HUMAN GEOGRAPHY AND BEHAVIOR ANALYSIS:
AN APPLICATION OF BEHAVIOR ANALYSIS TO THE EXPLANATION
OF THE EVOLUTION OF HUMAN LANDSCAPES

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Human geography is a social science concerned primarily with data-based analyses and the utilization of various theoretical constructs mostly developed in other social science disciplines. A discussion of the character of human geography supports the suggestion that human geographic analyses of landscapes will benefit from employment of additional theories, specifically from a judicious interpretation and application of work in behavior analysis. Human landscape-making behavior can be explained using the concepts and principles of behavior analysis as developed in psychology and as applied in sociology and anthropology. For human geographers, this suggestion is at variance with most other recent conceptual contributions that emphasize alternative social theorizations, such as those associated with Marxism, humanism, or critical science. A preliminary application of behavior analysis to one specific research issue, namely, 19th-century agricultural landscape change in southeastern Australia, using the concepts of operant conditioning, establishing operations, rule-governed behavior, and metacontingency, indicates the value of the approach.

A principal goal of human geography is identification of the variables that lead human behavior to shape landscapes in particular ways. This paper proposes that the concepts and techniques of behavior analysis can be applied to help achieve this goal. One specific human geographic research problem involving the analysis of the evolution of a built landscape is discussed in both traditional human geographic and behavior analytic terms.

Human geography has traditionally been linked with physical geography in the larger discipline of geography. The distinguished British

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Norton, Haggett (1990), noted that geography occupies "a very puzzling position within the traditional organization of knowledge . . . . It is neither a purely natural nor a purely social science" (p. 9). Further, human geographic research emphasizes methods and approaches such that the core subject matter, human behavior as it relates to natural and built environments, is seldom explicitly acknowledged by practitioners. Indeed, although the encyclopedic Dictionary of Human Geography defines human geography as being "concerned with the spatial differentiation and organization of human activity and with human use of the physical environment" (Johnston, Gregory, & Smith, 1994, p. 259), there has been little explicit theoretical discussion of human behavior. These circumstances of disciplinary history have resulted in two consequences. First, human geographers are increasingly uncertain as to the legitimate content of human geography, and, second, there has been a general failure to significantly advance theory construction. Both of these circumstances are attested to by such leading practitioners as Harvey (1990) and Johnston (1991). Thus, concerning the character of human geography, Harvey (1990) noted that: "Our seeming inability or unwillingness to resist fragmentation and ephemerality suggests a condition in which something is being done to us by forces beyond our control" (p. 431), while, concerning theoretical discussions of human geographic landscapes, Johnston (1991) found it necessary to "state the case again" (p. 253). It is argued that both of these failings may be overcome if human geographers become familiar with the concepts and techniques of behavior analysis.

The Academic Discipline Of Human Geography

Definition

The basis of the word, geography, is Greek: "geo" means "the world," "graphei" means "to write." Literally, then, geographers are involved in writing about the world. This task has included concerns both with the natural world and with the human world, and geography has often striven to be a truly integrating field, integrating natural and human components. Today, human geographers write about the human world, and the key subject matter of human geography is human behavior, specifically human behavior as it affects the earth's surface. Expressed in this way, the subject matter of human geography is similar to that of the various other social sciences, all of which are concerned with human behavior (for a fuller introductory statement, see Norton, 1995a).

History

The earliest geographic descriptions were in the form of local area maps with the earliest preserved maps dating from about 4000 BCE. Because they experienced geographic mobility, the Greeks initiated a descriptive geographic tradition, including mapping the known world. From the 5th to the 15th centuries CE, only sporadic and limited
advances in geographic knowledge were achieved in Europe whereas in China, from about 2000 BCE onwards, and in the Islamic world, from the 7th century CE onwards, geography flourished; exploration, mapping, description all proceeded apace. From the 15th century to the 19th century, Europe expanded overseas, works of geographic description reappeared, and cartography was transformed with new map projections. Geography was established as a university discipline beginning in Prussia in 1874. Other countries rapidly followed suit, and the first North American department of geography was established at the University of Chicago in 1903.

Recurring Themes In Human Geography

There are three recurring themes in human geography. First, the human world is the ever-changing result of individual and group human actions, working within natural and institutional frameworks. Thus, human geographers often focus on the evolution of the human world with reference to people, their cultures, and natural environments. It is usual to describe this human world as a landscape, the first recurring theme. There are two closely related aspects of landscape. It is the human addition to and modification of physical geography, and, as such, landscape includes crops, buildings, lines of communication, and other visible, material, features. Landscape also has significant symbolic content in that it has cultural significance. It is hardly possible, for instance, to view a church without appreciating that it is much more than a mere landscape feature; it is a reflection of the creators of that feature.

Second, human geographers often divide large areas into smaller areas that exhibit a degree of unity. Such divisions are regions, the second recurring theme. A regionalizing process is essentially one of classifying, and it may employ one or more variables. The fact that we are able to regionalize tells us that human landscapes make sense, that they are not random assemblages of features. Groups of people occupying particular areas over time create regions as human landscapes that reflect their occupancy and that differ from other landscapes.

Third, understanding the human world requires that we explain why things are where they are; location is the final recurring theme. For example, towns in an area may be spaced at relatively equal distances apart, or industrial plants may be located close to one another. Such questions are addressed with a typical focus on theory construction, models, hypothesis testing, and quantitative methods (for a more detailed account of these themes, see Norton, 1995a).

These three recurring themes reflect three separable but necessarily overlapping approaches: human landscape geography, regional geography, and spatial analysis. One common thread is that the human world is ever-changing and hence human geography, regardless of the specific theme adopted, typically incorporates a time dimension. Landscapes change in content and meaning, regions increase or lose their distinctiveness, and locations adjust to changing circumstances.
**Theory In Human Geography**

The history of human geography includes an overriding concern with description; theories and concepts being employed sparingly. The principal contemporary theoretical inspirations include positivism (not including behaviorism), humanism, Marxism, and critical science, but many human geographers concerned with the analysis of changing landscapes recognize a need for further theory construction. Wagner (1990) noted that the “lack of solid theoretical foundations remains a formidable weakness of social and cultural geography” (p. 41) and asserted that “a theoretically well-grounded, intellectually vigorous, and practically effective social and cultural geography might well assume, in time, a major role in guiding and guarding the evolution of humanity’s environments” (p. 41). Most tellingly, Wagner (1994) argued that human geography “deserves a much deeper, clearer, more operational conception of human behavior and development” (p. 5).

The question arises: Where can human geographers turn in seeking to enhance the theoretical basis of their discipline? The answer proposed is prompted by the suggestion that the “different ‘areas’ of human behavior that are covered by the various social sciences form an intellectual division of labour which can be justified in only a very general way” (Giddens, 1987, p. 9). Thus, because the subject matter of human geography is similar to that of the other social sciences, namely some aspect of the study of human behavior, it is appropriate to turn to those other disciplines. One such discipline that holds much promise for the human geographer is behavior analysis. B. F. Skinner argued that most behavior is controlled by its consequences, and behavior analysis, as pioneered and developed by Skinner, is a comprehensive approach to the study of behavior (Skinner, 1974).

**Bases For A Behaviorist Human Geographic Theory**

*Concepts and Principles of Behavior Analysis*

The Skinnerian tradition in psychology is concerned with understanding the relations between behavior and the circumstances in which it occurs, with a principal goal being improvement in our quality of life. Three major research areas have developed within this tradition: the experimental analysis of behavior contributes to the development of new and modified concepts and principles; the conceptual analysis of behavior focuses on historical, philosophical, and theoretical issues and contributes to the development of concepts and principles; the applied analysis of behavior focuses on using the concepts and principles for practical purposes and provides a means for evaluating their relevance.

*Operant conditioning.* Behaviors that operate on the environment to generate consequences, and are in turn controlled by those consequences, are called operant behaviors. The operant paradigm proposes that any situation in which operant behavior occurs can be conceptualized as involving three events, namely the antecedent
conditions (also called discriminative stimuli or environmental context), the operant behavior, and the consequences (reinforcing or punishing stimuli for responding). The antecedent conditions lay the basis for the operant but do not impel it; the operant is functionally defined with respect to antecedents and consequences; and, the consequences select behavior. Together, these three comprise a contingency.

Although these concepts are the basis for much behavior-analytic research, contemporary work incorporates a range of concepts in addition to those related to the three-term contingency. The additional, and still developing, concepts greatly increase the value of the approach, especially for the type of application that is being attempted in the present paper. Four of these additional developments are summarized.

Establishing operations. Although it has been usual to classify operant events using the three-term contingency, it is recognized that it is both possible and useful to distinguish between antecedent events that are most correctly described as discriminative stimuli and antecedent events that are most correctly described as establishing operations. This distinction is based on function: Antecedent events that have discriminative functions are discriminative stimuli, whereas those that have motivative functions are establishing operations. Deprivation can be identified as an establishing operation, where deprivation refers to the time during which a reinforcer is not experienced. Specifically, an establishing operation is an event or stimulus that momentarily changes both the reinforcing effectiveness of other events and the frequency of occurrence of behaviors that have had those other events as consequences.

A distinction can be made between an unconditioned and a conditioned establishing operation. An unconditioned established operation evokes behavior that is genetically determined, whereas a conditioned establishing operation affects behavior because of prior learning. Consider the following example of a conditioned establishing operation: If a woman asks a man who is attracted to her to write down his phone number so that she may call him later that day, this will change his behavior by making a pen reinforcing to him, that is, he wants a pen (Martin & Pear, 1996, p. 116). Thus, an establishing operation is a variable that affects both the likelihood and the direction of behavior.

Both discriminative stimuli and conditioned establishing operations exert control over behavior by changing the momentary frequency of behavior, but only the conditioned establishing operation changes the momentary effectiveness of consequences as reinforcers. Distinguishing between established operations and discriminative stimuli is useful because it allows for the incorporation of motivation into a behavior analysis. As Michael (1993) noted, for behavior to occur, "the behaver must know how and must also want to do it" (p. 191).

Cultural practices and metacontingencies. Radical behaviorism has proven influential in some other social science disciplines; indeed, for Homans (1987), the propositions of behavioral psychology are the
general explanatory propositions of all the social sciences. Behavioral sociology is an important, but certainly a minor, concern in contemporary sociology (see Kunkel, 1975; Michaels & Green, 1978; Ritzer, 1975). Close conceptual links between radical behaviorism and Marvin Harris's cultural materialism (see Harris, 1964, 1979) have been recognized by several psychologists (for detailed and sympathetic reviews of these links, see Glenn, 1988; Lloyd, 1985). Radical behaviorism is concerned with the identification of the principles of individual behavior and talks about reinforcers and punishers, while cultural materialism is concerned with group behavior and talks about benefits and costs. Both argue that behavioral responses to environmental variables precede mental rationalizations as to the reasons for responses.

Some behavior analysts have proposed that operant methodology can be applied not only to individuals but also to groups. For example, Pierce (1991) noted that the "principles of behavior that describe individual action presumably operate when people act in a political context or in economic circumstances" (p. 13), and Lamal (1991) asserted that "behavior analysis . . . has, with few exceptions, been limited to a consideration of small groups of individuals in circumscribed and usually controlled settings . . . . the working assumptions, constructs, and methods of behavior analysis can, and should, now be extended to societies and cultural practices" (p. xiii). The operant behavior of group members is a set of coordinated actions, often called a cultural practice, with respect to some common environment. "Cultural practices involve the operant behavior of many people who compose the members of a culture" such that they are "functionally similar to operants at the individual level" (Pierce, 1991, p. 28). This is an important idea for the human geographer whose interest in human behavior is typically with the coordinated behavior of members of a group.

Application of operant methodology at the group level characteristically involves the identification of metacontingencies as the specific relations between cultural practices and related outcomes (Glenn, 1988). A metacontingency exists if (a) the object of analysis is the cultural practices of some identifiable collection of individuals, a group; (b) the cultural practices that have consequences for the collective performance of the group can be identified; (c) a functional relation between group performance and consequences for the group can be identified; and (d) antecedents of cultural practices can be identified. "Much like an individual operant contingency, a metacontingency requires that changes in consequences influence group performance, and that the presence of antecedents that are correlated with reinforcing consequences (adaptive outcomes for the group) increase the probability of selected patterns of response by the group" (Redmon & Wilk, 1991, p. 107).

Delayed outcomes and rule-governed behavior. Contingencies can be divided into two general classes, depending on the relationship between the outcome and the behavior that generates that outcome.
Direct-acting contingencies involve outcomes that function as behavioral consequences for the causal response class; such outcomes are effective because they are immediate and sizable. For example, the principle of positive reinforcement states that, "if, in a given situation, somebody does something that is followed immediately by a positive reinforcer, then that person is more likely to do the same thing when he or she next encounters a similar situation" (Martin & Pear, 1996, p. 29). Indirect acting contingencies involve outcomes that do not function as effective behavioral consequences for the causal response class; such outcomes are ineffective because they are too delayed, too improbable, or too small (although the outcomes may be of cumulative significance).

Application of operant methodology in the typical group-focused human geographic context requires recognition that the material outcomes are usually delayed, that is, there may be no direct-acting contingencies or metacontingencies. Behavior analysts have addressed the problem of delayed outcomes in several ways. One argument is that knowledge of the delayed outcome is itself sufficient to permit delayed outcomes to act as reinforcers. Another view holds that the correlation-based law of effect plays a key role, in that responding is maintained if rewards are delivered at an increased rate during those periods when responding occurs at an increased rate, even though the rewards do not follow the responses immediately (Baum, 1973). In the present discussion, the problem of delayed outcomes is overcome by the inclusion of the concept of rule-governed behavior, which refers to behavior that accords with established verbal cultural rules or norms (Chase & Danforth, 1991; Malott, 1988; Vaughan, 1989). Thus, the cultural rule functions as the antecedent condition. In this formulation, individuals are responding as group members to the rule in situations in which the consequence is delayed; "human beings optimize outcomes by following instructions or rules that specify the outcomes of their actions" (Malott, 1989, p. 283).

The appropriate metacontingency is as follows: antecedent conditions (cultural rules)—operant behavior (cultural practices)—consequences (typically a delayed reinforcer). However, "a problem arises when an attempt is made to explain how rules govern behavior" (Hayes, 1991, p. 6). There are various answers to this problem, including that concerned with the study of relations between responding and stimulating (see Hayes, 1991). Malott and Malott (1991, p. 240) provided a concise summary of the theoretical analysis of rule-governed behavior that included two points that are critical to this research: first, rules that describe contingencies that are indirect-acting typically control behaviors provided that the consequences, although delayed, are both probable and sizable; second, rules usually control behavior when performance is self-managed.

In this discussion, it is also argued that there are direct-acting contingencies related to both the statement of rules and the following of
rules. There are at least three general types of reason why rules are followed, notwithstanding that they identify delayed consequences (Martin & Pear, 1996, pp. 209-210). First, even though the reinforcer identified in the rule is delayed for an individual, it may be the case that other group members provide immediate direct-acting consequences for the individual who follows the rule. In this way, rule-following is immediately reinforced. Second, an individual may reinforce their own rule-following behavior by, for example, anticipating the delayed outcome (this is a form of self-management). Third, the previous reinforcement experiences of an individual may mean that rule-following is immediately reinforced.

A rule might be more appropriately described as a conditioned establishing operation rather than as a discriminative stimulus. Martin and Pear (1996, p. 217) provide the example of a parent who offers a teenage daughter points for assisting in the garden with a fixed number of points earning the daughter use of the family car at the weekend. In this case, the rule linking work in the garden with use of the family car is a conditioned establishing operation rather than a discriminative stimulus; this is because the rule influences the daughter to want points and tells her how to earn points, whereas a discriminative stimulus is a cue that tells a person what to do in order to get what they already want.

Context. Skinner and others have recognized that the basic formulation of the three-part contingency is not necessarily adequate because there is a need to incorporate context. As expressed by Morris (1992), context is defined as the “conditions that change the relationships between stimuli and responses” (pp. 13-14). For example, when one is driving in Great Britain, the highway dividing line is an antecedent condition for the behavior of steering to the left of it (which has several consequences, including avoiding an accident), while in the U.S.A., the dividing line is a cue to steer to the right of it (Martin & Pear, 1996, p. 117). More generally, the probability of an individual following a rule varies according to the source of the rule. If the source is a person, group, or institution that the individual respects given the nature of the rule, then the probability of rule-following is higher than if the source is unreliable, unfamiliar, or lacking respect. Martin and Pear (1996, p. 211) noted that we are more likely to follow career advice received from a friend than from a stranger, but we are more likely to follow route directions from a stranger who knows the area than from a friend who does not know the area.

Summary. A basic tenet of behavior analysis, namely that operant conditioning is a process that involves the environment strengthening those behaviors that are adaptive and effective in achieving reinforcers and avoiding or escaping from aversive stimuli, has applicability outside the conventional areas of concern to psychologists. Similarly, some more advanced behavioral concepts, especially those of establishing operations, of rule-governed behavior, and of context, can be applied in areas of interest to other social scientists. These are principal reasons
why human geographers need to consider the research tradition of behavior analysis. Further, both behaviorist theories in sociology and cultural materialism in anthropology have succeeded in applying some important behavioral principles to groups. I believe that human geography will also benefit from applications of behavior analysis. That is, human geographers might profitably employ a behavior-analytic framework to facilitate the analysis of problems relating to the creation of human landscapes by relatively distinct groups of people.

Human Geographic Interest In Behavior Analysis

There are three reasons why human geographers have not been attracted to the philosophy of radical behaviorism and have not employed the concepts and techniques of behavior analysis. First, since about 1970, a principal trend in human geography and in the social sciences in general has been to reject objectivist philosophies in favor of subjectivist philosophies. "No matter how much we prefer to focus on overt behavior and to eschew mentalistic concepts, we cannot emulate the extreme behaviorist stance, rejecting theoretical structure in general and unobservable variables in particular" (Pipkin, 1979, p. 311). Human geographers have chosen alternative procedures to those of behavior analysis because of their predilection for philosophies other than radical behaviorism.

Second, radical behaviorism and behavior analysis have been neglected by human geographers because of some misinterpretations, especially concerning differences between methodological behaviorism and radical behaviorism. It has not been recognized that there are several versions of behaviorism, and that behavior analysis is an approach to the study of human behavior that is identified with radical behaviorism. According to Gold and Goodey (1984), "behaviourism viewed human behaviour in terms of stimulus-response relationships in which specific responses could be attached to given antecedent conditions" (pp. 544-545). This is not correct in the case of the radical behaviorism of Skinner which consistency relegates the stimulus-response label to Pavlovian conditioning, emphasizing the study of responses that are not necessarily elicited by any stimulus but rather are under the influence of consequences. Human geography literature does not include discussions of the several versions of behaviorism, with the inevitable result of confusion and misunderstanding. Such a state of affairs is not surprising given that there continue to be debates about the character of radical behaviorism within the discipline of psychology (see Catania, 1991; Mahoney, 1989).

Third, in addition to the fact that the human geography literature does not include informed discussions of behavior analysis, the literature of the discipline of behavior analysis is relatively inaccessible to the human geographer. Most of the relevant conceptual advances and results of experimental work are published in specialist journals, such that recent modifications of and additions to behavior analysis, including...
the concepts of establishing operations, direct-acting and indirect-acting contingencies, rule-governed behavior, and context, that serve, at least partly, as reactions to criticisms from cognitive psychology, are unlikely to be read by a group of scholars already unfavorably predisposed to the research tradition of behavior analysis. Further, the terminology of behavior analysis can be difficult for scholars from other disciplines to penetrate (Catania, 1993).

Landscape Change In 19th-Century Southeastern Australia

The Problem

This application of the concepts and principles of behavior analysis to a human geographic research problem is viewed as a preliminary attempt in what is an important theoretical endeavor. The specific research problem analyzed is that of the creation of a pastoral landscape and the subsequent transition to an arable landscape in 19th-century southeastern Australia. Why did British settlers move away from the established coastal region to initiate a pastoral economy beginning in the 1820s? One answer is that expansion by pastoralists, known as squatters, inland from Sydney and later Melbourne was partly motivated by the demand for wool prompted by industrialization in England and partly motivated by the desire to occupy land (Abbott, 1971). Why did arable farmers, known as selectors, succeed in displacing the squatter pastoral economy after about 1860? One answer is that there was a change in social circumstances, favoring an increased density of settlement, and changes in world prices that resulted in wheat replacing pasture (Norton, 1995b). For both of these landscape changes, factual material is presented, an accepted human geographic explanation is discussed, and a behavior analysis is conducted.

Two points need to be acknowledged prior to presentation of this material. First, the human geographic explanations and the behavior analyses rely on the identical factual material. Second, the two accounts are not substantially different in terms of the logic of the arguments, excepting that the behavior analyses emphasize the study of responses that are not necessarily elicited by a stimulus, but are rather under the influence of the consequences of the responses. Given these circumstances, the concluding section of this paper includes a rationale for favoring the behavior analyses over the more typical human geographic analyses.

The Squatting Phase

The period before the onset of the squatting phase, from the first British settlement in 1788 to about 1820, is not of great importance to an understanding of subsequent landscape changes. The initial settlements were isolated penal centers and the total population by 1820 was only about 35,000. Exports were negligible and domestic demand limited. In this early period, Australia was a penal colony in the eyes of the British,
and hence there was no reason to initiate economic change by means of labor and capital movement. For economic change to occur it was necessary for Australia to become involved in trade with Britain and this involvement began with the onset of pastoral activities and the emergence of wool as a staple. The facts of this involvement are as follows.

Wool was a vital raw material for British industry and the economic value of this staple, to Britain not Australia, was emphasized in an 1822-23 official report which stated that wool producers should receive preferential treatment (Goodwin, 1974, p. 9). Following the 1814 crossing of the Blue Mountains west of Sydney, the settlement of the interior proceeded with "comparative ease and astonishing rapidity" (Langford-Smith, 1968, p. 99). This expansion occurred without any roads, without security of tenure, and in circumstances demanding self sufficiency. The result was the emergence of a relatively distinct society, united by a common way of life and by the inevitable land conflicts with governments. The colonial government viewed such expansion with some concern for administrative reasons and because it was felt that land claims should not be excessive for both economic and social reasons; they were unable, however, to limit movement, and it was during the period through to 1850 that expansion was most evident (Jeans, 1972, p. 91; Perry, 1963, p. 122). Most of this squatter pastoral occupation was technically temporary and illegal until the 1836 introduction of annual pastoral licenses. At least through the 1860s, squatting dominated the economic, social, and political environments of southeastern Australia.

A traditional human geographic analysis. To explain the expansion of the squatting frontier, human geographers have acknowledged the importance of global, regional, and local factors, and have focused explicitly on identification of the causes of landscape change. Globally: It is evident that, almost from the beginning, Australian economic change was closely tied to an industrializing world system. Pastoral expansion could not begin until it became clear that there was a market for the product. Regionally: Southeastern Australia was seen as an empty land, well suited to sheep farming. "The large area of good land, in its southeastern corner was Australia's passport to absorption into the process of international economic growth" (Sinclair, 1976, p. 2). Locally: The specific details of frontier expansion related to the technology of pastoral occupation and to the economic and social aspirations of those involved. "The fast rate of pastoral expansion into new territory can be explained not only by the large size of runs, but also by the low carrying capacities, the dislike of being hemmed in and the prodigal faith that there was good land further out" (Jeans, 1972, p. 136). Thus, there were a variety of causes that resulted in individuals making the decision to move beyond the initial settled areas and to take up land for the purpose of pastoral occupation.

This traditional human geographic analysis is plausible, in that it
addresses a series of relevant considerations. But it is limited in scope because it is not framed in general conceptual terms that might also apply to a variety of other situations of human landscape evolution. Although it is not inconsistent with a behavior analysis in principle, in practice it is much less sophisticated. It is not framed within a well developed and continually refined set of concepts and principles, and it does not enjoy close links to a philosophical context.

A radical behavioristic analysis. Specifically, the traditional human geographic analysis is inadequate because it does not address the issue in terms of behavioral contingencies. Consider a behavior analysis as follows.

The antecedent conditions include a natural environment well suited to pastoral activity, and economic and social environments that encouraged pastoral activity as the norm. The natural environment serves as a discriminative stimulus, in that it is a cue informing squatters what to do in order to get what they already want, namely economic success. The economic and social environments are better described as establishing operations, in that they motivate the specific behavior of pastoralism. Specific examples of establishing operations are the presence of neighbors practicing pastoralism, and market prices received for wool; because these circumstances indicate that pastoralism is an economically successful activity, they serve to encourage that activity. More generally, deprivation, the absence of the reinforcer of economic success, is an establishing operation.

Squatters were responding to the overseas demand for a staple, wool, such that the decision to be a sheep farmer is an example of an operant that results in a reinforcer. The consequences that served to reinforce the behavior included occupation of land and economic success. The reinforcer of economic success is not, of course, direct-acting. However, there are direct-acting contingencies related to the statement of rules that specify the consequences of sheep farming, and the behavior of an individual also involved imitating the behavior of other group members. Expressed in this way, the behavior of squatters is related to both the consequences and the antecedent conditions.

The decision to be a sheep farmer was likely a form of rule-governed behavior, where a rule is a verbal description of a behavioral contingency. The goal of economic success can be considered as a rule. The point made by Malott (1989) with regard to the agricultural behavior of planting applies in the present context of pastoralism: "The delay between intentional planting and harvesting almost insures a need for the behavior of planting to be under the control of delayed outcomes" (p. 282).

With the above generalizations as a basis, a more detailed radical behaviorist analysis is now outlined as follows. First, the antecedent conditions, including establishing operations and reinforcement patterns over time, influenced squatters to formulate new rules concerning sheep farming. The concept of context is important, affecting the likelihood of
rule-following behavior. Because others who follow the rules, primarily existing squatters, are individuals that the new sheep farmer respects and wishes to emulate, the probability of rule-following is high.

The antecedent conditions are well summarized in an official report prepared at the beginning of the pastoral phase in 1827:

The unlimited extent of ungranted Land, the abundance and goodness of the Natural Grasses, and the favorable nature of the Climate for the production of Wool, added to the comparatively higher proportion of labour and expense essential to the cultivation of the Soil, have naturally attracted a great majority of the Capital and intelligence in the Colony to Grazing.... On the subject of the adaptation of this Colony for producing fine Wool, there is now only one opinion, and the increased activity of the Spirit of improvement in this pursuit leaves nothing to be desired. (quoted in Abbott, 1971, p. 58)

The suitability of both the physical and economic environments for pastoralism, explicitly identified in the above quote, prompted the formulation of rules that focused on the financial benefits of pastoralism. For example, “Because appropriate land is readily available, I will succeed commercially if I become a sheep farmer.” Similarly, “Because wool prices in the local markets are high, I will succeed commercially if I become a sheep farmer.” Pastoral activity was likely encouraged by a second set of antecedent conditions that also prompted the formulation of rules. New immigrants viewed pastoralism, specifically the claiming of an extensive land area, as offering the opportunity for both social and political advancement. For example, “Because the occupation of land is associated with social prestige and power, I will enhance my personal and my family status if I become a sheep farmer.”

Second, there were delayed consequences that supported the decision to become a sheep farmer. Examples include witnessing their own flocks enlarge through natural increase, the high quality of the fleeces, and the stable or perhaps increasing prices at market centers. Even more delayed consequences were those of economic success and social and political advancement. The historical record confirms that these consequences were usual, as amply evidenced by Waterson’s (1968) reference to the fact that squatters in the Darling Downs area of Queensland “coined money” (p. 13), and, in areas such as the Riverina in southern New South Wales, by the rise of a “squattocracy,” exercising political power and often in control of the press (Buxton, 1967, p. 129). One indication of both the economic and political power that Riverina squatters achieved was their petitioning in 1861 for the creation of a new squatter colony separate from the colony of New South Wales. This attempt was unsuccessful, not because the squatters were weak, but because the British government were no longer interested in additional colony creation.

Third, there were direct-acting contingencies related to both the
statement of rules and to the following of rules, some of which were likely social in nature. For example, when one squatter explains to a second squatter the reasons for his decision to become a sheep farmer, the second squatter will appreciate the logic of the decision. Once such a decision is made, other direct-acting contingencies probably supported the following of rules, namely the daily activities of functioning as a sheep farmer. Helping a ewe give birth would be reinforced by the addition of one more lamb to the flock. Killing of predators would be maintained through escape and avoidance contingencies. Moreover, some of the delayed consequences with respect to the decision to become a sheep farmer (cited above) likely served as direct-acting reinforcers for ongoing sheep farming activities. Examples include witnessing flocks increase and observing the high quality of fleeces. Also, modeling of pastoral activity likely influenced the behavior of new squatters. The relevance of rules favoring pastoralism was evident to a new squatter who was able to observe and imitate existing squatters who were experiencing the reinforcing consequences relating to economic prosperity and to both political and social success. Overall, direct-acting contingencies encouraged sheep farmers to keep emitting pastoral behavior until the reinforcing consequences specified by the rules came into play.

To summarize, pastoralism qualifies as a cultural practice, a set of coordinated actions with respect to some common environment. The squatters qualify as a permaclone (Harris, 1964); that is, the individuals composing the group change over time, but there is a continuity to the cultural practices of the group until those practices no longer achieve the desired outcome. Thus, this metacontingency is a set of circumstances, namely an environmental context, a set of behaviors, and consequences, that make the continuation of pastoralism probable. Squatting was in complete accord with the contemporary economic circumstances. Settlers behaved as one during the squatting expansion phase, from about the 1820s to about the 1860s.

The Selection Phase

Important changes to both the economic and social environments occurred beginning in the 1850s. Increasing knowledge of the physical environment included the discovery and rapid exploitation of alluvial gold in large quantities. These discoveries proved to be a significant discontinuity in Australian development. The economic status quo was disturbed with massive population increases and increased demand for food and services. After 1856, employment in gold mining decreased and the result was a population attracted by gold and with little prospect of subsequent employment (Sinclair, 1976). The wool industry was incapable of absorbing the surplus labor, and retention of the population attracted by gold necessarily resulted in a situation that could not simply return to the pre-gold era. Indeed, rapid immigration continued throughout the 1860s, adding to the pressures already faced.
The three colonies of southeastern Australia (New South Wales, Victoria, and South Australia) were thus faced with a difficult problem after the brief gold phase, namely, "how to reconcile a new social situation with an old economic fact" (Fitzpatrick, 1941, p. 123). How were the needs of the new population to be accommodated, given that the labor requirements of the activity that dominated the economic landscape, pastoralism, were minimal? The answers were varied and had differing levels of success in the three colonies, but most involved some form of attack on squatters who were generally regarded as unreasonably wealthy and with inappropriately large land holdings.

Land laws were the basic solution in all three colonies. The lack of a single federal system of land disposal, as in the United States, meant that each colony introduced legislation. The details of the land acts varied, but the key aim in all cases was to promote arable occupation at the expense of pastoral occupation. The pre-1860 location of squatters meant that South Australia had the least severe problem, while Victoria and New South Wales had the most severe problems, both facing a powerful group of squatters. Victoria also faced the largest labor surplus.

A traditional human geographic analysis. The characteristic approach to analyzing this changing human landscape, the transition from pasture to wheat, is similar to that already described for the expansion of the squatting frontier. Analyses focus on global, regional, and local factors and emphasize the identification of causes. Globally: Demand for wheat increased because of a growing European market, and because of a general move from rye to wheaten flour. Further, decreasing distance friction, both oceanic and continental, was important for all the new wheat regions, but especially so for Australia, given the distance to market and the inland location of the wheat belt. Regionally: The interior of southeastern Australia is characteristic of those areas that emerged as major wheat producers in the late 19th century. Similar areas included the Canadian prairies, the American plains, and parts of Argentina and Russia. All of these areas were sparsely populated until they experienced immigration of wheat farmers after about 1860. Locally: A market for wheat was appearing and the new land laws encouraged arable occupation. Wheat gradually replaced wool in the later 19th century such that, in suitable areas, wheat was the economically logical enterprise.

The decision to be a wheat farmer was not a difficult one, but this does not mean that wheat cultivation was straightforward. Success was not assured, despite the various land acts which aimed to create stable and prosperous agricultural landscapes and societies. Selectors often had to compete with squatters for land ownership; they frequently had inadequate capital; they sometimes located at inappropriate distances from railways; they often suffered from environmental hazards; and they also failed sometimes because of a lack of any prior experience. In a discussion of selection in Victoria, Dingle (1984) considered it to be the "survival of the fittest" (p. 70).
A radical behavioristic analysis. The important changes that occurred beginning in the 1850s can be considered as changes in the antecedent conditions and in the consequences of behavior. Because of these changes, a different behavior was favored, namely being a wheat farmer. Hence collective behavior changes and landscape changes—a different place is created. The concept of context is relevant in that the natural environment in which pastoralism occurred is the same natural environment in which wheat farming occurred. The natural environment is unchanged but the context, namely the economic, social, and political conditions, is changed. Again, as with the previous discussion, this behavior analysis uses the same factual base as does the human geographic analysis but it is more specific because it is structured in terms of behavioral contingencies.

To summarize the key changes in antecedent conditions: (a) what was happening in southeastern Australia was linked to British economic needs in particular, (b) the ability of wheat to replace wool was tied to the world prices for each product; (c) there was a general awareness within Australia that the economy required diversifying such that land capable of wheat cultivation should be so used; (d) there was a need to feed the rapidly increasing mining population and to provide economic opportunities for miners after the mining frontier moved on; (e) there was a growing political impetus to provide land for the poor which was a major cause for new land laws from 1860 onward that aimed at replacing squatters with selectors; (f) a general realization to the effect that wheat was cultivable in areas previously regarded as marginal emerged during the final decades of the 19th century; (g) new agricultural techniques began to facilitate economic wheat cultivation in the sometimes difficult physical environment of the southeastern Australian interior; (h) rapidly growing urban areas opened up a new regional market for wheat; and (i) an expanding railroad network provided links between the wheat areas and markets.

The antecedent conditions include a natural environment suited to wheat, and economic, social, and political environments that encouraged wheat farming. The natural environment serves as a discriminative stimulus, in that it is a cue informing selectors what to do in order to get what they already want, namely economic success. The economic and social environments are better described as establishing operations, in that they motivate the specific behavior of wheat cultivation. Specific examples of establishing operations are the presence of neighbors cultivating wheat, the presence of a railroad, the implementation of land acts, and market prices received for wheat; because these circumstances indicate that wheat farming is an economically successful activity, they serve to encourage that activity. More generally, as was the case with the earlier pastoral phase, deprivation, the absence of the reinforcer of economic success, is an establishing operation.

Thus, just as it was clear in 1830 that pastoralism possessed a number of advantages over arable activity, so, after about 1860, it was
clear that arable activity possessed a number of advantages over pastoralism. This occurred because of the many significant changes in the antecedent conditions and in the consequences of the two behaviors. These considerable changes in the antecedent conditions, along with the fact that the consequence of wheat farming was to generate more profit than that of pastoralism, combined to produce a different metacontingency after the 1860s.

Cultivating wheat is an example of an operant that was reinforced and hence maintained by its consequences. As was the case with pastoral activity, the reinforcer of economic success is not, of course, direct-acting. However, there are, once again, direct-acting contingencies related to the statement of rules that specify the consequences of wheat farming, and the behavior of an individual involved imitation learning. Expressed in this way, the behavior of selectors is rationally related to both the consequences and the antecedent conditions. Rules are again serving an important role. A more detailed analysis of the selection phase can be presented as follows.

The antecedent conditions influenced selectors to formulate new rules concerning wheat farming. The concept of context is important again, affecting the likelihood of rule-following behavior. Because others who follow the rules, primarily existing wheat farmers, are individuals whom the new wheat farmer respects and wishes to emulate, the probability of rule-following is high. The physical environment, and the economic, political, and social environments after about 1860, were suitable for arable activity and prompted the formulation of rules that focused on the financial and other benefits of wheat cultivation. For example, "Because the land is suitable for wheat farming, and is readily available because of the building of railways and the new land laws being introduced, I will succeed commercially if I become a wheat farmer." Similarly, "Because wheat prices in the local markets are high, I will succeed commercially if I become a wheat farmer." As was the case with sheep farming at an earlier time, wheat farming was likely encouraged by a second set of antecedent conditions that also prompted the formulation of rules. Selectors viewed arable farming, involving as it did ownership of land, as offering an opportunity for both personal advancement and for social stability. For example, "Because the ownership of land is associated with economic success and social cohesion and stability, I will enhance my personal and my family status if I become a wheat farmer."

As was the case with pastoralism, there were delayed consequences that supported the decision to become a wheat farmer. Given the rules noted above, the principal delayed consequences were those of economic success and social stability. With reference to Victoria, Dingle (1984, p. 72) noted that: "All selectors benefited from being able to harvest bumper crops from the fertile virgin soil for the first few years." Bumper crops, combined with high prices for wheat, were an effective reinforcer. A detailed analysis by Fahey (1984) of selection in
three Victorian counties confirmed that a class of prosperous capitalist farmers was created. This social stability associated with arable activity is evident in many of the contemporary accounts of wheat farming that heaped praise on selectors for creating an ordered landscape with small fields, for "softening the horizon," and for yielding a "pleasantly settled aspect" (Williams, 1975, pp. 61-103).

There were direct-acting contingencies related to both the statement of rules and to the following of rules. These contingencies served to support arable activity until the time when that activity paid off with the consequences noted. For example, the relevance of rules favoring wheat cultivation was evident to a new selector who was able to observe and imitate existing selectors already experiencing the reinforcing consequences relating to economic success and social stability. For selectors in Victoria, Dingle (1984) noted that: "The prize of possession and dreams of the future buoyed their spirits" (p. 65). Wheat farmers were able to observe their first crops maturing, and the high wheat prices at market centers. Their neighbors were able to confirm the profitability of wheat farming and the prospects for increasing wheat acreage. Each of these direct-acting contingencies encouraged wheat farmers to keep emitting pastoral behavior until the reinforcing consequences specified by the rules came into play. According to Dingle (1984, p. 66): "if all went well a selector who took up a 320-acre block in one of the most easily cleared parts of the Wimmera would be able to crop twenty acres in his first year, twenty-five in the second and thirty-two in the third." Although this rate of clearing may not seem considerable, the very act of removing forest or natural grassland, wilderness to the selector, and replacing it with cultivated fields, civilization to the selector, was a clear indicator of progress, and progress was an important direct-acting contingency.

Conclusion

A central concern in human geographic research is the analysis of behavior in landscape. Human geography is most appropriately seen as a social science and further conceptual advances are desirable. With these assertions as a basis, the advantages of adopting the concepts and techniques of behavior analysis are emphasized. Interpretation of these ideas in a human geographic context is followed by a preliminary application to one specific case of human landscape creation.

What are the advantages of conducting behavior analyses rather than pursuing the more usual human geographic accounts? First, behavior analyses emphasize the study of responses that are not necessarily elicited by a stimulus, but are rather under the influence of the consequences of the responses. The considerable success of Skinnerian psychology indicates that this is an important conceptual advance beyond the cause and effect approaches more characteristic in human geography.

Second, the behavior analyses are more rigorous in that they
incorporate a well established set of concepts and principles that have been subject to considerable previous evaluation and refinement. They explicitly distinguish between antecedent conditions and consequences, and they allow for the inclusion of such concepts as those of establishing operations, direct-acting versus indirect-acting contingencies, rule-governed behavior, metacontingency, and context. Such distinctions and concepts are not acknowledged in the typical human geographic analysis which is more characteristically presented as a predominantly factual account incorporating more limited concepts in a less formal manner. Thus, the traditional human geographic analyses outlined in this paper, although cause and effect oriented, are much less rigorous.

Third, when addressing problems of landscape evolution, human geographers do not employ concepts and principles that extend significantly beyond those described in the relevant sections of this paper, whereas the behavior analyses conducted employ only a portion of the larger frameworks available. There are, of course, other types of concepts available to human geographers, but they are not related to those used in this paper. Rather, they are concepts associated with quite different emphases, such as perceptual and cognitive analyses (for example, Powell, 1970).

Fourth, this demonstration of the application of behavior analysis to the evolution of human landscapes enhances our awareness of the essential commonality of the problems investigated by the various social science disciplines. This is an important general observation and, from the perspective of behavior analysts, this preliminary excursion by a human geographer into what was previously terra incognita might appropriately be seen as another example of the uncovering of "some important commonalities with like-minded colleagues . . . in the other sciences" (Morris, 1992, p. 24).

Future analyses might profitably employ the concepts identified in other, more elaborate, empirical studies and might seek to extend the conceptual basis. The most important conclusions are, first, that human geographers are currently neglecting an important philosophy and a powerful body of concepts and related techniques and, second, that further conceptual and empirical work in this area needs to be accomplished by both human geographers and behavior analysts. Several behavior analysts have recognized the value of "increased interaction and eventual cooperation with researchers and practitioners in other areas and disciplines" (Kunkel, 1996, p. 22), and this paper is a first, tentative, step along one possible route.
References


