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EFFECTS OF NEGATIVE PRACTICE ON BRUXISM:  
AN EXPERIMENTAL ANALYSIS

by

Kenneth D. Keith

A DISSERTATION

Presented to the Faculty of  
The Graduate College in the University of Nebraska  
In Partial Fulfillment of Requirements  
For the Degree of Doctor of Philosophy

Department of  
Educational Psychology and Measurements

Under the Supervision of Professor Jay M. Toews

Lincoln, Nebraska

May, 1975

**TITLE**

**EFFECTS OF NEGATIVE PRACTICE ON BRUXISM: AN**

**EXPERIMENTAL ANALYSIS**

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K.D.K.

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## Foreward: Two Faces of Science

Hence, before writing a word of his dissertation; a researcher once again reviews the institutional format requirements and remodels sections of his outline that do not conform to it (Van Dalen, 1962, p. 349).

I have built apparatuses as I have painted pictures or modelled figures in clay. I have conducted experiments as I have played the piano. I have written scientific papers and books as I have written stories and poems. I have never designed and conducted an experiment because I felt that I ought to do so, or to meet a deadline, or to pass a course, or to "publish rather than perish" (Skinner, 1970, p. 17).

## Chapter I

### The Conduct of Science

Research has been described as "...the activity of solving problems which leads to new knowledge using methods of inquiry which are currently accepted as adequate by scholars in the field" (Helmstadter, 1970, p. 5). Some of the classes of problem-solving behavior in which scientists may engage in the course of research have come to be regarded as fairly conventional. These may include defining the problem, the formulation of hypotheses, deductive reasoning leading to tentative conclusions about the consequences of suggested solutions, and the actual testing of hypotheses (Van Dalen, 1962). There are some scientists (e.g., Skinner, 1969) however, who hold that hypothetico-deductive procedures do not exhaust the range of potential scientific behavior, and that they furthermore may not be required for the study of human behavior. Adherents of this position are not without conventions, with respect to the nature of data, procedures for data collection, experimental design, and the like (Baer, Wolf, and Risley, 1968; Sidman, 1960). The key point is that the behavior of scientists at work may vary widely within broad classes.

Various attempts have been made to analyze or describe scientific activity. Aside from the numerous textbooks which discuss research design and the way in which scientists should behave in relation to acceptable norms, some accounting has been made of what scientists in fact do. These accounts range from broad analyses in the context of historical sociology (Feuer, 1963) to individual case (self) reports in an anecdotal vein (Selye, 1964; Skinner, 1956). Some personality (behavioral) characteristics of productive scientists as a group have been studied and summarized (Roe, 1961), and individual investigation has been undertaken with the aim of including an account of the investigator's scientific behavior (Zifferblatt, 1969).

The fact remains, however, that it may yet be said that the creative process is not well understood (Roe, 1961), and that a functional analysis of scientific inquiry remains to be done (Skinner, 1969). In the preface to his unique account of the discovery of the DNA structure, Watson (1968) states his belief that "...there remains general ignorance about how science is 'done'" (p. xii). It has been noted that scientists themselves have not been particularly helpful in this regard, due to their failure to recognize and report the significance of social relations and events relative to their scientific judgments (Hagstrom, 1965).

As Skinner (1956) has made clear, while methodologists and statisticians may seem to imply how the mind works -- problem identification, the making of deductions, design of experiments, etc. -- it in fact remains for the behavioral scientist to make the observations and analyses which will in truth describe scientific behavior. While the writings of investigators may be public, their behavior typically is not, particularly as it involves decision making, reasoning, and other private events. Rosenthal (1966) has suggested, for example, that publication policies may establish contingencies which foster outcome-oriented (as opposed to procedure-oriented) research behavior. He implies that there is a need for improved evaluation of the process of research activity, as it relates to an understanding of investigator behavior.

Alternatives to conventional modes of scientific reporting may conceivably fill some of the gaps in existing knowledge of scientific behavior, while maintaining or improving the conventional content of such reports. One alternative which is germane to this concern is an accounting of the investigator's activity as it relates to identifiable aspects of his research. In fact, if research is defined in terms of problem-solving, it might be said that the scientist's behavior is his research. I propose, in the course of this investigation, to attempt such an accounting. I will describe, as

forthrightly as possible, the events, decisions, and history which bear upon and constitute the substance of this report. This is a logical step in the development of my own graduate studies, particularly as an extension of prior work with Dr. Jay Toews and Dr. Larry Braskamp.

The events of this undertaking will be reported in order of their occurrence. The result will thus be a chronology, and the format will be sequential, its components dictated by the behaviors which have transpired. This would seem to enhance the probability that my reporting will come under control of the data and their implications, rather than those contingencies which circumscribe "acceptable writing."<sup>1</sup> A further, and perhaps more fundamental, aim will be a demonstration of the significance of the development of a conceptual context within which data are gathered and analyzed. In this way, some sense of the bearing of the behavioral history of the writer upon a particular undertaking may be conveyed.

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<sup>1</sup>This is not to say that the conventions of scientific writing are inappropriate, particularly with respect to conveyance of specific forms of data and ideas. It is simply suggested that such conventions should not limit investigative behavior.

While scientific activity may be typically regarded as fairly conventional in its scope, a variety of approaches are extant. Understanding of the process of scientific behavior has not been generally furthered by scientists themselves. The methodologies of research design and statistics will not substitute for observation and description of investigator behavior. One available option for the first steps in such a study is inclusion by the investigator of some accounting of his own activity. Included may be a description of the evolution of his behavior in the recognition and investigation of a particular problem, as well as a synthesis of the behavioral history and conceptual context from which it arises.

## Chapter II

### Evolution of the Problem

Early in 1973, I was approached by Dr. Gary Jones, of the University of Nebraska College of Dentistry, to discuss a group of patients in whom he had a special interest. These were the so-called TMJ (temporomandibular joint) dysfunction patients -- a group presenting with various forms of discomfort and restriction of function in the temporomandibular area of the head. I learned from Dr. Jones that many of these patients do not have readily discernible dental causes for their problems, and that a particularly interesting sub-group consists of those patients known as bruxists. Bruxism is defined as "the grinding, clenching, or tapping of mandibular teeth against maxillary teeth at times other than during mastication and swallowing" (Meklas, 1971, p. 31).

At the time of our first discussions, Dr. Jones was seeking consultation in the area of psychological assessment for TMJ patients. He considered the identification of predictive criteria for these types of problems to be an important concern; in other words, could patients prone to bruxism or related problems be identified from assessments of personality and other characteristics? Although aware



that Dr. Jones had invested a substantial amount of time and behavior in this line of research, I suggested that an alternative approach might be more productive -- that an analysis of the variables controlling and maintaining bruxing might lead more directly to its treatment.<sup>2</sup> If this view was of interest to Dr. Jones, I was willing to consider further investigation of the behavior. His response was encouraging, and I went to the literature to learn something of the prevalence, symptomology, and etiology of bruxism.

I found rather quickly that bruxism is among the most common and most important of the functional dental disturbances (Posselt, 1968). Reding et al. (1966) found that bruxism occurred in more than five percent of the young adult population, with nearly equal frequency in both sexes. Olkinuora (1972a), however, found a substantially higher frequency among females than among males. Additional studies have placed the prevalence of bruxism from twenty to eighty percent of dental patients examined (Ramfjord and

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<sup>2</sup>The nature of my own training and experience had led me to a position similar to that articulated by Ullmann and Krasner (1969); that the "real" person does not underlie overt behavior, and that description of behavior (or certain of its characteristics) does not substitute for an explanation of its occurrence. The latter problem would remain, even if the bruxism-prone patient could be identified.

Ash, 1966). The variation in prevalence figures seems in part due to variations in diagnostic criteria.

Bruxists may or may not be aware of their habit (Meklas, 1971). The signs and symptoms of bruxism may include wear facets on the teeth (Krogh-Poulsen and Olsson, 1966; Meklas, 1971), and tenderness or pain in the masticatory muscles or temporomandibular joints (Krogh-Poulsen and Olsson, 1966; Olkinuora, 1972a; Posselt, 1968). Tooth wear may be so severe as to seriously abrade the teeth. Meklas (1971), for example, reported cases in which anterior teeth were cupped and gold crowns had been worn completely through. In addition, patients may report fatigue or tension in the masticatory muscles, and difficulty in opening the mouth upon awakening in the morning (Olkinuora, 1972a). These conditions are related to increased tonus of the masticatory musculature, often accompanied by unilateral or bilateral hypertrophy (Ramfjord and Ash, 1966).

The most direct and obvious indicator of bruxism is perhaps the report of a patient or the patient's spouse of persistent toothgrinding. The spouse may become involved due to the rather high incidence of nocturnal bruxists (Olkinuora, 1972a), whose toothgrinding may produce noises which preclude sleeping for the spouse (Ayer and Gale, 1969).

A number of dental and non-dental conditions have been reported to be instrumental in the etiology of bruxism. Among the dental conditions believed to be causative are interference from teeth or restorations which are too "high" (Ramfjord and Ash, 1966); "jamming" (failure of buccal peaks of mandibular teeth to fit into central section of maxillary teeth) (Ross, 1970); tipped or malpositioned teeth (Meklas, 1971); and chronic periodontal inflammation (Meklas, 1971). Many patients, however, persist in bruxing despite various dental treatments, leading some researchers (e.g., Brecker, 1966) to consider dental conditions secondary etiologic factors to psychological factors. The conclusions of electromyographic studies (Ramfjord, 1961) suggest that occlusal interferences may trigger bruxism if they combine with "nervous tension."

Psychogenic components of bruxism have been widely postulated (Brecker, 1966; Krogh-Poulsen and Olsson, 1966; Meklas, 1971; Olkinuora, 1972a, 1972b, 1972c; Ramfjord, 1961; Ramfjord and Ash, 1966; Ross, 1970). Analysis of the psychology of bruxism has typically centered, as Dr. Jones had indicated, on the comparison of scores of bruxists and non-bruxists on various anxiety scales and personality tests. Studies have shown that bruxists may score higher on measures of

anxiety (Molin and Levi, 1966; Thaller, et al., 1967; Vernallis, 1955), hostility (Molin and Levi, 1966), and emotional imbalance (Olkinuora, 1972c). Some writers have interpreted bruxing as an expression of oral gratification (Meklas, 1971), aggression (Shapiro, 1972), or of emotional tension (Ross, 1970). It has been observed that nearly all persons respond to emotional stress with increased skeletal motor system activity (Goldstein, 1964), and that for many individuals this tendency may include transitory pressing of the teeth and jaws (Shapiro, 1972), as well as other rather specific, localized increases in muscle tension (Malmo, 1962). The behavior is often considered a symptom of an underlying problem, leading some practitioners (e.g., Ross, 1970) to believe that the behavior should not be extinguished because it provides an outlet for neurotic feelings of frustration, hostility, aggression, and the like. Ramfjord and Ash (1966) have stated that the danger of substitution of a more severe symptom exists if attempts are made to treat bruxism directly as a problem behavior. Data to substantiate this assertion were not presented, however, and more comprehensive reviews e.g., Ullmann and Krasner, 1965) do not support the hypothesis of symptom substitution.

My review provided sufficient information to allow at least three conclusions:

1. Bruxism is indeed a problem for substantial numbers of persons.
2. Uncontrolled bruxism may cause significant destruction of dentition, and impaired oral health.
3. Dental treatment does not provide relief for many bruxists (i.e., many cases may be behaviorally determined.).

If a behavioral treatment was to be developed, a tentative analysis of the problem would be required.

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Bruxism is a functional dental disturbance which presents serious dangers to the oral health of many patients. In a large number of cases, bruxing is considered psychogenic in origin, and unresponsive to traditional dental treatments. The psychology of bruxism has been developed mainly in studies of personality traits of bruxists, and in speculation regarding the role of bruxing as a symptom or outlet for underlying conditions or feelings. Unfortunately, the former (personality) studies do not lead directly to the development of treatment approaches, and the latter form of analysis

is unsupported by data. A formulation which can identify potential controlling variables for the behavior will be required.

PREVIEW

### Chapter III

#### Development of a Conceptual View

The attempt to relate bruxing to hypothetical states of the organism, or to broadly defined personality traits, did not constitute a form of analysis which was likely to facilitate control of the behavior. For example, if one accepts without further investigation that bruxists are anxious or hostile persons, several questions are left unanswered: Does anxiety (or hostility) cause bruxism? Does bruxism cause anxiety? Does bruxism equal anxiety? Are both (if they are not synonymous) the result of some common experiential history? The assertion that bruxism should not be extinguished because it provides an outlet for neurotic feelings (Ross, 1970) harks back to the view of William James (1892) that a habit is simply a new pathway in the brain, via which incoming current is discharged. I sought an account which might bring some precision to the investigation of this behavior.

One form of analysis could be derived from the work of Yates (1958a), who suggested that motor behaviors may be conditioned avoidance responses to anxiety. Yates' analysis showed that the maintenance of such a habit may be a circular

function, since the behavior is originally a response to anxiety, but also may serve (through its performance) to increase anxiety, thus providing the occasion for increased responding, and so forth. While this discussion was in general terms plausible, it perpetuated the assumption that anxiety and the habit are separate entities. A more direct analysis should be possible.<sup>3,4</sup>

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<sup>3</sup>Anxiety, for example, might be considered not as an entity distinct from behavior, but as a class of emotional responses which is itself conditioned to aversive stimuli (Skinner, 1969).

<sup>4</sup>It was at this time that I began to seriously consider development of a treatment for bruxism as appropriate subject matter for thesis research. I met several times with Dr. Toews to discuss the general idea, as well as some methodological concerns. He made suggestions which influenced my thinking with respect to the potential importance and scope of the research--indicating that it might be appropriate to view bruxism as an instance of a broader class of persistent habits, and that some interesting methodological issues might be examined in the process. I determined to proceed, and developed a proposal to be taken to my supervisory committee. I also took the action of adding Dr. Frank Wentz to the committee, in recognition of his training and expertise in dentistry and anatomy and my own obligation to provide a source for any necessary technical consultation to the other committee members. The committee provided substantial reinforcement for my proposal, as well as some helpful methodological suggestions; for purposes of clarity, I shall describe this chronology in a subsequent chapter, and return here to the problem of a conceptual formulation.