CONTROL

Douglas Walton
University of Winnipeg

It is my belief that behaviorists are perfectly accurate in their contention that the language of responsibility in moral and jurisprudential contexts is rife with unclarity, confusion and fallacy to the extent that it is fair to say that we lack any scientific account of the notion of responsibility or accountability.[1] On the other side, I concur with those critics of extreme behaviorism who feel that (a) the moral and social consequences of the entire rejection of the notion of responsibility are abhorrent, and (b) the concept of responsibility is intrinsically amenable to explication — the concept, while unclear at present, is in no way otiose, inherently ill-formed, or essentially beyond the scope of scientific treatment. What we lack is a logically exact concept of *control* through which eventually a concept of responsibility may emerge. I believe that through the analysis of concepts of behavior such as control and causation a new rapprochement may take place between the behavioral scientist and the moral philosopher.[2] One obstacle to this rapprochement in the past has been the insistence of the moral philosopher on cleaving to an idiom that, in the eyes of the behavioral scientist, is too reminiscent of the logically spurious concepts of faculty psychology — terms such as 'will,' 'choice,' 'want,' 'try,' 'can' and the like too often mask a retreat into metaphysical territory or a refuge into "ordinary language."[3] By choosing the quasi-technical and comparatively restricted concept of control as a focal point for entry into the family of responsibility concepts, many such entanglements can be *a fortiori* eliminated. The base language of control can then be extended in attempts to capture richer, more complex concepts such as ability, intentionality, and voluntariness.

[1] B.F. Skinner, *Beyond Freedom and Dignity* (New York: Knopf, 1972).

[2] Much interesting work along the lines of developing indeterministic models of causation for the social sciences has been done by Herbert A. Simon. In particular, see his 'Causal Ordering and Identifiability' in *Cause and Effect: The Hayden Colloquium on Scientific Method and Concept* (New York: The Free Press, 1965), 157-190. See also H.M. Blalock, Jr. (Ed.), *Causal Models in the Social Sciences* (Chicago and New York: Aldine-Atherton, 1971).

[3] For a collection of various such attempts see Myles Brand (Ed.), *The Nature of Human Action* (Glenview, Ill.: Scott, Foresman, 1970).

Control, Behaviorism, 2(2), 1974, 162-171.

Control and Determinism

Control and its cognate, causation, are basically indeterministic concepts. They are also relative or binary concepts, best regarded as obtaining only relative to a set of contingencies (antecedent conditions) which must be regarded as fixed in a given context — they are, so to speak, context-sensitive.[4] When I turn a faucet on, filling a container with water, we say that I cause the water level in the container to rise, or that I control the water level in the container. Both assertions are perfectly clear in this context despite the fact that in neither case is the relation perfectly deterministic.[5] It is not false that I control the water level even granting that something unexpected, such as my dropping and breaking the container, may *possibly* occur that would effectively prevent my raising the water level in the container.

What this shows is that the concept of control may be pursued in a basically empirical, stochastic, indeterministic context in such a manner that the spectre of determinism ceases to be a threat to the eventual evolution of concepts of moral responsibility. Moreover, once causation and its companion, scientific explanation, are seen to be conceptually distinct notions from control (not to deny that these families of concepts will almost certainly turn out to be connected), we can relinquish the deterministic assumption that causation vitiates control. Causation, being a basically probabilistic concept is not deterministic to begin with. And even if it were, any thesis of determinism can only arise from an entirely spurious conflation of causation and compulsion, two essentially distinct notions.[6] Hence the working behavioral scientist need fear no rejection of the notion of control, and with it moral responsibility, as a consequence of maintaining scientific rigor and a requirement of empirical testability in his hypotheses. Determinism can thus be viewed as a relic of Newtonian science that is in no way necessary or even appropriate in an accurate reconstruction of scientific practice.[7]

I wish to suggest that the beginning of route to reconciling the scientific explanation of behavior with our notions of moral responsibility, culpability and blameworthiness lies through the development of a formally adequate concept of control. Contrary to the claims of many hard determinists, I believe that such a concept is feasible and that means for its preliminary explication are at our disposal.

What is Control?

Control may be characterized in a preliminary way as the capacity to bring about a certain result or make something happen, or, alternatively, to preclude something from happening. In exercising control, an individual (which need not be an intelligent agency)

[4]Myles Brand, 'On Having the Opportunity,' *Theory and Decision*, Vol. 2, 1972, 307-313.

[5]*Vide* Patrick Suppes, *A Probabilistic Theory of Causality* (Amsterdam: North Holland, 1970). Suppes develops a causal algebra, based on a probabilistic notion of causation.

[6]Douglas Walton, 'Hume Exhumed: A Polemic Against Determinism,' *The Journal of Critical Analysis*, Vol. IV, No. 4, January 1973.

[7]For an excellent extended treatment of a probabilistic view of explanation in science, see Nicholas Rescher, *Scientific Explanation* (New York: Free Press, 1970).

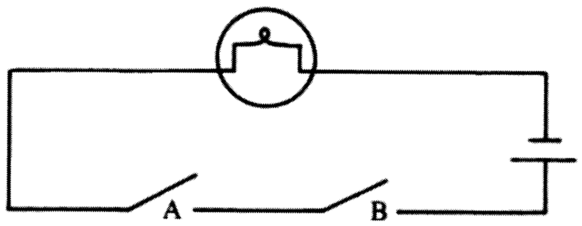
Control, Behaviorism, 2(2), 1974, 162-171.

intervenes in the course of events so as to bring about a certain result or state of affairs. We are all familiar with instances of control — the mad scientist controls his hands, the control panel and the robot, and, in turn, the fate of the heroine. The skyjacker controls the pilot who controls the airplane. The dancer controls his feet and economists try to control inflation. Control is akin to such concepts as potential, capability, capacity and being able to bring something about. Thus we must distinguish between the possession and exercise of control, as between possibility and actuality. I may have control of a state of affairs, R, without ever actually exercising that control by bringing R about. Conversely, however, if I bring R about, I am said to have control over R.

To say that I have control over R is not, however, exactly equivalent to saying that I *can* bring R about. The modal verb *can* encompasses more, including the notion of ability even when control is absent through lack of opportunity. We say that I can wiggle my ears even when I am wearing a football helmet, meaning that generally I have the ability to wiggle my ears even though I do not have control over my ears at the moment. While there is not an equivalence between *can* and *control*, there may be some merit in the thesis that there is one sense of *can* that is equivalent to the concept of control.

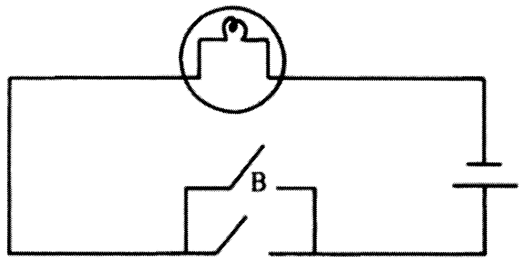
Positive and Negative Control[8]

Positive control is possessed when the controller can bring about a certain result R, negative control when the result can be prevented. Full control is where both obtain. Where two switches are hooked up to a light in series as below, both switches, A and B, need to be on for the light to be illuminated (R), but if either switch is in the 'off' position the light will not be illuminated.



Neither Mr. A (at switch A) nor Mr. B (at B) has positive control over R, although jointly they exercise positive control over R. Thus neither, separately, has full control over R. Each separately, however, exercises negative control over R, as either one can prevent the light from being illuminated by keeping his switch open. Where the switches are hooked up parallel, the closing of either is sufficient to illuminate the light, but both switches must remain open to prevent the light from being illuminated.

[8]The account of control that follows is initially based on that of Nicholas Rescher in 'The Concept of Control,' *Essays in Philosophical Analysis* (Pittsburgh: University of Pittsburgh Press, 1969). Readers should compare Rescher's account with the one offered herein. Our account partially utilizes Rescher's results and notation, with some changes, but goes beyond Rescher's conclusions considerably at various points. Rescher's article appears to be the only substantial work on the logic of control and is basic reading for students of this topic. All references to Rescher in the sequel are to this article.



Here Mr. A and Mr. B each exercise positive control, by neither exercises negative control separately. Mr. A, for example, can illuminate the light by closing his switch, but he cannot be assured that it will remain unilluminated unless Mr. B also decides to keep his switch open. Thus Mr. A has positive control, but he lacks full control because he lacks negative control.

The Ontology of Control

Control is a relative concept, relating an individual, x, to a certain result or state of affairs R — we say that the individual, the pilot, controls a state of affairs, the altitude of the airplane. Control always has an object, but it specifically relates only to one aspect of the object. Thus the pilot controls the airplane, but specifically he controls the altitude, the speed, rate of climb, direction of travel and so on. According to Rescher, the full exposition of the control-situation involves four elements apart from the controller (Rescher, p. 347).

(1) The *object* under control (e.g., the window, the lever)
(2) the *control parameter*, i.e., the aspect of the object control over which the controller exercises control (the *height* of the window, the *position* — i.e., angular position — of the lever)
(3) the *control* alterations, i.e., the changes (or constancy-maintenance) in the control parameter that are put into effect in the exercise of control (i.e., by *raising* — or *lowering* — of the window, or by the *motion* of the lever from one position to another)
(4) the *modus operandi*, i.e., the set of procedures specifying the means and manner by which the controller effects the control alterations.

According to Rescher, "[w]hat is under one's control invariably comes down to the alteration of a "control parameter," i.e., the readjustment (or constancy-retention) of an aspect of the object with respect to which control is said to be exercised" (Rescher, p. 348). Hence control over an object is never exercised over the object *as such*, but over some aspect of the object. This is the rationale behind the argument that the second element, R, of the control relation is best described as a result or state of affairs rather than as an object or whatever else.

The first element of the control relation is best said to be an individual, though not necessarily a human agent, a purposive agent, or even an intelligent agent. We frequently speak of machine control, such as a traffic light controlling the flow of vehicles or a thermostat controlling the temperature. True, in both of these cases human beings are lurking in the background, as is generally true in control situations, but such agent-control may be relatively indirect. In general, it seems most reasonable to follow Rescher in viewing agent-control as a special sub-species of control. In other words, we reject the thesis that all control is exercised by agents.

On the other hand, it is not possible to retain the intuitive idea of control without retaining some aspect of deliberative agency or purpose contrivance on the part of the controller (Rescher, p. 332).

> To be "under control," things must go along more or less as the controller plans them to. The traffic light gone berserk may still be said to determine the flow of traffic, but this flow is no longer a controlled one. The terminology of "control" has become inappropriate. If purely natural arrangements were involved, without any admixture of purpose or intention, I would propose speaking not of "control" but of "determination." The movements of the moon *determine* the ebb and flow of the tidal waves (in our technical sense of this term): To say that the moon controls the tides is (on our view) to speak figuratively. In control, a controller must be somewhere on the stage, no matter how much on the sidelines.

The concept of control, as opposed to mere determination, inevitably involves an aspect of planning or deliberate agency somewhere on the scene though not necessarily on the part of the individual controller. Yet when turning to the task of specifying the logic of control in exact terms, the prospect of specifying such a notion of "deliberate agency" in formal terms seems not very good. Therefore, if we wish to maintain the intuitive concept of control with its overtones of "deliberate agency," the best course would be to introduce an informal constraint on the domain of individuals, allowing something to be an "individual" that can stand in a control relation only if it exhibits, somewhere along the line, an overtone of "deliberate agency." However, from a logical point of view, it is neater to jettison this constraint altogether, and heroically accept the unintuitive consequences that the moon "controls" the tides and that the berserk traffic light "controls" the flow of traffic, albeit erratically. This latter course would certainly be the more acceptable to those of behavioristic inclinations, as it leaves open the possibility of explaining control in purely physical terms without any evident need to refer to inner mental states or concepts of agency not reducible to purely physical components.

Partial Control

Whenever control is exercised conjointly by more than one controller, we will say that each individual has partial control. In our earlier example, Mr. A and Mr. B each have partial control only in both the series and parallel situation. Here we can discriminate further by speaking of partial positive and partial negative control. In the series case, Mr. A and Mr. B each has partial positive control of R although each has complete (as opposed to partial) negative control of R. In the parallel case, Mr. A and Mr. B each has complete positive control of R but each has only partial negative control of R. In both cases Mr. A and Mr. B jointly have full complete control of R.

Thus we can make the following classifications.

Cont^{+} complete positive control
Cont^{-} complete negative control
Cont^{P+} partial positive control
Cont^{P-} partial negative control
Cont^{P} (full) partial control
Cont (complete) (full) control

The only case we do not have an instance of in our switches examples is (full) partial control, the case where A and B jointly, but not individually, have both positive and negative control over R. In the series case they jointly have full control, but individually have negative control; in the parallel case, again they jointly share full control, but individually have positive control. Hence in neither case do they have (full) partial control. A case of (full) partial control would obtain where A and B are separately at the mercy of C with respect to R but where A and B can team up and wrest control of R from C. Here A and B are individually powerless to produce or prevent R, which is fully controlled by C, yet jointly they can either produce or prevent R.

The system of classification can be summarized in the following matrix.

	COMPLETE	PARTIAL	
	Cont^{+}	Cont^{P+}	POSITIVE
Cont			Cont^{P}
	Cont^{-}	Cont^{P-}	NEGATIVE

Control must be either complete or partial, not both, but it may be either positive or negative or both. Where it is both positive and negative, it is said to be full control.

Definitions of Control Concepts

Negative control can be easily defined in terms of positive control and negation. Negative control of R is simply positive control of $\sim$R.

$$x\ \text{cont}^{-}\ R =_{df} x\ \text{cont}^{+}\ [\sim R]$$

To say that I have negative control over the illumination of a light bulb is simply to say that I have positive control over its non-illumination. Full control can be defined in terms of the primitive, cont^{+}, conjunction, and negation.

$$x\ \text{cont}\ R =_{df} x\ \text{cont}^{+}\ R\ \&\ x\ \text{cont}^{+}\ [\sim R]$$

Partial control can be defined using cont, negation, conjunction, and the existential quantifier.

$$x\ \text{cont}^{P}\ R =_{df} (\exists x)(\exists x_1)(\exists x_2)\ldots(\exists x_n)(\{x, x_1, x_2, \ldots x_n\}\ \text{cont}\ R\ \&\ \sim(x\ \text{cont}\ R))\ \&\ (\exists x_i)(x_i \neq x)$$

Control, Behaviorism, 2(2), 1974, 162-171.

In words, × has partial control over R when he controls R only in conjunction with someone else. Since $cont^-$, cont, and $cont^P$ (and the hybrids $cont^{P+}$, $cont^{P-}$) can all be defined using only $cont^+$ as primitive and the standard logical symbols, ~ , & , ∃ , { , and } , the next step is to try to determine a set of axioms for $cont^+$, or, at any rate, some way of further explicating this basic concept.

The Semantics of Control

Suppose I have access to two light switches, each one of which is connected to a separate bulb, but where each switch is hooked up in such a way that if it is turned to 'off' the other switch will automatically flip to the 'on' position.

L_1	L_2	Control	
Off	Off	No	
Off	On	Yes	*Disjunctive*
On	Off	Yes	*Control*
On	On	Yes	

Here I have positive control over p-or-q-or-both. The only power I lack is the power to turn both bulbs off simultaneously.

Suppose I have access to a reset button in a panel of two light bulbs. From time to time, for reasons beyond my control, one light or both will go out. If I push the reset button, both lights will immediately go on.

L_1	L_2	Control	
Off	Off	No	
Off	On	No	*Conjunctive*
On	Off	No	*Control*
On	On	Yes	

Here I have positive control over p-and-q-both. I also thereby have control over p simpliciter, and control over q simpliciter. But I do not, of course, have control over p & ~ q. Nor do I have control over q & ~ p.

We can see immediately from the above tables that to control $L_1 \vee L_2$ is to control L_1 & L_2. That is, disjunctive control is a stronger form of control than conjunctive control. Thus we should have as a theorem of positive control

$$\times\ cont^+ (p \vee q) \supset \times\ cont^+ (p \,\&\, q)$$

Conjunctive control can be better understood by contrasting a theorem which, as we observed, does obtain,

$$\times\ cont^+ (p \,\&\, q)\ .\supset.\ \times\ cont^+ p \,\&\, \times\ cont^+ q$$

with an expression that should not be a theorem,

$$\times\ cont^+ p \,\&\, \times\ cont^+ q\ .\supset\ \times\ cont^+ (p \,\&\, q)$$

Example: let q be ~p. × may control p and also ~p (full control), but he cannot control p & ~p.

There is no such asymmetry for disjunctive control, however. We have as a theorem

$$\times\ cont^+ (p \vee q) \equiv .\ \times\ cont^+ p \vee \times\ cont^+ q$$

Control, Behaviorism, 2(2), 1974, 162-171.

Thus one must be careful to distinguish between 'control over p and q' and 'control over p and control over q,' whereas no such care is required in the disjunctive case.

An interesting case of *biconditional control* is found in the operation of the brake lights on a car. By operating the brake pedal, the lights may be made to go on or off jointly but normally it is not possible to make one go on while the other remains off.

L_1	L_2	Control	
Off	Off	Yes	
Off	On	No	*Biconditional*
On	Off	No	*Control*
On	On	Yes	

A case of *strong disjunctive control* (either p or q but not both) is found in the operation of the signal lights on a car. By operating the signal lever, the left or the right signal light may be made to flash, but normally both sides cannot be made to flash simultaneously. A table for strong disjunctive control may be constructed by inter-changing 'Yes' and 'No' in the biconditional table above.

Imagine a case where turning on L_1 breaks control over turning off L_2.

L_1	L_2	Control	
Off	Off	Yes	
Off	On	Yes	*Conditional*
On	Off	No	*Control*
On	On	Yes	

As long as L_1 remains off I have full control over L_2. But if I turn L_1 on then L_2 automatically comes on. Enabling L_1 disables $\sim L_2$.

A Syntax of Control

The preceding semantical considerations suggest that the concept of control is sufficiently regimented to be characterized as an operator in a logical system. Such a system would have the following axioms.

(A 1) $p \supset \text{cont}^{+} p$

(A 2) $\text{cont}^{+} (p \vee q) \equiv (\text{cont}^{+} p \vee \text{cont}^{+} q)$

Generally it seems reasonable to expect that the cont^{+} operator will be similar, if not isomorphic to, the M-operator in von Wright's System M of Standard Modal Logic (shown in 1953 by Sobocinski to be equivalent to Feys' System T) as suggested by (A 1) and (A 2). The foregoing is however only a tentative suggestion for further exploration of control, a basic, minimal system of control that might be modified or extended in various directions.

(A 1) and (A 2) can be made much more closely adequate to human agency by iterating the control-operator over an operator, δ_a p, to be interpreted '*a* brings it about that p obtains'.[9] According to this conception, the axioms for control would read as follows.

[9] For discussions of axioms for δ, see Frederic B. Fitch, 'A Logical Analysis of some Value Concepts,' *Journal of Symbolic Logic*, Vol. 28, No. 2, June 1963, 135-142.

Control, Behaviorism, 2(2), 1974, 162-171.

(A δ 1) $\delta_a p \supset \text{cont}^+ \delta_a p$
(A δ 2) $\text{cont}^+ \delta_a (p \vee q) \equiv (\text{cont}^+ \delta_a p \vee \text{cont}^+ \delta_a q)$

Here it is a *desideratum* that δ be regarded as a vacuous operator over tautologies and inconsistent schemata much as a quantifier is vacuous over a schema containing no variables of its type within its scope.[10] Thus sentences like '$\delta(p \vee \sim p)$' and '$\sim \delta(p \& \sim p)$' will all be theorems. What emerges here is a fragment of a minimal theory of agency and control. This fragment is formally suggestive, but I will not pursue it further here.

In further research on control, I would like to suggest that two factors need to be emphatically kept in mind. First, the basic model for control is that of *nihil obstat*, i.e., to say that I control a state of affairs is to say that my action in bringing about that state of affairs is consistent with the scientific laws and initial conditions that obtained at the time just preceding the action. That is, to say that I control p is to say that my doing P is physically possible, that nothing obstructs it (*nihil obstat*). Let L be the set of nomic universals and C the initial conditions.

$$\times \text{ cont}^+ p =_{df} \text{'}\times \text{ brings it about that } p\text{' is consistent with L and C}$$

To avoid certain difficulties, it is necessary to specify times as follows. Let subscripts indicate times so that in '$\text{cont}^+_{t_1}$', t_1 refers to the time during which control was operative. In 'P_{t_2}', t_2 refers to the time at which p was brought about.

$$\times \text{ cont}^+_{t^1} P_{t^2} =_{df} \text{'}\times \text{ brings it about that } P_{t^2}\text{' is consistent with } L_{t^1} \text{ and } C_{t^1}$$

We may also wish to specify that t_1 be no later than an instant before t_2, but such difficulties need not be detailed here.[11]

In general, control is best viewed along the lines of a *nihil obstat* model. In this respect, control can be distinguished from the notion of ability. An ability is not linked so closely to a specific performance of an action at a particular time.[12] The analysis of the concept of ability is an ongoing problem of Action Theory, and not without its complexities.[13] Suffice it here to follow Kenny in remarking that (A_1) and (A_2) are not true of the concept of ability.[14] Thus control can be contrasted with ability, and this

[10]For a similar convention in deontic modal systems, *vide* Frederic B. Fitch, 'Natural Deduction Rules for Obligation,' *American Philosophical Quarterly*, Vol. 3, No. 1, January 1966, 27-38. See especially p. 37f.

[11]See Douglas Walton, '*Can*, Determinism and Modal Logic,' forthcoming in *The Modern Schoolman*.

[12]*Vide* Irving Thalberg, *Enigmas of Agency* (London: Allen and Unwin, 1972), esp. Ch. VI, 'How is Ability Related to Performance?'

[13]Douglas Walton, 'The Logic of Ability,' *Systematics*, forthcoming.

[14]Anthony Kenny, in considering whether the 'can' of ability is exemplified in the two basic laws of modal logic corresponding to (A_1) and (A_2), writes as follows.

> Consider first the law 'if p, then possibly p'. I cannot spell the word 'seize'; I can never remember whether or not it is an exception to the rule about i before e. Yet on a particular occasion I may spell it correctly, assuming that I toss a coin each time to decide the order of the vowels. On such an occasion, 'I am spelling "seize" is true and yet, 'I can spell "seize" is false.
>
> For an example of the second law consider the case in which I know two identical twins whom I cannot tell apart. When I meet both of them I can point to either Tweedledum or Tweedledee but it isn't true either that I can point to Tweedledum or that I can point to Tweedledee.

Anthony Kenny, 'Freedom, Spontaneity and Indifference,' in *Essays on Freedom of Action* (London and Boston: Routledge and Kegan Paul, 1973), p. 99f. I would like to express my thanks to Dr. Kenny for several helpful discussions during the 1973 Conference for Philosophical Studies Conference at Calvin College on ability and control instrumental in some of the thoughts in the latter parts of this paper.

Control, Behaviorism, 2(2), 1974, 162-171.

contrast I suggest is the second major factor we need to keep in mind in further explorations of the logic of control.

Concluding Remarks

While there are complexities and difficulties in explicating the concept of control, the foregoing account suggests that the concept of control is sufficiently regimented to encourage further work in analyzing it. The hard determinist contention that such concepts are intrinsically obscure and fallacious constructs beyond the scope of scientific treatment is thereby made to seem considerably less *prima facie* plausible. It is my belief that only through explication of control will an explicit understanding of the even more difficult concept of responsibility be forthcoming. That the notions are linked is clearly conveyed by the frequent use of control idioms in jurisprudential and moral contexts.[15] The notion that we are responsible only for those actions we control has a long history going back at least to Aristotle.[16]

The formal difficulties of explication are best resolved along the lines of the *nihil obstat* model if a suitable interpretation of cont+ is forthcoming that will correlate with measurable phenomena in such a way as to make this concept a useful device in the behavioral sciences and social technology. The various problems of explication of action-related concepts such as control should function in a way similar to that of the paradoxes in mathematical logic, as aids to the attainment of consistency by imposing certain limitations rather than as sources of despair. Thus as against the deterministic claim that the failure of emergence of a viable control concept betokens the incoherence of the notion, I suggest that the rudiments of a calculus of control are available, and that there is no reason in principle that rules out the further exploitation of our resources in this area.

[15] See Rescher on the connection between control and responsibility, *op cit.*, in footnote 8, and Douglas Walton, 'Philosophical Perspectives on the Insanity Defense,' *The Human Context*, forthcoming.

[16] Aristotle, *Nichomachean Ethics*, Book III, Ch. 1, 1110_a.

Control, Behaviorism, 2(2), 1974, 162-171.