THE EFFECT OF CERTAIN PERSONALITY TRAITS ON THE PERFORMANCE OF SENSORY TASKS

A Thesis

Presented to

The Faculty of Graduate Studies and Research

University of Manitoba

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

by

Diana Henderson

1968

ACKNOWLEDGMENTS

The author is grateful for the kind co-operation and assistance of Mr. James Downey and the students of Vincent Massey Collegiate throughout the administration of the Personality Research Form and the sensory panels. Appreciation is also extended to Dr. Clarry Lay of the Department of Psychology for procuring the PRF test materials and supervising the administration of the tests.

The author is grateful to Mr. Farouk Chebib of the Computer Centre who wrote the programme for the analysis of the sensory data and Mr. A.P. Donner of the Statistics Department for his patience and help in the interpretation of the data.

With most sincere appreciation and deep gratitude the author wishes to acknowledge her advisor, Mrs. Marion Vaisey, whose encouragement, optimism and invaluable assistance made this report possible.

ABSTRACT

Fifty-six Ss, divided into high and low achievers, participated in a study designed to (1) predict from two achievement-oriented traits, achievement and endurance, Ss who would not satisfactorily complete a sensory task, and (2) compare the triangle test, paired-comparison test and intensity-rating scale, using the effectiveness of each test in arriving at the expected result as the index of sensitivity.

Plain butter cakes baked with four whole egg treatments: fresh, spray-dried powder, irradiated powder and a 50% blend of irradiated and unirradiated powder, were the media by which the two objectives of the study were tested.

Chi-square analyses of daily performance data, and covariance analyses of the responses to the triangle tests and the achievement levels showed significant differences in the level of performance in completing a sensory task by the high achievers but not by the low achievers. Multiple regression and chi-square analyses did not show dependency of attendance or improvement in performance upon the two motivation traits.

When considered alone, the triangle test, directional paired-comparison test and intensity-rating scale were comparable. However, the triangle test plus the intensity-rating scale was more sensitive than either the triangle plus the paired-comparison or the paired-comparison plus the intensity-rating scale.

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INTRODUCTION

Of concern in the sensory evaluation of food is the problem of identifying, in advance, those Ss who lose interest in the task and quit. Ss can "quit" in either of two ways, i.e., by failing to attend the tests, or ceasing to be conscientious in making the comparisons. The primary objective of the present study was to investigate the influence of the individual's level of motivation upon:

(a) attendance
(b) performance
(c) improvement in performance

This objective is within the realm of motivation research. Motivation is learned and therefore differs with each individual. The individual's motivational level can be measured by personality inventories.

Equipped with a battery of variables and carefully worded definitions, Douglas R. Jackson of the University of Western Ontario developed the Personality Research Form (PRF). Both a long and a short form of the test was published. In the present study the short form was used to select high school students on two motivation-oriented traits, achievement and endurance. High scorers on these two traits (hereafter known as high achievers) and low scorers (low achievers) were selected for the taste tests.

In addition to the calibre of the performance of Ss, researchers in food science are concerned about the sensitivity and efficiency of the tests they use.

Difference tests are the most frequently used designs in the sensory evaluation of food. A very sensitive method of analysis, difference testing demands precision in test design, in administration of the test, in the reaction of the Ss to the test environment, and in the analysis of results. The object of difference testing is to establish a difference if one exists, and if not, to confirm the null hypothesis, i.e., no difference.

There are two types of risks involved in the use of null hypothesis as applied to difference tests, error of the first kind and error of the second kind. Consideration of error of the second kind has led researchers to look at the relative sensitivity or power order of the various difference tests. The main tests studied have been the triangle, paired-comparison, intensity-rating scale and duo-trio tests. The present study investigated the comparative sensitivity of the first three, i.e., triangle, paired-comparison and intensity-rating scale, with emphasis on the use of the quality designation or directional modification.

A sensory task measuring the effects of spray-drying and irradiation upon whole eggs was the medium by which the primary objectives of the study were investigated. A convenient identifiable difference was established between treatments in order to (1) enhance the Ss motivational level by affording him a check on his progress, and (2) assess the usefulness of the test designs in picking out the differences between treatments.

REVIEW OF LITERATURE

Motivation Research

The Standard Dictionary (1962) defines motivation research as

> "the use of psychological ... techniques in marketing ... and public opinion research to investigate the conscious or subliminal causes of consumer behaviour, and the motives triggering action or decisions that bring about favourable or unfavourable response toward a product ..."

The theories and findings of motivation research have been "borrowed" by workers in the area of the sensory evaluation of food to improve the performance of candidates in taste tests. Taste testing can be considered an ability test because it requires a certain amount of memory and concentration as well as innate acuity. Underlying all ability tests is the assumption that the Ss are operating at peak performance. To ensure this, every S should be motivated by drives or incentives to put forth his maximum efforts.

McClelland (1965) has set forth six propositions as basic guides in the manipulation of Ss' motivational level to increase performance. They are:

(1) the more reasons an individual has in advance to believe that he can, will or should develop a motive, the more attempts to develop motives will succeed.

(2) the more an individual perceives that developing a motive is consistent with the demands of reality and reason, the more these same attempts will succeed.

(3) the more an individual keeps a record of his progress towards achieving goals to which he is committed, the more influential the newly formed motive.

(4) changes in motives are more likely to occur the more the setting dramatizes the importance of the study and lifts it out of the routine of everyday life.

(5) changes in motives are more likely to occur and persist if the new motive is a sign of membership in a new reference group.

(6) if motives are to persist, warm interpersonal relationships must be built between the E and his Ss.

Studies in Motivation

Studies have shown that incentives, positive or negative, strong or mild, do affect the performance of the test Ss as compared to the controls (Eysenck, 1964, and Young, 1961). Children who felt inferior were highly motivated by praise although neither praise nor punishment affected the self-confident children (Schmidt, 1941). Motivation serves to make S more aware of the environment, and hence, selective in his response to it (Amerine et al, 1965). When a motive has been highly developed, responses to questions, for example, are made with a better vocabulary of terms (Amerine et al, 1965), and efforts generally are highly goal-directed (Atkinson and Raphaelson, 1956). The strength of the motive is dependent upon the drives or incentives initiating it. Some incentives are hunger, money, special attention from the E, and personal achievement.

However, motivation techniques must be used with discretion. "Overmotivation" can lead to increased activity with decreased

efficiency (Young, 1961). Test-oriented students are often immune to motivation stimulants (Anastasi, 1954). The typical middle-class student is usually so highly success oriented that his level of motivation in competitive situations is naturally high (Anastasi, 1954). In some instances the rapport between the E and his Ss may be so well developed that attempts to increase the level of motivation are futile (Amerine et al, 1965). Anastasi (1964) further cautions that the information gathered in motivation research is often of a highly personal nature and cannot be readily generalized.

Measurement of Motivation

Motives are learned determinants of behaviour (Cattell and Baggaley, 1956; Lindzey, 1964; Young, 1961, and McClelland, 1965). A motive is an "attitude". Cattell and Baggaley used this paradigm to define attitude: "In these circumstances I want so much to do this with that." In this definition the S is measured as to the extent to which "he is for or against a course of action" regardless of the object involved. The attitude, therefore, is not a response but a "habit structure" which allows responses to be made.

Attitudes, or personality traits, can be measured by personality tests. Information of this kind is important because personality traits may determine the success or failure of an individual in any task. Personality tests are designed to measure the non-intellectual aspects of behaviour such as emotion, social bias and motivation (Anastasi, 1954 and 1964).

Personality inventories and projective needs tests are frequently used in the assessment of personality traits. Personality inventories are often preferred because as paper and pencil tests they are easily administered and scored. The major drawback to such tests has been an overlapping in the variables measured because criteria and definitions were obscure. In a personality inventory the responses to the questionnaire are correlated with defined personality variables. The age of computers has helped to overcome most of the problems inherent in correlating and defining personality variables.

The PRF was developed by D.R. Jackson in order to improve upon existing personality inventories. He initially published a test comprised of twenty 20-item scales and requiring about an hour and a half to complete. In order to curb the time factor, he later produced a shorter form.

The short form of the PRF (Appendix A) is a battery of 300 questions divided into fifteen 20-item scales. The scales cover a range of personality variables from an individual's honesty to his level of ambition (Table I). The Desirability and Infrequency scales mark respectively those Ss who attempt to respond to questions in only a favourable light, or make careless random responses (Jackson, 1967). In such a test the S does not know the aspects of his behaviour which reveal his attitudes to the E (Cattell and Baggaley, 1956). The PRF personality dimensions are bipolar, therefore both high and low scores indicate important characteristics which serve to differentiate Ss (Jackson, 1967).

TABLE I

DEFINITIONS OF SCALES COMPRISING
THE PERSONALITY RESEARCH FORM (JACKSON, 1967)

Scale	Definition
1. Affiliation	Enjoys being with friends and people in general
2. Nurturance	Gives sympathy and comfort; helpful
3. Dominance	Attempts to control his environment and to influence or direct others
4. Harmavoidance	Avoids danger, is fearful, cautious, vigilant
5. Play	Lighthearted, enjoys social activities, sports and games
6. Exhibition	Enjoys being conspicuous, dramatic, colourful
7. Achievement	Aspires to accomplish difficult tasks; maintains high standards and is willing to work toward distant goals; desires to excel; competitive
8. Autonomy	Enjoys being unattached, free, not tied to people, places or obligations
9. Impulsivity	Spontaneous, hasty, impetuous, uninhibited
10. Social recognition	Works for approval and recognition of others
11. Understanding	Wants to understand many areas of knowledge; likes logical thought, verifiable generalizations

TABLE I (continued)

Scale	Definition
12. Order	Dislikes clutter, confusion, lack of organization
13. Aggression	Combative, quarrelsome, revengeful, destructive, argumentative
14. Endurance	Willing to work long hours; persevering, steadfast, patient, unrelenting
15. Desirability	Consciously or unconsciously, or inaccurately, presents favourable picture of self in personality test responses
16. Infrequency	Shows high rate of pseudo-random and inconsistent responding; may be unmotivated to follow directions or unable to comprehend questions

Martire (1956) used 53 male volunteers to obtain Achievement scores for Ss under two conditions, Neutral and Achievement-Oriented. He expected that: (1) self-conflict (i.e., the difference between Self and self-Ideal) would be related to high generalized achievement motivation, and (2) high achievers would show a significantly greater discrepancy between their self-Ideal and Self ratings on the five achievement-related traits than the other Ss. Under the achievement-oriented condition, the high achievers showed greater self-conflict than under the neutral condition. The self-Ideal-Self rating discrepancy in the high achievement group was thought to mean that people with high generalized motivation desire those traits associated with achievement but do not see themselves as possessing those traits. Hence these Ss would have high standards, would strive to reach high goals. Therefore, it could be hypothesized that the high need for achievement, innate in some subjects, coupled with achievement-oriented instructions could affect the S's level of performance in a task.

Atkinson and Raphaelson (1956) studied the performance of 24 males in order to test the strength of achievement motivation. They found that the recall of interrupted tasks was greater for the high achievement Ss than for the low achievement Ss following the Test Instructions which aroused the achievement expectancy but not following the Task Instruction which did not. In a second experiment, consisting of two parts, two months apart, the same Ss were administered an interruption of tasks experiment in conditions

designed to be (1) minimally achievement-related, and (2) highly achievement-oriented. It was discovered that when the possibility of personal accomplishment as a goal was removed, there was no relationship between strength of achievement motive and recall of interrupted tasks.

Therefore, it is not sufficient to select Ss on the basis of achievement motivation without some type of motivation technique employed as well.

Difference Tests

In sensory analysis the choice of test used in the comparison is as important as the selection of the Ss. Of all the testing procedures used, difference tests are the most popular.

Difference testing is the basic approach to sensory analysis. It is used when strict identity with the product standard is required, within a limited range of response. The S's task is completely defined within the experimental situation and he is required to give easily interpretable responses, i.e., yes or no (Amerine et al, 1965; IFT, 1964; Larmond, 1967 and Peryam, 1958).

There are three basic types of differences: (1) simple difference; (2) directional difference of a specified criterion; and (3) quality preference difference. In simple difference testing, the S is required to respond in one of two ways: "there is a difference" or "there is no difference". The results are easily adapted to quantitative statistics which increases the reliability of the

interpretation. Information from such testing is restricted by the fact that when a difference is established, there is evidence neither of the dimension of the difference nor whether each S differentiated on the same basis (Amerine et al, 1965). Directional difference testing is not as objective as simple difference because the S is required to choose the sample which is more intense in a pre-defined characteristic. As an example Amerine et al (1965) point out that by discriminating between samples on a predesignated standard, interpersonal disagreement among Ss could be increased because the Ss may not fully understand the criterion. Comparisons made on the basis of quality preference are two-tailed, therefore, unfavourable and favourable responses must be considered.

Difference tests fall into one of three classifications, (1) two-sample tests; (2) three-sample tests, and (3) multisample tests. A descriptive summary of the first two classifications is in Table II.

Comparison of Two and Three Sample Tests

In his discussion on true difference tests Lockhart (1951) proved that it was impossible to carry out a true difference test with a two-sample design, e.g., A-B. He explained that the basic assumptions in true difference testing are that a difference exists, and "no difference" answers are not allowed. Therefore, it was impossible for Ss not to be correct in the separation of the samples into two groups. The two sample design was felt to be best suited

TABLE II

SOME DIFFERENCE TESTS*

Name	Method of Presentation	Standard	Response	Probability of a correct guess
Paired-Comparison	AB or BA	subjective	"Different" or "Not different"	$\frac{1}{2}$
Paired-Comparison	AB	subjective	"which has more of the defined criterion"?	$\frac{1}{2}$
Duo-trio	A/AB	one presented and one designated	"which is the same as A"?	$\frac{1}{2}$
Triangle	AAB,ABA,BAA, ABB,BAB,BBA	none designated, criterion is within the test	"which is the odd sample"?	1/3
Triangle	AAB,ABA,BAA, ABB,BAB,BBA	none designated, criterion is within the test	"which is more intense in the defined criterion"?	1/3

*Adapted from Amerine et al, 1965.

for quality judgments and that only triangle or duo-trio tests could be used in true difference testing.

Using difference tests as the basis for quality judgments, Lockhart divided the problem into two parts to determine whether Ss could detect a difference, and the direction of that difference. When the two-sample design was used as a directional test the probability of guessing correctly by chance was obtained by multiplying together the probability of making a correct discrimination, which is one, and the probability of quality assignment, which is one-half. The probability of guessing correctly by chance in the directional triangle test is one-sixth, one-third for identifying the odd-sample multiplied by one-half for the probability of quality assignment.

For the same probability, i.e., the chance that no difference exists between samples, triangular tests have a statistical advantage over duo-trio or paired presentation both per replicate and per aliquot (Amerine et al, 1965). However, in a study comparing triangular and two-sample taste test methods, Byer and Abrams (1953) found more significant results in the selection of the more bitter or sweet sample in the two-sample test than in the selection of the odd sample in the triangle. Unfortunately, the number of Ss used in the study was not reported. Nonetheless, the two-sample test did give more clear-cut evidence of a taste difference, and it was suggested that this was probably due to the fact that fewer inter-comparisons were necessary.

Filipello (1956) studied two and three sample tests by having one S taste three series of sucrose solutions for a total of 60 to 90 judgments for each concentration comparison in each series for each design. A twelve-member panel was used for some of the tests to support results obtained by the single S. Filipello found a noticeable lag in response in the triangle test and concluded that in a comparison of solutions of recognizable concentrations, the two-sample design was more sensitive, i.e., the statistical advantage that the triangle has was reduced by its greater j.n.d.* as compared to that of the pair. To determine the nature of the difference between the two designs, Filipello presented two variations to the one S. The 1% sucrose level was presented in four arrangements with concentrations higher than 1%. In the paired design the S had to indicate if the samples were like or unlike. In the triangle test, the S had to choose the odd sample which he knew was always the higher concentration. By earmarking the odd sample as the higher concentration, Filipello turned the triangle test into a duo-trio test, with a $\frac{1}{2}$ probability of guessing correctly and hence the triangle presentation approached the sensitivity of the pair.

Therefore, one would assume that the paired-comparison was more sensitive than the triangle test. However, this assumption is not valid from the above studies because a directional two-sample design was compared to a simple three-sample difference test. The

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*just noticeable difference

probability of guessing correctly in a directional triangle, as stated previously, is one-sixth as compared to one-third for the simple triangle test and one-half for the directional paired-comparison.

Intensity-Rating Scales vs Paired-Comparison

In 1963 Duncan reported that strong instructions significantly reduced the number of overt responses, and instructions to "think" and "take more time" improved performance. Hence, in difference testing, the intensity-rating scale might influence the S's behaviour in a way similar to Duncan's strong instructions by defining S's reaction to the test samples in explicit terms.

Three strawberry varieties representing three flavor levels were examined organoleptically in a study by Murphy et al (1957) comparing intensity scales and paired-comparison. As criteria to appraise adequacy or superiority of a design, they used: the number of significantly different varieties, the significance level of the differences, and the sensitivity of the judges to flavour differences. They found the paired-comparison technique most sensitive. Using these same criteria they found that simple preference gave as much information as the intensity scale.

Gridgman (1961) compared rating scales with multiple paired-comparison using a 12-member panel to evaluate stored and fresh eggs. Paired-comparison was shown to be more discriminating than rating. The authors pointed out a discrepancy between the two designs which

weakened the design of the experiment. The Ss on the "rating" panel were given an identified fresh egg as a preliminary, which brought an element of matching which was absent from the paired-comparison test.

The intensity-rating scale gave results at least equal to those obtained by the paired-comparison test, when Ough and Baker (1964) used eleven panelists to investigate fourteen odour levels. In addition, the scale proved to be more stable and consistent, requiring less time to complete.

The problem of the relative usefulness of sensory tests still persists coupled with the problem of where and how to use the intensity-rating scale.

Sensory Task

An investigation of the primary objectives of the present study required that the results of the sensory task be known ahead of time. Therefore, egg powder, irradiated and unirradiated, proved to be a most convenient medium.

A great deal of information has been published on the effects which spray-drying has upon the fresh whole egg.

During World War II spray-dried eggs were processed to meet the nutritional requirements of both civilians and soldiers. Liquid whole eggs, egg yolks,and egg albumen were usually spray-dried at the recommended temperature and holding time of 140°F (60°C) for two minutes (Proctor et al, 1953). The criteria of quality of egg powders

included odour and flavour, aerating or leavening power, coagulation or thickening power, emulsifying power, colour, and nutritive value (Lightbody and Fevold, 1948).

Odour and Flavour - Off-flavours noticed in egg powders were: (1) burnt (severe drying conditions), (2) fishy (copper contamination), (3) sour (bacterial action in liquid prior to drying), (4) flavours traceable to storage in non-airtight containers near odourous articles, and (5) flavours from storage deterioration (Lightbody and Fevold, 1948). These workers reported a study which examined whole egg powders and certain fractions of such powders, and found that off-flavours developed when lipids were present in samples held at high temperatures, because of oxidized phospholipids. Free fatty acid formation (aldehydes and rancid odours) were important in off-flavour development also. Addition of small quantities of carbohydrates (0-20%) resulted in good flavour stability at first, but marked instability later on (Brooks and Hawthorne, 1944). Spray-dried egg flavour was best at 2-5% moisture (Miller et al, 1947), and Griswold, 1962). Off-flavours noticeable in scrambled mixtures tended to be masked in baked products (Lightbody and Fevold, 1948; Joslin and Proctor, 1954, and Knowles, 1962).

Aerating or Leavening Power - Spray-drying usually resulted in marked diminuation of aerating powers even though palatability was retained (Miller et al, 1947; Lightbody and Fevold, 1948, and Brown and Zabik, 1957). When samples were frozen when spray-dried, aerating powers persisted for a short time but were quickly lost

during storage (Lightbody and Fevold, 1948). A decrease in aerating powers was evident with structural changes in protein and yolk lipids (Lightbody and Fevold, 1948 and Joslin and Proctor, 1954). The decreased whipping power of dried eggs was attributed to the loss of emulsifying properties and release of free oils which coated the particles of egg powder and acted as anti-foam agents (Joslin and Proctor, 1954).

Coagulation or Thickening Power - Thickening power decreased upon storage (Miller et al, 1947) but was retained when sugar was added to the powder. However, the addition of sugar caused palatability to deteriorate rapidly (Lightbody and Fevold, 1948). Kline and co-workers (1954) recommended desugaring whole eggs prior to drying to preserve quality.

Emulsifying Power - Emulsifying power of the yolk was retained up to one year (Lightbody and Fevold, 1948), but there was a loss of foaming properties upon deterioration because of the anti-foam properities of free oils (Joslin and Proctor, 1954).

Colour - Changes in protein and the formation of free fatty acids accompanied the brown discolouration of egg powders (Maillard Reaction). Additions of sucrose to whole eggs before spray-drying retarded this reaction while improving flowability and blending properties (Kline et al, 1954, and Kline et al, 1964). Removal of glucose by yeast prevented darkening but left an off-flavour (Lightbody and Fevold, 1948, and Knowles, 1962).

Nutritive Value - During spray-drying there was no loss of the

vitamins A, D and riboflavin. Vitamin A was lost rapidly if the powders were stored at high temperatures (Denton et al, 1944). Thiamine retention was inversely related to moisture contents from 1-6% at 37°C (Olsen et al, 1948).

An additional measure of quality is the solubility index of eggs. Solubility was found to be related to protein changes, and decreased with excessive heat. As the storage time increased, the solubility decreased along with the foaming properties (Lightbody and Fevold, 1948; Bishor and Mitchell, 1954, and Knowles, 1962). Sucrose or lactose retarded insolubility thus helping aerating power (Knowles, 1962).

The performance of spray-dried eggs in baked products has been studied extensively in the light of important functional properties of eggs. The functional properties of eggs are: (1) to form voluminous, stable foam, (2) to give extensibility through proper coagulation, and (3) to be emulsifying agents in products using mixtures of fats and oils with water (Joslin and Proctor, 1954).

Brown and Zabik (1957) found that the volume of angel cakes baked with egg powder was smaller than that of cakes made with fresh eggs. However, in shortened cakes the aerating property of eggs is less important because air is encorporated by manipulation techniques and the addition of chemical aerating agents. When good quality dried eggs were used there was no decrease in shortened cake quality (Ary and Jordan, 1945; Grover and Hawthorne, 1946, and Griswold, 1962). When poor quality eggs were used, volume, appearance and texture of

cakes was inferior, and off-flavours were more pronounced.

Therefore, the expectation was that cakes made with high quality spray-dried egg powder would be similar to cakes made with fresh eggs.

Irradiation

Since the early 1900's it has been known that x-rays can kill micro-organisms. Recent research has demonstrated the value of this technique in the destruction of Salmonella, a micro-organism harboured in poultry and poultry products. Salmonellosis is not fatal to an adult but can be if contracted by small children.

Ionizing radiations of use in the food industry can be produced either from high voltage machines or are formed during the decay of radioactive cobalt (cobalt-60) or caesium (caesium-137) (Glew, 1966). The two units of dose used are: the "rad" and the "rep". Rad is an arbitrary unit equivalent to the absorption of 100 ergs per gram of material irradiated. A rep is equal to 83.5 ergs/g tissue (Proctor and Goldblith, 1951). Most radiation doses of possible use in the food industry are measured in thousands (kilorads) or millions (megarads) of rads (Table III) (Glew, 1966).

Changes in Foods Caused by Irradiation

Ionizing rays excite atoms in the tissue causing changes in biological functions. For example, metabolic changes inhibit root sprouting or fatally damage micro-organisms (Proctor et al, 1952; Dickson, 1966, and Glew, 1966).

TABLE III

POTENTIAL APPLICATIONS OF IONIZING RADIATIONS IN THE FOOD INDUSTRY (GLEW, 1966)

Application	Dose required (rads)
- inhibition of sprouting in root vegetables, e.g. potatoes	10,000
- destruction of parasites in meat	10,000
- disinfestation of grain	20,000
- destruction of moulds and yeasts	250,000
- pasteurization of fish	300,000
- destruction of Salmonella	500,000
- sterilization of meat	4,800,000
- lethal dose for man	700

The high dose of radiation required to kill some bacteria is also usually associated with a considerable amount of chemical change in the food. Off-flavours produced by cathode ray sterilized materials were probably due to free radicals produced by the effect of ionizing radiations either on water (Robinson, 1954), or the dry constituents of the material (O'Meara and Shaw, 1957). Whatever the source, the free ions, which may be strong oxidizing or reducing agents, react with any number of the components of the food being sterilized. This may result in an oxidized flavour or in simply a flavour change by modification of certain constitutents of the food (Robinson, 1954). Other possible changes occur in the texture and colour of foods. Side-effects are generally produced by much lower doses than those required for sterility (Proctor et al, 1952).

Early workers, in several reviews on irradiation, believed that because high protein foods, when irradiated, exhibited obvious changes, much of the radiation effect was on the protein components of the food. Denaturation of protein by heat was thought to involve the rupturing of three adjacent residue bonds in the molecule (Adams and Pollard, 1952). This would then cause the main chains to drift apart, and the molecule to change from a globular configuration to an asymmetric one. The biological alteration of the protein molecule subjected to heat treatments paralled the changes occurring after radiation. With more points of attack exposed, hydrolysis by proteolytic enzymes increased and more rapid breakdown of the food took place (McArdle and Derosier, 1955 and Evans, 1955). In protein, odour changes were produced by

the degradations of the S-methyl group, methionine. By means of vapor fractionations, methylmercaptan, disulphide, hydrogen sulfide and a series of other sulfides were isolated from irradiated foods (Pollack, 1959).

Flavour changes in irradiated eggs have been studied extensively. Proctor and co-workers (1953) reported a noticeable off-flavour detectable in scrambled egg dishes prepared from whole eggs irradiated at .3 megarads. Spray-drying of irradiated fresh eggs so minimized differences between treated and untreated eggs that there was no significant preference for scrambled egg dishes from spray-dried irradiated or unirradiated eggs. Brogle and co-workers (1957) also found that spray-drying of irradiated fresh whole eggs practically eliminated off-flavour due to irradiation even when custards were used as the test material. Additional organoleptic studies on sponge cakes made with irradiated and non-irradiated liquid whole egg showed that the treated and untreated samples were comparable. However, when Parsons and Stadelman (1957) irradiated shell eggs at six levels, 1×10^3 reps to 3×10^5 reps for holding periods from 14 to 166 seconds, they felt that the eggs were sufficiently damaged to rule out ionizing irradiation as a cold sterilization technique. Obviously, therefore, spray-drying altered the structure of the irradiated egg to such an extent that adverse properties were partially eliminated. However, when Brogle and co-workers (1957) investigated the effects of irradiation upon the organoleptic and physical properties of whole egg powder, triangle tests indicated that at 850,000 rep, irradiation of

whole egg powders used in sponge cakes, custards and scrambled eggs had a significant effect on flavour preference. Therefore, using eggs, irradiated after spray-drying, would mean coping with noticeable irradiation flavour.

EXPERIMENTAL METHOD

Psychological Test

To assess the feasibility of using a psychological paper and pencil test as a tool for screening sensory panel candidates, selection of 56 students was based on responses to the Personality Research Form (PRF) (Jackson, 1967). Sensory acuity and the relationship of motivation to performance were evaluated in an experiment examining the flavour of fresh, dried, and irradiated dried eggs in plain butter cakes.

Subject Selection

The short form of the PRF test was administered to approximately 500 grade twelve students in their classrooms at a local high school. Testing time lasted one hour. The grade twelve students were chosen for the study because suitable numbers of these young adults were available at the time of the tests. Supervision of the tests was in accordance with the PRF Manual. Personnel involved with the sensory task did not administer the PRF to avoid possible confounding of results by the association of the sensory and psychological tasks.

After the tests had been scored, the students were ordered from high to low on the basis of their scores for two needs, achievement and endurance. These two needs, or personality variables, were chosen as the two qualities measured by the test most desirable

in a good S. A good S was taken as one who strives to improve himself and does not easily give up. The PRF definitions of the needs to achieve and endure (Table I) describe these traits. Thirty-one Ss were chosen from the lower end of the scale for the low achievement sensory panel. The maximum score possible for every variable was 20. Their scores ranged from two to nine. The high achievement sensory panel included the top twenty-five Ss, with scores ranging from twelve to twenty. All Ss selected had an infrequency score of one or zero, thereby attesting to the validity of their scores. Two months after the PRF tests had been administered each S received an invitation, by telephone, to attend the first sensory panel session one week later. The E and one other Home Economist phoned each candidate using the same invitation:

> Hello ..... ,
> I'm Mrs. Henderson from the University of Manitoba. (I'm calling on behalf of Mrs. Henderson ... etc.). I (she has) have been asked to run some tests for Canadian Food Technologists and therefore I have randomly chosen students to help me. You are one of these students. This coming Tuesday at four o'clock I will meet with these students in the theatre at _____ _____ High School to explain the test to you. At that time I will be pleased to answer any questions you may have.
> Have you any questions now?
> Will you be able to attend?

Questions relating directly to the tests or the source were left to the first session.

Sensory Task

Sensory evaluation was done on plain butter cakes made with

four egg treatments. Preliminary tests showed a distinct difference between the irradiated egg powder and the unirradiated samples. The difference was so apparent that a 50% blend of the irradiated and unirradiated treatments was included as a challenge for the high achievers. Therefore, the treatments in this study were: (1) fresh egg (F), (2) spray-dried egg powder (D)*, (3) 50% blend of irradiated and unirradiated spray-dried egg powder (H), and (4) irradiated spray-dried egg powder (I). The spray-dried egg powder was irradiated by a central field gammacell 220 with a cobalt-60source. The ferrous sulphate measurement technique was used. The original measured dose rate was 1.6 X 10^6 $\pm$ 2.2% rads/hour (.5 megarads). The gammacell was operated by the Department of Food Science, University of Manitoba.

These egg treatments were selected to afford 6 comparisons expected to decrease in difficulty as follows:

1. FXD - most difficult; least difference expected as other workers have reported no observable difference between these egg forms in plain cake (Ary and Jordan, 1945;Grover and Hawthorne, 1946).
2. IXH - next most difficult because both treatments have the "metallic, salty, irradiation" flavor.

3,4. DXH = FXH, assuming F = D.

5,6. DXI = FXI, assuming F = D; these comparisons should exhibit the greatest difference and so should serve as the least difficult tasks for the Ss.

At each trial the Ss received 18 samples divided into six sets of triangle tests (Table 1V).

To avoid the influence of uncontrollable error, sampling of the product and Ss was randomized. A table of 10,000 random digits was used to randomize the order in which each S tasted each triangle and the order in which the samples within each triangle were examined. After the tests were completed, two errors were found during the analysis of data (Table 1V). Presentation of AAB and ABB was not equal for the DI and IH comparisons in particular. As well, in any one taste test trial only three orders of presentation in the triangle were used, e.g., AAB, ABA, BAA, instead of all six, e.g.AAB,ABA,

---

*Borden Co. Ltd., St. James, Manitoba.

TABLE IV

TRIANGULAR PRESENTATIONS OF FOUR EGG TREATMENTS*

Day \ Comparison**	FD	FI	FH	DI	DH	IH
1	FFD	FII	FHH	DII	DDH	IHH
2	FFD	FII	FHH	DII	DHH	IHH
3	FDD	FFI	FFH	DDI	DHH	IIH
4	FDD	FFI	FFH	DII	DHH	IHH
5	FDD	FFI	FFH	DII	DDH	IHH
6	FFD	FII	FFH	DII	DDH	IHH
7	FDD	FII	FFH	DII	DHH	IHH

*order of presentation within each triangle, randomized

**F = Fresh egg
D = Spray-dried powder
I = Irradiated spray-dried powder
H = 50% blend of D and I

BAA, BBA, BAB, and ABB.

The questionnaire used by the Ss is shown in Figure 1. The decisions made for the samples in each triad of samples were: (1) triangle test - choose the odd sample, with 1 assigned to the right answer, and 2 for the wrong answer; (2) paired-comparison test - to choose the sample or samples having the stronger flavour, with 1 meaning equal, 2 for the sample having the stronger flavour, and 3 for the weaker; (3) rating scale - to evaluate the degree of flavour difference between the two samples on a six point scale with six equal to the greatest degree of difference, and (4) paired-comparison test - to check the pleasant or unpleasant sample(s) with 2 meaning pleasant and 3 meaning not pleasant. In each test the numbers were only used on the computer program, the Ss never used numbers. All decisions were made on every triangle test at each trial. Milk was provided for rinsing between sets of triangles. Seven taste test trials were each held for half an hour after school over a four week period in an 80-seat theatre in the school.

Administration of the Sensory Tests

At the first sensory trial, the Ss were introduced to the E and the project. The importance of the project in the fight against world hunger was stressed, with emphasis placed on need for their co-operation. The introductory speech following sample distribution, was as follows:

Set: _____

ame: _____ Date: _____

irections: Salivate well before tasting. Taste the entire set of three samples first, then make your judgment. You may retaste if you wish. Clear your mouth with milk between sets. If you require more milk please raise your hand.

There are 3 samples per set. Two samples are the same and one is different. Indicate by a check:

a) the different sample
b) the sample or samples with the stronger flavour
c) the degree of flavour difference
d) whether the flavour is pleasant or unpleasant

Samples	Different Sample	Stronger Flavour	Degree of Flavour Difference						Pleasant	Unpleasant
			None	Slight	Sl-Mod.	Moderate	Mod-Pron.	Pronounced		

PLEASE CHECK TO SEE THAT YOU HAVE ANSWERED EVERYTHING

Figure I. Questionnaire used by the Sensory Panel.

Hello, I am Mrs. Henderson, and I would like to thank you for coming. My assistant is _____ _____ . A government department has asked the university to launch studies related to the world's food problem. Because protein is a very important part of man's diet which is often omitted, attention is directed towards foods high in protein.

The egg is almost a perfect food. Therefore, research is being carried out to find the best way of processing eggs to preserve for long storage periods. An example of one storage process, familiar to all, is freezing.

This will be a preliminary survey. The results of this study will be regarded as an indicator of the project's worth.

There are two ways in which a test can be run. Hundreds of individuals can test a product once, or a few people can taste many times. I have chosen the latter alternative because it is more convenient, and also, tasters improve with practice. Therefore, the trials at the end become more important.

We will plan to meet in the theatre after four on these dates: Wednesday, May 10th, Wednesday, May 17th and Thursday, May 18th, Wednesday, May 24th and Thursday, May 25th, and Tuesday, May 30th. Each day you will receive a large bag of cake samples to taste, and then you will be required to fill in the questionnaires.

In the bag are six small bags containing three samples. Each small bag is numbered, and each questionnaire is numbered. Choose the numbered bags in the same order as the questionnaires are numbered. Within each bag are three labelled samples. Taste the samples in the order that they appear on the corresponding questionnaire. For each set of samples answer all the questions. Now look at the questionnaire. You will taste all three samples. Two of the samples are exactly the same, and one is different. In the first column you are to choose the sample which is different. In the second column check the single sample or pair of samples which have the stronger flavour. Then, opposite the sample(s) with the stronger flavour, indicate how much stronger the flavour is. In the last column check whether the samples have a pleasant or unpleasant flavour.

(At this point the students felt quite confused and a dry run using imaginary samples was carried out using a replicate of the

questionnaire drawn on the board).

> Please salivate well before tasting. It is not necessary to swallow the samples but it is better. In order to remove the flavour of previous sets of samples, rinse your mouth with milk between sets of three samples.
>
> After today, please come in after class, and immediately begin tasting.
>
> Now you can start.

The questions and instructions had to be carefully worded because studies have shown that they can influence performance. Pettit (1958) studied the effect of information on tomato juice preference. Preference ratings were higher if the panel "knew" that a sample had additional salt, lemon or sugar, but were not affected when quality, chemical treatment, exposure to rays and MSG were stated to differ. Thus, when the information in the instructions was familiar to the taster it influenced his preference score. In an odour threshold study, Engen (1960) had instructed his subjects to observe the "quality" of the odorant by seeking the minimum level at which a stimulus smells like a more familiar substance (e.g. amyl acetate smells like "banana oil"). However, when the E told the Ss that a less desirable odour, e.g. "vinegar" smell, was noticeable in dilute concentrations, threshold levels dropped. When the S was instructed to go back to looking for the criterion of quality, he found it very difficult.

Ss competed with one another to improve their triangle scores to ultimately correctly identify all six triangle comparisons. The latter goal was probably the most important source of motivation because self-motivation is always stronger than group-motivation

(Amerine, et al 1965). A conscious effort was made at all times to maintain a relaxed atmosphere and cordial relationship with the Ss. Each day after a S had completed the test, he received his score on the triangles and was encouraged to return for the next session (Pfaffman, 1954; and McClelland, 1964). A great deal of importance was attached to the interpersonal relationships established between the E and the S because the Ss were not to receive money payment for their participation (Amerine et al, 1965; McClelland, 1964, and Atkinson and Raphaelson, 1956).

The relationship became so cordial that the Ss felt free to request "a real cake with icing" at the end of the tests, and this request was granted.

Preparation of Cakes

One basic recipe (Table V) was used for all treatments with variation in liquid content for the dried egg powder.

The dry ingredients, plus the dried egg powder for the D, I and H treatments were sifted into the larger bowl of a Sunbeam Mixmaster (Model 12) containing the hydrogenated shortening. Half the total liquid was added for the D, H and I treatments. For treatment F, the blended eggs plus 28 mls distilled water were added.

The ingredients were mixed at the slowest speed for one minute. Mixing was increased to speed seven for two minutes. The sides of the bowl were scraped with a rubber spatula. The remainder

TABLE V

RECIPE FOR BUTTER CAKES*

Treatments	F	D	I	H
Ingredients**	g	g	g	g
Hydrogenated shortening	184	184	184	184
Granulated sugar	600	600	600	600
Cake flour	448	448	448	448
Double-acting baking powder	20	20	20	20
Dry skim milk powder	40	40	40	40
Iodized table salt	2	2	2	2
Blended whole eggs	384	---	---	---
Whole egg powder	---	96	96	96
	ml	ml	ml	ml
Distilled water	328	616	616	616

*Foods and Nutrition, 1967

**All ingredients at room temperature

of the distilled water was added. Slow mixing was resumed for thirty seconds. The mixing rate was then increased to speed six for two minutes. The bowl was scraped again. A one minute mix at speed six completed blending. Two hundred and twenty-five grams of batter were weighed into each of eight 6-inch round aluminum pans, which had been greased lightly and lined with waxed paper. Four pans were immediately placed in each of two gas ovens at 350°F*. The cakes were removed from the oven at the end of the thirty minutes, cooled on racks for ten minutes, and then turned out of the pans. When thoroughly cool, the cakes were wrapped in plastic freezer bags, sealed, labelled and frozen. Cakes were frozen for a period ranging from four to six days. Freezing for this period of time reportedly does not affect the quality of shortened cakes (Meyer et al, 1953).

Preparation of Sensory Samples

The day before each taste test trial five cakes out of each treatment were trimmed while frozen to a height of 5/8-inch with a General Electric knife. Two cakes, one on top of the other, were centered in an aluminum miter box ($7\frac{1}{4}$" X $7\frac{1}{4}$" with 3/8-inch grooves spaced every 5/8-inch) and cut. The square cake samples were placed in coded plastic creamers sealed with cardboard lids. Four treatments, taken two at a time, gave six comparisons so that all treatments were compared with every other treatment. The six comparisons were: (1) F X D, (2) F X I, (3) F X H, (4) D X I, (5) D X H, and

*30-inch Moffat gas range, and a 30-inch Moffat Gourmet gas range

(6) I X H. The six comparisons were placed into sets of triangle tests. Each triangle test was wrapped in a plastic sandwich bag. Six different triangle tests were combined together in one larger plastic bag for each S.

Objective Measurements

All objective measurements were taken in an air-conditioned environment. Samples were cut from one cake in every treatment for each replicate (Figure 2).

Shear Force Value - Resistance to shear was measured on three samples from each treatment (3.9cm X 6.3cm X 2cm) using an Allo-Kramer Shear Press fitted with a Varian recorder and the shearing cell. A piston speed of four second and a 5,000 pound ring at the five percent range, i.e. 250 pounds, were used.

Planimeter Readings - The K & E Compensating Polar Planimeter, Model 4236M, was used to measure the area of two inkprints (Barnard, 1966) from the cross-section of the cakes.

Compressibility - Two circular samples ($1\frac{1}{4}$ X 5/8 inches) without crusts were each compressed for one minute (by stopwatch) by a Precision Penetrometer fitted with the 150 gram weight and the plunger attachment.

Wetability - Two to three frozen circular samples ($1\frac{1}{4}$ X 3/4 inches), without crusts, were held in aluminum moisture dishes before the moisture absorption measurements were taken (adapted from Swartz, 1938). The samples were dipped in the water for ten seconds. High

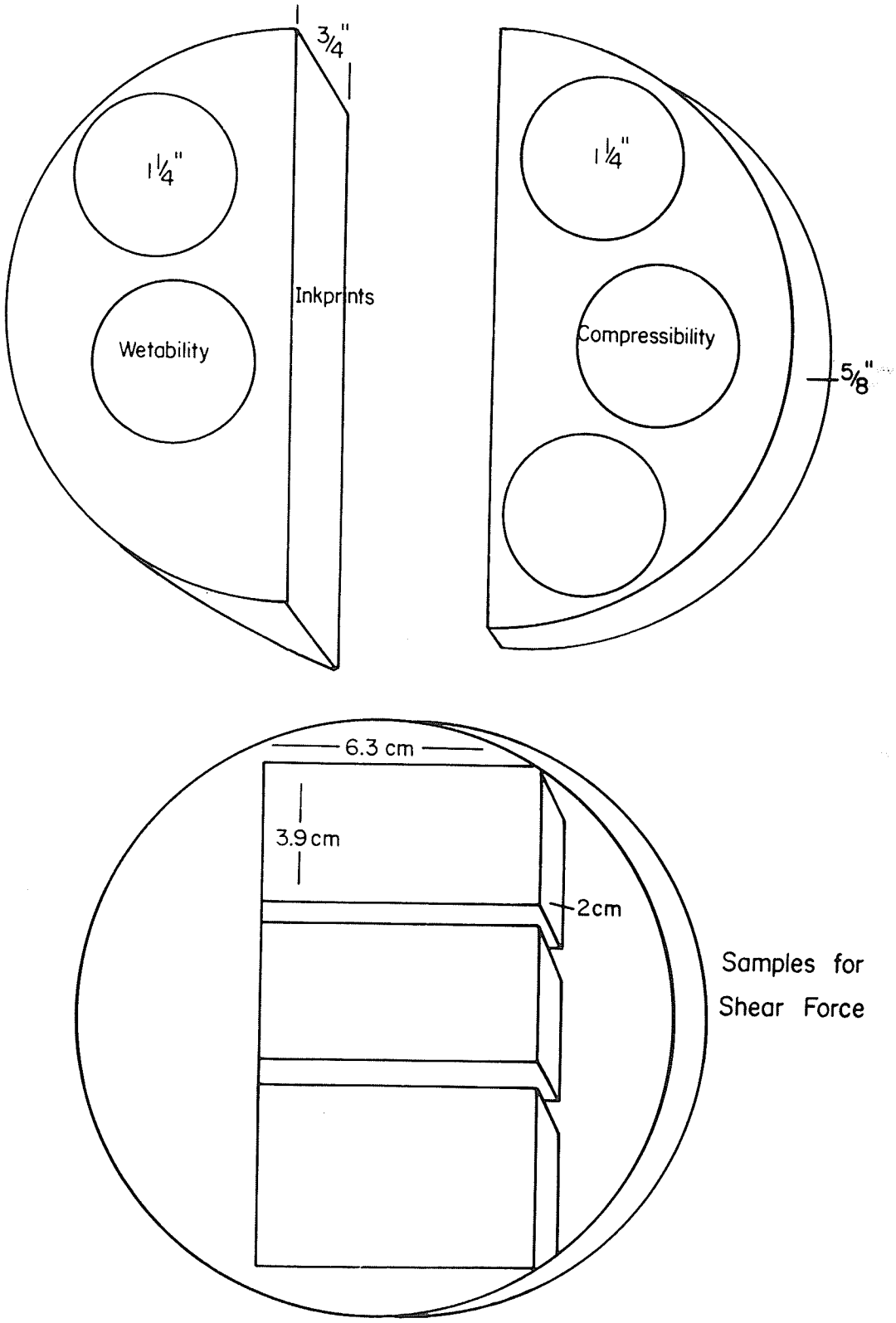

Figure II Sampling Technique for Objective Measurements

moisture absorption was reported to be associated with high palatability scores.

Specific Gravity - One quarter cup of batter was used in the measurement of the aerating property of the batters (Griswold, 1962).

Analyses of Data

A computer program was written to perform the following analyses:

(1) simple correlation of all fifteen personality variables,

(2) multiple regression analysis of the answers from the triangle test and intensity-rating scale by all fifteen personality variables and the day of the test, and

(3) co-variance analysis of the day of the test and the answers from the triangle test and intensity-rating scale.

Significance in triangle tests was determined by the probability method developed by Roessler and co-workers (1948).

Chi-square analysis was performed on two sets of data:

(1) $X^2 = \{\hat{p}A - \{\hat{p}/\hat{p}\ (1-\hat{p})$ (Steele and Torrie, 1960) was used for data from the flavour strength judgments, daily performance figures, and attendance, and

(2) $X^2 = (X_1 - X_2 - 1)/n$ (Amerine et al, 1965) was used in the analysis of the data from the pleasantness ratings.

All the objective measurements were compared by analysis of variance.

Duncan's Multiple Range Test (Larmond, 1967) was applied to the shear force values and the data from the intensity-rating scale.

RESULTS AND DISCUSSION

The data from the objective measurements was compared by analysis of variance. In using shortened cakes as the test media, it was presumed that the primary difference between cakes would be that of flavour, attributed by the irradiation of the eggs. Data in Table VI shows that there was no difference between treatments in wetability, compressibility, total area and specific gravity. Shear force differed significantly between the F treatment and the three powdered treatments. Therefore, spray-drying altered the tenderness between the fresh egg and powdered egg treatments. Data in Table VII shows that F and D were equal and hence the tenderness difference between F and D did not influence Ss' discrimination. No significant tenderness differences were found among the three spray-dried egg treatments, therefore irradiation had no measurable effect on the properties of the egg powder. Thus it was concluded that all the Ss were using flavour differences as the basis of discrimination. According to Amerine et al (1965) unanimity of criteria among the Ss enhanced the sensitivity of difference tests.

The volume of the cakes produced from the experimental recipe did not reach optimum standards. The large quantity of batter was probably not mixed thoroughly enough by the domestic mixer and thus the leavening properties were not developed fully. This fault was apparent in all treatments and therefore objective measurements were relative. The sensory measurements were flavour directed only and

TABLE VI

EFFECTS OF SPRAY-DRYING AND IRRADIATION UPON THE PHYSICAL PROPERTIES OF PLAIN BUTTER CAKES

Test	Treatment Means F	D	I	H	Ratio of Mean Squares Observed F	df	Tabulated F .05	.01
Specific gravity*	1.04	1.03	1.07	1.07	2.500	3/12	3.49	5.95
Wetability (gms)	3.70	3.80	3.50	3.40	1.300	3/18	3.16	5.09
Compressibility (ml)	20.80	25.70	22.80	27.00	0.034	3/18	3.16	5.09
Planimeter (cm^2)	34.20	35.96	35.03	37.06	0.880	3/18	3.16	5.09
Shear force (lbs)	38.80	34.06[a]	35.54[a]	34.94[a]	5.200	3.18	3.16	5.09

*taken on batter

[a]these figures are not significantly different from each other (Duncan's Multiple Range Test)

TABLE VII

FLAVOUR DIFFERENTIATION IN TRIANGULAR
TASTE TESTS COMPARING FOUR EGG TREATMENTS

Comparison	Correct Answers Obtained	Number of Tastings	No. of Correct Answers necessary to establish Significant differention*	
			P= 0.05	P= 0.01
FD	83	212	84.20	88.35
FI	109	214	85.20	89.15
FH	109	208	82.65	86.85
DI	81	212	84.20	88.35
DH	100	212	84.20	88.35
IH	88	211	83.75	87.95

*Roessler et al, 1948

thus would not be expected to be affected by volume.

From preliminary tests and outside studies reported in the literature certain flavour differences between treatments were expected. Ary and Jordan (1945) and Grover and Hawthorne (1946) studied the use of egg powder in plain butter cakes and found that good quality egg powder was as acceptable as fresh eggs. Preliminary tests by the author exhibited noticeable flavour differences between the unirradiated treatments, and the irradiated treatments at .5 megarads. Later work in the same laboratory by Vaisey and co-workers (1968) using irradiated egg powder in plain butter cakes confirmed that, on an hedonic scale, irradiated treatments were less preferred to the unirradiated treatment with preference decreasing as the irradiation level increased.

Hence, the responses to the triangle tests showing no flavour difference between the F and D treatment met the expectations (Table VII). Expected flavour differences were significant between the FI, FH, DH and IH comparisons, i.e., in four out of five comparisons the irradiated treatments differed in flavour from the F and D treatments. The one inconsistency is the "no difference" result between the D and I treatments. Because F and D were judged the same, flavour differences between F and the two irradiated treatments, I and H, should have been the same as the flavour differences between D and the irradiated treatments. The inconsistency in the DI comparison probably resulted from the sampling error noted in Table IV. Work by Grim and Goldblith (1965) on whole egg magma showed a discrepancy in

odd sample judgments when irradiated samples were used. They explained this finding by suggesting that the irradiated flavour coated the tongue and palate rendering sensory evaluation unreliable. These workers warned that when irradiated samples were used in triangle tests, AAB and ABB had to be equally distributed among the trials. In the DI comparison, DDI was presented only once in seven trials. So it is likely that the masking effect of the irradiation treatments made it very difficult for the panelists to discriminate between treated and untreated samples within the difficulty of the triangle task.

Using the correct and the incorrect triangle tests, analysis of the flavour strength paired-comparison judgments supported the expected pattern (Table VIII). All the irradiated treatments were stronger in flavour than the unirradiated treatments. Thus analysis of the combined incorrect and correct answers from the triangle tests showed a significant degree of ability to discriminate which was not altogether displayed in the selection of the odd sample in the DI comparison in the triangle test. The confidence level is better for the FI and DI comparisons than the FH and DH comparisons indicating that I actually was greater in flavour strength than H although the IH comparison itself did not show this conclusively.

The triangle test is sometimes accompanied by a quality differentiation question, which is really a paired-comparison test. When the experiment uses known concentrations of the variable, as in the present study, the quality of differentiation of incorrect triangles can be used in the analysis (Byer and Abrams, 1953). Byer and Abrams

TABLE VIII

PAIRED-COMPARISON FLAVOUR STRENGTH
JUDGMENTS USING CORRECT AND INCORRECT TRIANGLE TESTS

Comparison	Flavour Strength 1>2	2>1	χ^{2*}	Level of Significance**
F X D	74.5	92.5	1.7	NS
F X I	58.0	114.0	17.6	.001
F X H	68.5	98.5	5.0	.05
D X I	53.0	116.0	22.7	.001
D X H	68.5	100.5	5.7	.05
I X H	100.0	74.0	3.6	NS

* one degree of freedom

** two-tailed

reasoned that regardless of the taster's correctness in selecting the odd sample, it was possible to tell whether the quality designation as more or less intense in the defined quality reflected whether the product was of greater or lesser intensity. Therefore, it was on this basis that these supplementary designations could be treated as two-sample test results unrelated to success or failure in the selection of the odd sample from the triangle.

Table IX summarizes data from the intensity-rating scale for both the correct triangle tests and all answers. In both sets of data, the intensity of flavour difference between pairs of samples fails to progress in the expected order. Two inconsistencies occur in both sets of data: i.e., the degree of flavour difference between D and H was not significantly less than that between F and I, and, as well, the IH comparison was only third in line of difficulty rather than second as expected.

Consideration of scale data using correct and incorrect triangular scores, shows that the degree of flavour difference between D and I was greater than the differences between pairs in all other comparisons at $P = .01$. Evidence in the literature had supported the assumption that F = D and therefore it would have been expected that both FI and DI would exhibit the greatest differences between pairs. Using correct answers only, the flavour differences between F and I, and between D and I were the same, and those between FD, FH, IH and DH the same.

When the data from the correct triangles and the scale were considered together the flavour strength order became: FD = FH = DH < FI = DI.

Superimposing the paired comparison results from Table V111 on the scale data from all triangle tests in Table 1X did not contribute any additional information to the order of flavour intensity as illustrated below where lines indicate data not significantly different.

FD IH FH DH FI DI

TABLE IX

ORDERED DEGREE OF FLAVOUR DIFFERENCE BETWEEN PAIRS

Egg Comparison (in order of decreasing difficulty)* (N/comparison)	Scale**	
	Correct and Incorrect Answers (97 - 201)	Correct Answers (68 - 94)
FXD	2.41^{a}	2.59^{a}
HXI	2.61^{b}	2.65^{a}
DXH	2.68^{cg}	2.75^{ab}
FXH	2.51^{d}	2.61^{a}
DXI	2.81^{e}	2.92^{c}
FXI	2.69^{fg}	2.86^{bc}

*The second member of each pair is the exptected stronger flavor.

**Scale ordered from 1-6; 1=no difference, 6=extreme difference between pair members.

a,b,c,d,e,f,g
Values within columns bearing different superscripts are significantly different at P=.05.

Because the paired-comparison test was already a directional design, i.e. "Which sample or samples has or have the stronger flavour?", the scale repeated available information.

The comparison in Table IX of the use of correct responses to the triangle test plus the intensity-rating scale (i.e. triangle-intensity test, Davis and Hanson (1954) and the directional paired-comparison findings, in the light of the probability of guessing correctly, shows that the triangle-intensity test (one-sixth probability) gave more reliable results than the paired-comparison (one-half probability). So these results were more reliable because of the probability level and also because they best approximated the expected order of flavour differences.

The paired-comparison test alone not only was less reliable in terms of the one-half probability but also gave less information regarding the differences between samples. The data in Table X from the pleasantness rating showed that when Ss approached the pleasantness comparison positively, they did not choose one treatment over another to a significant degree. However, when the response came from a negative viewpoint the irradiated treatments were considered significantly more unpleasant than the unirradiated treatments. Other work in this laboratory, using an hedonic scale, examining the effect of four levels of irradiation on spray-dried powder baked in butter cakes confirms this (Vaisey et al, 1968). Table XI shows that

TABLE X

COMPARATIVE PLEASANTNESS AND UNPLEASANTNESS OF TREATMENTS*

Number** of Pleasant Ratings		χ^{2***}	Number of Unpleasant Ratings		χ^2	Level of Significance
F 81	D 93	.695	F 25	D 30	.30	NS
F 73	I 72	0	F 19	I 65	24.1	.001
F 82	H 85	.024	F 24	H 44	5.31	.05
D 62	I 83	2.76	D 24	I 56	12.01	.001
D 85	H 66	2.15	D 24	H 50	8.4	.01
I 66	H 91	3.67	I 37	H 36	0	NS

*Amerine et al, 1965

**Maximum judgments of the odd sample were 221. Total omissions and judgments of both samples account for the disparities in totals.

*** NS

as the level of irradiation increased from .45 to .75 megarads, hedonic scale scores dropped. Only the lowest level of irradiation, .3 megarads, had so little effect on the egg powder that its preference score was not significantly different from the score of the untreated sample.

TABLE XI

CAKE PREFERENCE DIFFERENCES AT 5 LEVELS OF EGG IRRADIATION*

Megarads	0	.3	.45	.6	.75
Hedonic Rating**	6.19	5.12	4.70	4.53	4.08

*Vaisey et al (1968)

**Values not underlined with the same line are significantly different

In the beginning of this report six of McClelland's twelve propositions were set forth as guides in motivation research. An evaluation of their role in the present study follows:

> (1) and (2) Whether the introductory remarks really did convince the candidates that they were vital elements in the fight against world hunger cannot be stated without reservation, however, here is the reply given by one student when asked why he had completed the task:

"a) I realize the food problem of the human race as a whole.
b) I believe in solving problems the practical way.
c) As a scientist, I believe science can solve the problem."

(3) The odd sample identification provided a speedy means of letting the students know how well they had done on each test. Disappointment was very noticeable if scores failed to improve. Many small competitions developed between the students as shown by this reply:

"I found the test interesting and a challenge (more a contest between myself and Paul) to see how accurate I could be at testing."

(4) Every attempt was made to emphasize the serious nature of the task. The experimenter and assistants wore professional uniforms. Talking was kept to an absolute minimum throughout the conduct of the tests. Any notices about the tests were announced by the principal of the school over the P.A. system.

(5) Candidates became quite proud of their roles in the test, often flouting this before other students. On several occasions students who had not been selected for the tests asked if they could join the other students. This request was always denied, thereby increasing the desirability of the tests. On one occasion an unknown student sat in on the test and was not discovered until he handed his questionnaire to the E to be marked.

(6) The interpersonal relationship became very cordial. The Ss joked about wanting something other than milk to rinse their mouths with. Examples of some of the remarks made are:

"The food as well as the atmosphere of the food testing was pleasant. I also enjoyed the experience of working with you."
"It was fun."
"P.S. I was usually hungry by the last period."
"And finally, I didn't want to miss the chocolate cake at the end."

The importance of the tests must have impressed two panelists

who could not attend because of prior committments and sent substitutes. Several students became "angry" when they missed a test because they "had not been reminded." Finally, when Ss did miss tests they were anxious to taste these as well as the sets for that day.

As a check it was noted that the personality characteristics, achievement and endurance, maintained a high positive correlation throughout the study, with coefficients covering a range between .88 and .91, despite the continuous loss of Ss. The validity of these coefficients was supported by Jackson (1967).

Chi-square analysis of data in Table XII rejected any dependency of attendance at the taste test sessions and triangle test response upon the individual's level of motivation as predicted from the achievement and endurance scores.

The graphical representation of % correct triangle tests in Figure 3, illustrates the greater consistency in performance over the seven test days exhibited by the high achievers as compared to the low. Although low achievers were capable of good performance (days one and five), they could not be relied upon to put forth their best efforts at every test day. Therefore, high achievers were better candidates for sensory panels because of their consistently superior performance.

Chi-square in Table XIII did show that the ability to identify correctly the odd sample was dependent upon the motivational level of the Ss. However, this superiority of high achievers was significantly only for data from the last 5 days of the test period. In days 1 and 2 performance was similar. Therefore, the PRF traits, endurance and achievement, were not useful as predictors of attendance but did show those Ss who

TABLE XII

EFFECT OF MOTIVATION UPON ATTENDANCE AND TRIANGLE TEST RESPONSES

Day	Number of Tasters		Daily Total Number of Responses			
			High		Low	
	High	Low	Possible	Observed	Possible	Observed
1	20	24	120	119	144	133
2	22	19	132	129	114	114
3	18	16	108	108	96	95
4	16	15	96	96	90	88
5	15	13	90	89	78	75
6	12	10	72	71	60	56
7	9	8	54	54	42	42
	$\chi^2 = .64$			$\chi^2 = .52$		

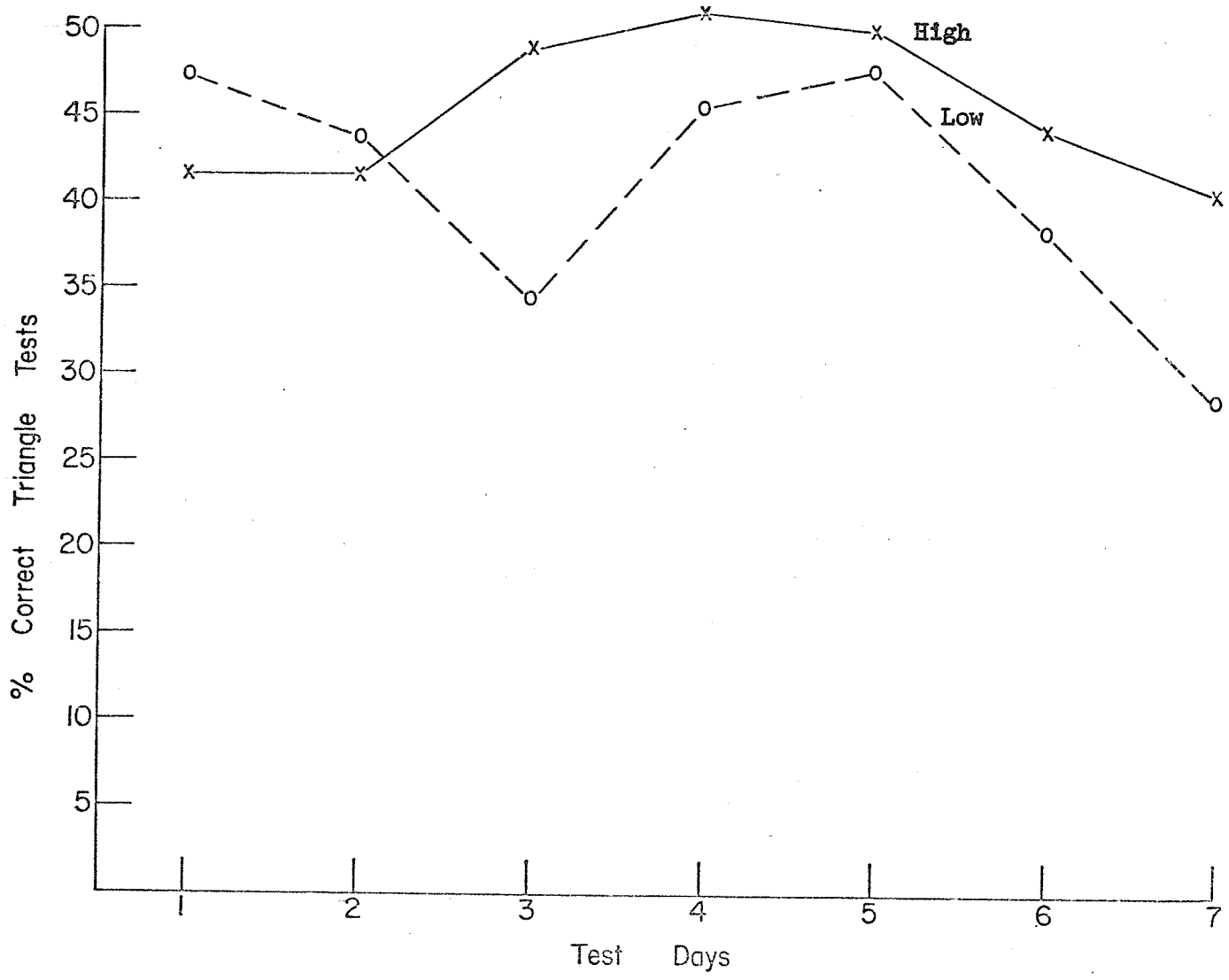

Figure III Performance Patterns of High and Low Achievers on Triangle Tests*

*For n values see Table XII

would give the best performance. The difficulties inherent in choosing the odd sample coupled with an immediate feed-back of results probably "spurred" the high achievement Ss onto greater efforts.

TABLE XIII

PERFORMANCE ON TRIANGLE TESTS FOR TWO ACHIEVEMENT GROUPS*

Answers	Level of Achievement/Endurance	
	High	Low
Correct	201	146
Wrong	217	210
Total	418	356

$\chi^2 = 3.52$**

*For days 3 - 7 inclusive

**P = .05 (two-tailed)

From the analysis of covariance shown in Table XIV it is concluded that real differences exist between comparisons and the achievement groups in terms of the triangle test performance. When the high achievers alone are considered, significantly more correct responses were made in the FH comparison (Table XV). Therefore, high achievers worked harder at the triangle task than the low achievers.

No significant differences were evident between achievement

TABLE XIV

RELATIONSHIP BETWEEN LEVEL OF MOTIVATION
AND PERFORMANCE ON THE TRIANGLE TESTS AND INTENSITY-RATING SCALE

Compared Data Sources X	Compared Data Sources Y	Group or Comparison	df	F	Level of Significance
Day	Answer*	High	5/658	3.278	.01
"		Low	5/694	1.432	NS
"		FD	1/209	0.541	NS
"		FI	1/210	0.340	NS
"		FH	1/206	4.425	.05
"		DI	1/208	1.460	NS
"		DH	1/207	1.009	NS
"		IH	1/207	0.035	NS
"		12 groups	11/1254	2.200	.05
Day	Degree of Difference**				
"		High	5/271	1.399	NS
"		Low	5/237	1.056	NS
"		FD	1/76	0.484	NS
"		FI	1/94	0.036	NS
"		FH	1/95	2.607	NS
"		DI	1/68	1.789	NS
"		DH	1/87	5.151	.01
"		IH	1/80	1.241	NS
"		12 groups	11/510	1.344	NS

*Composite value where 1= correct, 2= incorrect

**Scale value for correct triangles only

groups or among the six comparisons in the use of the intensity-rating scale (Table XIV). Multiple regression analysis of the personality scores of Ss correctly identifying the odd sample and scores on the intensity-rating scale exhibited an interaction between use of the scale and five of the fifteen personality traits measured (Table XVI).

TABLE XV

THE EFFECT OF HIGH ACHIEVEMENT
UPON CORRECT TRIANGLE DISCRIMINATION

Comparison	Mean of the Answer, Right or Wrong*	t Value
FD	1.63	0.48
FI	1.47	0.24
FH	1.40	-2.88
DI	1.58	1.46
DH	1.56	-0.60
IH	1.59	-0.16

*Mean of composite value where 1= correct, 2= incorrect

The significant positive t for aggression indicated that a high scorer in this personality characteristic would be blunt in his appraisal and therefore would give a high difference rating. It

TABLE XVI

MULTIPLE REGRESSION ANALYSIS
OF DEGREE OF FLAVOUR DIFFERENCE
ON PERSONALITY VARIABLES

Variable	Description of High Scorer*	t	B
Aggression	enjoys combat and argument; easily annoyed; will "get even"	6.00	.11
Autonomy	enjoys being unattached, free; tries to break away from restraints	-3.38	-.08
Harmavoidance	seeks to maximize personal safety; avoids risks	-2.10	-.046
Impulsivity	acts without deliberation; speaks freely; impatient	-2.97	-.066
Nurturance	assists others whenever possible; readily performs favors	3.48	.079

*Jackson, 1967

was his inborn antagonism and retaliative nature which caused him to be severe in his criticisms.

The negative t value for autonomy suggested that the PRF score for autonomy varied inversely with the degree of difference found. For example, a high autonomy scorer would find less difference between samples. A possible explanation was that the S did not feel comfortable in a task which required him to "pigeon-hole" his responses, and hence he did not care as much about assessing the degree of flavour difference.

In the harmavoidance score the negative t value showed the flavour differences rated low or high in an inverse relationship to the strength of the harmavoidance characteristic. The S possibly feared unpleasant repercussions by being overly critical of the differences between samples. The low harmavoidance S was closer to the high aggression S, and therefore would "dare" to be bold in his criticisms.

The inverse relationship between the impulsivity score and the degree to which the intensity-rating scale was used was provoked by the tedious nature of the task. Overcome with boredom and impatience, the high impulsivity scorer would have quickly checked a space at the beginning of the scale without serious consideration of the six possible degrees of difference. The higher degree of difference ratings were used by the low impulsivity scorer who took time to deliberate his decision.

The direct relationship between the nurturance score and

intensity of flavour difference ratings was attributed to the fact that the high nurturance scorer with his desire to help E tried to be as critical as possible to increase the value of the study in the "struggle against world hunger."

Consideration of the low scorer in each example would require opposite reasoning.

In regression analysis, the responses to the triangle tests and intensity-rating scale were examined for dependency upon day of testing for each achievement group, each pair of treatments and all data combined. Three assumptions were made and proved:

(1) y (number of responses) depends linearly on x (day of test).

(2) All x's are common, i.e., all x's have the same slope and hence are homogeneous.

(3) All y's are normally and independently distributed with zero mean and a common variance. Therefore the day of the test did not influence performance. Therefore, improvement was not related to PRF traits.

Multiple regression analysis of successful triangle performance up to the fourth day and the personality traits did not establish a relationship between PRF scores and improvement (Table XVII). Analysis of each individual's performance on his last day of testing also failed to reveal any dependence. Therefore, multiple regression and analysis of covariance rejected any relationship between PRF scores and improvement over time.

In conclusion then, performance on triangles and the intensity-rating scale was affected by personality traits measured by the PRF.

Neither attendance nor improvement were influenced by specific traits. Motivation techniques did seem to influence the performance of the high achievers suggesting that selection on the basis of personality traits and the application of motivation techniques leads to more successful sensory panels.

TABLE XVII

RELATIONSHIP BETWEEN IMPROVEMENT OVER TIME AND LEVEL OF MOTIVATION

Day	df	F	Level of Significance
1	15/246	0.612	NS
2	15/212	0.920	NS
3	15/177	0.923	NS
4	15/162	1.212	NS
All days	15/1218	1.588	NS
Last day for each S	15/32	0.593	NS

SUMMARY AND CONCLUSIONS

Two problems in the sensory evaluation of food were investigated: (1) to predict from two achievement-oriented traits those Ss who would not satisfactorily complete a sensory task, and (2) to compare three difference tests in terms of sensitivity.

Fifty-six high school students were selected from a sampling population of over 500 on the basis of scores on two achievement-oriented personality traits, achievement and endurance, measured by the Personality Research Form (PRF). Thirty-one Ss with scores ranging from two to nine on a twenty point scale were classified as low achievers, and twenty-five Ss with scores from twelve to twenty were classified as high achievers. All fifty-six Ss were invited to attend seven sensory trials in which the innate motivational level was related to attendance, performance and improvement in performance, i.e., improvement in discriminating differences between samples.

At the sensory trials the Ss were required to compare cake samples on a questionnaire using three difference tests: triangle, paired-comparison, and intensity-rating scale. The effectiveness of each test in arriving at the expected result was used as the index of sensitivity.

Plain butter cakes baked with four egg treatments: whole fresh egg, spray-dried whole egg powder, irradiated whole egg powder, and a 50% blend of irradiated and unirradiated egg powders were the media by which the two objectives of the study were tested. It was expected

that the two irradiated treatments would be stronger in flavour than the two unirradiated treatments, and that the fresh and spray-dried whole egg treatments would be similar. Analyses of variance of the objective tests established that the physical properties of the cakes had not been affected by irradiation.

By probability analysis four out of five triangular comparisons showed expected between treatment flavour differences. The exception was attributed to a sampling error. The expected result was also established by chi-square analysis of the flavour strength paired-comparison task, and analysis of variance of the intensity-rating scale data from correct triangle tests only.

The triangle test plus the intensity-rating scale was more sensitive in terms of arriving at the expected result than either the triangle plus the paired-comparison or the paired-comparison plus the intensity-rating scale.

Analysis of the paired-comparison preference data revealed that Ss did not choose one treatment over another when rating the more pleasant sample. However, when the response was expressed negatively, i.e., choosing the unpleasant sample, the irradiated treatments were considered significantly more unpleasant than the unirradiated treatments.

Chi-square analyses of daily performance data, and covariance analyses of the performance on the triangle tests and the achievement levels showed significant differences in performance by the high achievers but not by the low achievers. Multiple regression analysis

revealed that five personality traits: aggression autonomy, nurturance, harmavoidance and impulsivity, had marked effects upon the S's performance on the intensity-rating scale.

Multiple regression and chi-square analyses did not show attendance or improvement to be dependent upon the motivation traits.

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A P P E N D I X A

PERSONALITY RESEARCH FORM

FORM A

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DIRECTIONS

On the following pages you will find a series of statements which a person might use to describe himself. Read each statement and decide whether or not it describes you. Then indicate your answer on the separate answer sheet.

If you agree with a statement or decide that it does describe you, answer TRUE. If you disagree with a statement or feel that it is not descriptive of you, answer FALSE.

In marking your answers on the answer sheet, be sure that the number of the statement you have just read is the same as the number on the answer sheet.

Answer every statement either true or false, even if you are not completely sure of your answer.

Published by
RESEARCH PSYCHOLOGISTS PRESS, INC. GOSHEN, NEW YORK

1. I enjoy doing things which challenge me.
2. I pay little attention to the interests of people I know.
3. I get a kick out of seeing someone I dislike appear foolish in front of others.
4. If public opinion is against me, I usually decide that I am wrong.
5. I would enjoy being a club officer.
6. If I can't finish a task within a certain amount of time, I usually decide not to waste any more time on it.
7. Others think I am lively and witty.
8. I almost always accept a dare.
9. I admire free, spontaneous people.
10. I think a man is smart to avoid being talked into helping his acquaintances.
11. I often decide ahead of time exactly what I will do on a certain day.
12. I feel that adults who still like to play have never really grown up.
13. I consider it important to be held in high esteem by those I know.
14. Philosophical discussions are a waste of time.
15. I was born over 90 years ago.
16. Self-improvement means nothing to me unless it leads to immediate success.
17. I believe that a person who is incapable of enjoying the people around him misses much in life.
18. It doesn't bother me much to have someone get the best of me in a discussion.
19. I would like to wander freely from country to country.
20. I am not very insistent in an argument.
21. I don't mind doing all the work myself if it is necessary to complete what I have begun.
22. I am too shy to tell jokes.
23. I am careful about the things I do because I want to have a long and healthy life.
24. I have a reserved and cautious attitude toward life.
25. When I see someone who looks confused, I usually ask if I can be of any assistance.
26. I don't especially care how I look when I go out.
27. I love to tell, and listen to, jokes and funny stories.
28. I give little thought to the impression I make on others.
29. I often try to grasp the relationships between different things that happen.
30. I try to get at least some sleep every night.
31. I get disgusted with myself when I have not learned something properly.
32. Trying to please people is a waste of time.
33. I swear a lot.
34. Adventures where I am on my own are a little frightening to me.
35. I try to control others rather than permit them to control me.
36. If I find it hard to get something I want, I usually change my mind and try for something else.
37. I like to have people talk about things I have done.
38. I would enjoy learning to walk on a tightrope.
39. I find that I sometimes forget to "look before I leap."
40. All babies look very much like little monkeys to me.
41. When I am going somewhere I usually find my exact route by using a map.
42. I consider most entertainment to be a waste of time.
43. I very much enjoy being complimented.
44. I can't see how intellectuals get personal satisfaction from their impractical lives.
45. I have a number of outfits of clothing, each of which costs several thousand dollars.
46. I work because I have to, and for that reason only.
47. Loyalty to my friends is quite important to me.
48. If someone does something I don't like, I seldom say anything.
49. When I was a child, I wanted to be independent.
50. I have little interest in leading others.
51. If people want a job done which requires patience, they ask me.
52. I would not like the fame that goes with being a great athlete.
53. I would never want to be a forest-fire fighter.
54. Rarely, if ever, do I do anything reckless.
55. I feel very sorry for lonely people.
56. My personal papers are usually in a state of confusion.
57. I enjoy parties, shows, games — anything for fun.
58. Social approval is unimportant to me.
59. I do almost as much reading on my own as I did for classes when I was in school.
60. I make all my own clothes and shoes.
61. I will keep working on a problem after others have given up.

62. Most of my relationships with people are business-like rather than friendly.
63. If someone has a better job than I, I like to try to show him up.
64. I don't want to be away from my family too much.
65. I feel confident when directing the activities of others.
66. The mere prospect of having to put in long hours working makes me tired.
67. I don't mind being conspicuous.
68. I would never pass up something that sounded like fun just because it was a little bit hazardous.
69. The people I know who say the first thing they think of are some of my most interesting acquaintances.
70. I dislike people who are always asking me for advice.
71. I keep all my important documents in one safe place.
72. When I have a choice between work and enjoying myself, I usually work.
73. The good opinion of one's friends is one of the chief rewards for living a good life.
74. If the relationships between theories and facts are not immediately evident, I see no point in trying to find them.
75. I have attended school at some time during my life.
76. I try to work just hard enough to get by.
77. I am considered friendly.
78. I am quite soft-spoken.
79. My greatest desire is to be independent and free.
80. I would make a poor judge because I dislike telling others what to do.
81. If I want to know the answer to a certain question, I sometimes look for it for days.
82. I feel uncomfortable when people are paying attention to me.
83. I can't imagine myself jumping out of an airplane as skydivers do.
84. I am not an "impulse-buyer."
85. People like to tell me their troubles because they know that I will do everything I can to help them.
86. Most of the things I do have no system to them.
87. Once in a while I enjoy acting as if I were tipsy.
88. The opinions that important people have of me cause me little concern.
89. I have unlimited curiosity about many things.
90. I rarely use food or drink of any kind.
91. I often set goals that are very difficult to reach.
92. After I get to know most people, I decide that the would make poor friends.
93. Stupidity makes me angry.
94. I usually try to share my problems with someon who can help me.
95. I am quite good at keeping others in line.
96. When someone thinks I should not finish a projec I am usually willing to follow his advice.
97. I like to be in the spotlight.
98. I think it would be enjoyable and rather exciting t feel an earthquake.
99. I have often broken things because of carelessnes
100. I get little satisfaction from serving others.
101. Before I start to work, I plan what I will need an get all the necessary materials.
102. I only celebrate very special events.
103. I constantly try to make people think highly of m
104. When I was a child, I showed no interest in book
105. I have never ridden in an automobile.
106. I would rather do an easy job than one involvin obstacles which must be overcome.
107. I enjoy being neighborly.
108. I seldom feel like hitting anyone.
109. I would like to have a job in which I didn't have t answer to anyone.
110. Most community leaders do a better job than could possibly do.
111. I don't like to leave anything unfinished.
112. I was one of the quietest children in my group.
113. I avoid some hobbies and sports because of thei dangerous nature.
114. I make certain that I speak softly when I am in public place.
115. I believe in giving friends lots of help and advic
116. I can work better when conditions are somewha chaotic.
117. Most of my spare moments are spent relaxing an amusing myself.
118. It seems foolish to me to worry about my publi image.
119. I would very much like to know how and wh natural events occur in the way they do.
120. I could easily count from one to twenty-five.
121. My goal is to do at least a little bit more tha anyone else has done before.
122. Usually I would rather go somewhere alone tha go to a party.
123. Life is a matter of "push or be shoved."

4. I often do things just because social custom dictates.
5. I seek out positions of authority.
6. When other people give up working on a problem, I usually quit too.
7. I would enjoy being a popular singer with a large fan club.
8. I would enjoy the feeling of riding to the top of an unfinished skyscraper in an open elevator.
9. I enjoy arguments that require good quick thinking more than knowledge.
0. I really do not pay much attention to people when they talk about their problems.
1. I dislike to be in a room that is cluttered.
2. Practical jokes aren't at all funny to me.
3. Nothing would hurt me more than to have a bad reputation.
4. Abstract ideas are of little use to me.
5. Sometimes I feel thirsty or hungry.
6. I really don't enjoy hard work.
7. I try to be in the company of friends as much as possible.
8. If someone hurts me, I just try to forget about it.
9. If I have a problem, I like to work it out alone.
0. I think it is better to be quiet than assertive.
1. When I hit a snag in what I am doing, I don't stop until I have found a way to get around it.
2. At a party, I usually sit back and watch the others.
3. I try to get out of jobs that would require using dangerous tools or machinery.
4. I am not one of those people who blurt out things without thinking.
5. I am usually the first to offer a helping hand when it is needed.
6. I seldom take time to hang up my clothes neatly.
7. I like to go "out on the town" as often as I can.
8. I will not go out of my way to behave in an approved way.
9. When I see a new invention, I attempt to find out how it works.
0. I have never seen an apple.
1. I prefer to be paid on the basis of how much work I have done rather than on how many hours I have worked.
2. I have relatively few friends.
3. I often find it necessary to criticize a person sharply if he annoys me.
4. Family obligations make me feel important.
155. When I am with someone else I do most of the decision-making.
156. I don't believe in sticking to something when there is little chance of success.
157. If I were to be in a play, I would want to play the leading role.
158. Swimming alone in strange waters would not bother me.
159. I often get bored at having to concentrate on one thing at a time.
160. If someone is in trouble, I try not to become involved.
161. A messy desk is inexcusable.
162. I prefer to read worthwhile books rather than spend my spare time playing.
163. When I am doing something, I often worry about what other people will think.
164. It is more important to me to be good at a sport than to know about literature or science.
165. I usually wear something warm when I go outside on a cold day.
166. I have rarely done extra studying in connection with my work.
167. To love and be loved is of greatest importance to me.
168. If I have to stand in line, I seldom try to cut ahead of the other people.
169. I delight in feeling unattached.
170. I would make a poor military leader.
171. I am willing to work longer at a project than are most people.
172. When I was young I seldom competed with the other children for attention.
173. I prefer a quiet, secure life to an adventurous one.
174. I always try to be fully prepared before I begin working on anything.
175. I would prefer to care for a sick child myself rather than hire a nurse.
176. I could never find out with accuracy just how I have spent my money in the past several months.
177. I spend a good deal of my time just having fun.
178. I don't care if my clothes are unstylish, as long as I like them.
179. I am more at home in an intellectual discussion than in a discussion of sports.
180. I think the world would be a much better place if no one ever went to school.
181. People have always said that I am a hard worker.
182. I seldom go out of my way to do something just to make others happy.

183. I often make people angry by teasing them.

184. I respect rules because they guide me.

185. When two persons are arguing, I often settle the argument for them.

186. If I had to do something I didn't like, I would put it off and hope that someone else might do it.

187. I often monopolize a conversation.

188. To me, crossing the ocean in a sailboat would be a wonderful adventure.

189. It seems that emotion has more influence over me than does calm meditation.

190. I avoid doing too many favors for people because it would seem as if I were trying to buy friendship.

191. My work is always well organized.

192. Most of my friends are serious-minded people.

193. One of the things which spurs me on to do my best is the realization that I will be praised for my work.

194. I really don't know what is involved in any of the latest cultural developments.

195. I have no sense of touch in my fingers.

196. When people are not going to see what I do, I often do less than my very best.

197. Most people think I am warm-hearted and sociable.

198. I show leniency to those who have offended me.

199. I find that I can think better without having to bother with advice from others.

200. I would not do well as a salesman because I am not very persuasive.

201. When I am working outdoors I finish what I have to do even if it is growing dark.

202. I think that trying to be the center of attention is a sign of bad taste.

203. I never go into sections of a city that are considered dangerous.

204. I generally rely on careful reasoning in making up my mind.

205. When I see a baby, I often ask to hold him.

206. I often forget to put things back in their places.

207. I like to watch television comedies.

208. If I have done something well, I don't bother to call it to other people's attention.

209. If I believe something is true, I try to prove that my theory will hold up in actual practice.

210. If someone pricked me with a pin, it would hurt.

211. I don't mind working while other people are having fun.

212. When I see someone I know from a distance, I don't go out of my way to say "Hello."

213. I become angry more easily than most people.

214. I find that for most jobs the combined effort several people will accomplish more than person working alone.

215. If I were in politics, I would probably be seen one of the forceful leaders of my party.

216. If I get tired while playing a game, I generally st playing.

217. I try to get others to notice the way I dress.

218. I would enjoy exploring an old deserted house night.

219. Often I stop in the middle of one activity in or to start something else.

220. People's tears tend to irritate me more than arouse my sympathy.

221. I spend much of my time arranging my belongir neatly.

222. People consider me a serious, reserved person.

223. I feel that my life would not be complete if I fail to gain distinction and social prestige.

224. I would rather be an accountant than a theoreti mathematician.

225. If I were exploring a strange place at night, would want to carry a light.

226. It doesn't really matter to me whether I becor one of the best in my field.

227. I truly enjoy myself at social functions.

228. I do not like to see anyone receive bad news.

229. I would not mind living in a very lonely place.

230. I feel incapable of handling many situations.

231. I will continue working on a problem even with severe headache.

232. I never attempt to be the life of the party.

233. Surf-board riding would be too dangerous for m

234. If I am playing a game of skill, I attempt to pla each move thoroughly before acting.

235. I feel most worthwhile when I am helping someor who is disabled.

236. I rarely clean out my bureau drawers.

237. If I didn't have to earn a living, I would spen most of my time just having fun.

238. I don't try to "keep up with the Joneses."

239. I like to read several books on one topic at th same time.

240. I wear clothes when I am around other people.

241. Sometimes people say I neglect other importar aspects of my life because I work so hard.

242. I want to remain unhampered by obligations t friends.

3. I have a violent temper.
4. To have a sense of belonging is very important to me.
5. I try to convince others to accept my political principles.
6. I am easily distracted when I am tired.
7. When I was in school, I often talked back to the teacher to make the other children laugh.
8. I would like to drive a motorcycle.
9. Most people feel that I act spontaneously.
0. I become irritated when I must interrupt my activities to do a favor for someone.
1. I keep my possessions in such good order that I have no trouble finding anything.
2. I usually have some reason for the things I do rather than just doing them for my own amusement.
3. I would not consider myself a success unless other people viewed me as such.
4. I would rather build something with my hands than try to develop scientific theories.
5. I can't believe that wood really burns.
6. I am sure people think that I don't have a great deal of drive.
7. I spend a lot of time visiting friends.
8. I do not think it is necessary to step on others in order to get ahead in the world.
9. Having a home has a tendency to tie a person down more than I would like.
0. I would not want to have a job enforcing the law.
1. I won't leave a project unfinished even if I am very tired.
2. I don't like to do anything unusual that will call attention to myself.
3. I will not climb a ladder unless someone is there to steady it for me.
4. I think that people who fall in love impulsively are quite immature.
5. Seeing an old or helpless person makes me feel that I would like to take care of him.
6. I feel comfortable in a somewhat disorganized room.
7. I delight in playing silly little tricks on people.
8. When I am being introduced, I don't like the person to make lengthy comments about what I have done.
9. I am unable to think of anything that I wouldn't enjoy learning about.
0. I can run a mile in less than four minutes.
1. I enjoy work more than play.
272. I am quite independent of the people I know.
273. I often quarrel with others.
274. I can do my best work when I have the encouragement of others.
275. With a little effort, I can "wrap most people around my little finger."
276. When I feel ill, I stop working and try to get some rest.
277. I perform in public whenever I have the opportunity.
278. I like the feeling of speed.
279. Life is no fun unless it is lived in a carefree way.
280. It doesn't affect me one way or another to see a child being spanked.
281. I can't stand reading a newspaper that has been messed up.
282. I would prefer a quiet evening with friends to a loud party.
283. I do a good job more to gain approval than because I like my work.
284. There are many activities that I prefer to reading.
285. I would have a hard time keeping my mind a complete blank.
286. It is unrealistic for me to insist on becoming the best in my field of work all of the time.
287. I go out of my way to meet people.
288. I try to show self-restraint to avoid hurting other people.
289. My idea of an ideal marriage is one where the two people remain as independent as if they were single.
290. I don't have a forceful or dominating personality.
291. I am very persistent and efficient even when I have been working for many hours without rest.
292. The idea of acting in front of a large group doesn't appeal to me.
293. To me, it seems foolish to ski when so many people get hurt that way.
294. I like to take care of things one at a time.
295. I can remember that as a child I tried to take care of anyone who was sick.
296. If I have brought something home, I often drop it on a chair or table as I enter.
297. Things that would annoy most people seem humorous to me.
298. Inner satisfaction rather than fame is my goal in life.
299. If I were going to an art exhibit, I would first try to learn about the artist, his style and technique, his philosophy of art, and the story behind each piece of work.
300. I am able to breathe.