INTENSIONAL ACTION THEORY

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July 15, 1976
Abstract:

The aims of this paper are to survey, explicate, compare, contrast, and critically evaluate a number of (mainly recent and technical) contributions (Kanger, Pörn and Åqvist) to the logic of action locutions in connection with their treatment of the concept of an agent's bringing about a state of affairs. The discussion is primarily concerned with practical applications of these formalisms for the action theorist. It is suggested that these systems are best understood as capturing a strategic sense of bringing-about, and not a notion of actual bringing-about, which is merely presupposed by them. It is argued that the developments surveyed open up a new 'intensional' style of action theory, contrasted with the 'extensional' approach of Davidson. Yet because of the treatment of conditionals, they fail to capture a basic notion of 'bringing about' important for action theory. It is concluded that a study of the behavior of 'bringing-about' over non-standard conditionals would be a useful next step for intensional action logic.
The logical form of actions can be treated as similar to that of individuals, events or properties. Here, however, I will explore some developments in the approach of treating action as a unary operator, having a syntax analogous to classical negation. The most notable exponent of this approach is Roderick Chisholm whose work in the theory of action is centred around the notion of 'bringing about.' Following Chisholm, we will investigate locutions of the type 'a brings it about that p' where a is an agent, and p is thought of, along the lines of a proposition, as a "state of affairs." The most significant property of substitution instances of the propositional variables here is that they can be true or false—thus more strictly, the locution we investigate might be read 'a brings it about that p is true' or 'a makes it true that p.' The 'makes it true that' portion is thought of as an operation on propositions, an operation relativized to an individual, an agent. Where δ represents the operation 'making it true that,' the basic syntax for this style of action-locution appears as 'δap'.

Some remarks of Davidson [10] indicate that the Chisholm approach may have certain limitations in the representation of the full range of what are usually regarded as sentences expressing actions. Sentences like 'Jones walked to the store' or 'Jones sneezed' are not unproblematically characterized as states of affairs brought about by Jones (Try to parse them!) Perhaps all that is shown, however, is that

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*Research for this paper was partly supported by Canada Council Leave Fellowship W750356. An earlier version was read for the Philosophical Society of Victoria University of Wellington in October, 1975. Acknowledgement of much helpful commentary, criticism and discussion is especially due to Max Cresswell, and also to George Hughes, Dick Epstein, and John Bigelow for discussions on various points.

1 See Myles Brand, 'Particulars, Events, and Actions,' in [4].

2 See [6] and [7].
there are various kinds of actions and that the Chisholm approach is most helpful in certain restricted (but very important contexts) only. It seems a reasonable conjecture that Chisholm syntax is most appropriate in realizing the notion that an end-state or result is realized or effected by an agent—the key notion here is that of resolution or culmination. Whereas when the action is a continuing process or temporally extended activity not culminating in any obvious result, e.g., 'dancing the boogie-woogie all night long,' this syntax may be less appropriate than a language of events. Nevertheless, in at least some important contexts of action discourse, the Chisholm syntax is a powerful tool of analysis, as Chisholm's work has amply demonstrated. By bringing together and critically interpreting some attempts to work out this syntax formally, I hope to consolidate some results in this area, give a useful and readable survey of some highly technical but widely applicable work, and suggest some directions for future developments. Basically, three formal theories (those of Kanger, Pörn, and Åqvist) have been proposed. I plan to compare and evaluate them, in order to see how each might contribute to the action theorist's understanding of "bringing about."

§1 Action and Conditional Relations

One area of considerable interest to action theory lies in the intersection of the language of bringing-about with the language of conditionals. Some conditionals of the form 'If p then q' seem to preserve truth under the addition of agency to both components resulting in the form 'If δap then δaq': from 'If the trigger is pulled Jones is not alive we may infer 'If Smith brings it about that the trigger is pulled, then Smith brings it about that Jones is not alive.' Of special interest in this connection are causal conditionals, and various properties in this general area, especially of a causal type, have been studied by Danto [8] and [9] in the analysis of basic actions, Goldman [13] on the notion of level-generation, and Chisholm [6] and [7] on varieties of causally indirect agency. According to Danto, if action A is more basic than action B then A causes B.3 Similarly, according to Goldman, if A generates B, then A is at a lower level of an act-tree than B. Here it is the relation between actions that is critical. But the relations between the

3This is rather a rough paraphrase. For a fuller account and critique of the notion of basic action, see Annette Baier, 'The Search for Basic Actions,' American Philosophical Quarterly, 8, 1971, 161-170.
objects of actions can also serve to set up important relations between actions. Consider the differences that might obtain in relation to questions of allocations of responsibility among these three schemata.

(1) If p then q, and a brings it about that p.
(2) p obtains, and a brings it about that if p then q.
(3) a brings it about that p, and a brings it about that if p then q.

To exemplify case (2): Smith carefully places a bucket of water over a door in such a way that if anyone walks through the door, he will be drenched. Jones wanders through the doorway at random. Case (1): Schmidt has set up a bucket arrangement over the door, then Smith urges Jones (successfully) to walk through. Case (3): Smith not only sets up the bucket, but also brings it about that Jones walks through the doorway. In each case, Smith may be said to have brought it about that Jones is drenched. We may well be inclined to say that in each case, however, Smith's action is indirect. He did not drench Jones directly in the sense of throwing the water "through his own personal agency," but he set in motion a sequence of events that culminated in a drenching of Jones. It was a consequence of something Smith did that Jones was drenched. Thus conditional relations between propositions (the objects of actions) affect the question of whether propositions are correctly said to be made true by agents.

It is interesting to consider what kinds of conditionals might be appropriate in studying expressions like (1), (2) and (3). The first candidate to look at might be the material conditional, yielding these respective schemata.

(lm) \[ \delta_a p \land (p \supset q) \]
(2m) \[ p \land \delta_a (p \supset q) \]
(3m) \[ \delta_a p \land \delta_a (p \supset q) \]

Each of these might be thought to serve as a possible definiens for a variety of indirect agency. But (lm) is

\[ ^4 \text{In one respect, the approach of Davidson [11] is closer to the one followed here than that of Danto, Goldman and Chisholm: Davidson proposes relations between events (ordinary event causality) as agency-generators whereas Danto, Goldman, and Chisholm appear to focus on relations between actions in this connection.} \]
spurious, since it is equivalent to 'δp & q', given the reasonable axiom 'δa δp ⊃ p' and the truth-functional equivalence of 'p & (p ⊃ q)' to 'p & q'. (2m) might partially define a notion 'a brings about q relative to p', although it raises the difficult question of how to interpret "conditional actions" of the form 'a brings it about that if p then q.' (3m) is more promising initially and bears looking at in detail. In fact something based on (3m) has actually been suggested as an axiom* of bringing-about by Pörn [19], namely,

\[(3n) \quad (\delta_a p & \delta_a (p \Rightarrow q)) \Rightarrow \delta_a q\]

Other axioms, rules, and a model-sets semantics are given by Pörn in a way that is formally adequate. But many perplexing questions are forthcoming regarding the application to the theory of action of a notion of bringing-about of which (3n) is true.

What we call here the phenomenon of indirect action has been dubbed "the accordion effect" by Feinberg in [12]. To use Davidson's famous example: a man moves his finger, thus flicking the switch, causing a light to come on, the room to be illuminated, and a prowler to be alerted. Once he has moved his finger, "each consequence presents us with a deed." [11, 16]. However, the accordion effect is only one kind of indirect action, having the form of a series of relations conforming to schema (1).

In Danto [9], Goldman [13], and Chisholm [6], we find the conjecture that chains of actions of the accordion effect type commence at an origin or lower bound, the so-called basic action, the action not caused by any other in the chain (although the appropriate relation is not causal for Chisholm or Goldman). Davidson [11], for whom the relation is causal, accepts a similar notion, called primitive action. Here, we will discuss indirect agency only from a relative point of view, and not take the step of asking whether an indirect action can be traced back through a relational sequence to some absolute origin, the basic action. Obviously however, the question of indirect agency has significant implications for the issue of basic action.

§2 Tense and Overdetermination Problems

It has been suggested in [25] that (3n) admits of two special kinds of problems as an account of bringing-about:

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*What Pörn suggests is actually a truth-functional equivalent of (3n), namely: \(\delta_a (p \gg q) \Rightarrow (\delta_a p \gg \delta_a q)\).
problems of overdetermination, and (ii) tense problems similar to those described by Thomson [23]. One case may illustrate both kinds of problems. Suppose Smith shoots Jones at $t_1$ fatally in the sense that Jones must expire at $t_3$, shortly after $t_1$. But shortly after $t_1$ and before $t_3$, Jones is at $t_2$ struck fatally by lightning. To better fit the mould of (3), as opposed to (2) or (1), assume that Smith has treated the bullet with a slow-acting but deadly substance so that we may say that Smith has brought it about that if Jones is shot, Jones dies. The problem of overdetermination is that Smith apparently satisfies the antecedent of (3n), but not clearly the consequent, in the sense that he has brought it about that Jones died.* We might say: Smith ensured that Jones would die, but he was not the actual agent of the death. Second, the tensing problem may be exhibited as follows. Let $p_{t_1}$ represent 'Jones is shot at $t_1$' and $q_{t_3}$ represent 'Jones is dead at $t_3$'. Since the time of a bringing-about may be different from the time what is brought about actually obtains, we may reflect on the question of what might be the most appropriate time indices for the three $\delta$'s in (3n) as applied to our example. Let us take the three in order. First, presumably Smith's bringing it about that Jones is shot at $t_1$ occurred slightly before $t_1$ when, say, Smith pulled the trigger. Second, Smith brought it about that if Jones was shot he would die when Smith put the toxic substance on the bullet, say, at some time previous to pulling the trigger. Or did he? Perhaps he didn't actually bring about '$p_{t_1} \Rightarrow q_{t_3}' until the bullet came into contact with Jones. Temporal troubles already begin at this point, but let us pass on to the third $\delta$: when did Smith bring it about that Jones is dead? Here a philosophically troublesome dilemma is posed. At any time previous to $t_3$, Jones was not yet dead, and so Smith could not have brought it about that Jones was dead before $t_3$ except in an unusual way that reflects what is called in [23] the Hollywood use of language. But at $t_3$ Jones was already dead, and so Smith's bringing about of the death of Jones could not have taken place at $t_3$ or thereafter, when Jones was already dead.

We refer the reader to [23], [3], and [25] for a fuller presentation of tense and overdetermination problems for expressions of the type (1), (2), (3) and their companions, and now pass on to the recent proposals of Pörn [19] and Kanger [15] that throw a new light on (3m) and call for a reappraisal of these problems.

*The background to these problems (see [25]) is that schemata like '$p \Rightarrow (\delta a_p \Rightarrow q)$' obtain if (3n) obtains, i.e., statements like the following are ruled true: if Socrates does not scratch his head, then if Socrates scratches his head the earth collides with the sun.
§3 Kanger's Theory

To make the transition from the remarks above to Kanger's theory, two observations are in order. First, our problems with applying (3m) to the language of agency may suggest reinterpreting 'δ_a p' as it appears in (3m) to read 'a ensures that p' or 'a guarantees that p will obtain' where it is not implied that a actually brings it about that p; it is only required that a makes it "necessary" in some sense that p obtains. This reading would be in keeping with the essentially modal character of (3m) as well as being suggested by both tense and overdetermination problems. Second, a remark of Bennett [3] suggests a modification of (3m) in the analysis of action sentences. Bennett [3, 319f.] remarks that the right way to parse a killing is not, say a shooting which later became a killing (no mention of shooting is implied simply by killing), but rather an action which later became a killing. The word an here suggests an existential quantification. In other words, on one view, kill a may be parsed bringing about something that leads to a's dying. This thought might prompt us to modify (3m) as follows.

(3m3) (∀q) [(∃p) (δ_a p & δ_a (p ⊃ q)) ⊃ δ_a q]

Our principle would now read: for any q, if there is a p such that a ensures that p and a ensures that if p then q, then a ensures that q. Interestingly, (3m3) is equivalent to '(∀p) (∀q) ((δ_a p & δ_a (p ⊃ q)) ⊃ δ_a q),' and is therefore valid if, and only if, (3m) is valid. Thus the addition of quantifiers to (3m) further highlights its potential applicability to the explication of action.

The innovative aspect of Kanger's move in [15, p. 109f] is that he brings the existential element of (3m3) into the reading of the operator for which (3m) obtains by introducing the new reading 'p is necessary for something a does.' The connection with the preceding problems is not perhaps apparent until one reflects that if the relations of necessary and sufficient conditionality are regarded as converses of each other, this reading is equivalent to the reading, 'something a does is sufficient for p.'

Kanger introduces two operators: 'Dδ_a p' for 'p is necessary for something a does' and 'Dδ_a p' for 'p is sufficient for something a does.' Dδ has the following axioms.

(K1) If p is a theorem, then Dδ_a p is a theorem.

(K2) If p ⊍ q is a theorem, then Dδ_a(p ⊍ q) is a theorem.

(K3) (Dδ_a p & Dδ_a(p ⊃ q)) ⊃ Dδ_a q
\[(K4) \quad (D\alpha_a p \& D\alpha_a q) \supset D\alpha_a (p \& q)\]
\[(K5) \quad D\alpha_a p \supset p\]
\[(K6) \quad D\alpha_a p \supset \sim D\alpha_a \sim p\]

D\alpha admits only of axioms (K2), (K3), (K4) and (K6). Note that (K3), together with (K1), implies (K2), (K4), and (K5), and that (K5) implies (K6). Finally, this definition is added.

\[(KD) \quad D\alpha_a p =_d D\alpha_a o \& D\alpha_a p\]

Do p is to be read 'a sees to it that p.' Pörn [18] now follows Kanger essentially in main outline except that the second conjunct of (KD) is replaced by a weaker statement 'but for a's action it might not be the case that p.' We will not dwell on the details of Pörn's account of this statement, but merely point out in passing that some of our remarks directed to Kanger's theory will also apply to Pörn's account of the agent-causal construction 'a brings it about that (effects, causes it to be the case that) p' defined after the fashion of (KD).5

Far from attempting to develop a comprehensive appreciation or evaluation of Kanger's extraordinarily interesting theory, we confine the discussion in the sequel to our special theme here, namely the relevance of expressions of the style of (3) to the theory of action. But first some general remarks.

Being kicked in the pants is necessary and sufficient for something Jones does, say shouting in surprise. Therefore being kicked in the pants by Smith is something Jones does? Kanger might of course argue that if the kick is really sufficient, then Jones' shout is not an action, but a reflex or something of the sort. But perhaps in that case the shouting is really an action of Smith, since something he did is, by supposition, both necessary and sufficient for it.

But if it is difficult to see how Do connects with action, it becomes harder to square D\alpha with doing. No doubt my being alive is necessary for something I do, indeed for anything I do, but it may be quite false that my being alive is something I bring about, or do, in any straightforward sense. Similar questions arise in connection with Do where a does q (sufficient for p) and a does r

5 But see §6 below.
(necessary for p) and q and r are different actions. Is anything like the notion of agency yielded by (DK)?

§4 Modal Principles of Action

Smith hurls Jones off the 15th floor and Schmidt instantaneously kills Jones by shooting him as Jones passes the 10th floor. Something Smith does is sufficient for Jones' being dead. Assume further that if Smith had not hurled Jones off the roof, Schmidt would not have been able to get a clear shot at Jones. Accordingly, it is true that something Smith did was necessary for Jones' being dead. Did Smith kill Jones? First, he contributed to Jones' death, by exposing him to Schmidt's deadly fire. Second, and perhaps even more significantly, he put Jones in a position where he was about to become dead very shortly, even apart from the question of Schmidt's action. So we might say he ensured or guaranteed the death of Jones. But third, Smith was not the actual agent of the deed of the killing of Jones—that was Schmidt. We could ask the somewhat more guarded question: did Smith bring about the death of Jones? (Perhaps we do not accept the equation, 'a kills b if, and only if, a brings it about that b is dead.') But the same threefold answer seems equally called for.

Suppose Schmidt wires a bomb to the starter of Jones' car. Jones turns on the ignition, on his way to work in the morning, and dies as a result of the explosion. Here it is true that something Jones did (turning the key) was sufficient for his death (given the way the world was at that time). But it is not true that Jones committed suicide, or even brought about his own death, although he did in some way contribute to his own death, or to the process that culminated in his death. Even if Jones turning the key was a necessary condition of his becoming dead (if someone else tried to turn the key, they would not have succeeded because only Jones knew how to jiggle it in a certain way to make it work). It remains inappropriate to say that Jones brought about his own death or killed himself, even though Do-agency would be applicable to such a case.

Clearly many philosophical questions concerning the applicability of (KD) to the language of action remain, but let us return to considering expressions of the form of (3). Consider a scenario where removing the chains is a necessary condition of Jones' leaving the room—or to put it conversely—Jones having left the room is a sufficient condition of the chains having been removed. Suppose Smith removes the chains. Now it does not follow that Jones has
removed the chains, even though 'DoJones The chains are removed' is appropriate. By supposition, the removal of the chains is an action of Smith's. Nor does it follow in any obvious sense that Jones has ensured that the chains are removed, since we might quite consistently suppose that it was not possible in the given circumstances for Jones to remove the chains. Nor was the removal of the chains a consequence of something Jones did, even though his leaving the room was a sufficient condition of the chains having been removed. Nor did Jones, in any plausible sense, indirectly bring it about or cause it to happen that the chains were removed. Thus it seems best to dismiss the possibility of these kinds of interpretations at the outset and concentrate on the literal reading of 'Doap' and the like as 'something a does is sufficient for p' and so forth in considering expressions of the style of (3). So long as we waive any interpretation in terms of 'a brings it about that p' or 'a sees to it that p' or other idioms of agency of this kind, the following three principles seem secure from any of the objections canvassed above.

(K3Do) If something a does is sufficient for p and something a does is sufficient for 'p \supset q', then something a does is sufficient for q.

(K3Do) If something a does is necessary for p and something a does is necessary for 'p \supset q', then something a does is necessary for q.

(K3Do) If something a does is both necessary and sufficient for p and something a does is both necessary and sufficient for 'p \supset q', then something a does is both necessary and sufficient for q.

The third principle will be a logical consequence of the previous pair, at least in Kanger's system, for the following schema is a theorem in that system: ((Doap & DoaP) & (Doa(p \supset q) & Doa(p \supset q))) \supset (Doaq & Doaq). But our question is: what use are these three principles, so suggestive from a point of view of modal logic, in assisting us to work towards an account of the notion of bringing-about?

This is a speculative question, given the present development of the theory of action, but perhaps here we can provide a partial framework in which to set the question, and some clues to answers in recent work of Chisholm, Goldman and Danto. We noted earlier that action theory is concerned with certain kinds of relations (often causal)
between actions. Goldman, for example, writes that when action A stands in some certain kinds of transitive, non-symmetrical relations to action B, then A "level-generates" B. Here we might say that if a brings it about that p and p stands in a certain kind of "consequential" relation to q, then p consequentially level-generates q.

$$\delta_a p \land p R q \supset p / q$$

Goldman distinguishes a number of R-relations, but the work of Danto and Chisholm indicates that a very important R-relation is the causal relation. It is important to note however, that in defining different consequential level-generational connectives, p / q, there may be many heterogeneous kinds of R-relations. Thus the term 'consequential' should not be taken too strictly, merely indicating that the terms of R-relations are states of affairs (or propositions) as opposed to actions as in the Goldman notion of level-generation. Now a special case is that where a given state of affairs is consequentially level-generated by some state of affairs or other. That is, where the following open sentence is true of a given q.

$$\exists p \ ( \delta_a p \land (p R q))$$

Kanger's Dó is, in turn, a special case of the above expression where R is the relation 'is a sufficient condition of.'

Since there is no widely accepted, well-defined causal logic, it is not possible to say anything very definitive about causal consequential level-generation, but some conjectures may be in order. Very roughly, following Mackie [16], Suppes [22], and Burks [5], p causes q where p is a necessary condition of q such that p, taken together with a set of background statements K, constitutes a sufficient condition for q. Following these conditions on the causal relation, we might conjecture that p is consequentially causally implied by some statement, say q, where a brings about q and, given K, q is both necessary and sufficient for p. This conjecture is of course highly speculative—the work of Hart and Honoré [14], for example, indicates that more conditions on the causal relation seem required to yield a notion of cause that is adequate to the language of agency in jurisprudence. The question remains whether more direct applications of Kanger's logic to the language of action are feasible.

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§5 Facere Aliud Esse

In Lambeth Manuscript 59, St. Anselm of Canterbury argued that an agent can bring about something itself (facere idipsum esse), or bring something about through some other state of affairs (facere aliud esse). An instance of the distinction: Killing by personally using a weapon as distinguished from killing by arming the killer. Thus I can kill by directly bringing it about that the victim is dead, or indirectly by bringing about a state of affairs q (the killer has arms) such that q is necessary or sufficient for the death of the victim. In [1], St. Anselm distinguishes a number of interesting varieties of indirect agency that are outlined and analysed in [26], where the schema \( \delta aq \& (q \supset \delta bp) \) is constructed to correspond to the expression 'a makes the killer, b, have arms.' This schema is, however, not adequate to yield full truth conditions for that expression, for it is easily seen that the schema is equivalent to '\( \delta aq \& \delta bp \)' given the reasonable axiom '\( \delta ap \supset p \)'. Thus we turn to the question of whether Kanger's logic can be applied to the idiom of indirect and interpersonal agency-expressions of the Anselmian type.

The key to understanding indirect as opposed to direct agency is that in the former case a brings it about that q where q is sufficient (or necessary perhaps, or both) for p and q and p are distinct. Whereas in the case of direct agency we have the degenerate case where a brings about q, and q is in some way not separate from p. This suggests that one way to understand the distinction is as follows. a indirectly brings it about that p where a brings about q and q is sufficient for p and q is not logically sufficient for p. a directly brings it about that p in the degenerate case where a brings it about that q but q is logically sufficient (logically implies) p. The aliud requires that q be a distinct state of affairs from p, and since states of affairs are thought of here on the analogy of propositions, propositional notions of identity seem appropriate. Thus entailment or equivalence suggests themselves.

Consider Anselm's illustration. My giving the killer arms is a necessary condition of the death of the victim, and perhaps also a sufficient condition if the killer is a homocidal psychopath (foaming at the mouth). But giving this individual arms does not entail (nor is equivalent to)

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7See also Douglas Walton, 'Principles of Interpersonal Agency in the Free Will Defense,' Bijdragen; Tidschrift Voor Filosofie en Theologie, to appear.
the not being alive of the other individual in question (obviously we have to be careful at this point about calling them 'killer' and 'victim' respectively). Thus in this instance I bring it about that the second individual is not alive indirectly. Notice however that my stabbing, say Jones, with a knife is not to bring it about that Jones is not alive directly. But this is easily explained: my stabbing Jones is not, at any rate necessarily, a bringing-about-of-Jones-not-being-alive at all. However my fatal stabbing of Jones would be a direct killing of Jones.

Also we need to distinguish between interpersonal agency, 'a brings it about that q and q is a necessary (or sufficient) condition of b's bringing it about that p'; indirect agency that is not necessarily interpersonal, 'a brings it about that q and q is necessary (or sufficient) for p'; and non-interpersonal agency, 'a brings it about that q and q is necessary (or sufficient) for p, where p is not a bringing-about of any state of affairs by any agent (except indirectly by a')

Unfortunately for theoretical economy however, even St. Anselm's distinction seems to be inescapably causal in structure, since some of our earlier problems reappear in it if the R-relation is necessary or sufficient conditionality minus tense or other causal stipulations. Because it is true that Smith's doing an autopsy on Jones is a sufficient condition of Jones not being alive, it hardly follows that Smith indirectly brought it about that Jones is not alive, at least in any sense of 'bringing-about' that is any obvious way relevant to the theory of action.

In Pörn [19], 'Dap' is now read, following Kanger as 'it is necessary for something which a does that p'. Pörn now combines Dap with a new operator Dap which reads 'but for a's action it would not be the case that p' to yield the full notion of bringing about. But unlike Kanger he does not define bringing about by the condition 'Dap & D'ap'. Instead he introduces a weaker notion, 'C'ap', defined by the schema '¬D'a □p' and read as: without a's action it might not be the case that p. Thus the new definition reads: a brings it about that p if, and only if, it is necessary for something that a does that p and without a's action it might not be the case that p. The reason for this deviation from Kanger's theory will become apparent when we evaluate the theory of Åqvist below.

§6 The System of Åqvist

Åqvist [2] takes as his vehicle the binary notion of an agent's bringing about one state of affairs q by bringing
About an initial state of affairs, \( p \), Åqvist rules that '\( a \) brings about \( q \) by bringing about \( p \)' where the following five conditions obtain (See [2, 81]): (i) \( a \) brings about \( p \), (ii) \( q \) obtains, (iii) \( a \) could reasonably have omitted \( p \), (iv) by having omitted \( p \), \( a \) could reasonably have avoided that \( q \) was realized, and (v) \( a \)'s bringing it about that \( p \) is a sufficient condition of \( q \). So outlined, a certain similarity to the theory of Pörn or Kangér may seem apparent, but Åqvist's account of the language of (i) - (v) is expressed through the notion of a game-tree, and is thus radically different from the Kanger-Pörn approach that was set in possible worlds semantics. Åqvist's approach is highly innovative and, in the opinion of this author, should have a revolutionary effect on the development of subsequent action theory.8

Intuitively, a game-tree is an upwards-branching graph starting from one node called the initial situation and every node represents a concrete situation.

\[ \text{t}_0 \]
\[ \text{t}_1 \]
\[ \text{t}_2 \]
\[ \text{t}_3 \]

Åqvist thinks of the nodes as time-points and these may be ranked horizontally so that each set of points at a given level all occur "at the same time," and as we go up the tree, we go to succeeding times. This element of "times" is not essential to the notion of a "tree," however. A path can be traced out from each node to each other node, except that in a tree, as opposed to other kinds of connected graphs, nodes may not be joined horizontally to form

* As we will see, however, Åqvist does not use the term 'state of affairs.'

8 Åqvist's theory is specifically directed towards the analysis of the notion of culpability for one's own negligence in the Swedish law of torts, but our concern here is with the application of it to questions of action theory. See Lennart Åqvist, Kausalitet och Culpansvar inom en logiskt rekonstruerad skadeståndsrätt en studie i analytisk rättsfilosoofi (Causation and Liability for Negligence in a logically reconstructed Law of Torts: a study in analytic philosophy of Law), Uppsala, 1973.
closed loops. A path is called by Åqvist a possible course of events or a possible world. We can also have alternative possible worlds on a tree, that is, one path can represent an alternative to another if they both branch out from the same starting point—in this case, according to Åqvist, one world is a historical alternative to another.

In a game with a number of agents or players, each node may represent the move of one player called a decision point. Åqvist extends this notion so that an individual act is thought of as the line connecting a node with one above it: a is said to perform that act where the lower node is a decision point for a. Thus an action is thought of in binary fashion as a change or transformation from one state to another. A state of affairs is a set of nodes, that is, a set of concrete situations, and an event is thought of as a set of paths or in other words a possible world. An event Y is a historically sufficient condition of an event Z where Y and all historical alternatives to Y are included in Z. A simplified example would be that of the diagram below, where Y goes only to Z and where all the alternatives to Y (in this case there are only two, X and W) also go only to Z.

Y is said to be a historically necessary condition for Z where \( \lnot Y \) is historically sufficient for \( \lnot Z \). Finally Z is historically avoidable relative to Y where it is not the case that Y is historically sufficient for Z. It follows that Y is historically avoidable relatively if, and only if Y is not a historically sufficient condition of Z.

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9 See R. Duncan Luce and Howard Raiffa, Games and Decisions, New York, Wiley, 1957, ch. 3.

10 The definition [2, 80] reads (where Y and Z are events): Y historically necessitates Z in w at t (or, Y is a historically sufficient condition for Z in w at t) iff \( \text{HistAlt}(w, t) \cap Y \subseteq Z \). The set, \( \text{HistAlt}(w, t) \) is the set of all the historical alternatives to w at t.
Given this terminology, the five-part definition of 'a brings it about that \( A_2 \) by bringing it about that \( A_1 \)' can now be exactly restated in a game-theoretic fashion: (i) a performs \( A_1 \), (ii) \( A_2 \) is a concrete situation at a higher node along a path from \( A_1 \), (iii) there is a historical alternative to a's not performing \( A_1 \), (iv) \( A_2 \) is historically avoidable relative to a's not performing \( A_1 \), and (v) a's performing \( A_1 \) is a historically sufficient condition for \( A_2 \). In light of our discussion of Kanger, it is extremely interesting to note that it is shown by Åqvist to be a consequence of the framework he adopts that if a brings it about that \( A_2 \) by bringing it about that \( A_1 \) then \( A_2 \) must occur later than \( A_1 \). In other words, a more correct reading of Åqvist's binary concept of agency is 'a brings it about that \( A_2 \) by having just performed \( A_1 \)' (Vide [2, 8ff.]).

Åqvist points out that he has argued against replacing (iv), which requires only that a's not performing \( A_1 \) makes not-\( A_2 \) possible, by a stronger condition (iv') requiring that a's not performing \( A_1 \) be a sufficient condition of not-\( A_2 \) (or equivalently, that performing \( A_1 \) be a necessary condition for \( A_2 \)). In this, as we have seen, he sides with Porn against the stronger account of Kanger. Two reasons are given by Åqvist [2, 86] for this preference. First, he writes "it [(iv')] leads directly to the well known, but altogether unnecessary difficulties in cases involving multiple sufficient causation, which are easily avoided if we merely adopt our weaker condition (iv)." This is hard to understand, however, since the tense and over-determination problems we examined earlier appear largely independent of whether (iv) or (iv') is chosen, but pertain to (v). The second reason is made plainer in the context of a game which we simplify here for purposes of illustration. Suppose a and b, the two players, each have a pair of red chips and a pair of blue chips— each has a total of four chips. Each takes a turn to throw either (a) one chip or (b) two chips on a table. a always throws first and then b is required to throw. There are exactly two throws allowed in each round of the game. The point of a round is that if two chips of the same colour are thrown, a certain outcome 0 is realized. If different coloured chips are thrown, 0 is not realized. Each throw is independent of the other and each player must make his move—no passing is allowed. Now, in connection with this game-fragment, we can pose some interesting questions. For example, consider the round where a throws one red chip and b does likewise. Did a bring about 0? Did b bring about 0? Åqvist's theory would answer 'no' and 'yes' respectively, following the intuition of Hart and Honoré [14, 186] that there has intervened an independent decision
on the part of b. Now consider the round where a throws two red chips. Here 0 occurs no matter what b does. Accordingly, Åqvist's theory rules that a brought about 0 by throwing his two red chips whereas b did not bring about 0. Notice however that if (iv') had been stipulated, we would have had to rule that it is false that a brought about 0 by throwing his two red chips on the ground that a's throwing two red chips was not a necessary condition of 0: b could have brought about 0 by throwing two blue chips. Thus (iv) allows us to preserve the intuition that, in this case, a does indeed bring about 0 even though he could have used some other means to achieve the same result. This also explains why Pörn has deviated from the stronger theory of Kanger.

Two extensions of the theory are also worth note. First, Åqvist provides a framework for handling cases where the moves of the players are not independent, i.e., where one player influences another by his move, by introducing a notion of maximally probable historical alternativeness. Second, problems that arise from simultaneous plays are handled by using sequences of game-trees instead of single ones. The latter innovation could be used to handle the overdetermination problems we looked at, but since [2] only mentions this technique briefly, we will not comment further on it. Finally, one aspect of Åqvist's notion of indirect agency that is sure to provoke philosophical comment concerns (iii) and (iv), stipulations that, in effect, require that all actions are "free" in the sense that the agent could have done otherwise. It is often made clear by action theorists that there are genuine cases of "actions" where, in some sense, the alternative of not performing was not open to the agent at the time. That is, the question of what one does, is often assumed to be independent of the question of what one could have done (Vide Walton [24]). In defense of the applicability of Åqvist's notion, however, we can say that it does characterize an important class of actions even if there is reason to believe that there may be genuine cases of what, for various reasons, might legitimately be regarded as actions, that do not fall under it. Also, it is a difficulty for a notion of action that lacks (iii) and (iv), or some similar conditions, to distinguish between omissions and mere non-performances.

§7 Some Comparisons

While admittedly there are substantial differences among the views we have looked at, reflection on them exhibits a definite convergence and many fundamental points of agreement. All the writers focus on the binary action relation
of Åqvist as critical; Chisholm through his study of vari­
eties of causally indirect actions, Goldman through the concept of level-generation, and Danto through his study of causally linked actions in the concept of a basic action. Kanger and Pörn, through their use of the concepts of necessary and sufficient conditions also approach the same kind of mechanism. Of course what Åqvist makes explicit is not so clearly in the forefront in these other works where it emerges only as an adjunct to something else. Ironically, the binary concept of indirect agency is more clearly and independently displayed by St. Anselm than by these modern writers. Our survey here indicates that in future, action theorists should concentrate more effort specifically on this concept.

A second area of agreement is of course the sharing of the basic syntax of bringing-about, although this feature is most evident in Chisholm and the Scandinavian writers. Third, we have shown that modal logic and possible worlds semantics is characteristic of attempts to extend the logic of bringing-about. Here it is worthwhile noting that from a mathematical point of view, the game-trees of Åqvist are not as far-removed as they might seem from the possible-worlds semantics of Pörn and Kanger. Both approaches are fundamentally intensional in their logic. Also, the Goldman method of level-generation might easily turn out to be simply a fragment of the Åqvist method of game-trees.

How the three approaches compare in general outline can be seen by noting that Åqvist rules in effect that q is brought about by an agent if and only if there is some other state (or event, for Åqvist) p such that the agent brings it about that p, and the following conditions obtain. Read 'Mp' as 'p is possible' (In Åqvist's terms, p is avoidable if and only if Mp is possible) and 'p + q' as 'p is sufficient for q'.

(1) M ∼ p
(2) ∼p → M ∼ q
(3) p + q
Kanger gives two conditions, (3) and a strengthened version of (2), namely
(2K) ∼p + ∼ q
And Pörn is satisfied with (2) and (3). Thus the three approaches are not irreducibly dissimilar. Indeed, I think they are really very close. The Kanger-Pörn account is formally more highly developed, since at least axioms and a semantics are given. But Åqvist brings out much more clearly many practicalities of application. In particular, he makes the tense-structure explicit and displays clearly
the game-theoretic aspect of this concept of bringing-about, showing that it pertains essentially to possible alternatives.

§8 Concluding Remarks

The problem is that any logic for 'bringing about' that accepts (3n) and hence proceeds in a standard modal framework (as Kanger and Pörn do) or defines 'bringing about' exclusively in terms of a notion of necessity defined over sets of outcomes on a game-tree (as Åqvist does) bypasses the concept of actual bringing-about. Note that in the systems of Kanger and Pörn, the primary concept is 'something a does is sufficient for p' but the 'does' in this expression is itself unanalyzed. Similarly, in Åqvist's treatment, no axioms or semantical machinery for actual bringing-about is given. An action is merely an ordered pair of points on a tree. Thus we could say that both types of system yield up a notion of bringing-about that might be called 'strategic bringing-about', i.e., a strategically brings it about that p if, and only if, no possible alternative to p can be an outcome given what a does. In this sense, I bring p about if my actions are such that, given the state of the world (or the game) at the time, every possible development (or path) contains p. Informally, this might be paraphrased by idioms like 'I ensure that p happens' or 'I force p to happen.' This notion, however, assumes a prior notion of actual agency, as can be seen by observing that it fails to draw the usual distinction between 'actively doing' and 'allowing to happen' (or 'letting happen'). I might force something to happen (in the Kanger-Pörn-Åqvist sense) if I merely stand by without exhibiting any actual bodily movement, but merely by being ready to intervene should the need arise. Yet many commentators would quite rightly feel, I am sure, that in a basic sense of 'bring about', I did not bring the outcome about,

11 It is revealing to observe that the basic notion that Åqvist (and also Kanger and Pörn) seeks to capture can easily be defined over a tree, without any essential reference to bringing about. I.e., p is inevitable (over a tree) if, and only if, p occurs at some point on every path. The idea is that no matter what path you take, you must inevitably come to p. This notion of inevitability is familiar in branching tense logics (see R. H. Thomason, 'Indeterminist Time and Truth-Value Gaps,' Theoria, 3, 1970, 264-281). Thus for Åqvist (and also Kanger and Pörn) a brings it about that p if, and only if, a brings it about that it is inevitable that p. For more on this see §8.
but merely let it occur. Thus I think that there is a very basic and important notion of actual-bringing-about that the Kanger-Pörn-Åqvist style of theory simply fails to capture. Moreover, I know of no obvious additions to the axioms or semantics of either approach that could introduce an adequate formalization of actual bringing-about.

Very briefly, the problem is this. Utilizing the material conditional (as in Kanger and Pörn) or a tree-theoretic concept of inevitability (as in Åqvist) brings conditionals into the language of action in a way that clashes with some features of negation in action-contexts, for it fails to preserve the usual negation equivalences between actual bringing about and letting happen (i.e., a lets p happen if, and only if, a does not bring it about that p does not happen). The basic problem is the frustrating inadequacy of the material conditional in fundamentally causal contexts. For all this, it must be said that, at least in my opinion, the notion of strategic bring-about is a very important one for the action theorist. In short, while the Kanger-Pörn-Åqvist approach does not yield the usual notion of bringing about, the concept it does bring forth is significant and interesting, and will provide a fruitful, if partial, logical foundation for the theory of action. I think these logicians are right to explore the behavior of 'bringing about' over standard classical conditionals and tense-theoretic notions of inevitability. But I also think that the notion of actual bringing about requires the study of deviation from standard conditionals. Actual bringing-about behaves nicely over classical negation and conjunction, but as we have seen, starts to become unmanageable in the region of classical conditionals. The study of how bringing-about operates over non-standard conditionals that are, for example, not vacuously satisfied by the falsity of the antecedent or the truth of the consequent, is, however, a project that has not been attempted by these authors. However, their work serves to indicate that this is what is needed.

To understand how actual bringing-about can be closed under conditionals, what is needed is a new approach to the notion of physical necessity, a concept of necessity relativized to a set of laws and a fixed set of antecedent conditions. Relativized time-sensitive notions of necessity have been explored, notably in [20], [27], [21], and [17]. Suppose I release an object that falls onto a

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12 An extended discussion of the application of notions of relative necessity to action statements is given in my paper, 'Time and Modality in the Can of Opportunity,' in [4].
surface. The conditional statement 'The object is released at $t_1$ only if the object is on the surface at $t_2$' is necessary relative to a set of physical laws and relevant factual conditions. This, in turn, licences the conditional 'If I bring it about that the object is released at $t_1$, then it is relatively necessary that I bring it about that the object is on the surface at $t_2$'. Thus actions are thought to be closed under the relation of relatively necessary conditionality. This relation should be a main goal of analysis for intensional action theory. Although the Åqvist notion of historical necessity does not, as we have seen attain this goal, it is nevertheless an important step in opening up the intensional approach.

It is interesting to see that the by-relation studied by Åqvist can be dealt with in somewhat parallel fashion within the extensional framework of Davidson. Consider the action of John's burning down the house by kindling the bedding. This may be parsed in the Davidson manner as $$(\exists x) \ (\exists y) \ (\exists z) \ (x \text{ is by John} \land x \text{ causes } z \land z \text{ is a kindling} \land z \text{ is of the bedding} \land y \text{ is a burning down of the house} \land z \text{ causes } y),$$ That is, it seems a plausible extension of what Davidson writes in [11] to explicate the example as follows. There is a "primitive action" (see [11, 9]) which could be described as certain hand-movements by John. This event caused a kindling of the bedding which, in turn, caused a burning of the house. This possible extension would increase the capacity of the Davidson theory to deal with indirect agency, and if adopted, may make it seem more like a competitor to the intensional approach. Of course, to what extent an adequate theory of causality can be formed in non-intensional language is a moot point. Here again the problem is one of conditionals.

13 Incidentally, the method of relativized modalities may help to illuminate the tense problems of Thomson [18]. If I bring it about at $t_1$ that $p_{t_2}$ and '$p_{t_2} \Rightarrow q_{t_3}$' is necessary relative to a set of laws $\xi$ and a set of facts $\mathcal{F}_{t_k}$, then when am I said to bring it about that $q_{t_3}$? The upshot of [23] is that serious objections may be brought against any of the obvious answers, and that about the best one can settle for is to conclude somewhat lamely that I brought about $q_{t_3}$ in the interval $t_1-t_3$. Perhaps the reason why no answer seems really satisfactory is that none is--rather, the time of bringing about $q$ is relative to the time we pick at which $\mathcal{F}$ is alleged to obtain. This time might vary--see the reference in note 12.

14 This suggestion is due to Max Cresswell in discussion.
What emerges is an intensional style of action theory that strongly contrasts with the essentially extensional approach of Davidson. In the past however the intensional approach has never been clearly set out in a unified way, showing its common foundational structure. Some of this structure, however, begins to become apparent as elements of it in the works of these various writers are juxtaposed. It remains unclear whether the extensional and intensional approaches are competitors, or whether their domains are simply disjoint, that is, whether they yield up different, but possibly complementary, kinds of "actions." If the project of an intensional action theory continues to consolidate and mature, a future development to be hoped for would be the integration of it with Davidson's program.

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REFERENCES


[27] ________, 'Time and Modality in the Can of Opportunity,' in [4].