotheses were formulated:

First, subjects scoring high on tests of creativity will also score high on tests of overinclusive thinking. The underlying assumption of this hypothesis was supported by

Andreasen and Powers (1975). Their research indicates considerable overinclusive thinking for creative writers, based on the quantity of objects sorted, and conceptual overinclusiveness on the Goldstein-Scheerer Test.

Second, Simultaneous Sensory Stimulation (SSS) will significantly increase post-test creativity scores. This hypothesis was supported in studies by Taylor (1970 and 1972a) and Taylor and Knapp (1971). Since this research examines the relationship between overinclusiveness and creativity, the above hypothesis will be replicated as being relevant to the proposed experimental design.

Third, it was hypothesized that Simultaneous Sensory Stimulation (SSS) will significantly increase overinclusiveness as measured on the post-test. Since overinclusiveness has been viewed as a positive attribute, and research evidence indicates that SSS has a significant effect on other positive attributes such as divergent thinking, originality and creativity, it is reasonable to assume that SSS should also enhance overinclusive thinking.

Since the effects of SSS on overinclusive thinking in creative people have not been investigated, research in this area would be a contribution to the areas of both creativity and overinclusive thinking.

METHOD

Subjects and Design

Fifty-four volunteer subjects were drawn from the students at Lakehead University. A representative group of students whose ages ranged from 20 to 40 years were selected for this experiment. All subjects were screened for epilepsy and drug-taking, as a precaution against epileptic seizures and drug reactions that might result from the SSS treatment.

The subjects were randomly assigned to three groups of eighteen. Each of these groups had nine males and nine females, so as to control for sex differences. Group 1, the experimental group, received SSS for fifteen minutes, Group 2, the quasi-experimental control group, received the same treatment as the experimental group but only for three minutes; and Group 3, the control group received neutral stimulation (NS).

There were three conditions of the independent variable of stimulation, i.e., simultaneous sensory stimulation (SSS_1) full session, (SSS_2) short session, and neutral stimulation (NS). The dependent variables were performance scores on creativity as measured by the Guilford's Test of Consequences (1958), and scores on overinclusion as measured by Goldstein-Scheerer Object Sorting Test (1941).

The rationale for the quasi-experimental control group was to control for the effects of demand characteristics and

expectations of the subjects.

Tests and Apparatus

The Goldstein-Scheerer Object Sorting Test (O.S.T., 1941) was used to measure overinclusive thinking. A slightly modified version of the test was used in order to obtain three measures of overinclusiveness: behavioral overinclusion, conceptual overinclusion, and richness of association.

The test consisted of thirty-seven objects. The subject was presented with an object (called the "starting object") and asked to sort all the other objects that he thought belonged with it. This experiment thus requires the subject to build a concept around the initial object. After the subject had completed the sorting for the starting object, he was asked to give reasons for his selections, this procedure was followed with all seven starting objects.

The seven objects that were used as "starting points" were: (1) the sink stopper, (2) the fork, (3) the pipe, (4) the bicycle bell, (5) the red paper circle, (6) the pliers, and (7) the red rubber ball.

The measures of overinclusion were (1) behavioral overinclusion based entirely on the quantitative aspects of the person's overt performance, e.g., the sum of the number of

objects sorted with all seven starting objects, (2) conceptual overinclusion based on subjects overt behavior, and the reasons or thinking responsible for this behavior. The score for this is rated on a scale from 1 to 5, with the overall rating based on a composite of the subjects performance during the seven different sortings. High scores on conceptual overinclusion are assigned for responses that will involve: (a) attempting to force fit an object into a chosen dimension of the starting object which does not really belong in that dimension of sorting objects (e.g., for SO*: red paper circle - using the category "round" and sorting spoon, pliers, and candle as "roundish"); (b) using a vague, more distantly related concept as a categorizing principle when there are obviously closely related and more relevant concepts available (e.g., for SO: pipe - sorting objects which can burn); (c) arbitrarily changing starting points in the midst of sorting and using one of the already sorted objects as a basis for subsequent sorting (e.g., for SO: fork - sorting knife and spoon as silverware, then focusing on the knife, thereafter sorting objects which can be cut; and (d) using several dimensions of the original starting object without seeming to recognize that each dimension is discrete (e.g., for SO: sink stopper - sorting in hit and miss fashion the fork, pliers, plate and lock, with the implied categories, "items washed in sink" and "metal objects," not clearly stated). (3) Richness

Footnote.
*SO- Sorting Object.

of association, was rated on a scale from 1 to 5. Scoring was influenced by behavior which indicated originality, creativity and richness of associations as follows: (a) Using discrete qualities of the starting point which are original (not commonly used). (b) Recognizing consistently that the starting points offer many possible discrete, abstract dimensions from which to construct categorizing principles and acting on this recognition, (c) Using for all seven starting points discrete, abstract dimensions without elaboration, (d) finding an original and appropriate way in which a remaining object may be sorted according to the selected categorizing principle. Himmelhoch, Harrow, Tucker & Hersh (1973) report an inter-rater reliability of .89 for conceptual over-inclusion, and .79 for richness of association.

The Guilford's Test of Consequences (G.T.C., 1958) was used to measure creativity. Two parallel forms were used (Form 1 and Form II) and the subjects were asked to write alternate consequences for the test items within a ten minute time period. Each form of the G.T.C. yields two scores, one for originality and one for ideational fluency. In scoring the test, the responses were categorized as being either "obvious" or "remote". The number of obvious responses provides a measure of ideational fluency, and the number of remote responses provides a measure of originality. The test has a test-retest reliability coefficient of .86 and .82 for obvious and remote scores for the adult population.

Blind scoring was used to eliminate the possibility of a scoring bias for the experimental and control groups. The record booklets were assigned code numbers by a person other than the experimenter.

Simultaneous Sensory Stimulation (SSS) was administered in a stimulation chamber. The technique is based on Taylor's (1972) research in similar settings - The SSS chamber is a dark room with walls and ceilings covered with aluminum foil, and colored strobe lights which reflect off the walls and ceilings. An Archimedes wheel was used for visual stimulation, and an original composition by Carlos Chavez,"Tocatta for Percussion" was played stereophonically through earphones for auditory stimulation.

The subjects were seated in comfortable heated reclining chairs, which vibrate and provide somesthetic and thermal stimulation, lozenges were provided for gustatory stimulation; and incense for olfactory stimulation (Taylor, 1972b; Taylor, Austin and Sutton, 1974). All stimulation occurred simultaneously for a period of 15 minutes.

The short session of SSS was administered to subjects of the quasi-control group under the same laboratory conditions as the experimental group. The only difference between the full SSS session and short SSS session was duration of stimulation, i.e. subjects in the quasi-control group were exposed to a 3 minute period of SSS and subjects in the experimental group were exposed to a fifteen minute period of SSS. However, both

groups spent the same amount of time in the chamber.

Neutral stimulation (NS) was administered in a separate adjoining room where subjects listened to a fifteen minute taped lecture on "thinking" from a psychology text.

Procedure

The experimental procedure was divided into two sessions, each session separated by a day. In the first session all the subjects were administered the Object Sorting Test and the Test of Consequences. The subjects were then randomly assigned to three groups; the experimental group (SSS_1), the quasi-experimental control group (SSS_2), and the neutral stimulation group (NS).

The administration of the tests for both the pre- and post-treatment sessions was carried out on an individual basis. In the second session the subjects were given their respective treatments. The subjects for the SSS_1 and SSS_2 conditions were introduced to two confederates, and all three participants were taken to the stimulation chamber and administered the following instructions. "In this session you are about to receive various sensory experiences to see what effects they may have on your thinking."

The rationale for using the two confederates was to create a group environment for the SSS sessions, as research evidence indicates that SSS if given to a group is more effective than if administered on individual basis(Taylor, 1975).

The confederates were not tested on tests of creativity and overinclusiveness.

The subjects in the SSS_1 condition were exposed to a fifteen minute session of stimulation, whereas the subjects in the SSS_2 condition were asked to sit in the stimulation chamber for the initial six minutes, and for the subsequent three minutes they were administered the SSS after which they were kept there without the SSS for six minutes and just asked to relax.

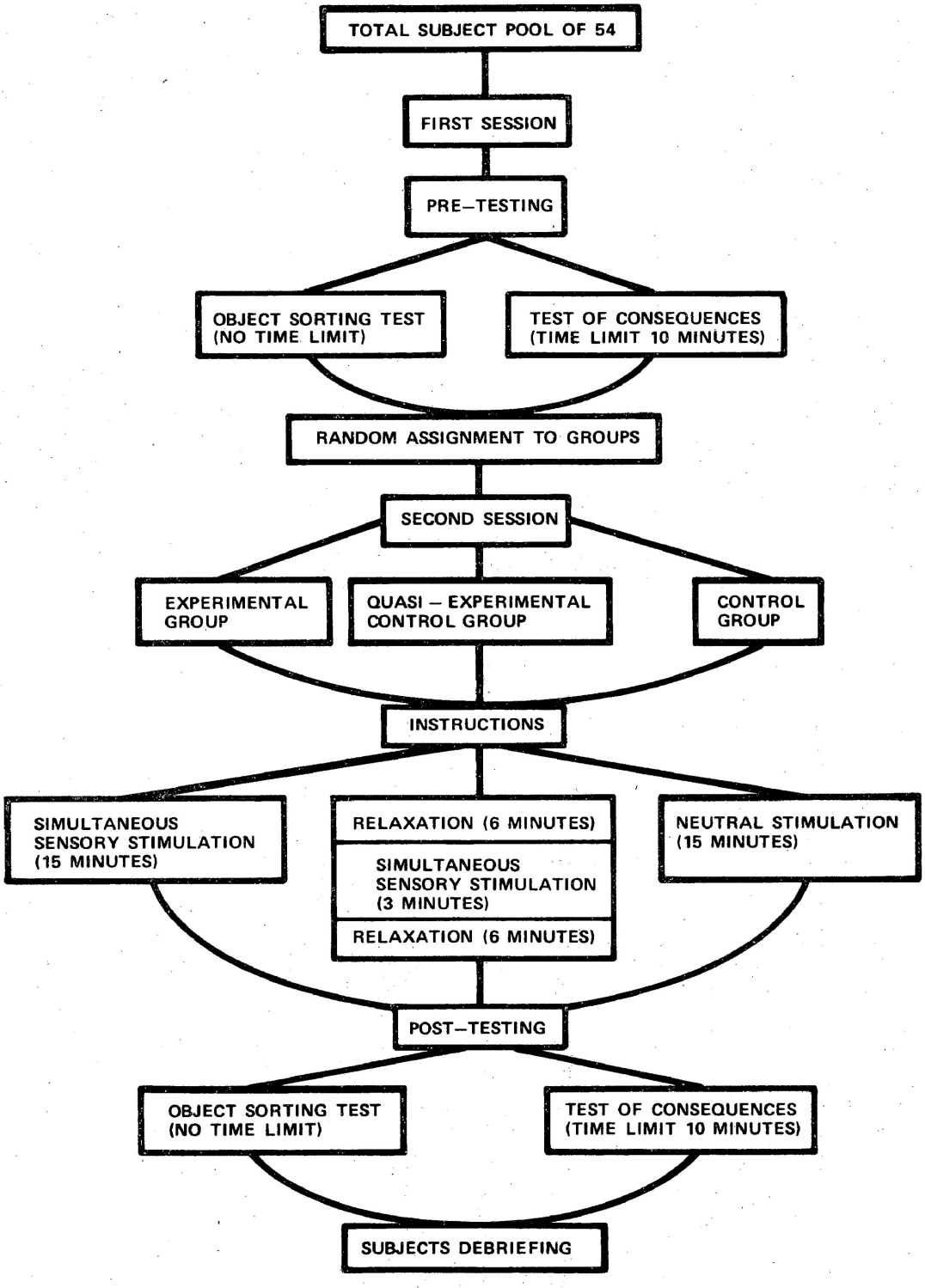
The same instructions were provided to the NS group. Yet, unlike the other two groups the NS group was administered the treatment on an individual basis. The subjects were seated in an adjoining room which was furnished with only a table and four chairs. Neutral Stimulation (NS), as indicated consisted of a fifteen minute recording of a lecture on "thinking" from a psychology book.

The reasons for not using confederates for the control group or the neutral stimulation group was based on the research evidence that indicates that neutral stimulation like the taped lecture has no differential effect, whether given to a group or an individual.

Immediately after the groups finished their respective treatments, they were retested on O.S.T. and form II of the G.T.C.

On the completion of these tests the subjects were required to write what they thought the purpose of the experiment was. Subsequently, they were debriefed by the experimenter as to the nature and purpose of the experiment. Each of these sessions lasted from forty to sixty minutes.

FIGURE 1: FLOW DIAGRAM OF EXPERIMENTAL PROCEDURE



Results

Randomized groups analysis of variance were performed on pre-test scores for the two measures of creativity and the three measures of overinclusion. The two measures of creativity as indicated were originality and ideational fluency on the G.T.C. The three measures of overinclusive thinking as indicated were based on measures of behavioral overinclusion, conceptual overinculsion, and richness of association from the O.S.T. The analysis indicated significant main effects for sex, F (1, 48) = 11.76, $p < .001$ and significant interaction effects for sex group on originality as indicated in Table 1. A significant main effect is found for sex on ideational fluency F (1, 48) = 6.53, $p < .01$ as indicated in Table 2.

Since the author was interested in studying the effects of treatment on the group, i.e., the extent of change in the means of the dependent variables, the rest of the statistical analyses were performed on change scores.

The first hypothesis was tested utilizing the Pearson Product-Moment correlation coefficients computed on the pre-test scores consisting of two measures of creativity and three measures of overinclusion.

The correlation matrix is shown in Table 3. The correlations are based on the pre-scores of all subjects and also contain the correlation of each of the five measures with every other measure. Tests of significance among the five measures of the two variables are indicated in Table 3.

Table 1

Complete Analysis of Variance on the Pretest Scores for the Originality Measure

Source of Variation	SS	DF	MS	F
Sex	322.57	1	322.57	11.76**
Group	117.71	2	58.86	2.14
Sex X Group	434.28	2	217.14	7.91**
Residual	1317.03	48	27.44	6.66

** < .001

Table 2

Complete Analysis of Variance on the Pretest Scores for the Ideational Fluency Measure

Source of Variation	SS	DF	MS	F
Sex	418.01	1	418.01	6.53**
Group	84.87	2	42.43	.66
Sex X Group	256.09	2	128.04	2.00
Residual	3071.17	48	63.98	

** < .01

Table 3

Pearson Correlation Coefficient Matrix

	CR2 Ideational Fluency	OV_1 Behavioral Overinclusion	OV_2 Conceptual Overinclusion	OV_3 Richness of Association
CR1	0.34**	0.06	0.09	-0.03
CR2		-0.02	-0.08	-0.11
OV_1			0.76*	0.72*
OV_2				0.80*
OV_3				

Two tailed test

CR1 - Pretest score of the originality measure of creativity.

CR2 - Pretest score of the ideational fluency measure of creativity.

OV_1 - Pretest score of the behavioral overinclusion.

OV_2 - Pretest score of the conceptual overinclusion.

OV_3 - Pretest score of the richness of association.

* $<.001$

** $<.01$

None of the coorelations between measures of creativity and overinclusion were statistically significant. Therefore, the first hypotheses stating that subjects scoring high on tests of creativity would also score high on tests of over-inclusive thinking was not supported.

To test the second and third hypotheses, separate 3 (SSS_1 - SSS_2 - NS) X 2 (Male X Female) analyses of variance were performed for each task because of the different nature of the five variables. All these analyses were performed on the change scores (post-test -- pre-test) for each of the two variables of creativity and three variables of overinclusion. The results are indicated in Tables 4, 5, 6, 7, and 8.

Although the 3 X 2 analysis of variance performed on the dependent variable of behavioral overinclusion shows a close to significant effect of sex, $\underline{F}$ (1, 48) = 3.33, $\underline{p} < .10$, and a significant effect is obtained of conceptual overinclusion, no significant differences were found for the rest of the variables.

The breakdown on the change scores for group and sex, indicated differences in means for the criterion variable (Diff. 1), i.e., change scores on the dependent variable of originality, indicating that most changes occurred in the means for the experimental group, presumably because of the administration of SSS. Though there are no statistically significant differences, the results indicated in Table 9, suggest a tendency for the experimental group to show the largest amount of

Table 4

Complete Analysis of Variance on the Change Scores for the Originality Measure of Creativity

Source of Variation	SS	DF	MS	F
Sex	26.74	1	26.74	1.01
Group	5.78	2	2.89	.10
Sex X Group	32.15	2	16.07	.60
Residual	1272.66	48	26.51	

Table 5

Complete Analysis of Variance on the Change Scores for the Ideational Fluency Measure of Creativity

Source of Variation	SS	DF	MS	F
Sex	90.74	1	90.74	2.19
Group	13.48	2	6.74	.16
Sex X Group	6.37	2	3.18	.07
Residual	1984.88	48	45.35	

Table 6

Complete Analysis of Variance on the Change Scores for the Behavioral Overinclusion Measure

Source of Variance	SS	DF	MS	F
Sex	1779.63	1	1779.63	3.33*
Group	816.15	2	408.07	.76
Sex X Group	1566.37	2	783.18	1.47
Residual	25595.27	48	533.23	

*$p < .10$

Table 7

Complete Analysis of Variance on the Change Scores for the Conceptual Overinclusion Measure

Source of Variance	SS	DF	MS	F
Sex	1.88	1	1.18	.07
Group	154.48	2	77.24	4.67**
Sex X Group	90.48	2	45.24	2.73
Residual	793.329	48	16.53	

**$p < .01$

Table 8

Complete Analysis of Variance on the Change Scores for the Richness of Association Measure

Source of Variation	SS	DF	MS	F
Sex	9.80	1	9.80	.61
Group	84.11	2	42.05	2.62*
Sex X Group	82.93	2	41.46	2.60*
Residual	770.66	48	16.05	

*$p < .10$

Table 9

Change Scores on Originality Broken Down by Group and by Sex

	Male		Female		
	Mean	Standard Deviation	Mean	Standard Deviation	EM
Experimental Group	2.88	5.98	1.55	5.41	2.22
Quasi-Group	1.22	5.89	1.66	4.69	1.44
Control Group	3.66	4.00	.33	4.60	2.00

change ($\bar{X}SSS_1$ = 2.22, $\bar{X}$ = SSS_2 = 1.44, $\bar{X}NS$ = 2.00).

The results for the criterion variable (Diff. 2), i.e., the dependent variable of ideational fluency, suggest that the experimental group showed the largest increase in mean scores as indicated in Table 10: ($\bar{X}SSS_1$ = 1.22, $\bar{X}SSS_2$ = .22, $\bar{X}NS$ = .11).

In terms of behavioral overinclusiveness, there is a tendency for the experimental group to increase in behavioral overinclusiveness after the administration of SSS as indicated in Table 11, ($\bar{X}$ = 15.56, $\bar{X}$ = 15.56, $\bar{X}$ = 6.11, $\bar{X}$ = 9.78). The mean scores on conceptual overinclusiveness and richness of association did not show an increase for the experimental group as indicated in Table 12 ($\bar{X}$ = .22, $\bar{X}$ = 2.72) and Table 13 ($\bar{X}$ = - .72, $\bar{X}$ = 2.33).

In addition, two 'a priori' orthogonal comparisons were performed on the three groups to determine which groups indicate the greatest change scores as a result of the treatment. The first comparison consisted of a contrast between the Quasi-experimental group and the Control group. The second comparison consisted of a contrast between the Experimental group and the combination of Quasi-experimental and Control groups. Significant results were established on the first contrast conducted on the variable of conceptual overinclusion F (1, 48) = 4.45, (p .05).

The results on the second contrast on the variable richness of association, were also significant ($p < .05$). These results are indicated in Tables 15, 16, 17, 18 and 19 of Appendix A.

Table 10

Change Scores on Ideational Fluency

Broken Down by Group and by Sex

	Male		Female		
	Mean	Standard Deviation	Mean	Standard Deviation	EM
Experimental Group	2.33	2.73	.11	6.31	1.22
Quasi-Group	1.22	9.12	-.77	5.14	.22
Control Group	.88	5.55	1.66	7.76	.11

Table 11

Change Scores on Behavioral Overinclusion
Broken Down by Group and by Sex

	Male		Female		
	Mean	Standard Deviation	Mean	Standard Deviation	EM
Experimental Group	17.33	34.40	13.77	21.33	15.56
Quasi-Group	-2.33	22.75	14.55	9.51	6.11
Control Group	-.77	9.95	20.33	29.23	9.78

Table 12

Change Scores on Conceptual Overinclusion
Broken Down by Group and by Sex

	Male		Female		
	Mean	Standard Deviation	Mean	Standard Deviation	EM
Experimental Group	2.00	4.24	-1.55	3.57	.22
Quasi-Group	-1.33	3.94	-1.44	4.06	-1.39
Control Group	1.33	2.78	4.11	5.35	2.72

Table 13

Change Scores on Richness of Association

Broken Down by Group and by Sex

	Male		Female		
	Mean	Standard Deviation	Mean	Standard Deviation	EM
Experimental Group	.11	4.67	-1.55	3.32	-.72
Quasi-Group	.88	5.11	.88	2.67	.89
Control Group	.22	2.72	4.44	4.77	2.33

In addition to the 'a priori' parametric analyses, a 'post hoc' nonparametric analysis was also performed on the three groups, using the Sign test to determine which groups indicate the most percentage increase in the number of individuals as a result of treatment on variables of creativity and overinclusion. Significant results were established for the experimental group on originality, ideational fluency and behavioral overinclusion. The Quasi-group did not show a significant change, but the control group did show a significant increase on originality and richness of association ($p < .02$). These results are indicated in Table 14.

Table 14

Non-Parametric Data Showing Percentage of Subjects That Increased on the Variables After the Treatment

Groups	Originality	Ideational Fluency	Behavioral Overinclusion	Conceptual Overinclusion	Richness of Association
Experimental Group (SSS_1)	77%*	77%*	77%*	55%	36%
Quasi Group (SSS_2)	57%	50%	65%	42%	65%
Control Group (NS)	77%*	55%	50%	65%	82%*

$p < .02$
Two Tailed Test

Discussion

The present study examined the relationship between creative and overinclusive thinking in a Canadian university population. The experiment was conducted to test three hypotheses. First, that subjects scoring high on creativity as measured by Guilford's Test of Consequences will also score high on overinclusion as measured by Goldstein-Scheerer Object Sorting Test. This hypothesis was not supported by the findings as none of the correlation coefficients between the creativity and overinclusiveness measures were statistically significant. This finding is inconsistent with those of Andreasen and Powers (1975), who had theorized the presence of overinclusive thinking for creative writers. It is possible that overinclusiveness could perhaps be an attribute of the creative writers only and not of creative people in general. Also, if a more creative group of individuals had been used, e.g., creative writers, artists and architects, the author may have found significant correlations between the creativity and overinclusiveness measures. Another explanation that can be offered for the lack of support for this hypothesis is that creativity and overinclusiveness may be basically two different cognitive processes that are independent of each other.

The second hypothesis, that SSS would produce creative outcomes was also not supported by the findings. Although the results were partially in the predicted direction as indicated

in figures 2 and 3, they were not statistically significant. This finding is inconsistent with those of Taylor (1972a), using the Guilford Consequences Test and Tuokko (1976) the Torrance Test of Creative Thinking.

The question arises as to why the increase on measures of creativity did not achieve statistical significance, especially when the literature indicates that originality and ideational fluency are essential manifestations of creativity (Wallach, 1970). Wallach concluded that only measures of ideational fluency and measures of originality, which place no emphasis on evaluation and appropriateness of responses, truly represent divergent thinking. The flexibility and elaboration measures have much more in common with convergent thinking. Various other explanations could be offered for these findings. However, the duration of the testing session, which resulted in a forty-five minute period between the SSS exposure and the administration of the creativity test may be an important factor.

The third hypothesis, that SSS would significantly increase overinclusiveness was also not supported by the results. However, a near significant effect of sex was obtained on the variable of behavioral overinclusion $F = 3.33$, $p < .10$. The experimental group also manifested the largest increase on this variable as indicated in figure 4. This

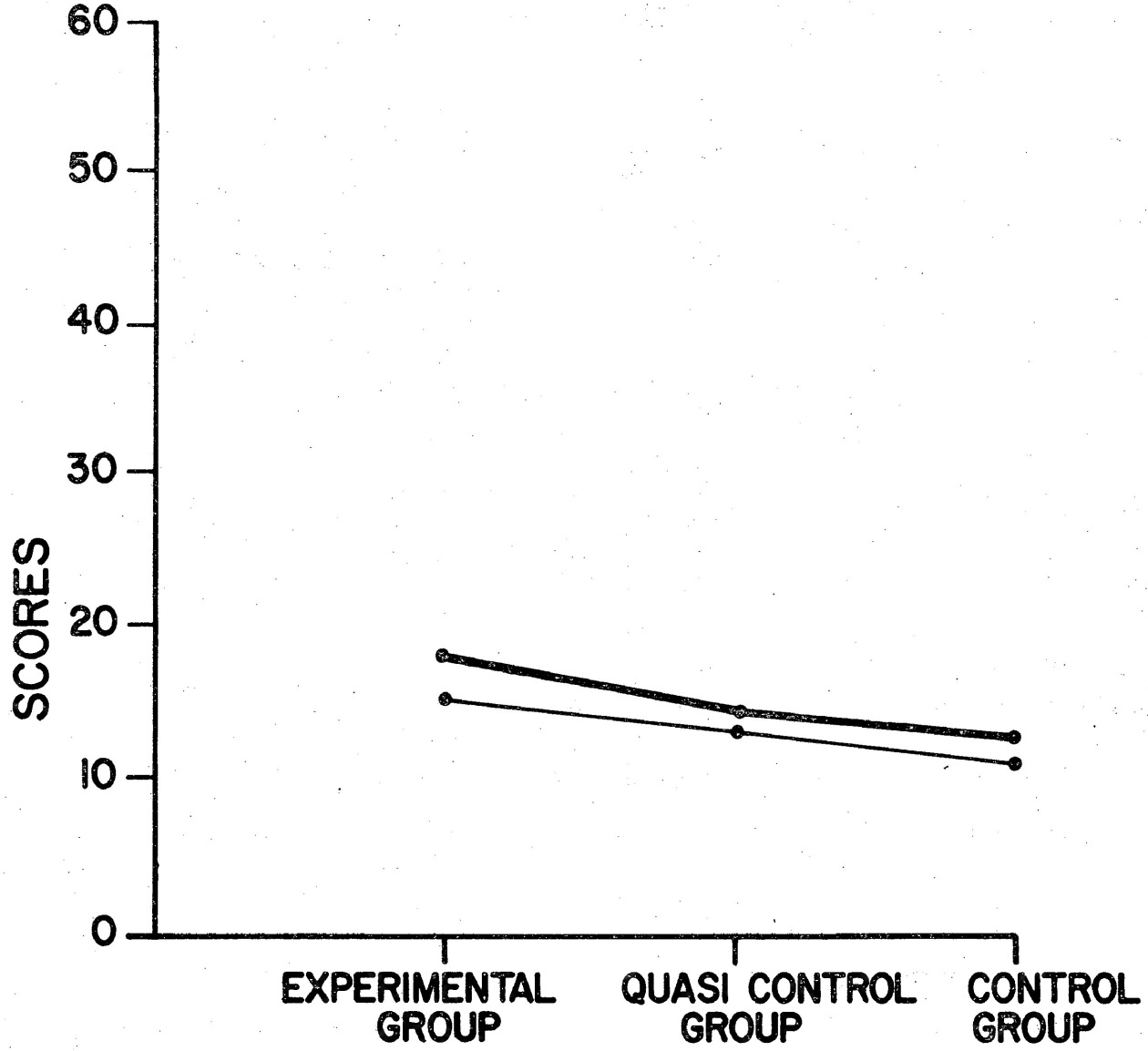


FIGURE 2: MEAN SCORES ON ORIGINALITY

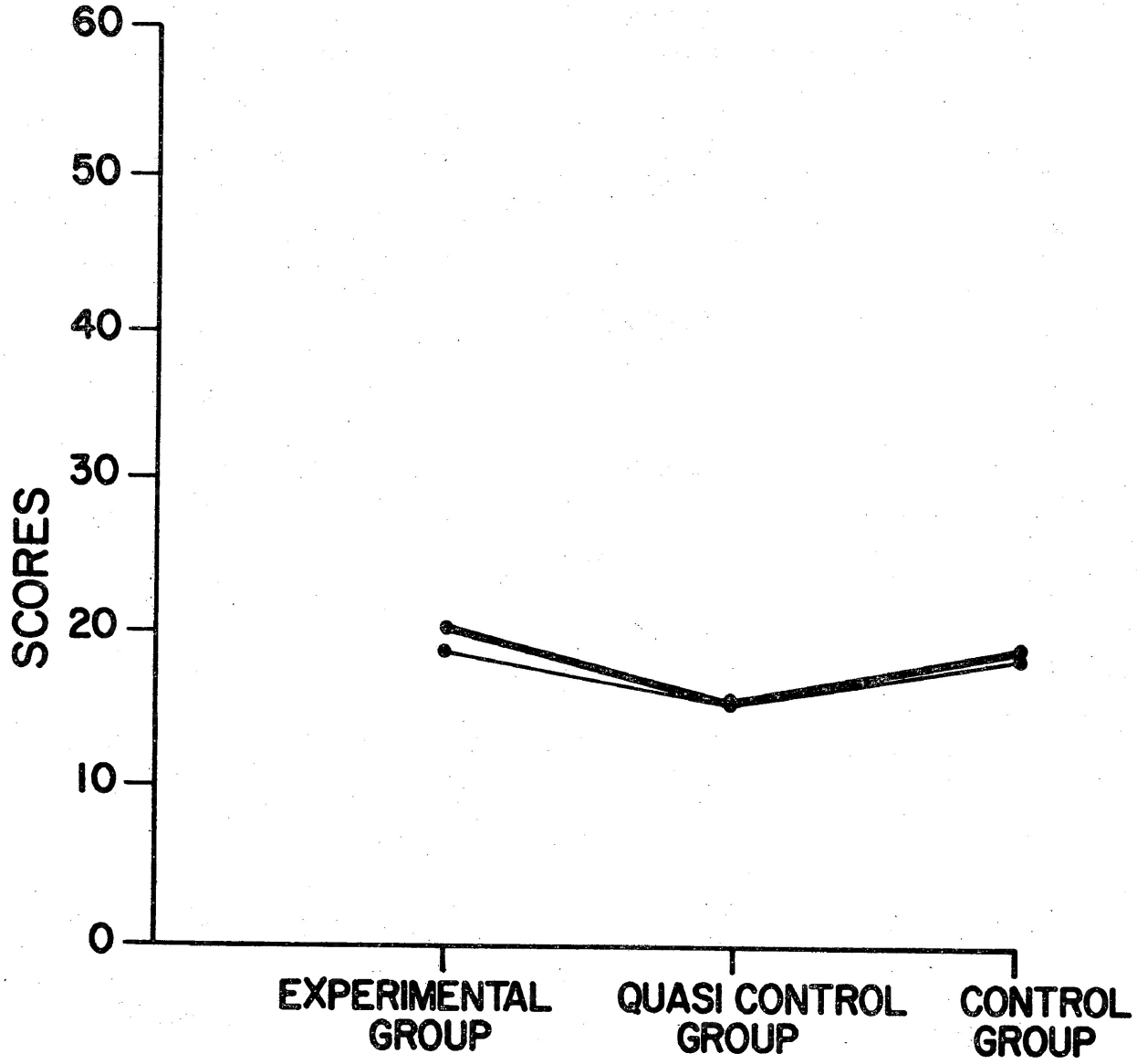


FIGURE 3: MEAN SCORES ON IDEATIONAL FLUENCY

kind of excessive behavioral output could be the result of overinclusive thinking, and which probably could also be influenced by such factors as high energy or drive level and increased associative activity.

However, significant effects of groups were obtained on the variable of conceptual overinclusiveness $F = 4.67$, $p < .01$, and near significance on richness of association for the control group, $F - 2.62$, $p < .10$, but the results were not in the predicted direction. (see figures 5 and 6). In the present study there was evidence of significant effects of sex on the pre-test scores on creativity, $F = 11.76$, p .001, and $F = 6.53$, p .01, but the analysis on the post-test scores did not indicate any significant effect due to sex. However, an interesting finding was that females as a group scored higher than males on pre-test scores for creativity, and males demonstrated a greater increase in creativity after the treatment SSS was administered.

For the overinclusiveness measures males scored higher on pre-test scores, whereas, after being administered SSS, males of the Experimental group demonstrated greater increases in behavioral and conceptual overinclusiveness. Therefore, on the basis of these findings a definite trend emerges in favour of sex differences, and it can be construed that simultaneous sensory stimulation has a more positive effect on males, than females.

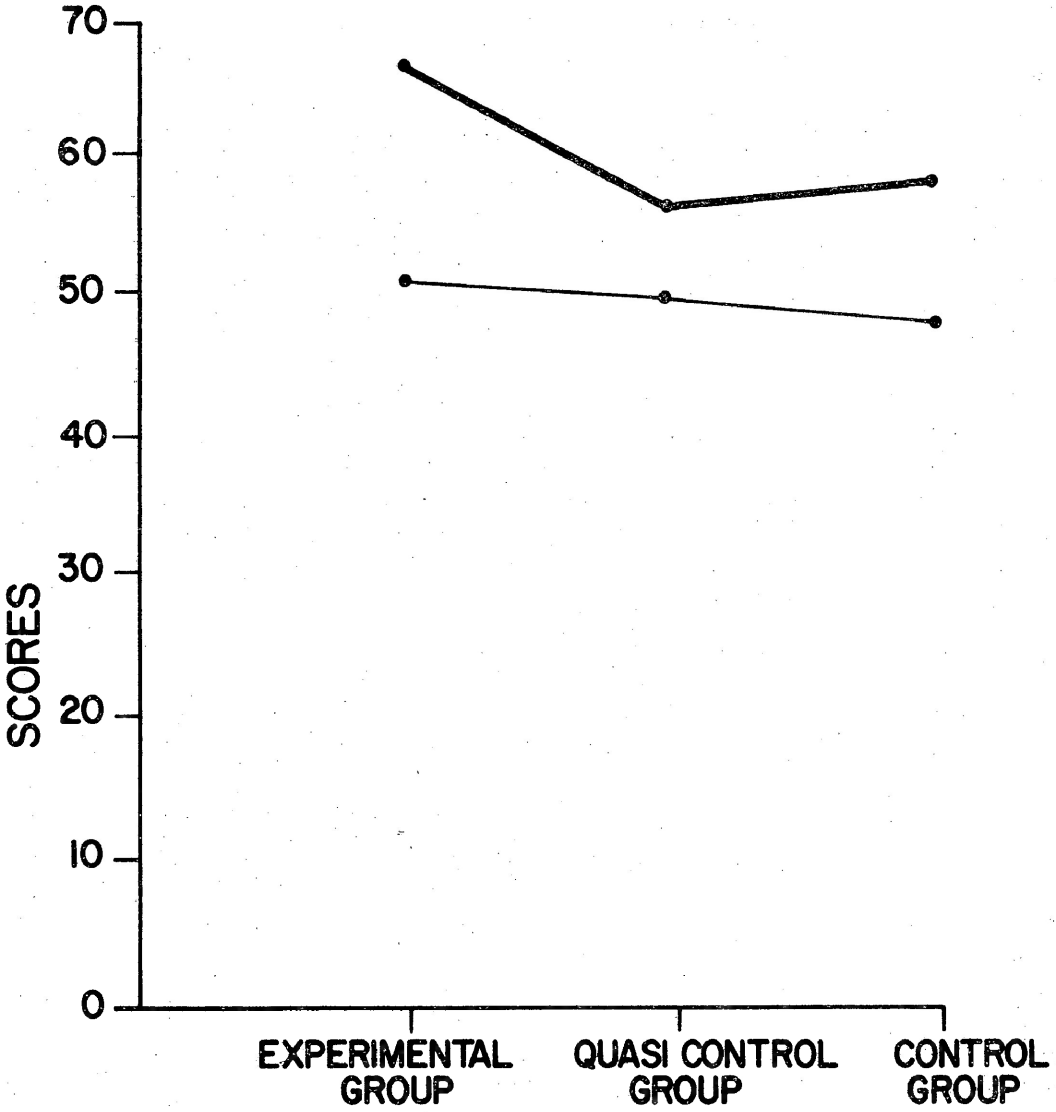


FIGURE 4: MEAN SCORES ON BEHAVIORAL OVERINCLUSION

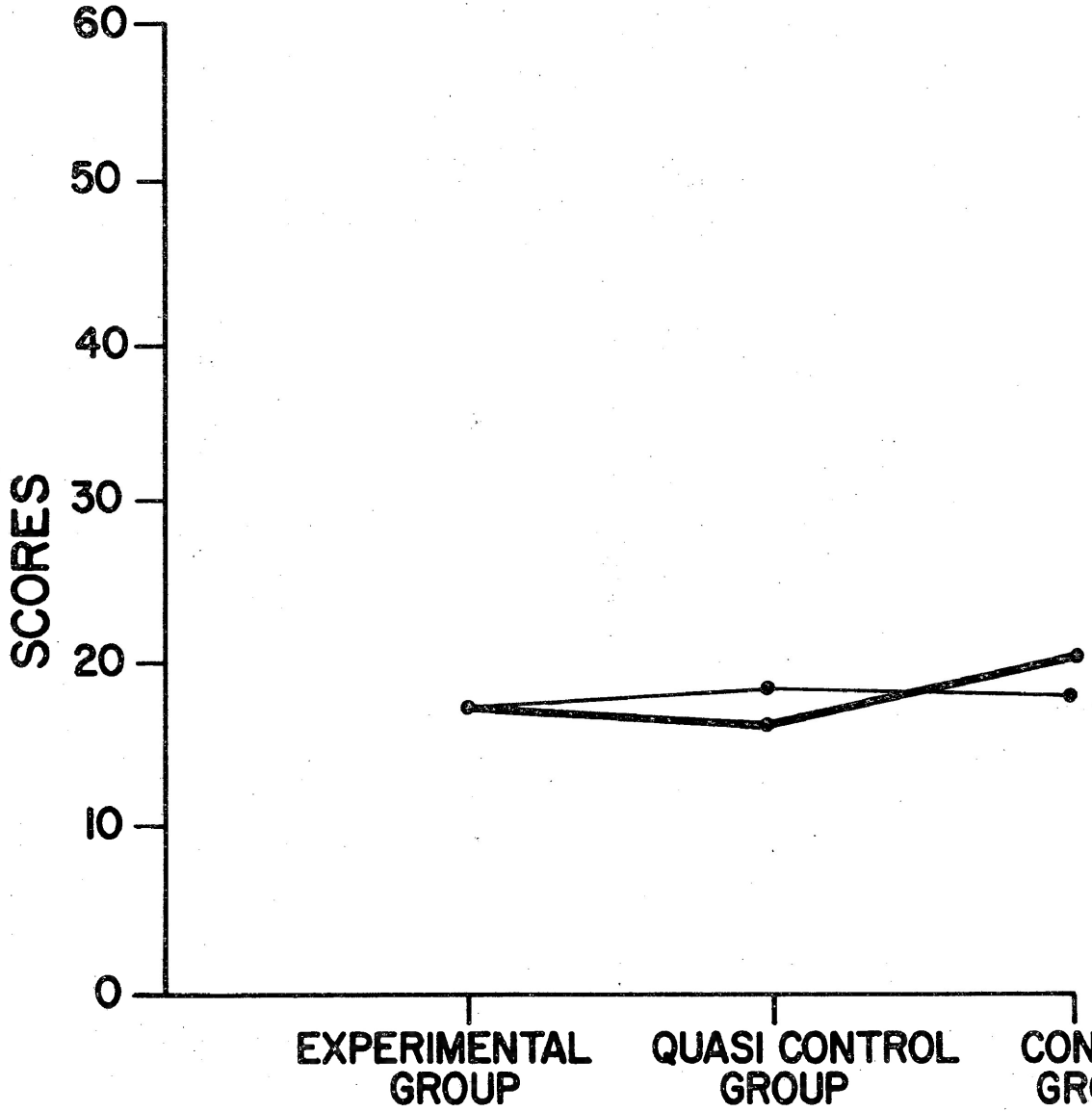


FIGURE 5: MEAN SCORES ON CONCEPTUAL OVERINCLUSION

PRE ——————

POST ——————

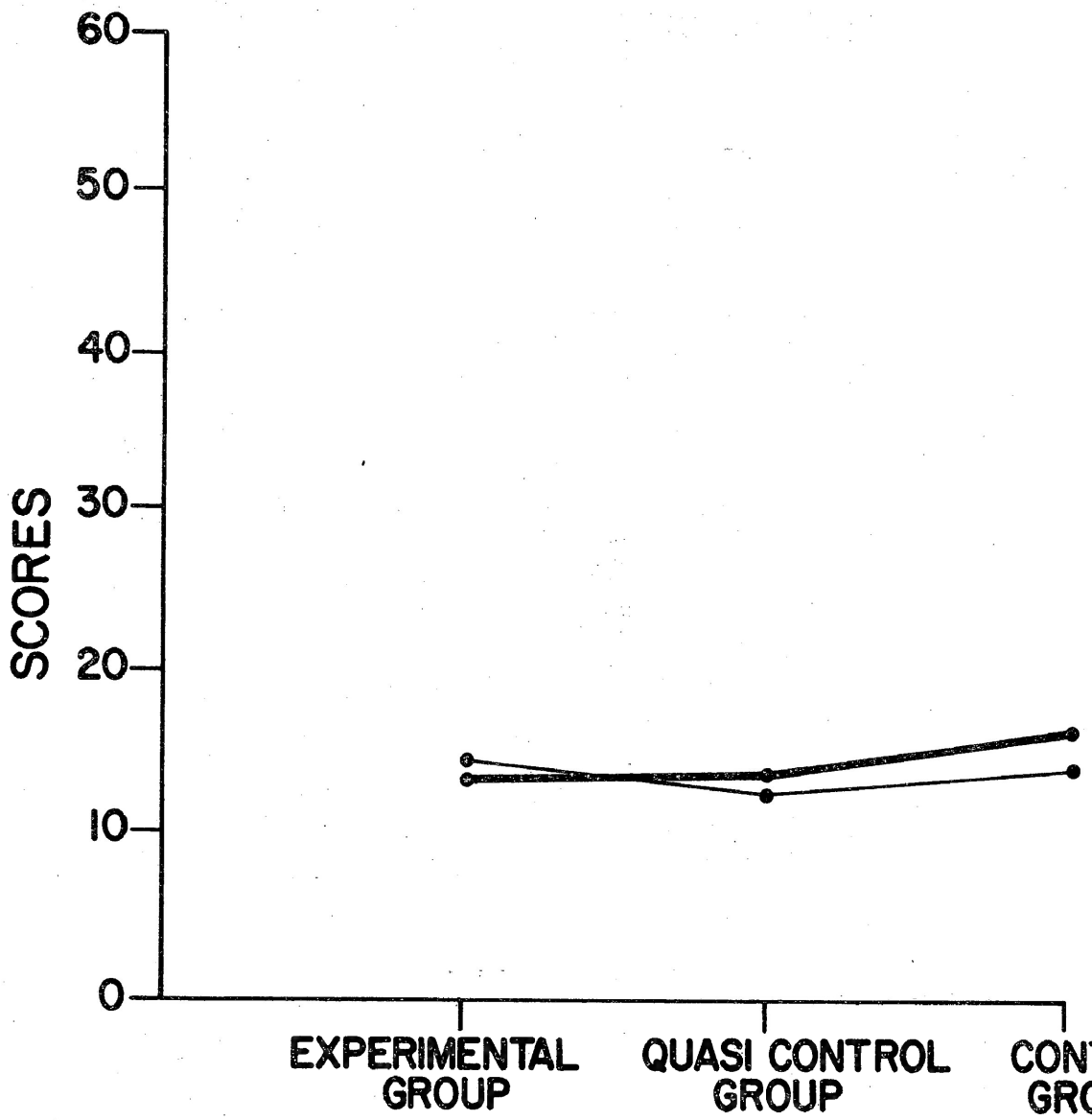


FIGURE 6: MEAN SCORES ON RICHNESS OF ASSOCIATION

PRE ——————

POST ——————

However, the nonparametric analyses performed on the data using the Sign Test, indicated a significant increase for the experimental group on the factors of originality, ideational fluency and behavioral overinclusion ($p < .02$), which is graphically represented in figure 7. Thus the second hypothesis, that SSS will increase creativity or divergent thinking, i.e., originality and ideational fluency was partially supported.

The experimental group indicated a significant effect of SSS on originality and ideational fluency ($p < .02$), and the control group indicated a significant effect of NS on originality ($p < .02$), but not for ideational fluency. This indicated that ideational fluency is more sensitive to the effect of simultaneous sensory stimulation.

The elements of ideational fluency and originality are emphasized in most definitions of divergent thinking while flexibility and elaboration have much more in common with convergent thinking (Wallach, 1970). From this point of view, the former appear to be specific aspects of creativity, and according to the present findings, ideational fluency was more sensitive to SSS.

The third hypothesis was partially supported only to the extent that the experimental group demonstrated a significant increase only on behavioral overinclusion at the .02 level, and not on conceptual overinclusion and richness

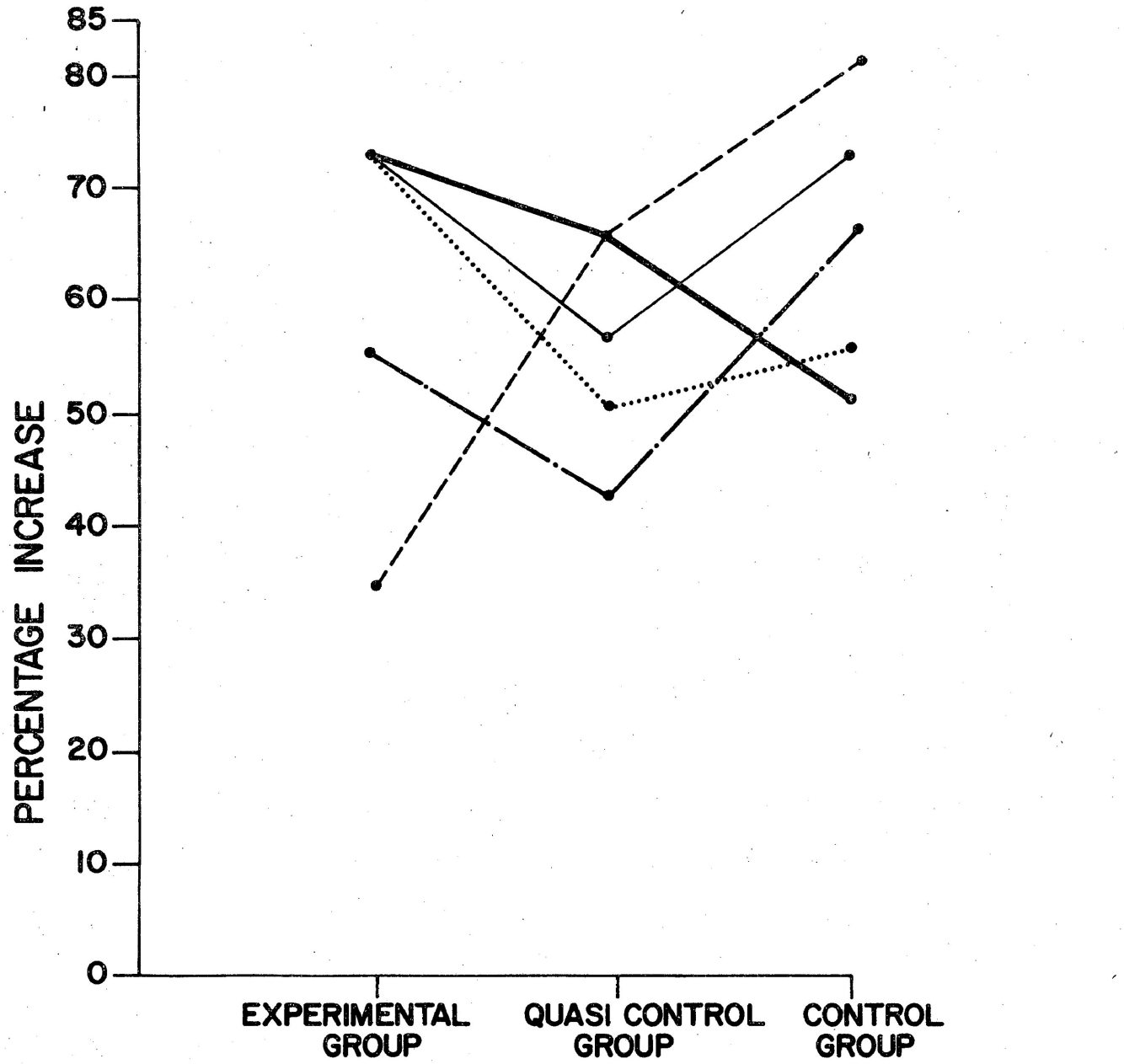


FIGURE 7: PERCENTAGE INCREASE OF SUBJECTS

of association.

The measure of behavioral overinclusion, it should be pointed out, measures one type of excessive behavioral output which may be influenced by overinclusive thinking, but which probably is also influenced by high associative activity as a result of SSS.

Suggestions for further research and conclusions

Creativity is a complex concept to experimentally examine. It would appear that standardized tests may not be the best method for assessing it due to variability in subjects exposed to varying degrees of stimulation. There is a need for developing short and sensitive measuring instruments, which could be geared to the short-term cognitive effects of SSS.

Future research should attempt to look for ways to translate laboratory conditions into real life situations in order to provide realistic conditions to stimulate divergent thinking.

It would be useful to use designs with two experimental groups. The first experimental group could be administered a test of creativity and then a test of overinclusion, and vice-versa for the second group. In this way, we might be able to assess changes in creativity and overinclusion measures before the transitory effects of SSS expired.

It is also suggested that in further research, extremely creative groups of individuals should be used for studying

the differential effects of SSS.

As mentioned in the introduction, there has been a dearth of fruitful psychological experimentation in this area. The present findings lead to the following conclusions: First, there were no significant correlations found between creativity and overinclusive thinking using parametric statistics. Secondly, using parametric analyses, no significant effect of the SSS on creativity was found, however, non-parametric analysis did demonstrate a significant effect of SSS on creativity. Thirdly, on the basis of the parametric analysis, no significant effect of SSS on overinclusive thinking was found, but to the contrary, the non-parametric analyses did indicate a significant increase on behavioral overinclusion due to the SSS. The results did, however, suggest partial tendencies which supported the validity of the SSS effect.

It is the task of future research to more fully explore the relationship between man and his sensory environment and to extend this knowledge to the understanding of creativity.

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APPENDIX A

Table 15
Orthogonal Comparison on the Change Scores for Originality

Pooled Variance Estimates

	Value	S. Error	T. Value	D.F.	T. Probability
Contrast 1	0.55	1.70	0.33	51.0	0.75
Contrast 2	-1.00	2.95	-0.34	51.0	0.74

Table 16
Orthogonal Comparison on the Change Scores for Ideational Fluency

Pooled Variance Estimates

	Value	S. Error	T. Value	D.F.	T. Probability
Contrast 1	-0.11	2.13	-0.05	51.0	0.95
Contrast 2	-2.11	3.69	-0.58	51.0	0.57

Table 17

Orthogonal Comparisons on the Change Scores for Behavioral Overinclusion

Pooled Variance Estimate

	Value	S. Error	T. Value	D.F.	T. Probability
Contrast 1	3.66	7.94	0.46	51.0	0.65
Contrast 2	-15.22	13.75	-1.10	51.0	0.27

Table 18

Orthogonal Comparisons on the Change Scores for Conceptual Overinclusion

Pooled Variance Estimate

	Value	S. Error	T. Value	D.F.	T. Probability
Contrast 1	4.11	1.38	2.96	51.0	0.05*
Contrast 2	0.88	2.40	0.37	51.0	0.71

*$p < .05$

Table 19

Orthogonal Comparisons on the Change Scores for Richness of Association

Pooled Variance Estimate

	Value	S. Error	T. Value	D.F.	T. Probability
Contrast 1	1.44	1.37	1.05	51.0	0.29
Contrast 2	4.66	2.37	1.96	51.0	0.05*

*$p < .05$

APPENDIX B

NAME OF THE STUDENT: _____

AGE: _____

DO YOU OR ANY CLOSE RELATIVE HAVE A HISTORY OF EPILEPSY? _____

_____

_____

_____

ARE YOU PRESENTLY TAKING ANY DRUGS OTHER THAN FOR THERAPEUTIC PURPOSES? _____

_____

_____

_____

APPENDIX C

CONTRACT

I AGREE TO PARTICIPATE IN TWO - 75 MINUTE SESSIONS FOR AN EXPERIMENT THAT IS DESIGNED TO STUDY THINKING PROCESSES. I UNDERSTAND THAT PROCEDURES DO NOT PRODUCE HARMFUL AFFECTS.

_____
(STUDENT)

UPON COMPLETION OF THE EXPERIMENT, THE EXPERIMENTER AGREES TO PROVIDE A COMPLETE EXPLANATION OF THE EXPERIMENT AND THE GENERAL FINDINGS.

_____
(EXPERIMENTER)

APPENDIX D

Name_____ Date_____ Age_____ TOTAL # OBJ._____

Over-Inclusion_____ Rich Associations_____ Bizarreness_____

	1	2	3	4	5	6	7
1.Fork							
2.Knife							
3.Spoon							
4.Toy Fork							
5.Toy Knife							
6.Toy Spoon							
7.Ball							
8.Wax Apple							
9.Red Paper Circle							
10.Red Saucer							
11.Red Poker Chip							
12.Yellow Poker Chip							
13.China Dog							
14.Toy Clapper							
15.Bicycle Bell							
16.Toy Screwdriver							
17.Toy Saw							
18.Toy Drill							
19.Toy Hammer							
20.Screwdriver							
21.Pliers							
22.Block with Nail							
23.Sink Stopper							
24.Padlock							
25.Padlock with 2 Keys							
26.Rubber Cigar							
27.Bubble Gum Cigar							
28.Candy Cigarettes							
29.Cigarette							
30.Cigar							
31.Pipe							
32.Matchbox							
33.Red Candle							
34.White Candle							
35.Sugar Cube							
36.Sugar Cube							
37.Cork							
38.Eraser							
TOTALS							

Comments:

Verbalizations - Sets - Behavior

1. Sink Stopper

2. Fork

3. Pipe

4. Bicycle Bell

5. Red Circle

6. Pliers

7. Ball