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Temporal Contiguity as a Defining Feature of the Terms Reinforcer and Discriminative Stimulus: A Survey of Journal Editorial Staffs

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TEMPORAL CONTIGUITY AS A DEFINING FEATURE OF THE TERMS REINFORCER AND DISCRIMINATIVE STIMULUS: A SURVEY OF JOURNAL EDITORIAL STAFFS

by

Julie Ann Fillhard

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
Department of Psychology

Western Michigan University
Kalamazoo, Michigan
August 1991

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Behavior analysis is a science that requires a consistent set of terms to describe independent and dependent variables and the relations between them. However, a review of literature indicates that behavior analysis is plagued by terminological inconsistencies, even with such basic terms as reinforcer and discriminative stimulus.

In the present study, 193 journal editorial staff members were surveyed to determine the importance of temporal contiguity in defining the terms reinforcer and discriminative stimulus. Eighty-seven editors (45%) responded to the survey which described two hypothetical scenarios and contained a series of questions relevant to each.

The results of the study indicate that there is no strong consensus among respondents about the importance of time delay in defining either a reinforcer or discriminative stimulus. The variety of responses to the questionnaire suggests disagreement exists at some level regarding these terms that are essential to behaviorism.
ACKNOWLEDGEMENTS

I would like to express my deepest appreciation to Dr. Alan Poling for all of his support, guidance and supervision, and to the other members of my Graduate Committee, Dr. Jack Michael and Dr. Alyce Dickinson, for their advice and assistance during the preparation of this thesis.

I also wish to acknowledge my family: Janet Fillhard, Vern Fillhard, Laura Gregg, Chet Fillhard, and Lloyd and Irene Lynch. I am extremely grateful and indebted to them for their endless love, support and encouragement.

Finally, I would like to thank the many friends who kept me going through all the hard parts, particularly Sandy Burdick, Sandy Miklosovic, and Patrick Griffin.

Julie Ann Fillhard
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Fillhard, Julie Ann, M.A.
Western Michigan University, 1991

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CHAPTER I

INTRODUCTION

History

Behaviorism, which offers a scientific and mechanistic analysis of the action of humans and other animals, is a relatively young science with antecedents in the fields of psychology, biology, and physiology. Over 300 years ago, Rene Descartes (1596-1650) offered a mechanistic interpretation of human behavior with his description of the body as a machine "incorporating many faculties previously assigned to the soul" (Leahey, 1980, p. 94). Mental events such as memory were described as activities of the body. This mechanistic point of view would ultimately support empiricism and behaviorism. Following Descartes, pre-behavioristic notions were evident in a movement called logical positivism, led by Auguste Comte (1798-1857). This movement was interested in accurately describing the nature of the world. To do so, it abandoned the use of introspection as a methodology for research and adopted a radical empiricism. This brought a scientific flavor to the study of humanity. Out of the positivistic movement came an individual, Ernst Mach (1838-1946), who would influence the
works of B. F. Skinner. Mach, a German physicist, was particularly interested in the nature of knowing and theorized that it served a biological function. As detailed by Smith (1986), Skinner was influenced by Mach's views in several areas, including the origin of science and empirical epistemology.

In 1879, psychology was founded as a "socially recognized and independent science" (Leahey, 1980, p. 182) by Wilhelm Wundt (1832-1920). Wundt was responsible for several "firsts" in the field of psychology. He offered the first course in psychological psychology, wrote the first psychological text, and developed the first psychological laboratory (Murray, 1988; Sahakian, 1975). Wundt was interested in studying immediate experience. He chose introspection as a methodology but insisted that it be experimental, thus scientific, in nature.

Wundt's early psychology evolved into what is now referred to as a structuralism. One of Wundt's students, Edward Titchener (1867-1927), brought this psychology from Germany to America. Titchener's structuralism was concerned with the investigation of sensations of consciousness. The first task in accomplishing this was to discover the basic elements of sensation. The second task was to determine how these elements were connected to form complex perceptions, ideas, and images. The
third was to determine the laws of the connections (Leahey, 1980, p. 197). Titchener provided most of the impetus for this movement, which was not strong and essentially died with him in 1927.

American psychologists did not readily adhere to structuralism; most were more impressed by the tenets of another movement called functionalism.

Functionalism was a psychology of adaptation that was based in large part on the works of William James, J. R. Angell, and Charles Darwin. Its primary focus was on the function of the mind rather than its structure. This emphasis eventually led psychology to a scientific approach.

The notions of functionalism influenced John B. Watson (1878-1958), who studied under the functionalist J. R. Angell at the University of Chicago and maintained contact with Jacques Loeb (1859-1924), a physiologist who was a strong advocate of reductionism and functionalism. Watson is often credited with first delineating the behavioristic position. He did so in, for example, "Psychology as a Behaviorist Views It," published in 1913. In this paper, Watson established the goal of psychology as the prediction and control of behavior, rejected introspection as part of its methodology, and recognized humans as animals. He dismissed both structuralism and functionalism because of their emphasis
on the mind. However, "for all his emphasis on objective methods, Watson failed to specify exactly what method or methods should be adopted" (Leahey, 1980, p. 283). While searching for an appropriate methodology, Watson turned to the conditioning methods of Ivan Pavlov.

Pavlov (1849-1936) was a Russian physiologist who won a Nobel Prize in 1904 for his work in the area of digestion. During his work, he observed a relation between antecedent stimuli and salivation that would lead to the development of the respondent conditioning paradigm. Watson made Pavlov's findings, which established the basic principle of respondent conditioning, the foundation of his psychology. Contemporary behavior analysts still recognize the importance of respondent conditioning in conditioning human behaviors (e.g., Chance, 1988; Mazar, 1986).

Edward Thorndike (1874-1949) was another individual who influenced Watson. Thorndike, a student of William James, was involved in the study of animal behavior. This research led to the formulation of the law of effect, for which he is most famous:

Any act which in a given situation produces satisfaction becomes associated with that situation, so that when the situation recurs the act is more likely than before to recur also. Conversely, any act which in a given situation produces discomfort becomes disassociated from that situation, so that when the situation recurs the act is less likely than before to recur. (Thorndike, 1905, p. 203).
According to Thorndike, the consequences of behavior stamp in (strengthen) or stamp out (weaken) connections between stimuli (the situation in which behavior occurs) and behavior. Because of this orientation, Thorndike is often called a connectionist.

Watson appreciated Thorndike's objectivity, but he did not accept Thorndike's law of effect. In a discussion of how learned responses are acquired, Watson (1930) complained:

Most of the psychologists, it is to be regretted, have even failed to see that there is a problem. They believe [that] habit formation is implanted by kind fairies. For example, Thorndike speaks of pleasure stamping in the successful movement and displeasure stamping out the unsuccessful movement. (p. 206)

Although Thorndike's analysis of the law of effect was in a sense mentalistic, its fundamental message—that the consequences of behavior can powerfully influence learning and performance—is a primary concept in contemporary behavioral psychology.

The person most closely associated with the development of that psychology, commonly known as radical behaviorism, is B. F. Skinner (1904-1990). The impact of Skinner's work is described by Leahey (1980):

By far the best-known and most influential of all the major behaviorists is Burrhus Frederic Skinner (born 1904), whose radical behaviorism, if accepted, would constitute a momentous revolution in humanity's understanding of the human self, demanding as it does no less than the complete
rejection of the entire intellectual psychological tradition.... (p. 314)

Skinner completely rejected all mental constructs of past psychologies. His emphasis was strictly on the accurate description of behavior and the environmental variables that control it. For him, the goal of a science of behavior is prediction and control. Skinner's first book, *The Behavior of Organisms* (1938), outlined the fundamental concepts of radical behaviorism. Following the appearance of this book, Keller and Schoenfeld wrote *Principles of Psychology* (1950), an introductory text based on Skinner's behavioral approach. Then, in 1953, Skinner wrote *Science and Human Behavior*, which suggested ways to improve human behavior. In it, he encouraged the application of basic principles to problems existing with humans. Shortly thereafter, in 1958, the first behavioral journal was established: the *Journal of the Experimental Analysis of Behavior*.

By the time the journal was founded, interest in behaviorism began to grow and, as it did, research expanded from experimentation with animals to the application of operant principles to humans. With this came the development of the *Journal of Applied Behavior Analysis* (1968), which allowed for the publication of works in the clinical area. Further growth in this science of behavior resulted in the development of other
behavioral journals such as the Journal of Organization Behavior Management, The Behavior Analyst, and The Analysis of Verbal Behavior. All of these address applications and developments in various areas of human behavior.

Throughout the history of behavioral psychology, the goal has been a scientific approach to human behavior. What has come of this is a science of behavior. It provides an "accurate and precise description of the relationship between observable variables and behavior" (Leahey, 1980, p. 316). As with any science, a science of behavior requires a consistent set of terms to describe independent and dependent variables and the relations between them. As noted by Catania (1969):

Through the verbal behavior of behavior, we bring our colleagues into contact with our research. Thus, the vocabulary and the grammar of behavior may be as important to our progress as the growth of the experimental literature and the refinement of apparatuses and procedures. (p. 846)

In addition,

we must be alert to the contingencies that operate in our verbal behavior, for our verbal behavior does have consequences. Part of our effort is to devise a vocabulary and a grammar that correspond to the dimensions of behavior in such a way that we can speak easily of behavioral operations and processes. (p. 846)

Unfortunately, behavior analysis has been plagued by terminological inconsistencies. As Deitz and Arrington (1983) wrote:
In the past several years, commentaries on problems in the language of behavior analysis have become more frequent. Most often these discussions have related to the need for precision in using the language of the field. (p. 117)

Among the commentaries to which they refer are those of Michael (1982), Ferster (1978), Hineline (1980), Williams (1983), Catania (1969), and Lattal and Poling (1981).

The need for precise language is especially great when the key principles of a science are defined. It might, for example, be assumed that there is by now a consensus among behavior analysts as to the appropriate definition of reinforcer and discriminative stimulus, for these terms represent fundamental behavioral principles (e.g., Chance, 1988; Mazur, 1986). But it may not be so.

Consider the issue of temporal contiguity. Some definitions indicate, or at least imply, that there must be a closeness in time between behavior and an antecedent or postcedent stimulus if these events function as discriminative stimuli or as reinforcers (e.g., Martin & Pear, 1988; Morse & Kelleher, 1977; Fantino & Logan, 1979). For example, Michael (1982) describes a discriminative stimulus as follows:

When a stimulus condition is identified as an S_D there is always the implication that it controls some behavior, which means that some particular type of response is stronger in the presence than in the absence of that stimulus condition. (p. 47)

Although the term immediacy does not appear in this
definition it is clear from other writings by Michael (e.g., 1988) that immediacy is essential in the definition. Other definitions, however, do not indicate or imply that a closeness in time is necessary (e.g., Zeiler, 1978; Williams, 1983).

From a behavioral perspective, the "meaning" of reinforcer, discriminative stimulus, or any other term resides in the stimulus conditions that occasion its usage. For example, as Poling, Schlinger, Starin and Blakely (1990) relate:

Suppose you hear someone say "fire." What does it mean? The answer depends on the variable responsible for its emission, that is, on why it was spoken. For example, if it was shouted by an army officer to induce his squad to shoot, then "fire" is a mand. If a child standing in front of a burning log says "fire," then "fire" is probably a tact. If it is someone's reply to the question, "What did early humans discover by rubbing two sticks together?" then "fire" is an intraverbal. The "meaning" of the response "fire" cannot be discerned by its form or by the way it sounds. Instead, its meaning depends on why the speaker said it. (p. 6)

Purpose of Study

In essence, the primary purpose of the present study was to ascertain whether established behavior analysts, those who are members of the editorial boards of prominent journals, would apply the terms "discriminative stimulus" and "reinforcer" to describe (i.e., have them controlled by) relations in which behavior was controlled by stimuli temporally distant from the response in
question. This was done by presenting written scenarios describing relations between environmental variables and behavior, and asking questions about those relations. The intent of the study was simply to determine characteristic patterns of responding (word use), not to evaluate the relative merits of those patterns.
CHAPTER II

METHODS

Respondents

A questionnaire, described in the next section, was mailed to each member of the editorial staff (i.e., editor, executive editor, associate editor, editorial board) of five primarily behavioral journals. The journals were the Journal of Applied Behavior Analysis (JABA), the Journal of the Experimental Analysis of Behavior (JEAB), The Behavior Analyst (TBA), the Analysis of Verbal Behavior (AVB), and the Journal of Organizational Behavior Management (JOBM). Editorial staff from these specific journals were queried because they appeared to represent a reasonable cross-section of behavior analysts. At the time the questionnaires were sent, The JABA editorial staff consisted of 56 people and the JEAB staff consisted of 38. The TBA staff comprised 46 individuals, the AVB staff 22, and the JOBM staff 31. A complete listing of all people to whom questionnaires were sent appears in Appendix A.

Questionnaire

The questionnaire developed for and used in the

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study appears in Appendix B. It consisted of two scenarios describing different hypothetical situations and a series of questions relevant to each. The scenarios were designed to introduce the issue of time delay in defining the terms reinforcer and discriminative stimulus. Each described a situation in which a stimulus was removed in time from the behavior it was presumed to control. Three questions followed each scenario. These questions were geared toward establishing whether the respondent would consider a stimulus a reinforcer or discriminative stimulus when a long time delay (six months in scenario 1, 10 days in scenario 2) existed between the stimulus and the response in question. An additional comment question followed each scenario. In it, respondents were asked to identify the length of time a stimulus could be removed in time from the response and still be called reinforcer or discriminative stimulus.

The questionnaires were sent with return envelopes that were coded in a manner in which respondents could not be identified while the journal that they were associated with could be determined.
CHAPTER III

RESULTS

Return Rates

Only questionnaires returned within two calendar months of being sent to respondents were used in data analysis. Only one was received after this time. Twenty JABA editors and 19 JEAB editors responded. Eleven surveys were returned by AVB editors, 20 by TBA editors, and 17 by JOBM editors. Thus, in all, a total of 87 of 193 (45%) of possible respondents returned the survey. Two surveys mailed to AVB, two mailed to JOBM editors, and two mailed to JABA editors were returned by the U.S. Postal Service as undeliverable (Table 1).

True/False Response Rates

Editors’ responses to the six true-and-false questions are summarized in Table 2. These data reveal that there was little consensus concerning the role time delay should play in defining stimuli as reinforcers or discriminative stimuli. In response to the first question, which pertained to money serving as a reinforcer for grant writing six months after the actual
Table 1
Questionnaire Return Rates

<table>
<thead>
<tr>
<th>Journal</th>
<th># Sent</th>
<th># Returned</th>
<th>% Returned</th>
<th># Undeliverable</th>
</tr>
</thead>
<tbody>
<tr>
<td>JABA</td>
<td>56</td>
<td>20</td>
<td>36%</td>
<td>2</td>
</tr>
<tr>
<td>JEAB</td>
<td>38</td>
<td>19</td>
<td>50%</td>
<td>0</td>
</tr>
<tr>
<td>AVB</td>
<td>22</td>
<td>11</td>
<td>50%</td>
<td>2</td>
</tr>
<tr>
<td>TBA</td>
<td>46</td>
<td>20</td>
<td>43%</td>
<td>0</td>
</tr>
<tr>
<td>JOB</td>
<td>31</td>
<td>17</td>
<td>55%</td>
<td>2</td>
</tr>
<tr>
<td>OVERALL</td>
<td>193</td>
<td>87</td>
<td>45%</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 2
Questionnaire Results

1. Receipt of money in scenario 1 is a reinforcer regardless of the long delay between the behavior (grant writing) and its consequence.

<table>
<thead>
<tr>
<th></th>
<th>TRUE (%)</th>
<th>FALSE (%)</th>
<th>OTHER (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JABA</td>
<td>85</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>JEAB</td>
<td>74</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>TBA</td>
<td>60</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>AVB</td>
<td>36</td>
<td>36</td>
<td>28</td>
</tr>
<tr>
<td>JOB</td>
<td>76</td>
<td>12</td>
<td>12</td>
</tr>
</tbody>
</table>

2. Receipt of the money scenario 1 is a reinforcer, but its effects are dependent on verbal behavior by the researcher. (Please answer only if you responded to question 1).

<table>
<thead>
<tr>
<th></th>
<th>TRUE (%)</th>
<th>FALSE (%)</th>
<th>OTHER (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JABA</td>
<td>76</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>JEAB</td>
<td>36</td>
<td>50</td>
<td>14</td>
</tr>
<tr>
<td>TBA</td>
<td>75</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>AVB</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>JOB</td>
<td>38</td>
<td>38</td>
<td>23</td>
</tr>
</tbody>
</table>
Table 2—Continued

3. In general, if an appropriate functional relation between a response class and a consequence can be demonstrated, the delay between the two is irrelevant in defining the consequence as a reinforcer.

<table>
<thead>
<tr>
<th></th>
<th>TRUE (%)</th>
<th>FALSE (%)</th>
<th>OTHER (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JABA</td>
<td>75</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>JEAB</td>
<td>68</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>TBA</td>
<td>50</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>AVB</td>
<td>36</td>
<td>36</td>
<td>27</td>
</tr>
<tr>
<td>JOBM</td>
<td>70</td>
<td>24</td>
<td>6</td>
</tr>
</tbody>
</table>

5. The antecedent stimulus in scenario 2 is a discriminative stimulus regardless of the long delay between the stimulus and the response. (Please disregard the problem of appropriate history).

<table>
<thead>
<tr>
<th></th>
<th>TRUE (%)</th>
<th>FALSE (%)</th>
<th>OTHER (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JABA</td>
<td>80</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>JEAB</td>
<td>68</td>
<td>21</td>
<td>11</td>
</tr>
<tr>
<td>TBA</td>
<td>70</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>AVB</td>
<td>45</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>JOBM</td>
<td>76</td>
<td>6</td>
<td>18</td>
</tr>
</tbody>
</table>

6. The antecedent stimulus in scenario 2 is a discriminative stimulus, but its effects are dependent on verbal behavior by the colleague. (Please answer only if you responded true to question 5).

<table>
<thead>
<tr>
<th></th>
<th>TRUE (%)</th>
<th>FALSE (%)</th>
<th>OTHER (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JABA</td>
<td>88</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>JEAB</td>
<td>46</td>
<td>31</td>
<td>23</td>
</tr>
<tr>
<td>TBA</td>
<td>79</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>AVB</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>JOBM</td>
<td>54</td>
<td>15</td>
<td>31</td>
</tr>
</tbody>
</table>

7. In general, if an appropriate functional relation between an antecedent stimulus and response class can be demonstrated, the delay between the two is irrelevant in defining the antecedent event as a discriminative stimulus.

<table>
<thead>
<tr>
<th></th>
<th>TRUE (%)</th>
<th>FALSE (%)</th>
<th>OTHER (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JABA</td>
<td>70</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>JEAB</td>
<td>58</td>
<td>21</td>
<td>16</td>
</tr>
<tr>
<td>TBA</td>
<td>55</td>
<td>35</td>
<td>10</td>
</tr>
<tr>
<td>AVB</td>
<td>45</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>JOBM</td>
<td>76</td>
<td>12</td>
<td>12</td>
</tr>
</tbody>
</table>
behavior occurred, a majority of JABA (85%), JEAB (74%), and JOBM (76%) editors responded true, indicating that in this situation money did serve as a reinforcer regardless of the long delay between the behavior and the consequence. A high percentage of TBA (60%) editors also identified the money as a reinforcer. However, only 36% of respondents from AVB did so. Across all journals, 10 respondents (27%) did not answer true or false to question 1, but instead wrote an answer. All of the individuals from AVB who responded true to question 1 agreed that, if receipt of money in scenario 1 was a reinforcer for grant writing, the delayed effects were dependent on verbal behavior by the researcher. Most from JABA and TBA (76% & 75%, respectively) also agreed that the reinforcing effects were dependent on verbal behavior. However, among JOBM and JEAB editors who responded true to question 1, only 38% and 36%, respectively, indicated that verbal behavior was responsible for the reinforcing effects. In fact, 50% of the JEAB editors who agreed that the delayed receipt of money was a reinforcer stated that the effects were not dependent on verbal behavior. All of the TBA and AVB editors who answered this question chose true or false, but 12%, 14%, and 23% of JABA, JEAB, and JOBM editors, respectively, wrote a response.

With respect to reinforcement in general, 75% of
respondents from JABA responded that time delay is irrelevant in defining a reinforcer if an appropriate functional relation can be demonstrated. Seventy percent from JOBM, 68% from JEAB, and 50% from TBA agreed. Editors of AVB were less likely to take this position: only 36% of the AVB respondents agreed that time is irrelevant in defining a reinforcer.

Responses to the second set of questions (which addressed whether the stimulus in scenario 2 could be defined as a discriminative stimulus despite a ten-day time delay between the stimulus and behavior) were similar to those from the first scenario. A majority of JABA (80%), TBA (70%) JEAB (68%), and JOBM (76%) respondents indicated that the verbal stimulus functioned as a discriminative stimulus under the conditions described (question 5). In contrast, only 48% of AVB editors did so. Across journals, 10 (27%) respondents failed to answer true or false to question 5.

Of the respondents who identified the antecedent stimulus as a discriminative stimulus, 88% from JABA, 79% from TBA, and 100% from AVB indicated that the effects the stimulus had on grant writing were dependent on verbal behavior. Approximately half of the respondents from JEAB (46%) and JOBM (54%) who responded to question 6 considered the effects of the discriminative stimulus to be dependent on verbal behavior. A substantial
minority of respondents failed to answer this question true or false.

With respect to the question involving the relevance of time delay in defining an antecedent event as a discriminative stimulus in general (question 7), editors responded as follows: Seventy percent of respondents from JABA and 76% from JOBM indicated that a stimulus could serve as a discriminative stimulus regardless of the time delay. Fifty-eight percent of JEAB and 55% of TBA editors were in agreement. Of the TBA editors, 45% were willing to consider an antecedent event as a discriminative stimulus without regard to the delay between the event and the behavior.

Comments

Comments were requested for questions 4 and 8 (from respondents who answered false to questions 3 and 7 only). These questions asked "how delayed can an event be from the response in question and still be considered a reinforcer or discriminative stimulus?" Comments appeared to fall within the three categories of "A few seconds at most," "A few minutes at most," and "Limit unspecified/don't know" with the majority of answers for all journal editors falling in the "few seconds" or "unspecifed" groups. Specific comments to these questions ranged from "One second?" and "not over 30
seconds" to "No limit." Other comments included "Time is not the issue. I suspect the delay is situation and/or species-specific" and "I don't believe the length of the delay is a critical factor when dealing with events of this length." Some comments indicated that time delay may be relevant in the reinforcer relationship but not the discriminative stimulus relationship: "I answered true immediately for scenario one, but had several debates with myself before responding true to scenario two."

The results and comments of the survey indicate that there is no strong consensus among respondents about the importance of delay in defining either a reinforcer or a discriminative stimulus. Clearly this survey should not be considered indicative of attitudes of all behaviorists. Surveys in general have inherent disadvantages as a method of data collection (Bridge, 1974; Warwick & Liniger, 1975). However, the variety in the responses to the questionnaire indicates that disagreement does exist at some level regarding terms essential to behaviorism.
CHAPTER IV

DISCUSSION

Results for the present survey indicate that there is disagreement among established behavior analysts regarding the role that temporal contiguity plays in determining whether particular behavioral-environment interactions portray the control of behavior by reinforcing and discriminative stimuli. Consulting printed materials leads to a similar conclusion. It appears that most formal definitions of reinforcement (and related terms) do not specify whether delayed long-events may definitionally function as reinforcers, or whether stimuli presented long before the responses that they control may definitionally function as discriminative stimuli. Consider, for example, the following definitions of reinforcement and related terms:

Reinforcement [is] the procedure of increasing the probability of a response by following it with a reinforcer. (Chance, 1988, p. 298)

Positive reinforcement refers to the process of presenting a stimulus as a consequence of a response that results in an increase in the probability that behavior will increase in the future. (Rusch, Rose, & Greenwood, 1988, p. 217)

Positive reinforcement refers to the situation in which the presentation of some stimulus follows a response and produces an increase in the prob-
ability that the response will recur. (Seiden & Dykstra, 1977, p. 10)

Reinforcement refers to the occurrence of a "reinforcing stimulus" or "reinforcer" defined as any event that increases the probability that the behavior it follows will recur in the future. (Fantino & Logan, 1979, p. 82)

If an event follows behavior and the frequency of behavior increases, the event is a positive reinforcer. (Craighead, Kazdin, & Mahoney, 1981, p. 117)

Positive reinforcement is an operant conditioning procedure in which a response is strengthened by the onset of an event (positive reinforcer) which follows the response in time. (Poling, 1985, p. 166)

Reinforcement refers to the process in which a stimulus which follows a response increases the frequency or probability of that response occurring again under similar circumstances. The specific stimuli that affect the operant response are called reinforcers. (Scibak, 1983, p. 340)

Reinforcing stimuli increase the frequency of the responses [they] follow; they increase the probability that these responses will [reoccur] in the future behavior of the organism. (Reynolds, 1975, p. 6)

By "reinforcement" is meant an increase in responding as a function of a stimulus event following the response. The stimuli having these effects are "reinforcing stimuli" or "reinforcers." (Zeiler, 1977, p. 202)

Other definitions clearly state the relevance of immediacy:

[A] positive reinforcer is any stimulus which, when presented immediately following a response, increases the rate of that response. (Powers & Osborne, 1976, p. 89)

A positive reinforcer is an event which, when presented immediately following a behavior, causes
the behavior to increase in frequency. (Martin & Pear, 1988, p. 30)

The increased occurrence of responses similar to one that immediately preceded some event identifies that event as a reinforcer. (Morse & Kelleher, 1977, p. 176)

Michael (1988) discussed specifically the importance of immediacy in the process of reinforcement:

It is essential to emphasize the importance of the immediacy of reinforcement. Events that are delayed more than a few seconds after the response do not "directly" increase its future frequency. When human behavior is apparently affected by long-delayed consequences, the change is accomplished by virtue of the human's complex social and verbal history, and should not be thought of as an instance of the simple strengthening of behavior by reinforcement. When, for example, industrial work behavior is increased by public posting of daily productivity, this effect could not possibly be the direct result of reinforcement, because the posting occurs hours (sometimes days) after the relevant behavior. This is not to deny that such procedures actually alter the relevant behavior, but only to insist that they do it in a more complex way, which is only just beginning to be understood. (pp. 10-11)

In this passage, Michael makes the point that delayed events do not "directly" increase the future frequency of a response. Malott and Garcia (1986) also make the distinction between direct-acting and indirect-acting contingencies:

A "direct-acting contingency" reinforces or punishes the casual response. An "indirect-acting contingency" controls the casual response, but not by reinforcement or punishment of that response by the outcome in that contingency. Such a contingency does not effectively act directly because the outcome is too delayed, too small, or too improbable. (p. 4)

They elaborate on the notion of indirect-acting...
Indirect-acting contingencies cannot by themselves control behavior; but rules describing those indirect-acting contingencies can sometimes control the casual behavior, though not always reliably. However, rules usually do control the casual behavior in one type of indirect-acting along only one dimension—the dimension of delay: their outcomes are too delayed to directly reinforce or punish the casual response class. But their outcomes are of a significant magnitude and are highly probable. (p. 4)

Malott and Garcia continue with a review of literature regarding delayed outcomes controlling behavior. They concluded:

In summary, we have considered a wide range of research examining the possibility of action at a distance (distant causes) in the form of behaviorally-effective consequences. And none of these data seemed to us to point to the possibility of delayed reinforcement and delayed punishment, where that delay is significant. Thus we still see a need to find a more immediate cause for control exerted by delayed outcomes, and it seems plausible to us that rule statements act as motivating operations for an aversive condition that is escaped by compliance with the rule.... However, all these issues are sufficiently complex that we can anticipate contradictory interpretations and continued debate about the efficacy of delayed reinforcement and delayed punishment. (p. 4)

The analyses offered by Michael (1988) and by Malott and Garcia (1986) are insightful. Long-delayed consequences surely do affect human behavior, but they appear to do so indirectly, that is, through verbal mediation. Many of the respondents in the present survey recognized this. Most, nonetheless, were willing to term such consequences "reinforcers" if they strengthened behavior. In part,
this may reflect the absence of an accepted alternative designation. Although "direct-acting consequences" and "indirect-acting consequences" appear to be accurate descriptors without superfluous connotation, they do not appear to be widely used. Perhaps the behavioral community would do well to consider adopting them, or similar terms (e.g., direct-acting reinforcement, indirect-acting reinforcement).

In general, it appears that formal definitions of "discriminative stimulus" usually, although not invariably, specify closeness in time between the SD and the discriminated operant as a defining feature.

For example,

discriminative stimuli, precede and accompany operants.... The presence of particular discriminative stimuli increases the probability of those operants which have previously been reinforced in the presence of the same discriminative stimuli. (Reynolds, 1975, p. 6)

Discriminative stimuli (SD's) are stimuli that precede and accompany operant responses. Such stimuli are called "discriminative" because they set the occasion on which operant responses are reinforced. (Fantino & Logan, 1979, p. 82)

If an event is a stimulus in the presence of which the occurrence of a specified response will be reinforced, then that event is called an SD. (Martin & Pear, 1978, p. 105)

When a stimulus condition is identified as an SD there is always the implication that it controls some behavior, which means that some particular type of response is stronger in the presence than in the absence of that stimulus condition. (Michael, 1980, p. 47)
There are, of course, situations where the term "discriminative stimulus" might be applied to an antecedent stimulus long removed from the response it controls. Scenario 2 in the present survey is a case in point. Such antecedent stimuli appear to control behavior indirectly, and it may be useful to adopt a conventional designation, other than SD alone, for them.

While the debate in this area continues, the issue remains of the importance of temporal contiguity in defining the terms reinforcer and discriminative stimulus. It would seem that a differentiation between stimuli which appear to control behavior that are removed in time and those that are within close temporal limits of the behavior would allow for a more rigorously defined terminology. Perhaps the use of the terms direct-acting and indirect-acting could be used as qualifiers for both terms. Qualifiers such as these may provide more complete definitions and facilitate clearer communication among those in the field.
Appendix A

Journal Editorial Staffs
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Appendix B

Questionnaire Sent to Journal Editorial Staffs
Scenario 1. There appears to be a functional relation between grant-writing and receipt of grant money: A researcher receives grant money six months after submitting a grant application and the time and effort spent in grant writing subsequently increases.

1. Receipt of the money in scenario 1 is a reinforcer regardless of the long delay between the behavior (grant writing) and its consequence.
   A. True
   B. False

2. Receipt of the money in scenario 1 is a reinforcer, but its effects are dependent on verbal behavior by the researcher. (Please answer only if you responded true to question 1).
   A. True
   B. False

3. In general, if an appropriate functional relation between a response class and a consequence can be demonstrated, the delay between the two is irrelevant in defining the consequence as a reinforcer.
   A. True
   B. False

4. If you answered false to question 3, how delayed can an event be and still be classified as a reinforcer?

Scenario 2. There appears to be a functional relation between an antecedent verbal stimulus and grant writing: A researcher tells a colleague "submit a grant to NIH and you will surely be funded" and ten days later the colleague begins to work on such a grant.

5. The antecedent stimulus in scenario 2 is a discriminative stimulus regardless of the long delay between the stimulus and the response. (Please disregard the problem of appropriate history).
   A. True
   B. False

6. The antecedent stimulus in scenario 2 is a discriminative stimulus, but its effects are dependent on verbal behavior by the colleague. (Please answer only if you responded true to question 5).
   A. True
   B. False
7. In general, if an appropriate functional relation between an antecedent stimulus and response class can be demonstrated, the delay between the two is irrelevant in defining the antecedent event as a discriminative stimulus.
   A. True
   B. False

8. If you answered false to question 3, by how long can an antecedent stimulus precede a response and still be classified as a discriminative stimulus?
Appendix C

Human Subjects Institutional Review Board Approval Letter
Date: December 10, 1990

To: Julie Ann Fillhard

From: Mary Anne Bunda, Chair

Re: HSIRB Project Number: 90-12-24

This letter will serve as confirmation that your research protocol, "Temporal Contiguity as a Defining Feature of the Terms Reinforcer and Discriminative Stimulus: A Survey of Journal Editorial Staffs," has been approved under the exempt category of review by the HSIRB. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the approval application.

You must seek reapproval for any changes in this design. You must also seek reapproval if the project extends beyond the termination date.

The Board wishes you success in the pursuit of your research goals.

cc: Jack Michael, Psychology

Approval Termination: December 10, 1991
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