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Behavioral contingency analysis

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Abstract

This paper presents a formal symbolic language, with its own specialized vocabulary and grammar, for codifying any behavioral contingency, including the complex multiparty contingencies encountered in law, economics, business, public affairs, sociology, education, and psychotherapy. This language specifies the "if, then" and temporal relationships between acts and their consequences for the parties involved. It provides for the notation of the probabilities, magnitudes, positive or negative valences, or time delays of the consequences for the parties, and for the parties that would perceive, misperceive, not perceive, predict, mispredict, or not predict events. The language's fractal-like hierarchical and recursive grammar provides for the flexible combination and permutation of the modifiers of the language's four nouns: acts, consequences, time intervals, and agents of acts; and its four verbs: consequate, prevent, perceive, and predict—thereby giving the language the ability to describe and codify various nuances of such complex contingencies as fraud, betting, blackmail, various types of games, theft, crime and punishment, contracts, family dynamics, racing, competition, mutual deterrence, feuding, bargaining, deception, borrowing, insurance, elections, global warming, tipping for service, vigilance, sexual overtures, decision making, and mistaken identity. Applications to the management of practical situations and techniques for doing so, as well as applications in current behavior analysis research and neuroscience, are discussed.

Keywords: Formal contingency language; Behavioral economics; Competition and cooperation; Cognitive-behavior therapy; Neuroscience; Behavior notation and codification; Social interaction codification; Operations research; Simulation

1. Behavioral contingencies

1.1. What are they?

Behavioral contingencies[1] are the ubiquitous "if, then" situations that influence what people do and do not do. The "if" part specifies some behavior; the "then" part some consequence for the involved party(ies): if you drop a glass (the behavior), it may break (the consequence), and a price label on a product in a store states that if you pay that price, you get the product. The price label contingency might have effects on customer behavior, sales of that product, and competitive pricing by other stores. Further contingencies may be implicit, e.g., if you wait too long, the product may no longer be available.

Behavioral contingencies exist independently of any behavior or dynamics that may occur as a result of their existence. The dropped glass would break if dropped even if no one ever dropped it or picked it up, and the price label contingency is in effect even if no one ever sees the price label or buys anything. In general, however, a behavioral contingency is of practical interest because of its possible behavioral effects.

1.2. Behavioral contingencies in human affairs

Behavioral contingencies, often rather complex ones, are a common element of all the behavioral sciences and are at the root of the behavioral phenomena that are of concern in such diverse realms as law, business, education, economics, management, public affairs, therapy, the social sciences, child management and everyday interactions between people.

1.2.1. Prominent examples

- Laws consist, in general, of "if, then" statements of the form, "If a person does or doesn't perform certain

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[1] B.F. Skinner (1969) applied the term behavioral contingency to the "if, then" conditional relationship, "If a response, then a consequence" originally to describe the basic paradigm of operant conditioning, "If a response, then a consequence." The more traditional usage – temporal contiguity regardless of conditionality – is not the sense in which the term is used here.

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acts, certain consequences for that person shall follow". Laws are, in essence, behavioral contingency statements intended to regulate, modify, or influence behavior in a society.
- Education systems involve the behavioral contingencies that govern the interactions of students, teachers, parents, administrators, unions, textbook publishers, and members of the community.
- When business managers seek to improve operations by means of incentive compensation systems, work flow systems, and safety practices, they operate on the behavioral contingencies involved.
- The rules of games, ranging from tic-tac-toe to baseball, bridge, poker, or chess, are behavioral contingencies that determine how the games are played.
- Many everyday interactions between people involve behavioral contingency statements of the general type "If you do A, I will do B," including promises, requests, enticements, and threats, sometimes with reference to other parties, time periods, probabilities, or other qualifications.

Unlike the other major determiners of behavior – the personal histories of the involved parties and the immutable realities of physics and biology – behavioral contingencies can be modified and designed.

1.3. The roles of signals and experience

The effects of a prevailing behavioral contingency depend on the individual's history or previous experience with that contingency or with related ones.

Example. The effect of a price tag depends on ability to read and on prior exposure to the product and to price tags. For verbal individuals, a contingency can be communicated by verbal descriptions, including "rules". For non-verbal individuals, a contingency can be communicated by other kinds of signals[2] and the information conveyed about a contingency can be accurate or inaccurate, complete or incomplete, well understood or only partially understood.

1.4. The value of a formal behavioral contingency language

The present paper presents a formal language, with its own specialized vocabulary, grammar, and syntax, for the systematic codification and analysis of any behavioral contingency. The practical application of this language falls into the province of behavioral technology,[3] but given the central place of behavioral contingencies in behavioral science and its applications, behavioral contingencies are also worthy of study in their own right.[4]

It is true that formal codifications of behavioral contingencies can often also be expressed, sometimes with less effort, by means of natural language, as can the codifications of other formal symbolic languages like those of mathematics or symbolic logic. But in the case of complex behavioral contingencies, formal codification, with the attendant identification of key variables and features, is often a necessary precondition for their systematic study and analysis, whether by means of experiments with living subjects, computer simulation, operations research, or other methods.

Formal symbolic languages, including the present one, also provide the advantage of cutting across all natural languages (universality), with codifications that are succinct and avoid ambiguity. They can reveal relationships among elements that would not be revealed as clearly by natural language descriptions, and in science they can aid in the development of classification systems and theories.

While the antecedent of the present language (Mechner, 1959) was developed as a tool for the specification of independent variables and experimental procedures (Mechner and Latranyi, 1963; Mechner et al., 1963), and has found pedagogic uses like those cited in Section 1.5, the present expanded language is designed for the codification of any behavioral contingency, including complex multiparty contingencies. The language is also well suited for the specification of the situations and contingencies that are the subject matter of behavioral economics (Camerer and Lowenstein, 2003; Becker, 1976, 1995, 1997), including some (described in Section 5) that have become the subject of current behavior analysis research.

Clearly, this type of language cannot generate new knowledge about behavior or make empirical assertions of any kind. Behavioral contingencies do not describe or predict what behavior will actually occur—they only specify consequences for the parties involved *if* some specified behavior occurs. From the standpoint of experimental science, behavioral contingencies have the status of independent variables, and if used as such in experiments, their empirically observed behavioral effects would have the status of dependent variables.

1.5. Related work

While this paper may be the first effort to develop a general language for codifying any behavioral contingency, special-purpose notation systems for behavioral contingencies have been proposed in the past.[5] The original language and notation sys-

[2] The technical term for "signal" is "discriminative stimulus." The term "stimulus" is avoided here because of its connotation of stimulus-response and reflex phenomena.

[3] The application of behavioral contingencies is key in such applied areas as educational technology, behavior management, clinical interventions, and business applications. Sidman (2004) pointed out that the application of behavior analysis to human affairs has still fallen far short of the potential.

[4] The distinction between independent and dependent contingencies proposed in Weingarten and Mechner (1966), and hierarchical contingency structures, may be examples of types of issues that a science of contingencies might address.

[5] Some behavioral notation systems or paradigms (e.g., Chisholm and Cook, 1995; Findley, 1962; Goldwater and Acker, 1995; Keller and Schoenfeld, 1950; Malott et al., 1993; Mattaini, 1995) have been used to codify behavior analysis principles for instructional purposes and for describing behavioral phenomena that actually occur, as opposed to behavioral contingencies as defined here. These behavioral notation systems have no direct relevance to the theme of the present paper.