then one would not have $t = t$; and they defend the view that $t = t$ is true regardless of whether or not t designates. (See reviewer's comment at end of review below.)

NUEL D. BELNAP, JR.

JAAKKO HINTIKKA. *Existential presuppositions and existential commitments.* ***The journal of philosophy,*** vol. 56 (1959), pp. 125–137.

Hintikka relates the problem of singular terms which do not or might not designate (e.g. *Homer, N. Bourbaki*) to Quine's thesis (QT), "To be is to be a value of a bound variable." He argues that resorting to Russell's theory of definite descriptions in order to defend QT's applicability to non-designating singular terms is unsatisfactory, and prefers rather to modify the underlying quantificational logic. His modification is essentially the same as that of the paper reviewed above. (The two papers are independent; the reviewer has been informed that they were submitted within five days of one another.)

Hintikka bases his formulation on a metalogical, monotonic equivalence relation $\leftrightarrow$, abbreviating $A \leftrightarrow A \mathbin{\&} B$ as $A \rightarrow B$. The axioms and rules are such that one does not have $A \leftrightarrow B$ unless A and B contain occurrences of exactly the same free variables; since this feature does not contribute to the main theme of his paper, it is possible he intended to offer a bit of lagniappe by formalizing the concept of entailment. It is therefore worth remarking that $A\&\bar{A}\&\bar{B} \rightarrow B$ is provable, though this seems a dubious entailment. On the other hand, Hintikka's system seems wholly in the spirit of Parry's *analytische Implikation* (473*1*).

In order to relate existential presuppositions to existential commitments, Hintikka bids us take $(\exists x)(x = t)$ as a translation of "t is a value of a bound variable," and hence by QT, of "t exists." Given the new system with $(\exists x)(t = x)\&At \rightarrow (\exists x)Ax$, but not $At \rightarrow (\exists x)Ax$, it follows that QT is equivalent with Quine's "older thesis," that for "t exists" to be true, it is necessary and sufficient that existential generalization on t be valid.

Since it is not presupposed that the individual constants designate, Hintikka labels his system a "logic without existential presuppositions" (first sense); but it is of course not such in the (second) sense of being valid in the empty domain. A logic which is without existential presuppositions in *both* senses seems to the reviewer more in the spirit of the enterprise. Existing proposals are, however, unsatisfactory for present purposes: Mostowski's (XVI 272(1)) for reasons cited by Hailperin and Quine (XX 284), and the systems of the latter because of the absence of free vaiiables or individual constants, required for applicability to singular terms.

One terminological matter needs clarification: Hintikka uses "free variable" and "bound variable" to distinguish two kinds of expressions of the alphabet, called by Leblanc and Hailperin "individual constant" and "variable" respectively. Thus Hintikka is led to speak somewhat confusingly of "expressions in which all bound variables are actually bound to some quantifier." In the first use of "bound" a kind of expression is distinguished, while in the second use the manner of its occurrence is indicated.

NUEL D. BELNAP, JR.

K. J. J. HINTIKKA. *Towards a theory of definite descriptions.* ***Analysis*** (Oxford), vol. 19 no. 4 (1959), pp. 79–85.

By building on the "logic without existential presuppositions" of the article reviewed above, Hintikka formulates a theory of definite descriptions which fails to have some of the counterintuitive consequences of Russell's theory for empty descriptions. The new theory is constructed in two steps. (i) Definite descriptions $(\imath x)Bx$ are admitted "on the same footing with" individual constants, thus assimilating them to ordinary names. Hintikka presumably intends thereby that if At is a theorem, then so is $A(\imath x)Bx$. (ii) Hintikka remarks that though in general we do not know quite how to eliminate a descriptive phrase in the absence of an assurance that it fits a unique individual (*contra* Russell), nevertheless we do know that for something a to be the so-and-so is for a to be a so-and-so, and the only so-and-so. Thus he introduces as the sole axiom governing the elimination of descriptions: (7) $a = (\imath x)Ax \leftrightarrow Aa \,\&\, (x)(Ax \rightarrow x = a)$.

We can then explicate the assertion that a unique thing satisfies the description $(\imath x)Ax$ by $(\exists x')(x' = (\imath x)Ax)$, and can use (ii) to eliminate the description in this context. Further, we can eliminate the descriptive phrase in $A(\imath x)Bx$ for an arbitrary context A, *provided* that we have as an additional premiss $(\exists x')(x' = (\imath x)Bx)$. Hence Hintikka's theory has the same results as Russell's in the presence of an assumption of unique existence, but, as Hintikka shows, does not have the following counter-intuitive consequence of Russell's theory: $a = (\imath x)(a = x) \leftrightarrow (\exists x')[(a = x') \,\&\, (x)(a = x \rightarrow x = x')]$.

On the other hand, if the reviewer is right in his interpretation of the quotation in (i), then Hintikka's theory is in certain respects stronger than Russell's; e.g., as Leonard pointed out, (i) leads to $(\imath x)Ax = (\imath x)Ax$, absent in Russell's theory. This seems all to the good. NUEL D. BELNAP, Jr.

J. H. WOODGER. *Formalization in biology.* ***Logique et analyse*** (Louvain), n.s. vol. 1 (1958), pp. 97–104.

The subject of this lecture is not, primarily, formalization in biology. Rather, it is a discussion of the well-known question how to distinguish between the influence of heredity and of environment. The author believes that the use of the symbolism of mathematical logic including some of the notation of ***Principia mathematica*** can help to elucidate this problem. After first introducing the notion of a genetical system, he defines the condition under which a phenotype is said to be environmentally insensitive in a genetical system, and then calls a phenotype hereditary if it is evironmentally insensitive in all systems. Corresponding definitions lead to the notion of an acquired phenotype.

To what extent does formalization advance the cause of a given discipline? This is an important question, and one which in general can be settled only by those who are experts in the field under consideration. In the present case it appears to an outsider that while the formalization of biology is interesting in itself, the problem as such can be dealt with equally well without the technique of symbolic logic.

ABRAHAM ROBINSON

HASKELL B. CURRY. *On definitions in formal systems.* Ibid., pp. 105–114.

Instead of concerning himself with the problem of the introduction of single definitions and of their legitimacy, the author presents a theory of definitions in a more general setting. He considers a formal language S_0, and an extension S_1 of S_0 which contains additional constants (in Curry's terminology, "obs"). S_1 is a deductive system with respect to a binary relation X D Y — which is intended as a formalization of "X is defined by Y" — and satisfies a number of axioms, which are partly of a general character. In particular D is reflexive and contains a number of explicit definitions, e.g. $\Phi(A_1, \ldots, A_\mu)$ D Y where the left hand side denotes an atomic sentence or operation. There is a single rule of deduction which expresses the replacement of a definiendum by its definiens.

Within this framework one may conveniently formulate, and sometimes answer, some standard questions regarding definitions, e.g. under what condition a definition is unique. This and other questions are discussed by means of a standard reduction procedure which falls into the category of algorithms in the sense of Markov.

Observation. By way of introduction, Curry remarks that the simple idea of intro-