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A Critical Exposition of Russell's Final Epistemology

Joseph Erban

A Thesis

in

The Department

of

Philosophy

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for the Degree of Master of Arts at
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ABSTRACT

A Critical Exposition of Russell's Final Epistemology

Joseph Erban

The central purpose of this thesis is a critical interpretation of Russell's later epistemology enunciated in Human Knowledge: Its Scope and Limits. This volume constitutes Russell's final major analysis as regards human knowledge and the degrees of certainty and doubtfulness associated with it. Moreover, based on a belief that scientific practise is an aspect of knowledge, an additional aim was to state explicitly the principles underlying scientific inference. The central topics discussed were data and experience, scientific concepts, probability, induction, non-demonstrative inference and knowledge.

The conclusions reached are that to Russell "data" is ambiguously defined; that Russell's causal theory of perception is incomplete by failing to account for the observed-observer interaction; and that Russell's account of memory is in need of amplification. Russell's dual connotations of probability as finite frequency and degrees

of credibility were retained, while dispensing with the principle of induction. Based on Keynes' mathematical proof of induction by simple enumeration and our need of principles bestowing generalities a priori probability in advance of experience, it was noted that Russell's five postulates of scientific inference are reducible to a single assumption. But it was also stressed that while Russell's postulates are reducible in number, they fail to stipulate all assumptions of science, hence are insufficient. Concerning Russell's theory of knowledge, it was maintained that as a subclass of true beliefs, both "truth" and "belief" are imprecise. Nevertheless his contention that knowledge is a subclass of true beliefs remains unchallenged.

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INTRODUCTION

The aim of this essay is to examine Russell's epistemology enunciated in Human Knowledge: Its Scope and Limits.[1] The volume constitutes Russell's final major analysis as to how much we know, and the degrees of certainty or doubtfulness associated with his conception of knowledge. Based on a belief that scientific practice is part of knowledge, an additional aim was to show assumptions required of science coupled to experience.

Chapter I will investigate Russell's conception of knowledge by way of a preliminary outline. In Chapter II, an analysis of Russell's conceptions of sensation, perception and memory as aspects of experience and as data of derived knowledge will be dealt with. In Chapter III, I will examine Russell's scientific ontology in order to introduce physical concepts required for an analysis of scientific inference. Chapter IV will deal with the nature

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[1]Bertrand Russell, Human Knowledge: Its Scope and Limits, (New York: Simon and Schuster, An Essandess Paperback, 1962).

of probability and its central role in non-demonstrative inference, the scientific method and degrees of belief. Finally, Chapter V will critically view Russell's solution to the problem of induction, non-demonstrative inference and knowledge.

The author maintains this evaluation of Russell's solution to the problem of knowledge by means of induction based on the postulates of scientific inference: (a) that some of the postulates are tautologies and hence reducible in number; and (b) that Russell's advocated solution is insufficient to explain all scientific assumptions. Throughout I will also present and respond to criticism by myself and others on various topics concerning Russell's epistemology.

This essay emphasizes the aspects of Russell's later epistemology not dealt with in his earlier works. Furthermore, it does not attempt to compare Russell's final theory of knowledge with post-Russellian epistemologies.[2] Rather, it highlights direct criticisms and responses concerning Human Knowledge.

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[2]Except for Popper; for example, the later Wittgenstein's philosophy of language, the non-foundational epistemologies of Quine, Kuhn, Feigl and Feyerabend, or the semantic theories of Searle, Kripke and Davidson were not discussed.

CHAPTER I

KNOWLEDGE: PRELIMINARY CONSIDERATIONS

Beliefs and Knowledge

Russell's conception of knowledge initially is confined to beliefs of our common world. Our beliefs of past, present and future occurences deserve to be called knowledge, it seems at a glance, provided they are true. This in turn requires an interpretation of Russell's views on belief and truth.

Beliefs, for Russell, is a wide generic term that is not confined exclusively as attributes of human experience; beliefs are a feature of varied life forms. Suppose you are about to walk your dog; when you hold the leash, the dog responds by way of excitation. This response, although an aspect of habit[1] is nevertheless conceived by Russell as a belief. Beliefs are therefore viewed by Russell as either mental or physical events of

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[1]Habits are said to consist in the production of a response due to repeated presence of stimuli such that the response would not have occurred if the animal did not have such repeated experience. Ibid., p. 100.

various life forms (most notable in the more evolved). His formal definition is:

> A belief, as I understand the term, is a certain kind of state of body or mind or both. To avoid verbiage, I shall call it a state of an organism, and ignore the distinction of bodily and mental factors...A belief, we may say, is a collection of states of an organism bound together by all having in whole or in part the same external reference.[2]

Beliefs are perceived as either physical or mental or both. The above passage suggests that there are physical or mental or both sorts of states, but in fact, to Russell, it is classified as a state of an organism having an external reference. Of external reference, Russell states:

> ...the external reference of an idea or image consists in a belief, which, when made explicit may be expressed in the words "This has a prototype.[3]

The prototype; (a) resembles a belief in structure; (b) is the cause of the belief; and (c) both the belief and the prototype result in the same particular response.[4]

The above definition of "belief" bears an inherent vagueness due to numerous possible states that are equally deserving of the term. Yet in Russell's philosophy every general term, i.e., a term designating a class of similar

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[2]Ibid., p. 145.

[3]Ibid., p. 110.

[4]Ibid., pp. 109-110.

qualities suffers in being vague.[5] The term "bald", for example, means "the class of individuals having some similarities among each member, namely, individuals who lack hair." We judge individuals as being bald and others as not, but between extremities, we may remain uncertain as to whether a given individual ought to be classified one way or another. Similar considerations apply to the class of beliefs, i.e., certain states might be classified as beliefs and others as not, but some states are indeterminate. It is by virtue of this vaguely delineated class denoted by any given general term that Russell also maintains the vagueness of "beliefs".

We therefore initially note two sorts of vagueness associated with "beliefs". The first is vagueness due to numerous states that combine and form the class designated by "belief" (i.e., physical or mental or both states) and, secondly, a vagueness due to a lack of sharp separation that would segregate and consitute the actual class. Within a Russellian comprehension of beliefs, the above noted double vagueness is present, yet Russell fails to assess explicitly the ambiguous character of the noted vagueness; moreover, his critics do not comment on this distinction.

Given that for Russell "knowledge" is defined in terms of "true beliefs", and the fact that "beliefs" is in

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[5]Bertrand Russell, An Inquiry into Meaning and Truth, (London: George Allen and Unwin Paperback, 1980), p. 24, and Human Knowledge, p. 98.

possession of two sorts of vagueness, "knowledge" is therefore equally vague or imprecise.

Suppose I look at a wall and note a blue patch. I can say that I have knowledge of blueness provided the patch is blue. Afterwards I may believe that my previous sensation was of a blue patch. Immediate memory therefore might also be termed "knowledge" providing the given fact, that what I previously sensed was of a blue patch. If I were now to turn my head towards the patch initally noted, I expect to sense blue. In such instances, a true expectation counts as knowledge. Immediate sensations, memory and expectation could all give rise to what might appropriately count as knowledge. It is in virtue of such wide and divergent states that give rise to what is initially noted of the term "knowledge", in Russell's philosophy, that the meaning of "knowledge" is imprecise. Moreover, as noted above, every general term suffers from some imprecision. This lack of precision becomes more acute when the issue of derived knowledge is to be subsequently dealt with. Under such considerations, the nature of certitude and doubtfulness become issues associated with knowledge. Certitude and doubtfulness to Russell are either not quantifiable, or when quantifiable, there exists no method of determining what quantity ought be to classified as confined to knowledge.

The above discussion of "beliefs" as a definiens to

"knowledge" dealt with beliefs of facts (as particular occurences). To Russell however, beliefs are also general, i.e., relating general connections of facts. This topic will be initially covered under the following heading of "general knowledge".[6]

General Knowledge

In any concern with minimal scientific theories as candidates for human knowledge, the broader topic of general propostitions as aspects of "general knowledge" must be dealt with and is defined by Russell as:

> By "general knowledge" I mean knowledge of the truth or falsehood of sentences containing the word "all" or the word "some" or logical equivalents of these words."[7]

Sentences containing "some" are thus also expressive

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[6]A.J. Ayer, Russell and Moore: the Analytical Heritage, (Cambridge: Massachusetts, Harvard University Press, 1971), pp. 98-105., gives a historic perspective upon Russell's conception of "beliefs" but stops short of examining the final position contained in Human Knowledge. Elizabeth Ramsden Eames, Bertrand Russell's Theory of Knowledge, (London: George Allen and Unwin Ltd., 1969), p. 145, notes the following, "His final definition of belief is a collection of states of an organism bound together by all having in whole or part the same external reference." Her interpretation is similar to one noted above. Bruce Freed, "Belief about Objects", Philosophical Studies 24, (May 1968): 41-47, confines his analysis on Russell's conception of belief to An Inquiry into Meaning and Truth, but not Human Knowledge. The same applies to R.M. Martin, "Truth, Belief and Modes of Description", Bertrand Russell, Memorial Volume, ed. George W. Roberts (London: George Allen and Unwin Ltd., 1979), pp. 253-263.

[7]Russell, Human Knowledge, p. 129.

of general knowledge.[8] This stance is maintained by Russell in virtue of logical considerations, namely, the falsehood of some-sentences are all-sentences and the falsehood of all-sentences are some-sentences.[9] Anyone who disbelieves a some-sentence believes an all-sentence, and a disbelief in an all-sentence implies a belief in a some-sentence.[10]

Also to Russell, linguistic considerations are involved in an analysis of some-sentences as general

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[8]I note that to Russell "some-sentences" apply general knowledge because, (a) it is contained in Russell's formal definition, and (b) is used in Human Knowledge as a counter argument to a claim that we do not possess knowledge of some or "unexemplified existence propositions", Ibid., pp. 445-452.

[9]This conviction was initially stated by Alfred North Whitehead and Bertrand Russell in Principia Mathematica, (Cambridge: The University Press, 1968), p. 16. "For reasons which will be explained in Chapter II, we do not take negation as a primitive idea when propositions of the forms $(x).\phi x$ and $(\exists x).\phi x$ are concerned, but we define the negation of $(x).\phi x$, i.e. of 'ϕx is always true,' as being 'ϕx is sometimes false,' i.e. '$(\exists x).-\phi x$,' and similarly we define the negation of $(\exists x).\phi x$ as being '$(x).-\phi x$.'. Thus we put

$$-\{(x).\phi x\}. = .(\exists x).-\phi x \quad Df,$$
$$-\{(\exists x).\phi x\}. = .(x).-\phi x \quad Df."$$

Also, in Russell's Human Knowledge, p. 501, he states "'f(x) always is the negation of 'not-f(x) sometimes' and 'f(x) sometimes' is the negation of'not - f(x) always'."

The above logic differs from Aristotlian logic. C. Lejewski. The Encyclopedia of Philosophy rev.ed., (1972), S.V. "History of Logic," notes that "A universal affirmation and the corresponding particular denial are said to be opposed as contradictories....Of any two such contradictories one must be true and the other false. A universal affirmation and the corresponding universal denial are said to be opposed as contraries,... they cannot both be true."

[10]Russell, Human Knowledge, p. 129.

knowledge. If I were to say "x is some individual I met today", this sentence signifies that "x is a member of a class denoted by 'individuals'". What in fact is considered in logic as an existential proposition pertaining to at least a single individual, is expressive in Russell's later epistemology of the entire class, of which at least a single member is noted. "Some-sentences" thus refer meaningfully to an entire class. To prove such a sentence would require that at least one member of the class be in possession of the noted quality, e.g., to prove "some dogs bark" would require that at least one dog be in possession of the feature of barking. That is to say, the class designated by "Dogs bark" be non-empty in order to prove such a proposition.

To further disprove the sentence "I met an individual" would require a method where we can go through the entire class denoted by the general terms of the copula and state, in the above example, that each, any and every member of the class of individuals was not met by me. In either case, the truth and falsehood of some-sentences signifies a collection or class and is termed "general knowledge".

To Russell sentences containing "all" such as "All A is B" can be understood by anyone who understands the logical term "all" and the noted predicates. To understand such an all-sentence, we require only an intensional

understanding of the logical terms and those for predicates, without having to enumerate the extension or membership of the noted class.[11]

When a sentence is intensionally stated, a corresponding extensional equivalent can only be formulated in virtue of a general negative sentence. If we wish to state the following all-sentence, "x are all the members who inhabit a certain city", where x is some constant, we can understand the intensional aspect of this sentences without having to actually count all members denoted by this sentence. Should , however, we desire to state an equivalent extensional sentence in terms of membership, we require a method that would generate the sentence "A is an inhabitant of this city, B is an inhabitant of this city....X is an inhabitant". But for Russell we require further to state "No humans except A,B,...X inhabit this city." The following example would , I believe[12], explain

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[11]Russell does not define "intensional" or "extensional" in Human Knowledge. He refers to these terms in p. 130, p. 138, p. 139, p. 404. His best quotation on this subject is "...you can fully understand the sentences...'All widows have been married' which is not known by means of enumerations of widows. In order to understand a general sentence, only intensions need be understood; the cases in which extensions are known are exceptional...." Ibid. p. 130.

[12]Aside from the above noted secondary souces, I was unable to find any additional sources regarding Russell, concerning beliefs, negations, general knowledge and intensional/extensional definitions as confined to Human Knowledge. The subject of universal propositions as aspects of general knowledge will be further discussed in Chapter V, as is Russell's overall conception of knowledge.

how according to Russell we come to know negative general propositions.

When we answer "No" to such questions as "Are you in pain?", "Do you see anyone?", "Do you smell anything?", our reply, according to Russell, is in a sense, a negative general propsition. This consideration is seen as a consequence of direct observation just as much as if we were to have replied affirmatively. When we answer negatively, we understand the meaning of the terms involved in the general question, note a relation of incompatibilty between the meaning of a term and one's observation, and conclude with a negative universal reply. Suppose you ask "Are you in pain?", the term of importance is "pain". I first know what this term means to me, I note my bodily states and the fact that differs or is incompatible with pain and conclude, "I do not feel pain".[13] This is evidence of a negative general proposition (as an aspect of general knowledge) namely, that no pain is experienced by me. It therefore refers to all pain in the universe and the fact that I do not experience any aspect of it, hence, my inital reply

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[13]It can be maintained that an example of pain is unsuitable to illustrate Russell's contention that negative general propositions can be derived through experience. But at this junction in Russell's epistemology, we are comparing an experience with a concept and whether or not there exists the relation of similarity or difference between the two. The experience or lack of pain would therefore do as an experience. As noted above, we could use the sight of redness in "Do you see red?", in order to illustrate Russell's handling of how we come to know negative general propositions.

implies a negative general proposition. Moreover, such a conclusion is arrived at by direct observation, in the same way as if I were to answer affirmatively. The fact that certain negative general propositions can be generated by direct observation allows Russell to conclude that we can derive general negations through experience.

To the above, we could question whether in fact all universal negations can be derived in the above manner, i.e., by the nature of the relation of incompatibility,[14] when stated, in the example of complete enumeration that "No inhabitants other than A,B...X live in a certain city." We can carry out tests in order to determine whether or not we overlooked an individual. It seems to me, however, that there are instances where negative universal claims are indeterminate by any direct observations. Suppose I was to say "No human has chromosomes numbering less than 43". This sentence is a universal negation, yet I fail to see how we can ascertain its truth in virtue of observation and the relation of incompatiblity, since the meaning of such a sentence refers to future and past events that are beyond my present experience. No finite observations of humanity and its chromosome number of 46 will permit me to logically infer that the class of humans is disjoint from the class of organism of chromosome numbers less than 43. I can attempt

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[14]To the best of my knowledge no criticism as regards Russell's concept of negative general propositions contained in Human Knowledge is published.

to falsify such a sentence by pointing out some individuals and stating that they all have 46 chromosomes, but I do not see how we can show the sentence "No human has chromosones less than 43" to be the case.

Thus, although as regards expression of enumeration, or aspects of experience, I can affirm a relation of incompatility between two occurences, and this allows me to arrive at a universal negation of certain sorts, many other universal negations cannot be derived by direct observation and the relation of difference or incompatibilty. They are general knowledge whose truth or falsehood must be derived by some other process than direct observation. The topic is thus of knowledge that transcends experience and whether or not we actually do possess such knowledge.

The subject of general knowledge as relevant to universal affirmation and induction will be re-examined in Chapter 5.

Given the lack of secondary sources as regards Russell's conception of "general knowledge", I will focus below on Popper's[15] position on all/some sentences, as an illuminating contrast to Russell's.

To Popper, unlike Russell, there are two sorts of universal statements. The first is termed "numerical

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[15]Karl R. Popper, The Logic of Scientific Discovery, (New York, Harper and Row, 1968), p. 62.

universality"[16], that asserts a totality of events where the totality is confined to a finite class of occurences. The statement "Of all human beings now living on earth, it is true that their height never exceeds a certain amount (say 8 feet)"[17] are claims for restricted and finite regions, and hence, are to be viewed as conjunctions of individual events constituting a limited region.

The second sort of universal statement, or "strict universal"[18], deals with events of an unlimited space-time confinement, i.e., "Of all harmonic oscillators, it is true that their energy never falls below a certain amount (wz. hv/2)"[19]. The latter sort of statement is viewed by Popper as representative of scientific or natural laws, and these are termed "strictly universal statements ('all statements')".[20]

Similarily, the claim such as "there exists at least one black raven" is viewed in Popper's epistomology as strictly an existential statement.[21] Existential statements are said to be incapable of falsification, [22] and hence, are

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[16]Ibid., p. 62.

[17]Ibid.

[18]Ibid.

[19]Ibid.

[20]Ibid., p. 63.

[21]Ibid., p. 68.

[22]Ibid., p. 64.

termed as metaphysical: "...my decision to regard strictly existential statements as non-empirical, because they are non-falsifiable."[23] To Popper no statement of observation can contradict a strictly existential statement. In order to contradict such statements we need to know strict universal statements.

The Popperian view concerning the nature of general knowledge differs greatly (but does not directly criticize), that of Russell. The primary difference is that to Russell "general knowledge" is knowledge of truth or falsehood of sentences containing "all" or "some". In Popper's epistemology only strictly universal statments fit as scientific laws of nature. Moreover, existential statments are viewed as metaphysical and non-empirical.

I tend to agree with Russell concerning the definition of "general knowledge". This conclusion is based essentially on Russell's arguments noted above. Popper's account fails to classify some sentences, such as " I met some person today", as aspects of general knowledge, but terms them non-empirical or metaphysical. To state that a some-sentence is non-empirical is somewhat surprising given that our stock of empirical assertions are largely confined to existential statements. When I look out my window and say "There is some snow on the ground", I fail to see how such a statement is non-empirical. Moveover, the term

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[23]Ibid., p. 70.

"empirical" is undefined in Popper's epistemology. It seems that he adhered to the above view in virtue of his conception of falsifiability. Accordingly, any sentence which is not falsifiable is deemed as non-empirical or metaphysical. But all true sentences, i.e., sentences that correspond to reality, (a topic to be developed in the following section) therefore fit the Popperian notion of non-empirical or metaphysical since no amount of experience can show that a true statement is false or falsifiable. Thus while I agree with Popper as regards the types of universal statements, i.e., numerical vs. strict, I cannot agree with his interpretation of existential statements as non-empirical or metaphysical. And as Russell points out rightly, we can, on occasion, arrive at negative universal statements from experience, hence, we can falsify certain some-statements. To say "Someone in this room is in pain" can be falsified if it is true that "No one in the room is in pain" and can be determined by testimony (assuming it to be true). Thus while I reject Russell's contentions that all negative univeral statements can be determined by direct observation (although some can), I also reject Popper's position on existential prepositions as non-empirical.

Facts and Truth

As noted, "general knowledge" was defined in terms of "truth" or "falsehood" of sentences containing the quantifiers "all" and "some". But what is meant by "true"

and "false" and their relation to knowledge? It will be found that truth or falsehood, according to Russell, are primarily relations between beliefs and facts and derivatively of sentences. This consideration therefore requires an examination of "facts".

The essential point is that to Russell, "fact" is indefinable in terms of more primitive concepts; the term can only be adequately defined by ostension.[24] It can be explained however as: "Everything that there is in the world I call a 'fact'".[25] The essential feature of facts is that whatever they may be we do not require of them that they be known. Facts are thus independent of being observed, known or even our very existence.

Beliefs for Russell were imprecisely identified as either bodily or mental or both sorts of states. Truth and falsehood are viewed initially as a property of beliefs:

> Truth is a property of beliefs, and derivatively of sentences which express beliefs. Truth consists in a certain relation between a belief and one or more facts other than the belief. When this relation is

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[24]For Russell, an ostensive definition of a term occurs when an individual is taught to understand and remember a sound (word)—other than by the usage of another sound (another word), i.e., rather by visual stimulation as opposed to auditory stimulation. Ibid., pp. 63-64. Moreover, Russell takes "fact" as a primitive term that cannot be defined in virtue of more primitive terms hence definably primitive. To Russell some terms must remain undefined if we are to avoid an infinite regress, and "fact" is such a term. Ibid., pp. 143-144.

[25]Ibid., p. 143.

absent, the belief is false.[26]

Elsewhere Russell states that truth and falsehood are external relations:

> Truth and falsehood are external relations, that is to say, no analysis of a sentence or a belief will show whether it is true or false.[27]

We therefore note that according to Russell truth is, (a) a property of beliefs, (b) a relation between a belief and fact(s). Given that truth is a property of beliefs, Russell does not differentiate whether it is an essential or an accidental property. This distinction is not judged to be a fundamental category in Russell's epistemology.

Concerning the relational character of a true belief Russell states:

> ...I shall assume that the physical world, as it is independently of perception, can be known to have a certain structural similarity to the world of our percepts, but cannot be known to have any qualitative similarity.[28]

The relation between a true belief and fact is therefore that of structural similarity, to be developed further in Chapter II. The facts that make a belief true are termed "verifiers";[29] Moreover, a false belief is lacking in verifier(s).

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[26]Ibid., p. 148.

[27]Ibid., p. 111.

[28]Ibid., p. 152.

[29]Ibid., p. 149.

Indicative sentences express beliefs, hence are viewed by Russell as either true or false: "It is in fact primarily beliefs that are true or false, sentences only become so through the fact that they express beliefs."[30] A sentence is rendered true according to Russell under the following condition: "A sentence of the form 'This is A' is called 'true' when is caused by what 'A' means."[31]

Similar considerations as regards beliefs apply to memories and expectations. A memory is said to be true if there exists a relation between what is remembered, i.e., an idea of a past occurence and a fact. In both memory and expectation, the occurences rendering them as either true or false are their verifiers. But since their determinations are clearly beyond present experience, their verifiers either occured or will occur respectively; memories and expectations cannot be verified in terms of immediate experience. To conclude, for Russell, the world is independent of our awareness, a belief is true if it has a relation to fact. The belief remains true even if we do not possess means of determining its verifier(s).

The formal definition of "truth" and "falsehood" is as follows:

> Every belief which is not merely an impulse to action is in the nature of a picture, combined with a yes-feeling or a no-feeling; in the

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[30]Ibid., p. 112.

[31]Ibid., p. 118.

> case of a yes-feeling it is "true" if there is a fact having to the picture the kind of similarity that a prototype has to an image; in the case of a no-feeling it is "true" if there is no such fact. A belief which is not true is called "false".[32]

The central issue concerning Russell's account of truth is his notion of correspondence between a belief, i.e., a mental picture coupled with either a yes or a no-feeling, and fact(s). In Russell's account, a belief is true by correspondence when the belief, in the form of a picture, has similarity of structure much like a prototype has to an image. When I believe that my book is to the left of my radio, I assume, according to Russell, that I have an image of a book that is left of my radio and this image coupled with a yes-feeling is true if structurally my book is to the left of my radio. The notion of correspondence therefore is correspondence of structural similarity between the complexes.

But are all beliefs (excluding those that are viewed as impulses for action) in the nature of a picture having

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[32] Ibid., p. 154. There is a stark resemblance in Russell's later epistemology between a belief as a picture (coupled with either a yes or no-feeling) and those views of L. Wittgenstein, Tractatus Logico-Philosophicus, trans. D.F. Pears and B.R. McGuiness with an introduction by B. Russell (London: Rutledge and Kegan Paul, 1977), pp. 8-9. Wittgenstein states "We picture facts to ourselves....The fact that the elements of a picture are related to one another in a determinate way represents that things are related to one another in the same way. Let us call this connexion of its elements the structure of the picture, and let us call the possibility of this structure the pictorial form of the picture.

structural similarity just as a prototype has to an image?[33] I do not judge this to be the case. In any one of my sensing experiences, I have, as associated, a belief which often has, as an origin, a sensing experience devoid of an image. When I smell a perfume and shortly afterwards believe that I just smelled a perfume, my belief is not in the form of an image and is devoid of any structural similarity to the perfume. The fact of the matter is that much of what we believe is either devoid of structural similarity to prototypes or is often in the form of sentences, phrases, or memory of some percepts. These, in turn, do not possess structural similarity to prototype or fact. The Russellian mistake regarding belief and structural similarity in relation to correspondence stems, I believe, from placing too much emphasis on beliefs being in the form of a visual picture. A more adequate position is that beliefs are often not in the form of images, but of a variety of states, most notably in the form of sentences, or beliefs derived through our sense other than vision, and these do not possess any structural similarity to their prototype. Thus while this position differs from those of Russell, it still fails to explain the nature of correspondence if we wish to adhere, in a limited sense, to a correspondence theory of truth.

Correspondence can be analyzed initially within my

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[33]This view was overlooked by all critics of Russell.

own experience. (The public aspect of correspondence is discussed below). When, e.g., I say "Today it is raining", there exists an associated image or belief to the above phrase, and this is the meaning of the phrase. Furthermore, I can express my image or belief in written or verbal representations and hence share the meaning of the phrase "Today it is raining". But the term, say, "rain" can be associated with an image of a drizzle, a rain storm and a host of varied images of rainfalls; any one corresponding fact would constitute a verifier (in a Russellian sense) to my claim. What constitutes the correspondence (fact(s)) is what would render my image or belief as true, and numerous verifiers, although different in structure would do. The issue of multiple types of verifiers rendering an image or belief true becomes more acute as regards scientific claims and observations as their verifiers.

The issues of public truth, as in science, in virtue of correspondence is imprecise in the same way as private correspondence of a sentence or belief; they can be verified in virtue of numerous and varied verifiers.

Suppose I wish to make a measurement of a certain weight, say for a flower. I calibrate my scale and state that the weight is 1.270 ± 0.003 grams. This result, upon numerous readings, is the average weight obtained from observing the scale dial. To make this a public finding would require that it be reproducible by another observer

making similar measurements. Let us assume that such finding is 1.268 ± 0.005. At this point our readings are not exact, though very similar. It would be absurd to conclude that either reading is incorrect since they compare similarly. Assuming the weight measurements were carried out correctly, our claims are both true even though the relation between facts and beliefs differ somewhat. The above implies that whatever beliefs we may entertain, the relation of it to fact (correspondence) is imprecise. This imprecision does not stem from the nature of a fact, but from our inclination as to what we are prepared to select as a verifier or falsifier to a belief.[34]

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[34]Ayer, Russell and Moore, pp. 105-109., discusses Russell's conception of truth but does not cover Russell's position contained in Human Knowledge. Similar considerations apply, to "fact", p. 100. Eames, Russell, p. 147, states of Russell's conception of truth that "truth is a property of a belief which depends upon something outside of the belief, and truth is the correspondence of a belief with fact.... His correspondence theory of truth in that what is believed must correspond with, that is , be closely similar to, the fact to which it refers". But Eames offers no criticism of Russell's views. Keith Habash, "A Critical Examination of Russell's Views of Facts", Nous 5 (1971):395-409., confined his criticism of Russell's position of "facts"contained in The Philosophy of Logical Atomism, but does not refer to Human Knowledge. Ronald Scales, "A Russellian Approach to Truth", Nous 11 (1977):169-174., deals with Russell's position on truth contained in his Principia Mathematica, and hence an analysis of logical truth. Karl Britton, "Truth and Knowledge," Analysis 8 (January 1948):39-43, deals with Russell's Inquiry into Meaning and Truth. Ernest Nagel, "Mr Russell on Meaning and Truth," Journal of Philosophy 38 (May 1941): 253-269, refers to Russell's conception of truth as it appears in the Inquiry. Donald Brownstein, "Denoting, Correspondence and Facts", Theoria, 42 (1972):115-139, refers essentially to Russell's views confined to The Philosophy of Logical Atomism.

Knowledge: Elementary Form

I will now state, by way of preliminary considerations, Russell's position on knowledge. The prevalent view is that knowledge is a sub-class of true beliefs.[35] Every item of knowledge is a true belief but not vice-versa. Suppose you were to select a lottery ticket believing it to be the winning ticket, and suppose it turns out to be the case. The fact that you entertained a true belief prior to selection does not constitute knowledge, even though the belief is true. It might be supposed, along a traditional mode of argument, that for a true belief, such as the above, to count as knowledge, it must be supported or derived from some other true belief(s). These in turn, are to be viewed as fundamental items of knowledge, for otherwise we are led to an infinite regression. A true expectation can, therefore, count as knowledge provided there are basic true beliefs or propositions and modes of inference in support of a conclusion. Candidates for basic propositions might be those derived from sensations, perception, memory and testimony (to be discussed below), thought to be incorrigible; and from modes of inference, such as deduction, induction and analogy. The settled Russellian view, however, is that in place of derived knowledge as extractible from fundamental basic propositions taken as true and mode of inference thought to be certain, a

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[35]Russell, Human Knowledge, p. 154.

coherence theory of knowledge is advocated. It is summed up as follows:

> In this modified form it will say that all, or nearly all, of what passed for knowledge is in greater or less degree uncertain; that if principles of inference are among the prima-facie material of knowledge, then one piece of prima-facie knowledge may be inferrible from another, and thus acquire more credibility than it had on its own account. It may thus happen that the body of propositions, each of which has only a moderate degree of credibility on its own account, may collectively have a higher degree of credibility.[36]

The Russellian concept of knowledge is thus defined as a subclass of true beliefs. In addition, derived knowledge is not based on incorrigible basic propositions and absolutely certain modes of inference. Knowledge is a body of propositions and modes of inference each possessing degrees of credibility, either on its own, or credibility derived by modes of inference which themselves are prima-facie knowledge.

The entire subject of credibility in knowledge and derived knowledge will be examined throughout the following chapters.

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[36]Ibid., p. 157.

CHAPTER II

RUSSELL ON DATA AND EXPERIENCE

There is, to begin with, a variety of philosophical treaties which maintain that belief is rationally sustained as to matters of fact transcending experience.[1] The

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[1]John Maynard Keynes, A Treatise on Probability, (London, Macmillan and Co., Ltd. 1929) pp. 3-16. According to Keynes, we are to view within the context of an argument two sorts of propositions. The first is termed "primary" and refers to propositions that do not express a probability relation between two propositions. We may view proposition "p" as having a probability relation, however, corresponding to its degree of rational belief. To determine such a probability relation we are further in need of certain data. These certain sorts of propositions or data are termed "knowledge".

Moreover, propositions of which we are uncertain due to partial ignorance can nevertheless possess a probability relation to certain knowledge (h). Thus, it can be said that P/h=a is to mean that in relation to knowledge proposition "p" has a probability relation or rational belief to certain knowledge "h" of value a. This may be termed "q" and "q" is termed as secondary proposition due to the fact that it states a probability relation of "p" relative to "h". This probability is termed "the degree of rational belief". Wesley C. Salmon, The Foundations of Scientific Inference, (Pittsburgh, University of Pittsburgh Press, 1966) p. 6, states that in order to determine the nature of knowledge we require a method of "determining whether the inferences by which we attempt to make a transition from knowledge of the observed to knowledge of the unobserved are logically correct."

following chapter is an examination of Russell's conception of data. Given the view that certain claims of experience supply information or data for beliefs, the process of inference to beliefs regarding what is not experienced must, nevertheless, take place in virtue of experience and modes of inference. This chapter analyzes Russell's conception of experience as relevant to premises or data which are, in part, to serve as information for beliefs about what is not experienced.

Sensation, Perception and Memory

In justifying any scientific theory, we are compelled by the very nature of the theory to show the relationship between the class of scientific hypotheses and experience as evidence. What we term "mental" consists of numerous experiences such as love, joy, anxiety, believing, doubting and many more. From this class of experience, we wish to select those aspects relevant to designate scientific ontology and regularities of nature, i.e., those having an external reference as to matters of fact, rather than solely expressing aspects of our mental life. Of these, certain experiences derived from our five senses are viewed by Russell as data for scientific and common sense knowledge. "Data" to Russell, means "...the indispensible minimum of premises for our knowledge of matters of fact.

Such beliefs I shall call "'data'".[2] By the "indispensible minimum premises" Russell means, the data in derived knowledge as to matter of fact which is initially confined to the experience of both sensation and memory. "Only sensation and memory are truly data of our knowledge of the external world".[3] "Data" is initially defined as "those matters of fact of which, independently of inference, we have a right to feel most certain."[4] Data as aspects of experience are therefore to serve as rationale (premises) as to beliefs of matters of fact and are confined initially to sensation and memory.

The Russellian conception of both sensation and perception is often referred to as "The Causal Theory of Perception".[5] This philosophical theory is a mixture of physics, physiological and psychological considerations, based on the assumption that science is mainly true. The physical aspect of this theory assumes that certain physical events have effects upon our five senses (visual, auditory, olfactory, taste and somesthesis). Such physical events as visual light, sound waves and mechanical forces all have

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[2]Bertrand Russell, Human Knowledge, p. 166.

[3]Ibid., p. 170.

[4]Ibid., p. 171.

[5]Ayer, Russell and Moore, pp. 121-129, and Wesley C. Salmon, "Memory and Perception in Human Knowledge", Bertrand Russell's Philosophy, ed. G. Nakhnikian (London, Gerald Duckworth and Co., ltd., 1974), pp. 139-167.

effects upon numerous living entities generally (from single cell organisms to higher mammalian life forms)[6]. As regards the latter, namely, humans and primates, our five senses respond to physical events (whose laws are stipulated in physics). The study of physical responses of higher mammalian forms to aspects of the environment is confined to physiology and biochemistry. In visual sensation, for example, physics and physiology maintain that when light reflected from an object strikes the retinae, an electrochemical process between cells constituting adjacent cells of the retinae and the brain sequentially occur. Similar considerations apply to our other four senses.

The psychological aspects are to the effect that associated with the physical process in the brain is the sensation of, say, a colour. "Sensation" is to be understood as "...the first mental effect of a physical cause."[7] Within this theory, perception is viewed as "The filling out of the sensational core by means of animal inference, until it becomes what we call perception..."[8] Within this causal theory, sensation is thus viewed as the first "mental" event, having as antecedent a causal physical process from various regions of the body to the brain. This

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[6]Thomas L. Bennett, The Sensory World: An Introduction to Sensation and Perception, (Montery California, Brooks/Cole Publishing Co., 1978), pp. 1-23.

[7]Russell, Human Knowledge, p. 36.

[8]Ibid., p. 169.

causal series must "...occupy a continuous series of positions, and since the physiological terms of this series end and begin in the brain, the 'mental' terms must begin and end in the brain."[9] Therefore, both sensation and subsequent volition "...must be located in the brain".[10]

The Russellian sensational core of perception or sensational data is obtained by stripping our perceptive experience of correlated adjuncts. In visual sensation, for example, the aspects of sensational data are complex occurrences where parts have the relations of up-down, left and right and the relation we come to understand as depth.[11] The experience of perceptions, which supplements the sensory experience by adding expected features to our sensory datum by a certain process is termed "animal inference". This process is to the effect that a sensed event A causes an idea[12] appropriate to event B, due to generated habit of both A and B having been associated in the past in a way of interest to the organism.

In humans, animal inference is said to occur when sensed event A causes a belief in B. This belief is due to the filling out of sensory data by animal inference and is

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[9]Ibid., p. 223.

[10]Ibid.

[11]Ibid., p. 218-219.

[12]A Russellian "idea" is "a state of an organism appropriate in some sense to something not sensibly present." Ibid., p. 95.

termed "perception". Thus the aspect of the visual sensational core brings to our attention colours, shapes, shades of colour differences, spatial relations and a host of raw data that differs from perception. In perception, we fill out rudimentary aspects of sensation by habit. Thus, when we see a canoid colour patch (a Russellian example) and infer "This is a dog", the sensational core of experience is a canoid shape of a certain sort. Due to habit, we supplement this sensation by stating more that is often given in pure sensation. Let A be canoid patch of colour, B the noise termed "barking" and C the concept of motion. We may sense A and due to habit believe in ABC collectively. The process of sensing A and believing ABC occurs by animal inference because of previous experiences of ABC were often noted as associated. The sensing of A is thus followed by the perception of ABC.

Russell's epistemology, contrasts the general concept of "inference" to animal inference. The psychological origin of inference in humans is that, once we become aware of our numerous occurrences of animal inference, that A causes a belief in B, we subsequently and explicitly state the "A is the 'objective' origin of B", where "objective sign" is to mean "A is in fact followed or accompanied by B".[13]

In addition to sensation as a source of minimum

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[13]Ibid., pp. 185-186., is where Russell uses this term.

uninferred premise of knowledge of matters of fact (and scientific laws) there is the premise of memory:

> What I wish to say about memory is that its general though not invariable trustworthiness is a premise of scientific knowledge, which is necessary if science is to be accepted as mainly true.[14]

That is to say, any reference to past occurrences or past regularities of nature, in the Russellian epistemology, assumes the probable trustworthiness or truth of memory as data (that which is felt most certain) of matters of fact. This is not to say that all of what we remember denotes an aspect of past occurrences. All that is required of memory as data of derived knowledge is the general truth of memory, i.e., that in the majority of cases memory is of a past occurrence. Each and every term of memory thus serves as data of derived knowledge:

> The ultimate evidence for any scientific law consists of particular facts, together with those principles of scientific inference which it is my purpose to investigate. When I say that memory is a premise, I mean that among the facts upon which scientific laws are based, some are admitted solely because they are remembered.[15]

There are two sorts of memory types in Russell's philosophy. The first is termed "immediate memory" and refers to a recall that occurs shortly after someone has had a perception of a certain sort, due to a sensation. The

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[14]Ibid., p. 188.

[15]Ibid., p. 189.

duration or lapse of time is unspecified. When, for example, I sense redness and shortly afterwards remember that I sensed redness, this aspect of memory is termed "immediate memory".

When the memory experience is to have occurred at a later time than its original prototype, the memory experience is termed by Russell true memory: "Whatever counts as memory consists of images or words which are felt as referring to some earlier experience."[16] Concerning the distinction between memory and imagination, "...in memory as opposed to pure imagination, there is the belief: ' A [memory] is related to something as idea to prototype'."[17] What in fact constitutes personal memory ought to be viewed not as a pile of memory images or sentential beliefs of past occurrences, but as a series of memory images such that some are felt as earlier than other:

> ...some must feel recent and others must feel remote. It must be by means of this felt quality of recentness or remoteness that I place remembered events in a series when I rely upon memory alone.[18]

The memory image in relation to knowledge generally is viewed as follows: "In regard to memory, the definition of 'truth' and therefore of 'knowledge' lies in the resemblance of present imagining to past sensible

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[16]Ibid., p. 108.

[17]Ibid., p. 109.

[18]Ibid., p. 211.

experience."[19] Part of what we term "knowledge" therefore consists of memory which is true.

"Data" initially defined as "...those matters of fact of which independently of inference, we have a right to feel most certain"[20] is regrettably redefined in his later account as "I define 'datum' as a proposition which has some degree of rational credibility on its own account, independently of any argument derived from other proposition."[21] I do not wish to dwell on Russell's second definition containing "rational' credibility" not mentioned in his earlier analysis, but simply to note that within his later and final developed definition perception counts as data, although initally only sensation and memory were viewed as the indispensible minimum premises for knowledge about matters of fact which are uninferred, and felt as most certain. Assuming his later account as that which is representative of his more developed argument, perception and its mode of expression, i.e., sentences, are viewed as aspects of data, independent of any collateral argument and possessing intrinsic credibility and general trustworthiness not derivable from other propositions[22]. They serve as data

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[19]Ibid., p. 423.

[20]Ibid., p. 171.

[21]Ibid., p. 392. The topic of "rational credibility" will be discussed in detail in Chapter IV.

[22]Ibid., p. 393, p. 456.

or premises for derived arguments.

That is not to say that all percepts and propositions expressing them are always true; it sometimes happens that what we perceive is false. To assume, however, that all or most of our percepts are false would result in an unliveable psychology, not to mention the rejection of science that places so much emphasis on observation. What Russell does state is that perception serves as data for derived knowledge much like sensation and memory; in addition, much of what we perceive "...may be uncertain in a greater or lesser degree."[23]

I shall defer a discussion of "rational credibility" to Chapter IV, and, at present, deal only with the subject of perception, assuming it to fall under the Russellian category of "data" and examine its role concerning knowledge. It was noted that both sensation and memory were viewed by both the first and second definition as "data". This position is consistently maintained throughout Human Knowledge.[24] We are told that "Of these sensation is more fundamental, since we can only remember what has been a sensible experience."[25] Furthermore, "But although sensation is a source of knowledge, it is not itself in any

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[23]Ibid., p. 395.

[24]This position is re-affirmed on page 422.

[25]Ibid.

usual sense, knowledge."[26] This is noted in view of the fact that while sensation reports private experience, say of redness, or, being in pain, it generally fails to report a relation between what is known and the experience of knowing. That is to say, we wish to view knowledge as, on the whole, involving a relation between knowing and what is known, in sensation we only state private experience without adhering to the noted relation.

Perception, however, does serve the above double role. That perception is inferred from sensation by animal inference does not contravene the notion that as data they are the minimum premises of uninferred knowledge about the external world. Perception is inferred from sensation by animal inference, which can be confused with the general Russellian concept of demonstrative and non-demonstrative inference. It is in reference to the latter that perception counts as data, since inference from sensation to perception is based on animal inference rather than inference in general.

Salmon on Russell's Conception of Memory and Perception

Salmon's excellent account of Russell's conceptions of memory and perception begins:

"The general, though not universal, trust-

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[26]Ibid.

> worthiness of memory is an independent postulate" wrote Russell in Human Knowledge....In view of this statement, it is natural to wonder why, when he explicitly lists his postulates of scientific inference, no such postulate appears."[27]

The answer seems evident enough, the postulates of scientific inference are probable statements regarding modes of inference and not premises or data for such inference. Memory as such is a premise of scientific inference and not an assumption concerning actual (non-demonstrative) inference. This seems to be the reason why the general truth of memory is not regarded (in Russell's epistemology) as a postulate of scientific inference. In deductive logic, when we say p is true and p implies q is true, we can infer demonstratively that q is true. To state, however, that p is true is to actually assert a proposition as true without reference to either the implication or the conclusion. Similar considerations apply to scientific inference in a sense that memory (and perception) are assumed by Russell as generally true, without reference to any inference or any conclusion derived from inference based on them. The role of memory (and perception) serves the same purpose as to assert the truth of p in demonstrative inference, such that in virtue of modes of inference we can infer the probablity of a conclusion.

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[27]Wesley C. Salmon, "Memory and Perception in Human Knowledge," Bertrand Russell's Philosophy, ed. G. Nakhnikian, (London: Gerald Ducksworth Co. Ltd., 1974), p. 139.

The postulates of scientific inference, therefore, serves a similar role as the relation of implication in deductive logic. When Russell writes of memory as an "independent postulate" he does not mean this to be a postulate of scientific inference, but rather, as data required of scientific inference in addition to his postulates.

Salmon's main intention in his analysis is as follows:

> The main purpose of this paper is to discuss the relative evidential status of memory premises and perceptual premises and in doing so, to compare the relation between sensation and perception with the relation between sensation and memory.[28]

He rightly begins by pointing out the distinctive types of memory. The first is termed "propositional" in a sense that under this category, what we remember are not occurrences but symbolic representations, such as Kepler's laws or the multiplication table. He points out that propositional memory is largely dispositional in a sense that it involves an ability to respond appropriately rather than recall an experienced occurrence. To reply to a question of multiplication is a disposition in virtue of a remembered rule.

The second type of memory is termed "practical" and like propositional memory, refers to a disposition. Our

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[28]Ibid., p. 143.

recall of driving a car or exercising are viewed as practical memories, once we acquire a physical habit and we can express this acquisition at will.

Lastly Salmon introduces the nature of "retrospective memory". This is a memory type along Russell's line, in the sense that we recall a past occurrence or event in virtue of an image or verbal expression. He defines "retrospective image memory" as "In this mode, the memory experience has the phenomenological character of a direct presentation of an object or event accompanied by a conviction that the object or event existed or occurred at some time in the past."[29] "Retrospective verbal memory" is defined as "...the memory experience consists of verbal description of the event or object, along with the same kind of conviction about its past existence or occurrence."[30] Thus while propositional memory is a recall of experienced propositions that occurred in the past, retrospective verbal memory is a recall of experienced events and their verbal representation. The above classification concerning memory, I believe to be correct. It further develops Russell's account of memory mentioned above.

Salmon rejects the contentions

that perceptual experiences are more vivid

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[29]Ibid., p. 147.

[30]Ibid.

> than memory and that his difference supplies both a criterion for distinguishing between the two kinds of experience and a basis for claiming that perception is more reliable than memory.[31]

He uses, as an example, the recent death of a loved one in comparison to faint perception of an aeroplane to illustrate that memory images may be more vivid than present perception and concludes,

> Thus, we must deny that the degree of vivacity or intensity of an experience bears any direct relation even to the apparent temporal proximity of the event being experienced.[32]

The above conclusion seems unsustainable. It seems obvious that when we perceive (along Russell's line), we are acquainted with a present perception that can be further examined in detail, while in retrospective image memory we have, generally, a vague image of a past percept. It may be the case that a few memory images are more vivid than present faint perception, but such occurrences are few and far apart. Generally speaking, our present perceptions are clearer in imagery than most past images. Moreover, we can further investigate and extract details from present perception but are limited to investigation of past imagery due to the limited amount of information stored in memory.

This is not to say that the above conclusion is as sound as a scientific law distinguishing the clarity of

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[31]Ibid., p. 150.

[32]Ibid.

perception from that of memory, but simply differs from those of Salmon. Also, this position applies to perception and memory in general. As regards any particular instance of either, we would have to compare it as such on its individual uniqueness. Nevertheless, generally speaking, perceptive experiences are more vivid than memory images.

Moreover, the vivacity of experience is indicative of the temporal proximity of experience. We experience most vividly in present perception, while often the more remote the recall is of date with respect to an occurrence, the less vivid memory is, unless the original occurrence was of importance. The degree of vivacity in memory increases the nearer one gets to the point of present perception, which is as clear as any image can be. Even dreams are less vivid than present perceptions.

Concerning Salmon and his rejection of perception as more reliable than memory, I fail to grasp his meaning of "reliable". If what he means to reject is that generally speaking perceptional experiences are more true than memory[33], than I disagree with him. But the reasons why I reject the contention that perceptions are more often true than memory is based on the fact that we cannot test the truth or falsehood of memory because the occurence has passed away. If a significant number of memory images is unavailable, memory cannot be compared to perception; for

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[33]See Chapter I on Russell and Truth

perceptions can often be tested. Therefore, the claim that perceptions are more reliable than memory, assuming "reliable" is to mean "truth" or "probable truth", is to be rejected.

Salmon rightly points out that Russell's notion of perception is "a causal theory of perception."[34] but adds that Russell's conception of memory is also causal. He furthermore points out that the process of visual sensation and the ensuing perception is not instantaneous. That is to say, light from the sun striking a terrestrial object takes time to reach the earth. Moreover, neural transmission from the retinae to the brain occurs with a finite time duration. Regarding memory, he is of the opinion that it is not the actual percepts or sensations that are stored in memory, but rather information, or the image that is stored. Regrettably, he does not go into details concerning the nature of stored information but states that:

> ...the memory experience involves the retrieval of information, stored in one way or another; the subject seems to become aware of the retrospective character of the experience as a result of storing and retrieving the information.[35]

Concerning whether or not memory requires for its storage first a percept due to an initial sensation he writes:

> It seems to me that memories can arise directly from sensation without requiring an

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[34]Ibid., p. 151.

[35]Ibid., p. 153.

> intervening perception as a necessary part of the causal chain, therefore reject the form of the immediacy objection that maintains the greater causal remoteness of memory experience from their objects on the ground that every memory experience requires a perception as immediate part of the causal process.[36]

Thus to Salmon we do not necessarily require an intermediate perception in order to subsequently have a retrospective memory experience, sensational data will do.

The above position is highly improbable, in a sense that this rarely happens, by virtue of a closer analysis of memory experience. When we remember a previous occurrence, our memory image or verbal expression of a memory image, in the majority of cases, is of complexes. When I say complexes, I mean images or verbal expressions of such images as designating a multitude of sensations. When, for example, I remember the context of my room, I remember my table, chair, radio and so on. An image of a table is a complex visual image where I remember its shape, colour, texture and the various parts. It is in virtue of numerous associated aspects contained within such a simple image that our memory image is termed "complex". This result is due to the fact that in the overwhelming majority of cases our visual field is a complex composed of numerous sensational data from which we both extract aspects of interest, and also, due to habit, associate unnoticed aspects to parts of interest to our visual experience. In such cases, we do not

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[36]Ibid., p. 154.

simply sense isolated colour patches, a sensational data, but notice or perceive shapes and other features which are inadvertently classified and often associated with a general term.

This description is meant to point out that in the majority of cases, we immediately perceive from our visual field. This, in reference to memory images, is meant to illustrate that they too are complexes once we have had a perceptive experience. We do not simply remember the redness of a patch of colour when we recall a painting we previously saw, but remember complexes of colours and above all associated images or representations of objects. If we recalled sensational data, all that we would remember would be colours and shapes, in retrospective image memory, without any object or event representation. This fact would contravene Salmon's view to the effect that memories arise directly from sensation and that in the majority of cases, our visual field is a complex occurrence, where we extract and supplement in perception that is subsequently remembered. It is true that we could, as an example, paint a room, say red, enter the room, sense it and sometime later recall the sensation of redness. But such occurrences are rarely, if ever, experienced. My conclusion is that memory images generally result from the retrieval of what was once a percept.

Salmon asks: "What is the status of the premises

furnished by perception and memory?"[37] His reply is to the effect that they are posits. He points out that the term "posit" is borrowed from Reichenbach's conception of inductive posits, but Salmon introduces the concept of "p-m posit" (perceptual-memory posits). He rightly maintains that their respective reliability is on equal footing, i.e., "that basically they have the same status and are adopted for the same reason - hence the single concept of p-m posit".[38] As such they are considered blind posits:

> A blind posit is a statement that is made without any assessment of its reliability. A blind posit can be transformed into an appraised posit on the basis of further inference based upon further blind posits, but a blind posit can be appraised only at the cost of introducing a new blind posit.[39]

This seems to me to be nothing more than a reformulation of Russell's conception of data. To term data as p-m posits is simply a linguistic play of words engaged in introducing synonyms. Moreover, Salmon fails to note the fact that to Russell they are the indispensible minimum premises for knowledge of matters of fact, which is uninferred and felt as most certain.

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[37]Ibid., p. 158.

[38]Ibid.

[39]Ibid.

Other Critiques of Russell on Sensation and Perception

Ayer [40] discusses Russell's views of both sensation and perception. He states:

> This conclusion is inevitable if we accept the view as to the physical causation of sensation which is forced on us by physiology. It is also in the light of 'the development of physics and physiology', that Russell here takes the view that there is only structural correspondence between percepts and physical objects.[41]

But Ayer does not explicitly state that, in Human Knowledge, "sensation" is defined as "a mental occurrence of which the proximate cause is physical"[42] nor does he refer to Russell's position on "perception" as the "the filling out of sensational core by means of animal inference, until it becomes what we call perception..."[43] Ayer focuses his analysis on Russell's conception of sensation and perception as to their locality. Ayer states:

> My own view is that it is neither necessary nor perhaps desirable, to find room in our physical theory for percepts as entities: they can be represented as ways in which persons are affected, and therefore as not requiring to be assigned a physical location.[44]

But Ayer, (a) does not attach any importance to the

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[40]Ayer, Russell and Moore, pp. 121-129.

[41]Ibid., p. 124.

[42]Russell, Human Knowledge, p. 456.

[43]Ibid., p. 169.

[44]Ayer, Russell and Moore, p. 128.

definitions of "sensation" and "perception" as contained in Human Knowledge, and, (b) does not emphasise the importance of perception as data of derived knowledge. Furthermore, although the subject of memory is covered by Ayer in his account of Russell's epistemology, he does not refer to Human Knowledge.[45]

Eames[46] states the following concerning data as confined to sensation and perception:

> By 'whittling away' the elements not due to immediate perceptive experience, partly through a behavioural analysis, theory of knowledge may eventually arrive, at a 'pure datum', the part of experience which is due to present sensation, that which is noticed, selected, become aware of, even though this element is embedded in the associations and interpretations which, together with the sensation, make up the whole perceptive experience.[47]

But Eames offers no criticism of Russell's position on data, sensation and perception. Moreover, regarding memory, Eames states:

> It seems that we have immediate knowledge of what has just happened, yet memory is notoriously fallible. If memory is put within the category of derived knowledge, however, it leaves the scope of what can be immediately sensed intolerably limited. Russell tried to meet this problem by distinguishing between immediate memory (part of the specious present) and more remote memory which involves description, or the relation of a present

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[45]Ibid., pp. 117-121.

[46]Eames, Russell, pp. 45-115.

[47]Ibid., p. 115.

image to past occurrence.[48]

Unlike Salmon, Eames does not clarify Russell's conception of memory.

O'Connor's[49] article traces Russell's developmental conception concerning perception. In reference to Human Knowledge, O'Connor emphasizes the ontology and location of the perceptive act. He does not state Russell's formal definition of perception referred to above, but proceeds to criticize, pointing out the ambiguous nature of "percept". He states:

> But in addition to using 'see' in an unusual sense, he [Russell] also uses 'percept' in a double sense without ever clearly distinguishing the two or justifying the ambiguity. In the first sense, a percept is private to the observer. It is what Russell once called a sense-datum (or a group of such data) and is located only in the sensory field (or what Russell calls the private space) of the percipient. But when he says that 'percepts are in my head' and that 'my head consists of percepts and other similar events', he seems to be using the term to mean 'events that are located in my brain and are therefore physically located in public space'.[50]

O'Connor concludes as follows: "We may perhaps criticise Russell for failing to mark the ambiguity of the term

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[48]Ibid., p. 98.

[49]D.J. O'Connor, "Russell's Theory of Perception," Bertrand Russell Memorial Volume, ed. George W. Roberts (London: George Allen and Unwin Ltd., 1979), pp. 304-319.

[50]Ibid., p. 317.

'percept'.[51] The above criticism seems to me to be incorrect.

To begin with, Russell's conception of perception is initially and foremost "the filling out of the sensational core by means of animal inference, until it becomes what we call perception..."[52] This is Russell's formal definition which O'Connor does not mention. Concerning "percept" no separate definition is ever developed in Human Knowledge. The seeming ambiguity stems from the mistaken notion that on one hand, we have the experience of perception as noted by Russell, and on the other, the physical locality of such an experience. That our perceptions are private and that they are located in the brain does not constitute an 'ambiguity in meaning'. What is actually stated is, (a) the definition of perception and, (b) the physical locality of such experience. I therefore fail to note any ambiguous meaning of perception associated in Human Knowledge.

The scope of Maxwell's[53] article is stated by the author as: "For this reason, this essay will be mainly expository, interpretative, and apologetic rather than

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[51]Ibid., p. 318.

[52]Russell, Human Knowledge, p. 169.

[53]Grover Maxwell, "Russell on Perception: A Study in Philisophical Method," Bertrand Russell, A Collection of Critical Essays, ed. D.F. Pears (New York: Anchors Books, Doubleday and Company, Inc., 1972), pp. 110-14[illegible]

critical...."[54] But the author does offer the following criticism:

> For, if physics and certain reformulated parts of common sense are true, we do know something about the first order (or intrinsic) properties of the physical world; we know that there are such things and we know something about them - we know what some of their properties are; in fact, the latter assertion is exactly equivalent to the assertion that we know what (some of) the structural properties of the physical world are, for structural properties are properties of intrinsic properties (and properties of other structural properties).[55]

I tend to agree with Maxwell's position. It is not enough to maintain, as Russell does, that the only feature we can ascertain in regard to the physical world is structure. I shall defer this discussion to Chapter III.[56]

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[54]Ibid., p. 111.

[55]Ibid., p. 135.

[56]G.E. Myers, "Perception and the 'Time-Lag' Argument," Analysis 47 (April 1957): 97-102., deals with Russell's earlier views in Problems of Philosophy on the nature of sense-data and physical objects. Janet A. Kaffant, "Memory," Journal of Philosophy 62 (August 1964): 387-398., refers to Russell's conception of memory in Our Knowledge of the External World. R.K. Perkine, Jr., "Russell on Memory," Mind 82 (October 1973):600-601 refers to Russell's earlier concepts of memory but not to Human Knowledge.

CHAPTER III

SCIENTIFIC ONTOLOGY

The aim of the chapter, is to introduce the concepts fundamental to the more advanced topic of scientific inference, the aspect of Russell's epistemology studied in Chapter V. We noted in Chapter II that to Russell sensation, perception and memory, are data for knowledge about matters of fact. Moreover, according to Russell we require principles of inference (these principles are as yet unnamed) to justify universal claims as aspects of knowledge in both science and common-sense. The intention of this chapter is therefore to analyse critically Russell's scientific ontology with emphasis on Russell's fundamental conception of science as required for a developed discussion of scientific inference and knowledge.

Space and Time in Classical Physics

Time

Classical physical laws express time as the variable t. The associated image of physical time is pictured as a

series of instants. The terms of analysis are therefore "instant" and "series." I shall begin with "instant."

According to Russell, a definition of "instant" is to be constructed in terms of data:

> I take as raw material 'events', which are imagined as each occupying a finite continuous portion of space-time. It is assumed that two events can overlap, and no event recurs.[1]

Moreover:

> Whatever is earlier or later than something else I shall call an 'event'...every event exists at a continuous stretch of a series of instants. That instants must form a series defined by means of the relation of earlier and later is one of the requests that our definition must fulfill...we must not regard instants as something independent of events, which can be occupied by events as hats occupy hat pegs.[2]

In addition to events, for Russell we require certain undefined terms:

> I choose the relation of earlier-and-later, or of wholly-preceding. Between two events a and b, three temporal relations are possible: a may be wholly before b, or b may be wholly before a, or a and b may overlap.[3]

To construct the concept of series of instants needed of classical physics, Russell assumes two events, A and B. These events may have one of the three relationships mentioned above. Event A may, in its entirety, precede event B, or B may precede in its entirety event A, or events

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[1]Russell, Human Knowledge, pp. 269-270.

[2]Ibid., p. 270.

[3]Ibid., p. 271.

A and B may overlap. To determine a date as to event A, we determine the relations between event A and other events. If events A and B overlap during a part of A, then we can say that the date occurs when A and B overlap. If we note event C that also overlaps with events A and B, the date can be more accurately stated as the date when events A, B, and C overlap. This process for determining a date is constructed by the usage of events which overlap temporally. When all events which overlap are noted, the group of events determine an instant. Russell thus defines "instant" as:

> ...a class of events having the following two properties; (1) all events in the class overlap; (2) no events outside the class overlap with every member of the class. [4]

To state that an event is of a finite duration is to state that changes occurred while it persists. That is to say, an event which overlapped with it when it began no longer overlaps when it ends; e.g., let event C be the event that lasts a finite duration; that event A overlaps with event C, and event B overlaps with event C, and that event A wholly precedes event B. The construction of a series of instants required of classical physics follows from the above definition if one event of an instant does not overlap temporally with every event of another instant, i.e., if one event constituting a given instant wholly precedes another

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[4]Ibid., p. 271.

event which is a constituent of another instant.[5]

Space

Newtonian physics assumed space to be constituted of points, "...each devoid of structure and each one of the ultimate constituent of the physical world."[6] It therefore, assumed that at any instant there exists a spread of three dimensional space; the ultimate parts are dimensionless points. Space of classical physics was thought to be absolute in a sense that, independent of the presence of matter, it remains an instantaneous cut at a given instant for all observers. Space was thus thought as composed of a juxtaposition of points independent of any observer.

According to Russell, the term "point" is to have a definition in terms of experience or is derivable from a vocabulary whose terms express experience. This process of defining "point" is required if mathematical physics is to viewed as a set of empirical expressions. That is to say, certain terms must be defined in terms of experience since such assertions are initially expressions of experience and only derivatively of something outside experience.

The following are conditions for a definition of

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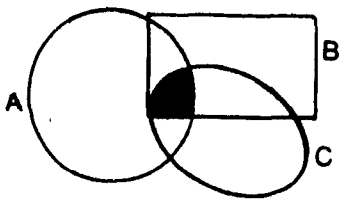
[5]E.A. Milne, "Review," Hibbert Journal 47 (July 1949): 297-299, in an otherwise hostile review of Human Knowledge had the following written response to Russell on "instant": "one rejoices to find a reasonable theory of overlapping events as leading to the concept of 'instant'".

[6]Russell, Human Knowledge, p. 277.

"point" in classical physics that to Russell are to be satisfied: the definition is to be such as to define "point" as constituting a manifold of three dimensions, and a point must be at an instant. When defining an instant Russell used the relation of temporal overlap between events. By "events" Russell meant something constituting a finite, continuous portion of space-time having the relations of either earlier - and - later, or overlap, to something else. The temporal relations are initially noted as relations of experience. Events are not to be viewed as impenetrable. Because "event" is undefined, it is assumed not to have a structure, yet to have relations analogous to finite volumes and finite periods of time. The analogy is that events, like volumes and periods of time, are "...similar as regards logical properties."[7]

Until now I stated that to Russell there are four undefined terms used to formulate "instant". These were "events" and "the relation of earlier, later and overlap." In the definition of "point", Russell makes use of an additional relation termed "copunctual." To define "point" in two dimensions Russell constructs three areas having a region in common (Figure 1).



The shaded area illustrates a region that is in common to

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[7]Ibid., p. 279.

area A, B, and C, i.e., it is copunctual. Suppose that there now exists a fourth area, D. If ABC, ACD, and BCD are all copunctual, area ABCD is also copunctual. In the above example, Russell defines a point in two dimensions as any number of areas such that any triad of this group is copunctual. Thus A,B,C, D, are copunctual because ABD, BCD, and ACD were all copunctual. If we assume a fifth region, E, and if ABE are not copunctual, then ABCDE does not form a group that defines a point in two dimensions. The assumption is that if any additional area is not copunctual with every previously existing copunctual areas, the previously copunctual areas form a point, and in this illustration, the point constitutes an aspect of a two dimensional manifold.

To define a point in three dimensions, Russell requires further "...a relation of copunctuality between four volumes."[8] In addition, we can enlarge the number of volumes until we cease to have copunctuality with the original copunctual four volumes. If, for example, we define the sharing of four volumes A, B, C, D as all copunctual and if A, B, C, D, E fails to be copunctual, A, B, C, D is a point in three dimensions. For any point in n-dimension, the sole requirement for the definition of "point" is that the relation of copunctuality hold between at least $\underline{n+1}$ regions appropriate to the number of

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[8]Ibid., p. 280.

dimensions. The above is not the only way of defining "point"; for Russell, any definition satisfying the previously mentioned requirement for "point" will do equally well: the above is but one interpretation.

Space-Time

The definitions of "instant" and "point" above were confined to such considerations, that would satisfy the requirements of classical physics. In addition, such definitions were constructed in terms derivable from our psychological states, i.e., "instant" was defined in terms of the relations of "overlap" and "event" both aspects from experience. According to Russell, further issues requiring elucidation develop when we consider discoveries in twentieth century physics. In particular, Russell develops his interpretation of Einsteinian space-time as a consistent aspect of epistemology.

He begins this analysis by pointing out that the term "simultaneous" is ambiguous. Unlike our psychological state of overlap used to define "instant" where there is no ambiguity of the term, insofar as it is confined to one piece of matter i.e., a single observer, the term "simultaneous" as applicable to different observers is ambiguous. This, for Russell, is a consequence of Michelson and Morley's experiment that resulted in the principle that the velocity of light is constant in any frame of reference moving at constant velocity to a given axis (inertial

frame).

The notion of distance is also ambiguous. When two bodies are moving, the distance between them changes. Classical physics would explain this by saying that at any instant there is an absolute distance between the bodies. But Russell points out that "instant" is ambiguous to begin with. Two different observers will form different estimates of what is "the same instant": "...neither time intervals nor spatial distances are facts independent of the movement of the observer's body."[9]

This summary of Russell on space-time concludes with a claim that although the terms "time" and "space" are ambiguous, there is a constant relation between two events termed "interval". Given the single relation of interval in place of classical spatial and temporal relations, Russell substitutes the concept of space-time in place of a classical conception of space and time. In special theory of relativity an interval is defined as "$c^2t^2-r^2$" if the interval is time-like and "$r^2-c^2t^2$" if the interval is space-like. An observer judges an interval if it is assumed that if at rest relative to a frame of reference, the distance between two events is r and the lapse of time is t. The symbol "c" is to stand for the velocity of light.

According to Russell, a single observer experiences no ambiguity as regards temporal relations of events.

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[9]Ibid., p. 289.

Ambiguities as to temporal relation occur only when we examine various observers traveling at different velocities. An interval is thus viewed by Russell as invariant:

> When neither gravitation nor electromagnetic forces are involved, it is found that the interval, as above defined, is the same for all observers, and may therefore be regarded as a genuine physical relation between two events.[10]

Space-time, like space and time, is viewed by Russell as ordered. If, for example, one is to travel along a route, any point-instant is between two point-instants at close proximity. An example Russell uses is of a traveling light ray whose origin is the sun. Although the interval for this ray is zero, between any two positions along the route, we "...still have a temporal order."[11] The light ray, having an origin at the sun, will have a temporal ordering of which an event that occurred first near the source will precede events of the light that occurred later. Space-time, like space and time of classical physics must use ordered events expressed in the usage of co-ordinate systems. The requirement for such an ordering of coordinates must be

> "...such that neighboring points have coordinates that do not differ much, and that, as points approach closer to each other, the difference between their co-ordinates

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[10]Ibid., p. 289.

[11]Ibid., p. 289.

approaches zero as a limit."[12]

Russell's further analysis of space-time order introduces the notion of "instance." He uses the example of a solar spectrum in which an aspect is a given color, say C. In each observation we note the various colors of which the color C appears. According to Russell we are to view such experiences as reflective of a complex of qualities of which C recurs. To secure a space-time order derived through experience, Russell's epistemology commits him to the view that the complex of qualities (as aspects of experience) does not recur. This group of qualities Russell terms "a complete complex of compresence."[13]

As psychological occurences, an individual does simultaneously experience various stimulations. This is not surprising since according to Russell, simultaneity as confined to a single observer is not ambiguous, even when confined to relativity. We may at any stretch of time smell, touch and have an auditory sensation. We can thus experience simultaneously a multitude of sensations, and hence, there is no ambiguity as regards the relation of simultaneity to experience as it occurs to a single individual. Moreover, the unity of experience corresponds to the various qualitative features that are psychologically

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[12]Ibid., p. 289.

[13]Ibid., p. 295.

experienced as simultaneous. Such a unity, initially confined to our psychological experience is referred to by Russell as a complete complex compresence and as having the attributes:

> ...(a) that all of them are compresent, (b) that nothing outside the group is compresent with every member of the group.[14]

Russell concludes by stating that a complete complex of compresents does not recur; that is to say, no two complete complexes of compresence within experience are absolutely identical given the complexity of the unit.

To construct an ordered space-time in terms of overlap of events, considerations exactly similar to those concerning complete complexes of compresence as aspects of experience must apply to units of physical events and their overlap in space-time.

A brief summary of the nature of Russell's complete complex of compresence is as follows:

(a) The term "compresence" is incorporated into both psychology and physics. In the latter it is to mean but is not defined as "overlapping in space-time". "Compresence" is undefined and is used as a term to define space-time order. In psychology, it is synonymous with simultaneity of psychological experience. In physics, it is overlap of events constituting a local space-time point-instant.

(b) A complex made of events has two properties: (i)

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[14]Ibid., p. 304.

all the constituent events are compresent, and (ii) no event outside this group is compresent with every member of the group.

(c) It is an empirical generalization that no complex of compresence recurs. That is, if A and B are such complexes A cannot be identical to B.

(d) "A complete complex of compresence counts as space-time point-instant."[15]

(e) For a complex to be incomplete, the group forms part of various complete complexes of compresence.

(f) An event is an incomplete complex of compresence and, hence, has the same properties previously mentioned regarding events. It, in a group, determines a continuous part of space-time. The event is part of various complete complexes of compresence constituting space-time. It is an element required to order space-time. As an incomplete complex of compresence, it may recur.

(g) A complete complex of compresence B is said to be between two other complexes, A and C if a part which is a component of A and C is also an aspect of B.

(h) To state that space-time is continuous is to state that between any two complete complexes of compresence, there exist other complexes.

(i) A definition of "point-instant" in terms of complete complex of compresence will not allow one to

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[15]Ibid., p. 304.

determine whether space-time is actually continuous or is discontinuous. What the above only states is that as a point-instant it has no parts.[16]

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[16] In reference to Russell's construction of point-instant, A.J. Ayer, Russell and Moore, p. 132, states as follows:"...point-instants, if they are needed, are found to be constructible out of assemblages of overlapping events, I believe that these constructions are feasible and illuminating, though I cannot agree with Russell that in failing to make them we should be giving hostage to fortune. The only sense which I can give to the question whether there really are point-instants is whether they are logically eliminable." It seems to me that the issue of logical construction of point-instant is not based on whether such concepts are either eliminable or not, but rather on the minimum assumption or empirical commitments we make. That is to say, "point-instants" can be defined in terms of "event" and "complete complex of compresence" which is one method we must assume if we maintain scientific practice as mainly true.

John Elof Boodin, "Russell's Metaphysics," The Philosophy of Bertrand Russell, ed. Paul Arthur Schlipp (Evanston, Illinois, the Library of Living Philosophies, Inc., 1946), pp. 477-509 states of Russell and his conception of space-time "I challenge Russell's assertion that relativity theory has banished cosmic space and cosmic time...I think I may say that cosmic space and cosmic time are as important in the new physics as in classical physics, and the evidence has become clearer." I don't believe that Russell actually conceived of "banishing" space and time, but following relativity theories fuses them as space-time. Moreover his unique contribution is to the effect that space-time order can be logically constructed out of overlapping events. Charles D. Fritz, Jr., Bertrand Russell's Construction of the External World (London: Routledge and Kegan Paul Ltd., 1952) p. 188., states:

> Even though I have maintained that the construction of points and other scientific entities does not solve Russell's problem they still might be of value as an analysis of those entities. They are clearly ingenious analyses, but I find it somewhat difficult to discover what has been gained by them. They do not reduce the entities to observable elements, nor do they help 'validate the inferences to physics'. It is also questionable to what extent they correspond to the common meanings of the terms involved, or

On What There Is

Events

According to Russell, we are to view the raw material of the world as constitued of events: "Broadly speaking, we may say that the fundamental technical apparatus of modern physics is a four-dimensional manifold of 'events'."[17] There are two sorts of events;

> ...by a 'physical' event, I should define it as an event which, if known to occur, is inferred, and which is not known to be mental. And I define 'mental' event (to repeat) as one with which someone is acquainted otherwise than by inference. Thus a 'physical' event as one which is either totally unknown, or, if known at all, is not known to anyone except by inference - or, perhaps we should say, is not known to be known to anyone except by inference.[18]

Our knowledge as regards physical events is therefore partial:

> In fact, on the principle which we are assuming, they are known, though perhaps incompletely, so far as their space-time structure is concerned, for this must be similar to the space-time structure of their effects upon percipients. E.g., from the fact

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> to the way in which the scientist actually uses those terms.

What has been gained is an attempt at reduction of assumptions that will validate scientific and certain common beliefs. Russell does reduce the entities to observable elements and relations, our knowledge of them increases the degree of credibility as to scientific theories being, knowledge. Furthermore, the notion of event is still a common term in science.

[17]Russell, Human Knowledge, p. 240.

[18]Ibid., p. 229.

> that the sun looks round in perceptual space we have right to infer that it is round in physical space. We have no right to make a similar inference as regards brightness, because brightness is not a structural property.[19]

Russell further adds: "The only legitimate inferences as regards the physical sun are structural; concerning a property which is not structural, such as brightness, we must remain completely agnostic."[20] And concerning the distinction between physical and mental events he states: "I conclude that while mental events and their qualities can be known without inference, physical events are known only as regards their space-time structure."[21]

Structure

Concerning the definition of "structure" he states "It is to be observed that structure always involves relations: a mere class, as such, has no structure....Every

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[19]Ibid., pp. 229-230, Milne, "Reviews," responded to Russell's contention concerning his belief that all we know of physical events is their structure "Why then should brightness not be an element of structure? We can speak of ordering the stars according to brightness, 'brighter than' is as good an ordering relation as 'later than' or 'louder-than.' Brightness in physics is stated as the instensity of light and is the "rate of supply of energy (i.e. the power)." Facts on File Dictionary of Physics, ed. J. Daintith, (New York, Intercontinental Book Productions Ltd., 1981), p. 21, brightness is energy/second. The notion of energy and seconds are thus assumed in physics in addition to structure.

[20]Russell, Human Knowledge, p. 230.

[21]Ibid., p. 231.

relation has what is called a 'field' which consists of all the terms that have the relation to something or to which something has the relation."[22] His formal definition of "identity of structure" is as follows:

> The definition of identity, of structure is exactly the same for relations of higher order as it is for dyadic relations. Given, for example, two triadic relations R and S, and given two classes α and β of which α is contained in the field of R while β is contained in the field of S, we shall say that a ordered by R has the same structure as β ordered by S if there is a way of correlating one member of a to one of β, and vice versa, so that, if a_1, a_2, a_3 are correlated respectively with b_1, b_2, b_3, if R relates a_1, a_2, a_3 (in that order), then S relates b_1, b_2, b_3 (in that order), and vice versa. Here, again, there may be several relations such as R, and several such as S; in that case, there is identity of structure in various respects.[23]

We therefore note that for Russell the ~~only~~ characteristic concerning physical events that can be legitimately inferred from data is structural identity as defined above or more accurately structural similarity.

Events as Particles

A particle or a material point is defined by Russell "...as a series of space-time points having to each other a causal relation which they do not have to other space

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[22]Ibid., p. 254.

[23]Ibid., p. 255.

time."[24] He further states:

> We say that given an event of a certain kind in a certain small region of space-time, there will be neighboring events in neighboring regions which will be related to the given event in certain specific ways. We say that a series of events related to each other in these specific ways is to be called one piece of matter at different times. Thus matter and motion cease to be part of the fundamental apparatus of physics. What is fundamental is four-dimensional manifold of events, with various kinds of causal relations.[25]

Also,

> ...they [particles] are no longer part of the fundamental apparatus of physics. They are, I should say, strings of events interconnected by the law of inertia. They are no longer indestructible, and have become merely convenient approximations.[26]

Mass

Concerning the notion of mass, his position is that "Mass is only a form of energy, and there is no reason why matter should not be dissolved into other forms of energy."[27] It is energy not matter that is fundamental to physics.

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[24]Ibid., p. 290.

[25]Ibid., p. 290.

[26]Ibid., p. 299.

[27]Ibid., p. 291.

Critiques on Russell's Scientific Ontology

Pearson: On Inferred Event

Russell's position, concerning the inferred nature of physical events was subjected to criticism by C.I. Pearson.[28] He begins

> ...his contention that all so called external happenings are inferred, i.e. that they are logical constructions deduced by reflecting over the one and only type of happening of whose nature and existence we can be absolutely sure; namely, those happenings that go on in our heads.[29]

To begin with, the claim that Russell says physical events are deduced form experience is incorrect. According to Russell, the intrinsic nature of physical events, namely structure, is not deduced in a logical sense, but is inferred in a non-demonstrative sense (in so far as it is probably the case that if we experience a certain structure, then there exist antecedent physical events of similar structure which were the cause). The inference as to a physical cause is not demonstrative or logically deduced, but rather non-demonstrative and in need of justification, if we are to avoid complete ignorance as to matters of fact.

Pearson continues:

> What I want to suggest is that the events that go to make up this world-picture may in fact be demonstrated to be just what, at first

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[28]C.I. Pearson, "The States of Inferred Entities," Philosophical Quarterly 11 (April 1961): 158-164.

[29]Ibid., p. 158.

> sight, they would naturally appear to be to common-sense; that is they are ideal candidates for the application of Occam's Razor. This particular cutting with the Razor, I suggest, throws non-Russellian light on the status of all inferred entities.[30]

But Pearson fails to show how he would go about eliminating events by the application of Occam's Razor. He follows by stating,

> I wish to say that when the argument for an immense multiplicity of events in any small region of space-time is fully analysed, there turns out to be no grounds whatever upon which to justify either that the inference is provable (what is not claimed) or even that it is justified as an inference (which is claimed). In other words, the objection to Lord Russell's theory is that there is no evidence for his inference.[31]

The Russellian position concerning the justification of our knowledge of physical events is based on data discussed in Chapter II and on the general principles termed "the postulates of scientific inference" which Pearson failed to mention in his article. Currently, I do not wish to go into the details of such justification until Chapter V, but to point out that in Russell's epistemology the very nature of justification from the observed as to the unobserved is the central theme throughout Human Knowledge, which Pearson failed to note in his article. Pearson continues:

> ...that the attempt to establish even the logical inferable status of co-present, overlapping, events passes beyond the rational

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[30]Ibid., p. 158.

[31]Ibid., p. 159.

> possibilities. There is no evidence of any kind whatever to suggest that any event connected with photography or mental experience is going on at any time other than when photographs are actually being taken, or minds actually being stimulated; and even the events causally inferable in these cases may be shown to be identical with causally remote points of origin of the supposed co-present events, and therefore admittedly not in the same space-time region.[32]

This suggests that the position Pearson wishes to maintain is that recording events (on photographic plates or in minds) are all that can be known and that it is irrational to suggest there are events which cause such effects and have the Russellian relations of earlier-and-later, and overlap. But the very nature of experienced events, such as sounds and smells, serve as the data for our belief as to an external cause; therefore, we do possess evidence as to external occurrences. This position, I believe, is rejected by Pearson. He states: "The events whose possiblity is asserted can at best have a 'blind guess' status; but the prudent person would probably feel that he had the right to expect more than this in a theory."[33] He therefore attributes "blind guess" to any reference of inferred physical events, yet he fails to point out how this blind guess differs from other blind guesses that do not maintain an external reference. Moreover, I do not find his conclusion to be based on a sustained argument.

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[32]Ibid., p. 161.

[33]Ibid., p. 161.

Pearson's initial rejection of Russell's inferred physical events confronts him with solipsism which he rejects. In place he states:

> ...the possibility for recording events photographically, turns out to be a logical possiblity, not because of the inferred spatio-temporal identity of these events with the image on the photographic plate, but on the contrary, because of their demonstrable spatio-temporal independence of the photographic plate....If the mind is anything like a photographic plate it knows with demonstrative certainty the independence and remote existence of its objects.[34]

He therefore states that physical events can be demonstrated (I assume logically) from experience and that because we experience something, something independent from experience exists. It seems to me that Pearson has failed to take into his account arguments derived from dreams, where experience does not refer to antecedent physical events. Under Pearson's analysis, if we experience a visual image, an independent object must be the cause of such an experience. There is no explanation, however, as to how this occurs, nor how we possess exceptions as in the case of dreams or mirages.

Kultgen: On Events

Kultgen's[35] article attempts to show that Russell's conception of events is incompatible with Kultgen's notion

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[34]Ibid., p. 162.

[35]J.H. Kultgen, "Operation and Events in Russell's Empiricism," Journal of Philosophy 53 (February 1956): 157-167.

of an operator. I will not deal with the notion of operator nor whether Kultgen has succeeded in such a procedure, but will point out his misinterpretation of concepts associated with Russell's ontology.

His initial misunderstanding begins by stating:

> A particular out of which "things" are constructed are events...an "event" may be defined as a complete bundle of compresent qualities, i.e., a bundle having the two properties (a) that all the qualities in the bundle are compresent, (b) that nothing outside the bundle is compresent with every member of the bundle (H.K. 83).[36]

In the first place, the notion of "particular" as opposed to "particle" is viewed by Russell, in his formal analysis as follows:

> The particular cannot be defined or recognized or known, it is something serving the merely grammatical purpose of providing the subject in the subject predicate sentence such as "This is red." And to allow grammar to dictate our metaphysics is now generally recognized to be dangerous. It is difficult to see how something so unknowable as such a particular would have to be required for an interpretation of empirical knowledge.[37]

The concept of "particular" does not serve any purpose in Russell's epistemology. Certainly not "...out of which 'things' are constructed."[38] Actually particulars serve no purpose at all.

Secondly, the concept of "things" are analogous to

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[36]Ibid., p. 161.

[37]Russell, Human Knowledge, pp. 243-294.

[38]Kultgen, "Events", p. 161.

particles not particulars and these particles were stated by Russell as,

> ...no longer part of the fundamental apparatus of physics. They are, I should say, strings of events interconnected by the law of inertia.[39]

Moreover, physical events may or may not possess qualitative features; the only legitimate inference as regards events is structure. Kultgen's definition of "event" in terms of qualities is extracted from Human Knowledge (page 83). He fails to note, in Russell's quotation "...an 'event' may be defined as a complete bundle of compresent qualities...(H.K. p. 83)"[40], the terms "may be." This was initially introduced as an explanation of the meaning of proper names as applicable to our sensing experience. It never was meant as a final definition of "event", which Kultgen failed to appreciate. Kultgen's article is based on this initial misinterpretation and no doubt his conclusion suffers from being based on false premises.

Quine on Ontology

Quine's[41] article attempts to account for Russell's ontological development. Concerning Russell's later

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[39]Russell, Human Knowledge, p. 299.

[40]Kultgen; I have added this emphasis to Kultgen's quotation from Russell.

[41]W.V. Quine, "Russell's Ontological Development," Bertrand Russell: A Collection of Critical Essays (New York, Anchor Books, Doubleday and Company, Inc., 1972), pp. 290-304.

epistemology, Quine states:

> Russell continued to champion facts, right through his Inquiry into Meaning and Truth and into Human Knowledge, 1948. In Human Knowledge the term applies not only to what true statements assert, but to more 'Everything that there is in the world I call a fact (p. 143).'[42]

And:

> It does not reach the physicalistic pole, even in Human Knowledge; but there is an increasing naturalism, and increasing readiness to see philosophy as a natural science trained upon itself and permitted free use of scientific finding....[43]

The term "event" never occurs once in Quine's article on Russell's ontology. I tried to show that events were fundamental in the construction of Russell's conception of points, instants, point-instant and particles. In this Quine failed to note the physicalistic nature of Russell's ontology. To state that the fundamental apparatus of physics and psychology are events, seems to me to participate completely in physicalism.

Eames On What There Is

Eames' excellent article gives an accurate summary of Russell's developmental ontology.[44] She states:

> Russell's conclusion with respect to "what there is" suggest a world of continuities and

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[42]Ibid., p. 301.

[43]Ibid., p. 304.

[44]E.R. Eames, "Russell on What There Is," Revue Internationale de Philosophie 26 (1972): 483-498.

> clusters of events, a hypothesis compatible with the tentative conclusions of science, the epistemological necessity of the postulates, and the required structure of language.[45]

Her article is essentially expository without any criticism. "My concern in this paper is not with critics, however, but with the clarification of the development of Russell's own view on 'what there is'."[46]

Ayer: On Russell's Ontology

Ayer[47] states:

> So in the contemporary version of this theory, the thing which I take to be continuous, coloured, stationary surface of the desk at which I am writing is really a discontinuous group of darting colourless electrons. Except for denying that the electrons are where the desk appears to be, this is also the view that Russell takes.[48]

Ayer is of the opinion that according to Russell electrons are the ultimate "stuff" of the world. Although, as follows, there are problems with his interpretation of Russell overall, even this position is incorrect, since to Russell all the ingredients of chemistry are assumed to be the case: "It has been found that, in addition to electrons and protons, there are two other constituents of atoms,

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[45]Ibid., p. 498.

[46]Ibid., p. 484.

[47]Ayer, Russell and Moore, pp. 129-133.

[48]Ibid., p. 130.

which are called 'positrons' and 'neutrons'."[49]

Ayer continues:

> We may, however, get a clue to this by considering why it is thought that physical objects do not possess the property of being coloured in the literal way in which it is ordinarily ascribed to them.[50]

I believe that Russell does not outrightly reject objects as having color, but rather remains agnostic. Certainly when he clarifies "event", the nature of color is not introduced but it is not rejected explicitly either.

Ayer introduces his conception of intrinsic properties of objects, in counter distinction to Russell's events: "Its intrinsic properties are those which it can be said to have without implication that it is related to anything else..."[51] But Ayer's definition is a tautology. He defines an intrinsic property of an object in terms of something not having implication or related to anything else. The definiens contains "anything else" which is what he wishes to define to begin with. He concludes "...the energy which is attributed to electrons would appear not an intrinsic but causal property: and indeed it is not easy to find examples of properties which are clearly intrinsic, outside the properties of percepts."[52] He fails to mention

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[49] Russell, Human Knowledge, p. 20.

[50] Ayer, Russell and Moore, p. 130.

[51] Ibid., p. 130.

[52] Ibid., p. 130-131.

or criticize Russell's contention that the intrinsic property of any event is that it occupies a finite continuous portion of space-time and is earlier-and-later or overlaps with another event(s). Finally Ayer does conclude that: "On the other hand, the energy of an electron may be intrinsic to it"[53], which is Russell's position as well.[54]

McLendon: On Structure

McLendon's[55] article examines Russell's conception of similarity of structure through his numerous epistemological books including Human Knowledge:

> I am concerned here both to describe one of the main technical concepts employed by Russell throughout most of his philosophy, namely, his concept of similarity of structure, and to judge its alleged usefulness for solving a number of important problems in philosophy.[56]

McLendon begins by distinguishing four associated concepts of "structure" in Russell's epistemology. These are:

> In the weakest sense, to say of something that it has a structure means simply that it has a complexity....In this sense, any entity with a plurality of components may be said to have a structure....Hence, in this second sense, a description of the pattern of relations holding among the terms or members or parts of the complexes in question is a description of their structure....In the third

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[53]Ibid., p. 131.

[54]Russell, Human Knowledge, p. 291.

[55]Hiram J. McLendon, "Uses of Similarity of Structure in Contemporary Philosophy," Mind 64 (January 1955): 79-95.

[56]Ibid., p. 79.

> use of 'structure', the relation which holds among the terms in the complex and give it its structure is a nonordering relation....In the fourth sense, to say of a class of terms that it has a structure means that the members of the class are related by an ordering relation (HK, pp. 254-256), that is, one which has the logical properties of transitivity, asymetry and connexity.[57]

He criticizes Russell for failing to state explicity the distinctive types of structural similarity:

> One very appropriate criticism both of Russell's discussion of structure and of his uses of it is that he does not bother to sort out these distinct senses. As a result, his readers, discovering that Russell does not use "structure" in a single sense, are left to puzzle out the different senses and to decide in given contexts which sense is intended.[58]

McLendon continues by stating that given the ambiguous meaning of "structure", similarity of structure is thus rendered also ambiguous, and as having four distinct senses. These are:

> This sense of "similarity of structure" corresponds to the first sense of "structure", namely, that of having a plurality of parts or members or terms.
>
> The sense of "similarity of structure" which corresponds to the second sense of "structure" is, however, the most important one and the one most difficult to define carefully. Just as "structure" in its second sense refers to the pattern of relations by which the components of a complex are arranged, whether the relations be nonordering or ordering, so also there is a sense of "similarity of structure" which refers to a relation between two structured classes α and

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[57]Ibid., pp. 80-81.

[58]Ibid., p. 82.

> β equally well whether α and β be themselves structured by nonordering relations or by ordering relations and whether α and β be imaginatively similar or not. To the definition of this fundamental and comprehensive sense of "similarity of structure" attention now is turned. Once it has been formally defined and illustrated, third and fourth senses may be defined as species of it, in the third sense where the structuring relations of α and β are nonordering and in the fourth sense where the structuring relations of and are ordering relations.[59]

McLendon then gives a detailed account of Russell's more developed definition of "similarity of structure (in a strict sense)":

> According to Russell, two classes α and β may be said to be similar with respect to structure in the most comprehensive sense if, and only if, all of the following conditions are fulfilled:
>
> (1) Members of class α are related to one another by a relation P.
>
> (2) Members of class β are related to one another by a relation Q. (HK, p. 254: "...structure always involves relations: a mere class, as such, has no structure." Cf. AMR, p. 259)
>
> (3) Each member of class α corresponds to one and only one member of class β and vice versa (IMP, p. 54; AMR, p. 250; HK, pp. 254, 255, 474). This relation of correspondence holds when, and only when, there is at least one one-one relation S which holds between the members of α and the members of β and which at the same time preserves the structuring relation P in class α and the structuring relation Q in class . This one-one relation S is the correlator of the two similar classes. (IMP, p. 54).
>
> (4) Whenever two terms a_1 and a_2 in class have to each other the relation P, then the two corresponding members of β, b_1 and b_2, have to each other the relation Q, and vice

[59] Ibid., p. 83.

versa (AMR, p. 250; HK, p. 254).[60]

McLendon's criticism is that:

> In Human Knowledge, when Russell defines "similarity of structure", he demands that each structured class be ordered (HK, pp. 253, 255, 461; IMP, pp. 58-61). But when he applies the concept of similarity of structure in important epistemological problems as well as in some of his expository common-sense illustrations, he regularly uses, and indeed is forced to use, the concept of similarity of structure in the looser, more comprehensive sense defined above rather than in the strict fourth sense of similarity of structure between ordered classes. This stringent definition is thus too narrow to cover the cases that he treats with it.[61]

McLendon uses two examples in support of his claim that the stringent definition of similarity in structure is too narrow as it occurs in Human Knowledge. The first is Russell's example of the map of a terrain and the terrain; the second is the similarity of structure visual sensation has to its prototype. But such examples are precisely the ones where to Russell, the strict definition is to apply. For instance, our visual sensation is comprised according to Russell, of various shapes and colors (under common conditions). The visual field is comprised therefore of a set of color shapes having to each other the relation of up-and-down, left-and-right, centrality and depth. The physical occurrence or the prototype is a set of events having similarity of structure to these relations. To be

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[60]Ibid., p. 83.

[61]Ibid., p. 85.

sure, the very notion of an ordered physical world is, according to Russell, derivable from our experiences, and since our experiences are ordered, there is, according to Russell a similarity of structure (in a strict sense) between our visual sensation and its prototype. McLendon sums up his initial criticism as follows:

> As the definition has been developed here, therefore, P and Q may be ordering relations, but need not be. This is in keeping with Russell's earlier and superior formulations of the concept of similarity of structure (in IMP and AMR), which have been the basis for my definition of it in the second, comprehensive sense.[62]

McLendon also maintains the following:

> However, when it is inspected more closely, its alleged and apparent usefulness for philosophy becomes very doubtful. In examining this concept of similarity of structure and Russell's uses of it, I have reached the following critical conclusion:
> (a) In its precise logical sense formulated by Russell, the concept of similarity of structure, though it is logically impeccable, is wholly useless for each of the many purposes to which Russell tries to adapt it, because the concept is so general that any statement whatsoever asserting of any two or more given wholes that they are similar with respect to structure not only will be true but also will be tautologously true and thus will convey no factual information about them.
> (b) If Russell's purely logical concept of similarity of structure is to be useful as Russell wants it to be, sharp empirical limitations must be imposed upon it.
> (c) It is not at all clear, however, what remedial limitations may be successfully imposed upon it.
> (d) Moreover, even if such empirical limitations were developed, the resulting

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[62]Ibid., p. 87.

> modified concept or concepts, being empirical, would be altogether different from Russell's purely logical concept of similarity of structure and acceptance of them would probably make it a superfluous piece of technical apparatus.[63]

These conclusions are based on the following line of reasoning. (a) Given any two classes having the same number of elements, it follows that given Russell's formulation of "similarity of structure", all conditions being satisfied renders the classes as similar in structure. "Likewise, any two similar classes whatsoever can be shown to be similar in structure in Russell's purely logical sense meticulously expounded above."[64] (b) Given any two wholes, each can be divided into two classes of parts each having the same number of elements, hence, any two wholes once divided into exactly equal classes of parts have similarity of structure. McLenden states:

> Now, from these two considerations, that any two wholes may be exhibited as two similar classes and that any two similar classes satisfy the conditions of Russell's purely logical definition of "similarity of structure", the third step in the argument follows, namely, that any two wholes whatsoever can be made to satisfy the conditions of Russell's purely logical concept of similarity of structure. This is the crux of the critical conclusion that was to be established.

McLendon's central error in analyzing Russell's conception of "similarity of structure" is not so much the

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[63]Ibid., p. 89.

[64]Ibid., p. 90.

formulation of the phrase, but a failure to appreciate that the relations between members of, say, class A and B are confined by Russell's epistemology as constant values and are not simply variables. For example, given our visual sensation, Russell states: "These relations are of right and left, up and down; there is also relations which we learn to interpret as depth. These relations belong to the sensational datum."[65] Our knowledge of the physical world is of structure only in so far as our world has the same or similar structure as our sensational data and as having the above noted Russellian relations between events. Given therefore the constant values assigned to relations P and Q above, we can maintain similarity of structure between our visual and physical world which is consistent with Russell's formal definition.

McLendon's views, namely that any two classes of identical numerical members, or wholes divided into identically numerical classes would satisfy Russell's epistemic requirement of "similarity of structure", fails to note empirical relations as values to the noted relations. The fact of the matter is that the notion of "similarity of structure" is not a purely logical definition but a definition with an empirical import.

On Causal Laws

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[65]Russell, Human Knowledge, p. 218.

Assuming that scientific inquiry and laws are knowledge, the Russellian conception of causal laws will now be investigated. I mentioned that to Russell, "What is fundamental is four-dimensional manifold of events with various kinds of causal relations."[66] Moreover, "...they [particles] are no longer parts of the fundamental apparatus of physics. They are, I should say, strings of events interconnected by the law of inertia."[67] In this section, I wish to examine the general Russellian conception of "causal relation" as is subsumed under the heading of "causal law."

By "causal law" Russell means:

> a general principle in virtue of which, given sufficient data about certain regions of space-time, it is possible to infer something about certain other regions of space-time. The inference may be only probable, but the probability must be considerably more than a half if the principle in question is to be considered worthy to be called a causal law.[68]

I shall defer the aspect of "probable" and proceed to interpret Russell's views concerning causal laws:

(a) The inference from one region of space-time to another need not be later. A backward inference is permitted and is often desired as is the case in both geology and history.

(b) The amount of data required to state a causal law is indeterminate.

(c) The inference as to an occurence is of a general

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[66]Russell, Human Knowledge, p. 290.

[67]Ibid., p. 299.

[68]Ibid., p. 308.

> kind. E.g., when we infer from noting meteorological conditions that it will probably rain, the aspect of inference we wish to state is a general feature of a complex event, namely, that it will rain. This, to Russell, is an inference as to a general characteristic of the inferred event.

(d) If a law confers high probability to inferred events, to Russell, this law may be stated as being a causal law.

There are two sorts of causal laws in Russell's philosophy: (a) those that refer to persistence and (b) those concerning change. An example of a causal law of persistence is Newton's first law of motion which states the persistence of a particle while at rest or in uniform motion. Causal laws of change e.g., refer to occurrences such as chemical reactions, or Newton's law of gravitaiton that stipulates a change in velocity due to the attractive force of matter.

A Russellian causal law must further possess an added feature expressing continuity:

> There are formulas (causal laws) connecting events, both perceived and unperceived; these formula exhibit spatio-temporal continuity; i.e., involve no direct unmediated relation between events at a finite distance from each other.[69]

Such laws further refer to ordered events in space-time, "...each event must have four co-ordinates and neighboring events are those whose co-ordinates are very

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[69]Ibid., p. 314.

nearly the same."[70] Russell states that we assign an order to events by the usage of causal laws:

> Events can be arranged in a four-dimensional order such that when so arranged they are interconnected by causal laws which are approximately continuous, i.e., events whose co-ordinates differ very little also differ very little. Or rather: Given any event, there is a series of closely similar events, in which the time co-ordinate varies continuously from rather less to rather more than that of a given event, and in which the space co-ordinates vary continuously about those of the given event.[71]

Therefore, space-time, for Russell, can be mathematically expressed in terms of four real numbers; three real numbers for the spatial components and the fourth for the temporal aspect. To determine the geometry of a manifold, one requires a way of determining the geometry of space-time not by a purely mathematical conceptualization, but in such a way as to render an expression an empirical claim. In a word, the geometry of space-time must be determined by experience. As such, the ordering of space-time refers to the relation previously termed "compresence."

I therefore noted that according to Russell, an event is something which is either earlier or later than something else. It can have the relation of overlap to another event. In psychology, Russell introduces the relation "compresence" of experience. Furthermore it is assumed that the relation

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[70]Ibid., p. 326.

[71]Ibid.

of compresence can hold between events of our physical world. This relation need not be always experienced, although its ontology for unexperienced events is a generalization derived from experience. That is to say, from the experience of compresence, Russell concludes that physical space-time has the same relation to events, and this is to mean that events overlap in space-time. It is also pointed out that "compresence" is not synonymous with "simultaneous." The term "compresence" is an undefined term and its meaning is derived through experience. In psychology, it is to mean an overlap of experience although the term has only an ostensive definition. From the relation of compresence, space-time order can be constructed using causal laws. An order can be had if we assume, as an example n events termed a_1, a_2,...a_n. If a_1 is compresent with a_2, and a_2 is compresent with both a_1 and a_3, and a_3 is compresent with a_2 and a_4, we can proceed to construct an order of events. We can say that a_2 is between a_1 and a_3 and that a_3 is between a_2 and a_4. In this fashion Russell constructs events as constituting space-time order.

The traditional conception of a physical object is replaced by Russell with "causal line":

> I call a series of events a "causal line" if, given some of them, we can infer something about the others without having to know anything about the environment....A photon which travels from a star to my eye is a series of events obeying an intrinsic law but ceasing to obey this law when it reaches my

eye.[72]

And concerning the traditional conception of "cause" and "effect":

> When two events belong to one causal line, the earlier may be said to 'cause' the later. In this way, laws of the form 'A causes B' may preserve a certain validity.[73]

There are in Russell's epistemology two distinct types of causal lines. The first is of the history of a piece of matter discussed above; the second involves change such as the relation between an aspect of the physical world and the experience of perception.

Summary

Our visual perception, in Russell's philosophy results when light emitted from a source strikes the retina and, via neural transmission from the retina to the brain, causes us to experience what may be termed "visual perception." From perception known to us by introspection or memory, we infer that something in the environment is the cause of such perceptual expereinces. Similar considerations apply to our other perceptual experiences due to our different senses. What is uninferred is our experience of sensation. Any references to an outer cause of such sensations is an inference. Our inference from sensation as to its cause tacitly refers to causal laws. By

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[72]Ibid., p. 316.

[73]Ibid.

contemporary standards, some such laws are stated in a discipline termed "psycho-biology." Common-sense, for example, assumes causal laws that will permit us to make the above noted inferences: we assume that when we see an object, there exists an object to which we refer in seeing it. Contemporary biology is just a refinement of such a common-sense view. What is stated is that both contemporary biology and common-sense infer from sensation and perception certain properties as to matters of fact that state more than what is actually experienced. Such inferences may, at any time, prove to be wrong. To use Russell's example, my retinae may be so stimulated as to cause me to experience the sight of a lake when, in fact, no lake is present, as in the case of a mirage. In what was exposed, the inference from sensation and perception as to an antecedent causation is to be viewed as what usually happens when one has an experience of a certain sort, but such an inference may at any time prove to be erroneous. Moreover, our acceptance of external causes of perception assumes the ontology of causal lines.

Ayer on Causal Laws

Ayer's[74] criticism of Russell on causal laws is as follows:

> If there is a criticism to be made of Russell's formal definition of causality, it

[74]Ayer, Russell and Moore, p. 113-117.

> must be that it is too general.....We need to distinguish between causal laws, in one of the narrower senses of the term, and statistical laws; between dynamic laws, qualitative laws and functional laws; between laws and correlate events at the same observational level which explain the behaviour of objects in terms of their underlying structure; we need to consider whether there is any justification, or necessity, for admitting a special category of teleological laws; above all, we need to find some way of distinguishing between generalizations of law and accidental generalizations of facts.[75]

Russell had the following to say as regards his definition of "causal law": "I have purposely made the above definition very wide."[76] It seems to me that Russell's definition of "causal law" was deliberately meant to cover the divergent parts of scientific laws of nature. In a sense, Russell seemed to extract a fundamental feature from his understanding of scientific laws, and by virtue of such abstraction to state a definition of "causal laws" that would be applicable to all physical laws of nature. These features, namely our ability to infer event(s), given data, and space-time continuity, is all that Russell saw fit to merit his definition of the term. Ayer's list of types of laws, although he fails to explain what such laws mean, or what distinguishes one from another, is subsumed in Russell's epistemology under the broader topic of "causal

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[75]Ibid., p. 117.

[76]Russell, Human Knowledge, p. 309.

laws."

Grene on "Cause"

Grene's[77] article states:

> In Human Knowledge: Its Scope and Limits (1948) he arrived at the statement of five postulates needed to validate the scientific method, three of which explicitly and the other two implicitly involve a reference to cause.[78]

But in her article, Grene fails to note that Russell's conception of cause is confined to having meaning only within the broader topic of causal line, "When two events belong to one causal line, the earlier may be said to 'cause' the later."[79] At a later place Russell notes:

> The conception of 'cause' as we have been considering it, is primitive and unscientific. In science it is replaced by the conception of 'causal laws.'[80]

It therefore seems to me that the notion of cause does not enter as a fundamental concept in Russell's philosophy as Grene might initially suggest.

Grene further states:

> . . . all these postulates (which look suspiciously like Kantian principles) are, as I said at the start explicitly or implicitly statements about cause. Apparently, therefore, an account of scientific

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[77]Majorie Grene, "Causes," Philosophy 38 (April 1963): 149-159.

[78]Ibid., p. 150.

[79]Russell, Human Knowledge, p. 316.

[80]Ibid., p. 457.

> explanation does after all involve reference to causes, as we saw at the beginning Russell agreed with Campbell that it does not. Russell does not define the term cause.[81]

But according to Russell, the notion of cause only enters validiy in his philosophy under the broader topic of causal law. Grene continues:

> He says instead that science elaborates various forms of causal laws. This would seem to indicate (1) that to think about knowledge at all we have to know what we mean by 'cause' - cause seems to be a primitive idea in thinking about knowledge in general or science in particular.[82]

According to Russell, however, cause and effects are not primitive or basic concepts of science, which Grene failed to note in her article.

Bunge on Causal Laws

Bunge[83] refers to Russell's position on causal laws as:

> The definition of causal law as a predictive instrument led Russell to regard, generalizations such as 'dogs bark' or 'lions are fierce' as causal laws just because they enable us to make predictions, even though they assert nothing but invariable association.[84]

Concerning predictability, he states:

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[81]Grene, "Cause", p. 158.

[82]Ibid., p. 158.

[83]Mario Bunge, Causality and Modern Science, (New York: Dover Publishing, Inc., 1979).

[84]Ibid., pp. 326-327.

> ...predictability is not the meaning of causation but is a criterion of truth of both causal and non-causal hypotheses.[85]

On Russell's conception of "cause" Bunge writes:

> Russell, among others, prophesied that "in a sufficiently advanced science, the word 'cause' will not occur in any statement of invariable laws." Now, this can easily be granted, and there hardly is any need to wait for the future. But it does not follow from it that the concept of cause will finally be extruded from philosophy, however scientific philosophy becomes. The word 'cause', which denotes a generic concept, need not occur explicitly in any particular scientific statement; the cause concept belongs to ontology, just as do the concepts of quality, change, connection, chance, and so on, which receive specific names in every chapter of science.[86]

There are three major topics in Bunge's position regarding Russell. These are causal laws, predictability and cause.

Russell's formal definition of "causal laws" refer to it as "...a general principle...given sufficient data about certain regions of space-time, it is possible to infer something about other regions of space-time."[87] Bunge on the other hand states Russell's position on causal law as "a predictive instrument" where "predictive" is "a criterion of truth for causal and non-causal hypotheses."

The first point to note is that Bunge identifies Russell's conception of "inference" with "predictability."

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[85]Ibid.

[86]Ibid., p. 345.

[87]Russell, Human Knowledge, p. 308.

This position is a mistake in so far as the term "inference" has varied meaning other than predictability and was never intended to mean a criterion of truth of causal laws in relation to facts, as is interpreted by Bunge. Secondly, Bunge sees Russell's conception of causal laws as expressive of invariable association. But Russell refers to the nature of inference of causal laws as being probable: "The inference may be only probable..."[88] This position does not necessarily state invariable association but only probable associations.

On Russell's position of cause Bunge notes that "the cause concept belongs to ontology." But for Russell, the fundamental ontological commitment is to causal lines, where 'cause' preserves some validity.[89] There is, in a sense, validity for Russell's position since Bunge also retains his conception of causal claims.[90]

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[88]Ibid., p. 308.

[89]Ibid., p. 316.

[90]Donald Lipkind, "Russell on the Notion of Cause," Canadian Journal of Philosophy 9 (December 1979): 701-720, refers to Russell's conception of cause as confined to "The Notion of Cause."

CHAPTER IV

PROBABILITY

"Causal law" defined above referred to our ability to infer with probability something about a certain region of space-time. The topic of "probable inference" is covered in Russell's epistemology under the broader more general heading of "Non-Demonstrative Inference,"and differs from logical (demonstrative inferences) in one basic sense: in logical (demonstrative) inference a conclusion of an argument is true provided the premises are true and the mode of inference correct. Non-demonstrative or scientific inference differs from its logical counterpart insofar as when the premises are true, and reasoning correct, a conclusion is rendered as only probable. For example, we all believe that when we see a dog, it will probably bark. Such a common-sense expectation is based on previous experiences we all had regarding dogs and the fact that they usually bark. In epistemology it seems reasonable to believe and assume as knowledge what is usually or probably the case, even though what is expected might not actually

occur. Considerations regarding such an inference thus seem to require an analysis of "probability."

An additional aspect of probability is that, for Russell, some scientific laws are so stipulated as to state probabilities only, i.e., to state what usually happens. Such theories state that, given classes of associated events, the association is only probable. Moreover, the claim that an association is only probable, is itself only probably the case. According to Russell, therefore, the term "probability' is ambiguous in a sense of having two meanings.[1]

Types of Probabilities

By one instance of "probability" Russell means "degree of credibility." Under such a signification, we

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[1]Ian Hacking, The Emergence of Probability, (London: Cambridge University Press, 1975) p. 10, points out as his central thesis that "probability" has had historically a dual meaning: on one hand it referred to frequency, and on the other to degree of belief based on data. "They forget that probability emerging in the time of Pascal is essentially dual. It has to do both with stable frequency and with degrees of belief. It is, as I shall put it both aleatory and epistemological. This quite specific character of probability is one of the clues to its emergence." Both sorts of probabilities are relevant to epistemology for Russell, and in this thesis.

The dual aspect of probability is also maintained by Ernest Nagel, "Probability and Non-Demonstrative Inference," Philosophy and Phenomenological Research 5 (June 1945): 485-507. He states: "I believe, in opposition to [Mr. Williams] that "probability" is not universal, and that, on the contrary, it has at least two meanings, one of which is rendered by the frequency theory."

Rudolf Carnap, "The Two Concepts of Probability" Philosophy and Phenomenological Research 5 (June 1945): 513-533., further mirrors the dual meaning of "probability."

could state that what we term knowledge is only probable insofar as knowledge claims may be predicated with degrees of credibility. I will return to a more systematic account of Russell and probability as degree of credibility below. A second, and what might be perceived as a more accurate sense of probability is defined as mathematical probability. This, for Russell, expresses a relation of propositional function or class relation. For example, let us suppose that the class of people with dark hair has m members and the class of Canadians has n members. The probability of choosing a Canadian at random and the individual being dark haired is designated as m/n. The expression m/n expresses either a class relation (namely the conjunction of classes) or a relation between propositional functions because we could reduce the notion of classes to those of propositional functions.

Probability has this twofold nature in Russell's epistemology. On one hand there is a definite mathematical interpretation signifying frequency; on the other hand probability is an epistemological concept associated with knowledge as degrees of credibility. Nevertheless the two concepts are interrelated in Russell's epistemology. I will begin by a detailed account of both.

Mathematical Probability

Probability as a branch of mathematics begins by a set of axioms as fundamental premises; all subsequent

theorems follow logically from the initial stock of probability postulates and definitions. In Human Knowledge, terms for the axioms of probability are so interpreted as to, (a) give signification for such terms that would satisfy mathematical requirements derivable from the axioms and, (b) show how such an interpretation can be dealt with in the ordinary use of "probability."

The axioms of probability that Russell refers to in Human Knowledge, are those obtained from C.D. Broad.[2] They are as follows:

I. Given p and h, there is only one value p/h. We can therefore speak of "the probability of p given h."

II. The possible values of p/h are all the real numbers from 0 to 1, both included.

III. If h implies p, then p/h=1 [We use "1" to denote certainty.]

IV. If h implies not-p, then p/h=0. [We use "0" to denote impossibility.]

V. The probability of both p and q given h is the probability of p given h multiplied by the probability of q given p and h, and is also the probability of q given h multiplied by the probability of p given q and h.

VI. The probability of p and/or q given h is the probability of p given h plus the probability of q given h minus the probability of both p and q given h.[3]

We note certain terms in the initial stock of axioms or assumptions. The term of importance is "probability" and

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[2]Charlie Dunbar Broad, "Hr. Von Wright on the Logic of Induction I," Mind 53 (January 1944): 1-24.

[3]Russell, Human Knowledge, p. 345.

is defined (in the mathematical sense) as follows:

> Let B be any finite class, and A any other class. We want to define the chance that a member of B chosen at random will be a member of A.... We define this probability as the number of Bs that are As divided by the total number of Bs. We denote this by the symbol A/B.[4]

An example of the above definition of probability will explain Russell's definition. Suppose we wish to determine the probability of it having rained on a certain day of this year, but we do not recall whether or not it actually rained. We do, however, know that there are 365 days to our year (this is class B), and also that it rained say, 100 days in that year (this is class A). The probability of it having rained on a particular day would be 100/365, according to the above interpretation of "probability." Using this definition, the total number of days would represent class B. We also know it rained 100 days of this year. The 100 days represent class A contained within the total number of days of the year, i.e., class B. We wish to know that if we were to choose any day of the year at random, i.e., a random member of class B, it also rained, i.e., it is also a member of A. This relation is expressed as the ratio A/B. Probability is thus expressed as a fraction or it may be 0 or 1.

We can return to the initial postulates in order to determine whether or not Russell's finite frequency

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[4]Ibid., pp. 350-351.

interpretation satisfies the postulates of probability mentioned above. The postulates are expressed in terms of variables p, q, and h. According to Russell, such terms are to be understood as either propositional functions or classes. When we state that h implies p, using set theory interpretation, we state that the class p is contained in class h. In addition, according to the above interpretation, when we say p and q, we mean the common member found in both sets p and q. Lastly, p or q means all members of sets p or q or both. Using the finite frequency interpretation for mathematical probabilities in terms of classes or propositional functions, Russell concludes that the finite frequency interpretation does satisfy mathematical requirements. There are, however, certain modifications he introduces.

(a) To the first postulate we are to add that the variable h cannot be zero. If it is, p/h is 0/0 and hence 0.

(b) Whereas p/h in the original postulate can acquire any real number value between 0 and 1, Russell's finite frequency interpretation allows the value of p/h as confined to rational numbers, zero or one.

The above interpretation of "probability" seems initially to possess certain drawbacks, insofar as all that we do when we state probabilities is to express finite class relations or relations between propositional functions. But

in common usage, we wish to state that a given event has such-and-such a probability, i.e., that "probability" can be predicated of propositions and not just of propositional functions. We wish to also say that Mr. C has such and such a probability of being a dark haired Canadian. In such instances we must specify what Russell refers to as "relevant data," namely, the general known probability of dark hair among Canadians, i.e., the relation between two classes:

> Given any object a, and given that a is a member of the class B, we say that in relation to this datum, the probability that a is an A is A/B as previously defined.[5]

One consequence of the finite frequency definition of "probability" defined as a ratio between two classes is that "probability" can also be predicated of particular statements as long as to Russell, we also state all relevant data. The data being that the stated event is a member of a given class B and this class B has some numerical relation to another class A. We know that a given event "a" is a member of B, but we do not know whether it is an A. In such instances we can say that given "a" is a B, the probability of "a" being an A is A/B. According to Russell, a mathematical definition of "probability" must allow for such an interpretation as applicable to individual events and not

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[5]Ibid., p. 353.

just class relations.[6]

The finite frequency interpretation refers to a relation of two finite classes, but in Russell's analysis it can be extended to infinite collections or an infinite series.[7] That is, should we continue to toss a coin ad infinitum, what will the probability be for the occurrence of heads to appear? According to Russell, we are to assume that in order to determine the probability of infinite a's being b's, we require that our a's, that is a_1, a_2,...a_n, where n is any finite number, form a series or a

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[6]Bas C. van Fraassen, "Russell's Philosophical Account of Probability," Bertrand Russell Memorial Volume, ed. George W. Roberts (London: George Allen and UnWin, 1979), p. 395, states that according to Russell's finite frequency interpretation we are left with two unresolved issues, one of which is inability to state that a single event can have such and such a probability: "Russell had two objections to the view that probability statements are statements of relative frequency. There are still two main objections today; I shall call them the single-case problem and the inference problem. The first tends to show that not all probability statements can be construed as relative classes; but the second remains even if we restrict the discussion entirely to statements about classes."

Setting aside the inference-problem, I maintain that to Russell, the single case probability is dealt with in Human Knowledge under two headings, the first being under mathematic probability mentioned above. It seems to me that Van Fraassen overlooked this. I will review Van Fraassen article at the end of this chapter.

[7]Both Carnap, "Two Concepts", and Nagel, "Probability" refer to the probability of an infinite series as "the limit of the relative frequency." In Carnap's case, he states "(ii) probability$_2$ = relative frequency in the long run" (p. 517); and Nagel, "The probability with which a property occurs in a specific class is thus defined as the limit of the relative frequency which the property occurs in it, the class being assumed to contain an infinite population and to possess a certain 'random' character with respect to the property in question." (p. 487).

progression. Russell denotes p_n as the probability of all a's up to a_n as belong to b as n increases. If the probability of p_n approaches a limit, then this limit is the probability of infinite a's being b's.

There are two alternative probabilities that we can associate with an infinite series as n increases in the above example. First, that p_n hovers over a limit; secondly, as n increases, p_n approaches the limit unidirectionally. When we toss a coin n times, the probability of tossing a head as n increases may oscillate over the limit of 1/2. This is an example of probability oscillating over a definite limit. Sometimes we are below this limit and sometimes we are above. In such instances we can say that the probability of tossing a head an infinite number of times oscillates above or below the limit of 1/2. A second possibility is that the probability p_n approaches a limit from one side. An example is of someone choosing a prime number from a set of integers as n increases. This limit approaches zero since, for Russell, we can calculate the limit of choosing a prime number for large numbers by using the function 1/log n. As n increases, the probability p_n approaches zero as a limit. According to Russell, we cannot maintain that, as n increases, p_n is actually zero; at best we can say that as n increases, the probability approaches zero however small this probability may be. We noted in relation to a coin being tossed n times and the probability

of heads as being 1/2. If we assume that this is an actual limit after an infinite number of tosses, according to Russell, we require an inductive principle that will logically permit us to infer from a finite number of tosses as to the behaviour for infinite occurrences. Empirical expressions that refer to an infinitely large set of occurrences which clearly cannot be experienced, require some sort of an inductive principle that will allow for such an extension.[8]

We thus note that from a purely mathematical point of view, Russell's finite frequency definition as stated above will satisfy the requirement for the foundation of probability.[9] Moreover, one could extend such a definition so it also applies to a given event, once we account for relevant data. In addition, one can also extend this definition so it applies to an infinite series of events provided the series approaches a definite limit. It is also noted that if one is to apply Russell's definition to an empirically infinite series, one requires an inductive principle or some other principle that will permit one to infer, from a limit arrived at during finite occurrences,

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[8]To Both Carnap and Nagel, no mention of any inductive principle is required in order to determine the probability of an infinite series. Actually both define "probability" as the limit of relative frequency and hence assume such a principle in their very definition.

[9]Van Fraassen, "Russell", criticizes this position. I will discuss his alternative position in detail below.

the limit of an infinite series.

Van Frassen on Russell and Mathematical Probability

Van Fraassen[10] describes Russell's finite frequency interpretation of "mathematical probability" correctly. However, he introduces his own notation to express Russell's account of probability. Thus Russell's mathematical definition becomes:

(I) P (B/A) = r

and is to mean that given two classes A and B, "...that a fraction r of the A's are B's."[11] Writing #(X) as the number of members of the class X, (I) is stated as:[12]

(II) #(B ∩ A) = r # (A).

He furthermore points out that "It is also possible to show that the theory is true about limits of finite frequencies when we consider classes as the sum of the expanding series",[13] but he disagrees with Russell concerning the application of the finite frequency interpretation to single case examples. He states:

> The precise point is this: the probability that a single case x is a B cannot be explicated straight forwardly as a proportion

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[10]Van Fraassen, "Russell", pp. 384-414.

[11]Ibid., p. 387.

[12]Ibid., where ∩ symbolizes the intersection of calss A and B.

[13]Ibid., p. 387.

> of classes. For the proportion P(B/(x)) equals either one or zero, and there are cases in which we are not prepared to say that the probability that x is a B equals one or zero.[14]

According to Russell, under noted circumstances, it is possible to predicate a probability value to single case examples provided all relevant data are stated. Thus, we say that the probability of it having rained on a randomly chosen day of a year is some fraction obtained from the data of the number of days it rained relative to the total number of days, and then predicating this number to the single case sentence. The value need not be one or zero which is what van Fraassen maintains.

The central issues of contention that van Fraassen levels against Russell's finite frequency definition are as follows:

> There are still the two main objections today; I shall call them the single-case problem and the inference problem. The first tends to show that not all probability statements can be construed as relative classes; but the second remains even if we restrict the discussion entirely to statements about classes.[15]

An example van Fraassen uses to explain his conception of a single case problem is the following sentence:

> (1) The probability that the next coin toss yields heads, equals 1/2.[16]

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[14]Ibid.

[15]Ibid., p. 395.

[16]Ibid., p. 395.

For an unknown reason he rewords the above to read:

> (1*) The ratio of the number of the next coin tosses yielding heads to the number of next coin tosses, equals 1/2.[17]

He concludes that: "But then (1) is analytically false, because the ratio mentioned in (1*) must equal one or zero."[18]

It seems to me that van Fraassen has misunderstood Russell's position on probability regarding future events. To Russell, the only way we can say that the probability of the next toss being a head is 1/2 is in virtue of an inductive principle, or some other principle that would legitimately ground such an inference based on previous frequency. Moreover, I fail to see how, according to van Fraassen, a priori, the probability must be one or zero. Suppose that out of a thousand tosses, i.e., t_1, $t_2 \ldots t_{1000}$, five hundred were noted as heads, the balance tails. Assuming as valid an inductive principle that will ensure a similar frequency, I fail to see how suddenly the probability of the next toss turns out as either one or zero, assuming Russell's frequency definition of probability.

Granted that on the next coin toss we will either get heads or tails. But when we speak of probability, we are not referring to an actual outcome being true or false, but

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[17]Ibid.

[18]Ibid.

simply stipulations of class relations. To say that the probability of the next toss is one or zero does not refer to class relations, but rather to a claim that either the toss will be a heads or not. Van Fraassen's conception of probability therefore has a different meaning.

Van Fraassen proposes four distinct significations associated with "probability":

> (1) probability$_1$, or credibility: measure of ignorance, probability$_2$ or frequency: class ratio, probability$_3$ or propensity: objective tendencies, probability$_4$ or subjective probability: degrees of belief.[19]

He once again rewords (1) p. 106 as

> (1**) The ratio of the number of coin tosses yielding heads to the number of coin tosses which are equals 1/2.[20]

but concludes by stating "...it seems extremely difficult here to disentangle what the statement says from the conditions under which it is reasonable to assert the statement."[21] I will return to van Fraassen's solution of the single case problem below.

The second source of disagreement van Fraassen refers to is the inference problem: "This problem concerns the passage from specific data to general hypotheses."[22]

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[19]Ibid., p. 396.

[20]Ibid., is the condition describing the reference class.

[21]Ibid., p. 397.

[22]Ibid.

According to van Fraassen, we could give a basis to this inference by using the Keynesian approach provided we have a finite a priori probability of "All As are Bs" coupled with numerous evidence of A's being B's and none of A's being non-Bs. He correctly points out that "...Russell finds this rule wanting..."[23] and proceeds to determine whether Bayes' theorem would do the job. He states Bayes theorem as[24]

$$P(H/E\&O) = \frac{P(H/E) \cdot P(O/H\& E)}{P(O/E)}$$

where H is the general hypothesis, E as old evidence and O as new evidence. Taking, as an example, Newton's law of gravitation as H, "the observation of Neptune in its calculated place is O"[25] and E is "old evidence". He rightly concludes that (P(O/H E)=1, but also states that P(E/H) and P(O/E) as 1/36 and 1001/36,000 respectively. He then concludes that:[26]

$$P(H/E\& O) = \frac{P(H/E)}{P(O/E)} = \frac{1000}{1001}$$

but correctly, I believe, points out that we require the priori probabilities of both P(E/H) and P(O/E).[27] He states: "So this method of evaluating, like Keynes's

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[23]Ibid.

[24]Ibid.

[25]Ibid., p. 398.

[26]Ibid., p. 398.

[27]These values are obtained from Russell's Human Knowledge, p. 347.

justification of inductive generalization, requires knowledge of prior probabilities"[28] and

> It does not seem that any 'objective probability' (probability$_2$ or probability$_3$ in the above listing of senses) could provide the initial probabilities in question....Inference requires not the existence of prior probabilities, but the knowledge or assumption thereof....Russell did not reach a very clear evaluation of these problems: to some extent his diagnosis must be inferred from the solution he offers.[29]

But Russell does offer a solution to inductive inferences. This solution is based not on an inductive principle but on his postulates of scientific inference to be discussed below. Van Fraassen continues

> First, the single-case problem throws doubts on the frequency interpretation, though not on the other interpretation. Second, the inference problem purports to throw doubt on both the frequency and propensity view, but in fact, does not.[30]

Van Fraassen's conclusion concerning Russell's position on probability is as follows:

> Let me sum up the general features of his diagnosis and solution in a very biased way, with an ulterior motive:
> (1) Probability statements are always intimately connected with frequency statements (but cannot be everywhere identified with them).
> (2) Single-case probability statements are meaningful, and nontrivial, and not explicable in terms of frequencies.
> (3) In scientific and ordinary practice there

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[28]Van Fraassen, "Russell", p. 398.

[29]Ibid., p. 399.

[30]Ibid.

> is something other than deduction that is at least analogous to inference: in the light of evidence, decisions are made to accept (provisionally) certain general hypotheses and reject (provisionally) their competitors.
> (4) In the testing of hypotheses (general or proportional) there is always a residue of assertions of the sort tested.[31]

Concerning (1) I wish to point out that according to Russell, not all probability statements are "connected" to frequency statements but some possess an aspect Russell terms "degree of credibility." Secondly, single case probability statements, though meaningful, can at times be explained (given all relevant data) in terms of frequency in Russell's epistemology, though this position is overlooked by Van Fraassen. Point (3) does express a Russellian view, but I do not quite know what van Fraassen meant in (4) by "there is always a residue of assertions of the sort tested."[32]

He furthermore declares: "The above four points are also articles of faith for the propensity interpretation."[33] His analysis of a propensity statement is what he refers to as a chance set-up (CSU). Thus in a single case example, such as the next coin toss has a probability of 1/2, we acquire under his propensity interpretation the following format:

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[31]Ibid., p. 401.

[32]Ibid.

[33]Ibid.

> But the basic non-elliptic statement is that the set-up consisting of this coin and this toss mechanism (yourself, now) has a propensity of one-half to yield the first outcome in the set (heads, tails). So a CSU has associated with it an outcome space and an assignment of real number in [0, 1] to the members (or to subsets) of that outcome space. A CSU is an individual, non-repeatable; [sic] attribution of a propensity to a type. CSU is to be construed as the attribution of the same propensity to each member of the class of CSU's that are this type.[34]

Whereas a coin toss previously may have had a probability of 1/2 of landing heads, under van Fraassen analysis, a CSU first seems to consist of a specific coin and a specific mechanism of tossing. Moreover, CSU has a propensity of one-half to yield the first outcome in the set (heads, tails). Van Fraassen never defines "propensity" other than to mention briefly that "probability$_3$ or propensity: objective tendencies."[35] I assume therefore that propensity is to signify objective tendencies. But what is this objective tendency? The objective tendency of, say, a coin toss landing heads in the long run could be one-half if the coin is unbiased. But this would be our straightforward frequency interpretation which I feel certain is not what van Fraassen wishes to mean.

He does state "...CSU has associated with it an outcome space and an assignment of real numbers in [0,1] to

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[34]Ibid.

[35]Ibid., p. 396.

the members (or to subset) of that outcome space."[36] Thus, while Russell's frequency definition of probability attributes values of fractions between zero and one, Van Fraassen's propensity acquires real number values.

Van Fraassen sets out an example of propensity by pointing out that the probability of radioactive nucleus decay will be 1/2 within the half-life of the nucleus and states:

> We have here a single-case probability specified by the theory (under a quite ordinary interpretation, though not under all interpretations) and this is a propensity.[37]

But to state that a given event has such and such a probability and this probability is also propensity seems to me to simply give the frequency conception an additional synonym, which is not what van Fraassen wishes to say, although he initially states this. His position regarding propensity is more along the following line: "This is just to say that a propensity statement is not equivalent, in any acceptable sense of equivalence, to a relative frequency statement."[38]

"What is CSU? A CSU is an individual not a type; it is unrepeatable."[39] But earlier on he said that: "So a CSU

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[36]Ibid., p. 401.

[37]Ibid., p. 402.

[38]Ibid., p. 403.

[39]Ibid., p. 405.

has associated with it an outcome space and an assignment of real numbers [0,1] to the members (or to subsets) of the outcome space."[40] If a CSU has an associated space constituted of members, then it is a class of occurrences and hence a type and to some extent repeatable. But this is clearly not van Fraassen's position. The best expression of van Fraassen's conception of CSU is that:

> A CSU is a physical system, which involves generally several other physical systems (continuants); which is subject to a specified process; whose existence is coterminous with that process, and whose possible final states are classified (exhaustively and disjointedly) into its set of possible outcomes ('outcome space').[41]

Although the above is the clearest account of CSU, I fail to appreciate van Fraassen's propensity theory given that the term is never defined. Moreover, although van Fraassen attacks Russell's account of a single case probability, and what he refers to as the inference problem, his propensity theory does not seem to justify his criticism.

Jeffreys on Probability

Jeffreys'[42] account of Russell on probability begins:

> He also agrees with Pearson's notion of probability as an epistemological relation, and recognizes that inference plays a far larger part than is usually supposed; but

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[40]Ibid., p. 401.

[41]Ibid., p. 405.

[42]Harold Jeffreys, "Bertrand Russell on Probability," Mind 5 (July 1950): 314-318.

> he mysteriously attributes this to Keynes instead of to Johnson, Pearson and a series of investigations going back to Bayes and possible to Leibniz.[43]

In this, Jeffreys' position is furthered by Hacking's contention that "probability" has had a dual meaning since Pascal.[44] I do not believe, however, that Russell attributes epistemic significance to "probability" based solely on Keynes's Treatise. What seems to have been the case is that Keynes exerted such a significant influence on Russell's conception of probability as degree of rational belief that Russell gave much attention to the notion of credibility (to be discussed later); but he seemed to have been aware of the history of probability in general.

Jeffreys continues:

> However, Russell's account of the further principles seems to me defective. He begins by discussing "Mathematical Probability", which is defined simply as the ratio of the number of favorable cases to that of all possible cases. He decides that is not what we need; but I wish that he had condemned the term outright. All probability theories use mathematics, and 'mathematical probability' makes no use at all of the notion of degree of reasonable belief - there is no probability in it.[45]

The above does in fact represent Russell's general position except for the fact that in given circumstances, "degree of credibility" is synonymous to mathematical probability.

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[43]Ibid., p. 314.

[44]Hacking, Emergence, pp. 1-18.

[45]Jeffreys, "Russell" p. 314.

When, for example, I wish to attach a degree of credibility to "The next coin toss has a probability of one-half of landing heads", I mean that the rational belief of one-half is obtained form mathematical considerations concerning probability. It seems to me that Russell dealt with the historically ambiguous nature of "probability", one sense of which is mathematical, the other epistemic. I shall continue with Jeffreys on Russell below.

Degrees of Credibility

The dual nature of Russell's "probability" was noted in the first section of this chapter. After reviewing mathematical probability in the second section, I now wish to discuss "probability" as "degree of credibility". Russell's "degree of credibility" can be understood as mathematical probability when all evidence concerning a claim can be expressed as a ratio between an event and relevant data. For example, the degree of credibility attached to the statement, "the next randomly chosen card is an ace of spades," has a degree of credibility of 1/52 since there is only one ace of spades in the stated deck of cards. In such instances, "degree of credibility" is synonymous with "mathematical probability."

According to Russell, however, "credibility" attached to propositions is a wider concept than its mathematical counterpart. Every proposition that expresses data is associated with some degree of credibility. Moreover, this

applies equally to conclusions of demonstrative and non-demonstrative inferences. The central issue is that what may be termed human knowledge may be devoid of absolute certainty. The highest degree of certitude may be attached[46] to simple arithmetic and logical inferences, as well as to propositions expressing immediate perception; other claims are less certain.[47] For Russell, propositions expressing data are probable only in a sense of degrees of credibility. Also, conclusions of arguments derived from data as premises are more or less probable based on the degree of credibility of both premises and on our mode of inference. Whereas probability in a mathematical sense is given to the relations between classes or between propositional functions, probability as degree of credibility applies to individual statements.

In some instances, though not all, Russell thinks it is possible to reduce the nature of degrees of credibility to an expression of finite frequency. For example, if I wish to know the degree of credibility of "the next card from a deck of 52 is an ace of spades," I would do well to accept the mathematical interpretation of probability, namely, my degree of credibility of "the next card is an ace of spades" is 1/52. In such instances the term "degree of credibility" is synonymous with mathematical probability.

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[46]Ibid., p. 381.

[47]Ibid.

However, for Russell, mathematical probability is simply counting how many A's are Bs; but in deriving degree of credibility from mathematical probability, we initially require a principle that will ensure that each card, in the above example, has equal probability of being chosen. The principle that stipulates that each member of a class has equal probability as any other member is termed by Russell "the principle of non-sufficient reason."[48] This principle is essential to interpret the degree of credibility as mathematical probability.

Russell derived the principle of non-sufficient reason from Keynes's Treatise on Probability.[49] However, he modified it. The Russellian interpretation of this principle is as follows:

> Given a description d, concerning which we know that it is applicable to one and only one of the objects a_1, a_2,...a_n, and given that we have no knowledge bearing on the question which of these objects the description applies to, then, the n propositions '$d=A_r$' ($1 \leq r \leq n$) are all equally credible, and therefore each has a credibility measured by $1/n$.[50]

An example of Russell's principle of non-sufficient reason will explain its significance. Let us state a definite description d, as "the first Canadian to have climbed Mount Everest." We do not know who this individual is, but we do

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[48]Ibid., p. 392.

[49]John Maynard Keynes, A Treatise on Probability (London: Macmillian & Co., 1929), pp. 41-64.

[50]Russell, Human Knowledge, p. 386.

know that there is one and only one person who fits this description. We can then say that there is a single person from A_1, A_2,...A_n, where A_1, A_2,...A_n are names for all Canadians of which only one fits description d. We can say that our description $d=A_r$ means that there is one and only one individual in the expression $d=A_r$ that is empirically true, and where r can acquire a value between 1 and n. The principle of non-sufficient reason states that if we choose any individual Canadian, this individual has equal probability of being the first Canadian who climbed Mount Everest as any other person. Since there are n inhabitants in Canada, the probability of an individual chosen at random from this group and having climbed Mount Everest is 1/n. This is Russell's analysis of the noted principle. The primary reason I believe for stating this principle stems from the sole fact that one cannot perceive degree of credibility as mathematical probability without also stipulating equal partition of probability to members of a relevant sample space, when we do not know that a particular description is definitive.

There is yet another aspect to degree of credibility in relation to mathematical probability. According to Russell, we are to view the knowledge of data relative to a description as being complete.[51] In the above example, the sample space or relevant data are the inhabitants of Canada.

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[51]Ibid., p. 388.

In mathematical computation of probability, we may chose any data as our sample space, but if we wish to state degrees of credibility attached to a proposition, Russell admits that we are to state all data relevant to the pertinent description. We thus need two sufficient, though not necessary, conditions for determining degrees of credibility as mathematical probability.[52] These are (i) the principle of non-sufficient reason and, (ii) that all relevant data must be included in determining credibility.

There is one final aspect to Russell's treatment of probability where we may say that a given member "a" is probably a member of class B. We state this to be the case when most a's are B's, or when we believe that probably all a's are B's. As consequences of these, Russell sets out two types of pseudo-syllogisms to illustrate the distinctive traits of the stated conclusion. We may say: (i) Since most A's are B's and since given particular a is an A, consequently, this a is probably B, or we can say, (ii) Probably all A's are B's and this is an a, therefore it is probably B. The first example of Russell's pseudo-syllogism for probable conclusions is a straight-forward example of finite frequency in a mathematical sense. Since most A's are B's, and a given entity is an A, it follows that there is a mathematical probability of it being a B. The second example requires an analysis of the term probability as it

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[52]Ibid.

occurs in the sentence, "Probably all A's are B's" and its relation to the conclusion.

There are instances where to Russell we may reduce the second pseudo-syllogism to a frequency interpretation, as well. An example Russell uses is the occurrence of the letter Z as it occurs in the English language. Through experience we remember that the majority of words do not contain the letter Z. We can denote B to be the class of letters except Z, and also A as the letters of a word chosen at random. One can say that since probably all A's are B's, and that a given word is an A, it follows that it is probably a B.[53] In such instances, it seems that the second syllogism can be also explained in terms of frequency. To Russell, however, there still remains another option for the interpretation of the second example.

One premise for the second pseudo-syllogism is of the form. "Probably all A's are B's"; the inference is that A, a particular, is thus probably B. The initial premise is an inductive generalization, from which a particular occurrence is inferred, namely A as being probably a member of B. Accordingly we note an inductive generalization is among the premises that profess to be explicable in terms of frequency. Since a Russellian frequency interpretation of "probable" makes references to known classes or known inductions, we are left with a justification in maintaining

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[53]Ibid., p. 390.

the first premise if we wish to attach a finite interpretation to the conclusion. This will be dealt with in the following chapter.

Credibility and Data

Russell's conception of data was previously noted in relation to science and perception. In that context, propositions of both sensation and memory were stated as constituting data. They were classified as data in order to emphasize that they are the minimum requirements in justifying knowledge about matters of fact. Degrees of credibility have been seen to be associated with every proposition except those that are not data and those not related to data. I wish to now re-examine Russell's analysis of "data" and its relation to credibility.

According to Russell, "probability" is ambiguous in that it means either "frequency" or "degree of credibility." We can predicate "probability" to propositions or propositional functions. It follows that most propositions, and certainly those conveying data, can be predicated with degrees of credibility; knowledge based on data can only be probable. Russell's conception of data is redefined as follows:

> I define a 'datum' as a proposition which has some degree of rational credibility on its own account, independently of any argument derived from other propositions.[54]

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[54]Ibid., p. 392.

It seems to me therefore that any inference of an argument based on probable data can bestow to its conclusions a degree of credibility that may or may not exceed the degree of credibility of the initial premises. There is nevertheless propositions that possess credibility on their own account. According to Russell all propositions expressing sensations, memory, perception or for that matter all derivative synthetic claims, possess degrees of credibility. Certain credible claims stand on their own as uninferred. These may be viewed as having degrees of credibility based on their own account. We may infer from such claims conclusions that possess degrees of credibility as well, and are based on the credibility of premises. Russell's conception of credibility associated with propositions which are either data, or derived from data are as follows:

(i) A proposition may have a degree of credibility based on its own account without reference to other propositions.

(ii) A proposition may have a degree of credibility attained solely from an argument whose premises possess degrees of credibility.

(iii) Propositions may have degrees of credibility on their own account and such degrees may also be inferred from other propositions that possess degrees of credibility. In the last case we are to note that such conclusions may or may not be of a higher degree of credibility than credibility associated with initial premises.

From the above we seem to be led to the question: in what sense do we predicate "degrees of credibility" to claims that we require in order to maintain knowledge for matters of fact? It would seem that for Russell we require that our percepts derived from our sensing experience possess credibility. Moreover, our memory required to both construct a time order as well as our justification of past occurrences also possess credibility on their own account. Lastly, we require credibility to be associated with our "awareness of logical connection."[55]

There seems to be in Russell's philosophy a variety of degrees of credibility associated with our perceptive experience. For example, we may notice a moving car on a straight road. At first we clearly perceive the car; afterwards we no longer notice it, but there exists a time period when we are no longer certain as to whether we actually see it or not. Russell noted various degrees of credibility that are to be associated with different percepts. Similarly, various degrees of credibility may also be associated with our memory. We can note, as an example, some images that feel certain and refer to past occurrences, or numerous others that are images devoid of reference. But we also note that there are aspects of memory for which we are uncertain whether this or that alternative occurrence took place: Did I buy 6 or 7 flowers

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[55]Ibid., pp. 393-394.

on Mother's Day? Our recollection therefore possesses varied degrees of credibility associated with its elements.

These considerations allow data only degrees of credibility. But how is one to quantify the degrees of credibility associated with data? Is it possible to apply a calculus similar to mathematical probability for degrees of credibility? According to Russell, in certain instances it is possible to compare degrees of credibility with mathematical probability. In the example of the moving car, when we are not certain as to whether we see the car or not, we could compare it to past occurrences of faint perceptions, and determine how often such past faint perceptions were correct. Under such circumstances we reduce degrees of credibility to mathematical probability. In practice, however, we do not make probability studies concerning our perceptive judgments. At best, I believe, Russell adhered to the view that credibility of data could be expressed quantitatively as being either equal, less, or greater than some mathematical probability, but in practice we do not possess such a method. We can, on a subjective side, state that when we feel equally certain as uncertain regarding matters of fact, the degree of credibility is to be viewed as one-half.

In this, certain misgivings arise. For Russell our knowledge for matters of fact is to be viewed, in part, as the consequences of data, and if data is to be viewed as

only probable in a sense of credibility, what becomes of knowledge? Russell's reply was that certain claims possess a high degree of credibility on their own account. Moreover, there exist other propositions that possess credibility and this credibility is increased in virtue of adding credibility derived through other statements containing degrees of credibility. The group of interconnected propositions may be viewed as therefore having a very high degree of credibility.

> Within this body, some are only inferred, but none are only premises, for those which are premises are also conclusions. The edifice of knowledge may be compared to a bridge resting on many piers, each of which not only supports the roadway but helps the other piers to stand firm owing to interconnecting girders. The piers are the analogues of the propositions having some intrinsic credibility, while the upper portions of the bridge are the analogues of what is only inferred. But although each pier may be strengthened by the other piers, it is the solid ground that supports the whole, and in like manner it is intrinsic credibility that supports the whole edifice of knowledge.[56]

Van Fraasson and Jeffreys on Russell's Degrees of Credibility

The general response to Russell's conception of degrees of credibility has been limited. Van Fraassen confined his account of Russell on probability as degrees of credibility as follows:

> Because of these apparent limitations to a

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[56]Ibid., pp. 395-396.

> frequency views, Russell concluded that there were two kinds of probability, namely, frequency and credibility. About credibility, Russell tells us, very little. He has grave objections to Keynes' view that it is a logical relation. He has long since considered Ramsay's proposal unworkable. He sees no reason why credibility even if appropriately discussed in terms of degrees, should obey the mathematical calculus.[57]

But Russell does speak extensively of probability as credibility, as the above exposition attempted to show. In Russell's epistemology, credibility and associated degrees play a vital role in so far as propositions termed data or derivative from data have only a greater or lesser degree of credibility, either on their own account, or as derived from other propositions, or some mixture of the two. Moreover, deductive inferences are devoid of certainty and are probable only in the sense of credible. Lastly, his postulates of scientific inference (to be discussed below) possess only degrees of credibility. As a matter of fact, the entire edifice of knowledge is probable only in the sense of credible.

Granted that Russell rejects Keynes on numerous aspects concerning probability as degrees of rational belief (Keynes' terminology of a logical relation between a proposition and of knowledge); but I am convinced that, if it were not for Keynes' Treatise, Russell's degrees of credibility would not have developed. It seems to me that

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[57]Van Fraassen, "Russell", p. 390.

Russell's position on degrees of credibility is in response to Keynes' work because Russell constantly refers to Keynes in working out this part of his epistomology.[58] Moreover, he does not disagree with Keynes on all points concerning probability. Russell states:

> ...it is enough that any proposition concerning which we have rational grounds for some degree of belief or disbelief can, in theory, be placed in a scale between certain truth and certain falsehood.[59]

Keynes' position on degrees of rational belief is as follows:

> Every probability lies on a path between impossibility and certainty; it is always true to say of a degree of probability which is not identical either with impossibility or with certainty, that it lies between them. Thus certainty, impossibility and any other degree of probability form an ordered series. This is the same thing as to say that every argument amounts to a proof, or disproof, or an intermediate position.[60]

The passage above is meant to point out similarities between Russell and Keynes on degrees of credibility, and to contradict Van Fraassen's claim that Russell rejects Keynes on probability as degrees of credibility.

Van Fraassen also states "He [Russell] sees no reason why credibility, even if appropriately discussed in terms of

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[58]Russell, Human Knowledge, p. 392.

[59]Ibid., p. 381.

[60]Keynes, Treatise, p. 38.

degrees, should obey the mathematical calculus."[61] This interpretation seems to me to be inaccurate: Russell's position concerning mathematical probability and credibility is as follows:

> There is a certain connection between mathematical probability and degrees of credibility. This connection is this: When, in relation to all the available evidence, a proposition has a certain mathematical probability, then this measures its degree of credibility.[62]

The above is overlooked by Van Fraassen in his article.

Jeffreys' account of Russell and probability as degrees of credibility continues:

> But when Russell discusses the epistemological theory he shows that he has paid very little attention to any work on it other than that of Keynes....But he does not state that, once we have adopted an epistemological approach, we are committed to finding a statement of the prior probability that expresses ignorance between a set of alternatives; otherwise we have an infinite regress.[63]

This true account refers to Russell's failure to mention degrees of ignorance associated with epistemic probability. But Russell's system, like Keynes, maintains that a degree of credibility is either greater than or equal to uncertainty, or less than or equal to certainty. If ignorance is synonymous with uncertainty, then Russell does refer to it in passing; but in my opinion, the notion of

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[61]Van Fraassen, "Russell", p. 390.

[62]Russell, Human Knowledge, p. 381.

[63]Jeffreys, "Russell", p. 314.

ignorance is not fundamental in Russell's epistemology, in counter distinction to belief and degrees of credibility. Since ignorance is non-fundamental, no associated degrees are dealt with in Russell's work.[64]

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[64] Both Wesley C. Salmon, "Russell on Scientific Inference or Will the Real Deductivist Please Stand Up?", Bertrand Russell's Philosophy, ed. George Nakhnikian (London: Gerald Duckisonth and Co., Ltd., 1974), p. 188., and R. Eames, Bertrand Russell's Theory of Knowledge, pp. 128-129, expound Russell's conception of degress of credibility but offer no criticism of it.

CHAPTER V

INDUCTION, SCIENTIFIC INFERENCE AND KNOWLEDGE

Our previous discussion of Russell's theory of knowledge dealt with his views on data, scientific concepts and probability. I extracted fundamental features as regards data in virtue of it being a subclass of experience (recalling that one of the goals of this thesis is to examine the relation of data to scientific inquiry). Our grasp of data contributed to the analysis of Russell's notion of scientific concepts where relevant topics such as causal lines and laws were reviewed. One such aspect is that of scientific inference. This was noted as being, unlike demonstrative inference, a probable inference, in a sense that given premises and correct reasoning, a conclusion is rendered only probable. I next proceeded to show the ambiguous nature of Russell's conception of probability.

It is sometimes maintained that both common sense and scientific inquiry require some sort of an inductive principle. I presently wish to examine Russell's position

on induction and its role in his epistemology.

Induction

A Russellian interpretation of the problem of induction may be stated as follows: Suppose we are given a finite number of members of class A all known to be members of class B. Is it (i) probable that the next A is a member of B and (ii) probable that all members of A are members of B? The term "probable" is therefore an aspect of the Russellian formulation of the induction problem.

A possible candidate as a principle to justify (i) and (ii) as conclusions, in the above, is the following inductive principle.

> "Given a number n of α 's which have been found to be β 's, and no α which have been found to be not a β , then the two statements: (a) 'the next α will be a β ,'(b)'all α 's are β 's, both have a probability which increases as n increases, and approaches certainty as a limit as n approaches infinity.[1]"

The first inference based on this inductive principle is termed "particular induction" and the second "general induction".[2] In addition Russell notes that "probability" confined to this principle means "finite frequency" and hence has a mathematical connotation, while the principle itself is probable in a sense of credible, therefore, in

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1 Russell, Human Knowledge, p. 401.

2 Ibid.

possession of a degree of credibility.[3] The issue at hand is whether or not scientific inference requires the above principle. If not, how does science arrive at laws and predictions based on data as experience? Stated somewhat differently, what is the justification for reasoning from the observed to the unobserved?

The first conclusion regarding the above principle is stated by Russell as follows:

> There is nothing in the mathematical theory of probability to justify us in regarding either a particular or general induction as probable, however large may be the ascertained number of instances.[4]

For a brief proof of this conclusion please see Appendix I.

Russell's second conclusion is as follows:

> If no limitation is placed upon the character of the intensional definition of the class A and B concerned in the induction, the principle of induction can be shown to be not only doubtful but false. That is to say, given that n members of a certain class A belong to a certain class B, the value of "B" for which the next member of A does not belong to B are more numerous than the values for which the next member does belong to B, unless n falls not far short of the total number of things in the universe.[5]

This conclusion seems evident enough if we considered that class B can be any class whatsoever. Let us assume that a_1, a_2... a_n where n a's also happened to be B's. We

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[3] Ibid.

[4] Ibid., p. 417.

[5] Ibid.

can produce class B so that a_{n+1} will not be a member of B. Thus both particular and general induction fail. He furthermore states concerning induction:

> If an inductive argument is ever to be valid, the inductive principle must be stated with some hitherto undiscovered limitation. Scientific common sense, in practice, shrinks from various kinds of induction, rightly, as I think. But what guides scientific common sense has not, so far, been explicitly formulated.[6]

Russell concludes his discussion on induction as follows:

> Scientific inferences, if they are in general valid, must be so in virtue of some law or laws of nature, stating a synthetic property of the actual world, or several such properties. The truth of propositions asserting such properties cannot be made even probable by any argument from experience, since such arguments, when they go beyond hitherto recorded experience, depend for their validity upon the very principle in question.[7]

The fact that scientific inferences are based on certain synthetic laws of nature stems from the fact that induction, by which Russell always means induction by simple enumeration, can be shown to lead quite as often to falsehood as to truth. Nevertheless it remains important as a means of increasing the probability of generalization in suitable cases".[8] Thus while induction can increase the probability of a given generalization, certain types of

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6 Ibid., p. 418.

7 Ibid.

8 Ibid., p. 434.

generalizations as premises must be arrived at, according to Russell, independently of induction. The need for such generalization or laws stating synthetic properties of nature is derived from Keynes' Treatise. Russell states: "As regards the scientific use of induction, I accept the results reached by Keynes...".[9]

Russell continues:

> Keynes supposes some generalization, such as 'All A is B' for which, in advance of any observed instances, there is a probability p_0....We want to know in what circumstance p_n tends to 1 as its limit when n is indefinitely increased. For this purpose we must consider the probability that we should have observed the n favorable instances and no unfavorable ones if the generalization were false. Suppose we call this probability q_n. Keynes shows that P_n tends to 1 as a limit when n increases, if the ratio of q_n to p_0 tends to zero as n increases. This requires that P_0 should be finite, and that q_n should tend to zero as n increases. Induction alone cannot tell us when, if ever, these conditions are fulfilled.[10]

The above refers to some finite probability p_o, such that relative to our knowledge a given generalization such as "All A is B" is in possession of such a probability in advance of any data either supporting or refuting it. That is to say, relative to our knowledge the generalization "All A is B" possess a finite a priori probability (p_0).

Russell states:

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[9] Ibid., p. 435.

[10] Ibid., p. 435.

> We have therefore to seek for principles, other than induction, such that, given certain data not of the form 'This A is B', the generalization 'All A is B' has a finite probability. Given such principles, and given a generalization to which they apply, induction can make the generalization increasingly probable, with probability which approaches certainty as a limit when the number of favorable instances is indefinitely increased.[11]

Assuming the general Keynesian procedure as valid (which I do) the principle we require in order to bestow this initial probability to a given generalization is termed by Keynes the "postulate of limited variety". Keynes states:

> The attempt, which I have made to justify the initial probability which Analogy seems to supply, primarily depends upon a certain limitation of independent variety and upon the derivation of all the properties of any given object from a limited number of primary character.[12]

Russell's reply to Keynes' postulate is as follows:

> We shall find that the postulate is adequate logically as a basis for induction. I think, also, that it can be stated in a form in which science to some degree confirms it. It therefore satisfies two of the three requisites of a postulate. But it does not, in my opinion, satisfy the third, namely, that of being discoverable, by analysis, as implicit in arguments which we all accept. On this ground, it seems to me necessary to seek other postulates, which I shall do in subsequent chapters.[13]

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11 Ibid., p. 436.

12 Keynes, Treatise ,p. 270.

13 Russell, Human Knowledge, p. 439.

I concluded this section by pointing out that, according to Russell, induction by enumeration will increase the probability of a given generalization provided we can ascertain an a priori probability associated with such a generalization. Although the Keynesian postulate of limited variety does satisfy this condition it is rejected by Russell not on logical or scientific considerations, but on the ground that this postulate is not discoverable upon analysis of arguments. Thus Russell's decision for its rejection is based on a further need to analyze the implicit assumption of an accepted valid generalization with the intention of clarifying such assumptions that will bestow an initial probability to a given generalization. This will be dealt with in the following section.

Postulates of Scientific Inference

> Our problem, therefore, is to find principles which will make suitable generalizations probable in advance of evidence.[14]

The postulates Russell proposes to confer upon generalizations a probability in advance of evidence are as follows:

a. The postulate of quasi-permanence,

b. The postulate of separable causal lines,

c. The postulate of spatio-temporal continuity in

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[14] Ibid., p 436.

causal lines,

d. The postulate of the common causal origin of similar structure ranged about a centre, or, more simply, the structural postulate,

e. The postulate of analogy.[15]

The Postulate of Quasi Permanence

This postulate confers a probability to a generalization of either a "thing" or "person" in advance of evidence. It is stated by Russell as follows:

> Given any event A, it happens very frequently that, at any neighboring time, there is at some neighboring place an event very similar to A.[16]

This postulate is enunciated in terms of "event" and "frequently". An "event" was stated by Russell as "... occupying a finite continuous portion of space-time".[17] The very attribute of events presupposes the continuity of space-time. I shall return to this topic when dealing with Russell's postulate of space-time continuity. The term "frequently" is to mean "probable" in a mathematical sense.

The Postulate of Separable Causal Lines

The postulate is stated as follows:

> It is frequently possible to form a series of events such that from one or two members of the series something can be

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15 Ibid., p. 487.

16 Ibid., p. 488.

17 Ibid., p. 270.

inferred as to all the other members.[18]

This postulate is said to be particularly helpful in bestowing an initial finite probability to physical processes such a perception (the causal theory) or the motion of a body (Newton's first law). The postulate contains "infer" and "series of events" not referred to in the quasi-permanence postulate; but other than this, it seems to me to be a development of the quasi-permanence postulate. When we say that a given event A constituting a space-time region is frequently similar to another event at a neighborhood space-time region, we wish to say that both events can form a series of events or the biography of a thing given a causal law. Once this is maintained, i.e., the causal line postulate, the nature of inference as to the remaining aspects of the series seems to follow tautologously in virtue of the fact that the series is defined by the relation of similarity to a given event and known spatio-temporal positions.

The postulate of quasi-permanence states that a given event A has at its neighborhood a similar analogue. This can be just another way of saying that an event A is a member of a series of events defined by the relation of "similarity of structure". The quasi-permanence postulate seems to state that a given event can be a member of a series of events while the causal line postulate explicitly

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[18] Ibid., p. 489.

states this, except that it further adds that given our knowledge of any member of this series, we can infer some other aspect of this series. It therefore seems that the postulate of quasi-permanence is, in fact, subsumed within that of the causal line. Assuming the need for the causal line postulate, we therefore presuppose, or better yet, we imply the postulate of quasi-permanence. I provisionally therefore propose the elimination of Russell's postulate of quasi-permanence as it is stated on the basis of it being implied in the causal line postulate.

The Postulate of Spatio-temporal Continuity

This postulate states the following:

> ... that when there is a causal connection between two events that are not contiguous, there must be intermediate links in the causal chain such that each is contiguous to the next, or (alternatively) such that there is a process which is continuous in the mathematical sense.[19]

But the causal line postulate refers to our ability to form a series of events. Assuming this postulate, we therefore presuppose the ontology of a series of events. Recalling that Russell states an event as "... occupying a finite continuous portion of space-time"[20] and also "whatever is earlier or later than something else I shall call an

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[19] Ibid., p. 491.

[20] Ibid., p. 269-270.

'event'... every event exists at a continuous stretch of a series of instants"[21], it seems to me that if we assume the postulate of causal line, we admittedly maintain the occurrence of a series of events. Once stated, there is no going back; we commit ourselves to continuity of space-time by the very nature of the attribute of events, since the term is intentionally analysed as occupying a continuous portion of space-time.

I therefore propose that the postulate of spatio-temporal continuity be subsummed under any postulate referring to a series of events, given that the very property of such a series presupposes continuity (in a mathematical sense) of space-time.

The Structural Postulate

Of this Russell states: "This postulate is concerned with certain circumstances in which inference to a probable causal connection is warranted".[22] Although he fails to specify whether "probable" is to mean "frequency" or "credibility", I assume, on the basis of previous considerations in regard to his other postulates that it is to mean "usually" and hence "frequency".

The postulate is explicitly formulated as:

> When a number of structurally similar complex events are ranged about a centre

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21 Ibid.

22 Ibid., p. 491.

> in regions not widely separated, it is usually the case that all belong to causal lines having their origin in an event of the same structure at the centre.[23]

An example of the usage of this postulate is of an audience viewing a performance at a theatre. Each spectator experiences a somewhat similar sensation due to light being reflected from the performers and the background stage. The postulate is to the effect that given an "... origin in an event of the same structure at the centre", i.e., the performers, "... a number of structurally similar complex events are ranged about the centre in a region not widely separated."[24] That is to say, the audience experiences similar sensation (though slightly different due to perspective) due to reflected light. My first comment concerning this postulate is that it assumes the veracity of the postulate of causal line. I briefly attempted to show that while the quasi-permanence postulate and the postulate of spatio-temporal continuity were tautologies in a sense of both being implicitly assumed within a reformulated postulate of causal line, it also seems to me that the structural postulate can be incorporated within such a reformulated postulate of causal lines.

The structural postulate adds to the causal line postulate the additional aspect of there being numerous

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[23] Ibid., p. 492.

[24] Ibid.

causal lines all having as a first member an identical element of their respective series. But is this worthy of an additional postulate? Clearly an empirical investigation as to the nature of causal lines would reveal the intrinsic character of such causal lines. For example, when we turn on our T.V. to watch the prime minister's speech, there is a causal process from the prime minister to the broadcast and finally to our perception. Similar considerations apply to anyone who happens to be attending to one's T.V. Each viewer's experiences may be explained in terms of a causal process having as an initial complex a set of events, namely the prime minister. The fact that causal lines have a common initial set of events does not add to the separable causal line principle which explicitly expresses such a process. We could add to the postulate of separable causal lines a provision as to the effect that certain causal processes have common members belonging to numerous causal lines.

In reference to the example of an audience viewing a performance, the inference from perception to a common causal ancestor can be enunciated in terms of the law for the propagation of light coupled with the postulate of causal line. I therefore wish to conclude tentatively that given certain provisions, the structural postulate can be explained by assuming only the causal line postulate coupled with established laws of physics.

Russell seemed to have been aware of drawbacks regarding his structural postulate. He states:

> It seems likely that the above postulate could be analyzed into several simpler postulates, and that the above way of increasing probabilities would then become demonstrable.[25]

To the above, my reply is that the simpler postulate is nothing more that the causal line postulate coupled with established laws, such as the propagation of light or sound or any other established laws which must initially assume only the occurrence of causal processes.

The Postulate of Analogy

The Russellian postulate of analogy is formulated as:

> Given two classes of events A and B, and given that, whenever both A and B can be observed, there is a reason to believe that A causes B, then if, in a given case, A is observed, but there is no way of observing whether B occurs or not, it is probable that B occurs; and similarly if B is observed, but the presence or absence of A cannot be observed.[26]

The above postulate is meant as a justification in maintaining the occurrences of other minds. Russell says:

> It is clear that belief in the minds of other requires some postulate that is not required in physics, since physics can be content with knowledge of structure.[27]

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[25] Ibid., p. 492.

[26] Ibid., p. 493.

[27] Ibid., p. 483

The postulate of analogy refers to the phrase "A causes B". Regarding cause, Russell was noted as stating: "The concept 'cause' as it occurs in the works of most philosophers, is one which is apparently not used in any advanced science"[28] and "The conception of 'cause' as we have been considering it, is primitive and unscientific. In science it is replaced by the conception of 'causal laws'".[29] Yet this very term (cause) viewed elsewhere as primitive and unscientific is used to formulate the perceived foundation of scientific inference. I therefore assume "cause" as it occurs in the above postulate means that given a causal sequence expressed by a causal law, the law expresses the invariable sequence of events that frequently occur, and that some events need not be members of any causal line. Within such a framework, any event that precedes another may be termed "cause" and events that follow "effect". I assume that for Russell only under such considerations can "A causes B" acquire the desired effect, confined to his postulate, while still consistent with his previous remarks.

The postulate furthermore includes the phrase "whenever both A and B can be observed". When I believe that it is raining and subsequently say "It is raining" I can refer to my belief as the cause (A) of having said the

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[28] Ibid., p. 453.

[29] Ibid., p. 456-457.

phrase (B). The minor issue at hand is whether we actually observe "A causes B" when either A or B is a belief. The term "observe" is usually confined to our perceptive experience. I therefore fail to see how we can observe our beliefs. At best we can say that we remember a given belief as being so-and-so.

Continuing with an analysis of the postulate, Russell states:

> ... there is a reason to believe that A causes B, then if, in a given case, A is observed, but there is no way of observing whether B occurs or not, it is probable that B occurs; and similarly if B is observed, but the presence or absence of A cannot be observed.[30]

But when he maintains "... there is a reason to believe that A causes B...", it seems to me to be a restatement that both events A and B are members of a causal line expressed by some causal law. A causal law was previously defined as:

> ...a general principle in virtue of which given sufficient data about certain regions of space-time, it is possible to infer something about certain other regions of space-time.[31]

By the very affirmation of a causal law relating events A and B, it follows that the definition of "causal law" allows us to invoke inferences of events given sufficient data about other events. I therefore propose that the postulate of analogy is implicit in the definition of "causal law" and

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30 Ibid., p. 493.

31 Ibid., p. 308.

is simply a reformulation of this definition.

The above discussion attempted to briefly show how Russell's postulates required to give a generalization a priori probability in advance of experience, can be reduced to a reformulated postulate of separable causal lines. The remaining postulates seem to me to be either tautologies or are contained in previous definitions. The remaining question, whether this enterprise, i.e., the stipulation of postulates in order to justify scientific inference cannot be dealt with otherwise, is dealt with in the following criticism.

Criticism of Russell on Postulates of Scientific Inference

Hay on Induction

In Hay's response to the above, Hay[32] begins by noting that:

> Russell takes the question of the justification of inference from sense-data to physical objects to be the same kind of question as that of induction in science...In either case the question concerns an inference from something already accepted to some as yet unaccepted thing.[33]

My reply to the above quote is that (a) the very notion of sense-data is never mentioned once in Human Knowledge; (b)

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[32]W.H. Hay, "Bertrand Russell on the Justification of Induction," Philosophy of Science 47 (July 1950): 266-277.

[33]Ibid., p. 266.

that inferences from sensation to perception do not involve the question of induction but are dealt with in Russell's epistemology under the heading of a "animal inference"; (c) that the inference from percepts to physical cause assumes at least one of his postulates (separate causal lines) but that the problem of induction does not directly enter this discussion; and (d) that Hay's formulation of the problem of induction, i.e., as an inference from something accepted to something unaccepted is vague. My own interpretation was to the effect that, given n A's as B's and no A's as not B's, is it (i) probable that the next A will be a B and (ii) that probably all A's are B's?

Hay continues "We may take it, then, that Russell's claim is that these postulates are both necessary and sufficient to scientific inference".[34] But Russell's position regarding his postulates is as follows:

> That there are such more of less self-determined causal processes is in no degree logically necessary, but is, I think, one of the fundamental postulates of science.[35]

and

> The above postulates are probably not stated in their logically simplest form, and it is likely that further investigation would show that they are

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[34]Ibid., p. 271.

[35]Russell, Human Knowledge, p. 459.

sufficient.[36]

It therefore seems to me that Russell was of the opinion that his postulates were sufficient but not necessary in confirming a prior probability to scientific generalization. Hay further states:

> Even in this case the knowledge that these postulates were true or probably true would not be sufficient to identify which laws were true or probable. Hence the knowledge of the truth or probable truth of these postulates would not be sufficient to the knowledge of the common sense world.[37]

Concerning either the truth or probable truth that Hay refers to Russell's postulates, Russell's position is:

> These postulates need not be either certain or universal; we require only a probability that some characteristic occurs usually in a certain class of cases.[38]

According to Russell, therefore, his postulates are viewed as sufficient in subjecting a generalization to the required antecedent probability. The postulates themselves were never meant to "identify which laws were true or probable." Hay concludes: "Hence the knowledge of the truth or probable truth of these postulates would not be sufficient to the knowledge of the common world", but to repeat, according to Russell, the postulates assuming that they are

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[36]Ibid., p. 494.

[37]Hay, "Induction" p. 272.

[38]Russell, Human Knowledge, p. 460.

known, are not meant to segregate true from false laws of nature. Their role in Russell's epistemology is: "The postulates collectively are intended to provide the antecedent probabilities required to justify induction".[39] It seems to me that the aspects rendering any generalization more probable is not so much the enunciation of Russell's postulates, but is the accumulation of data supporting the generalization that progressively increases the antecedent probability somewhat along the line formulated by Keynes.

Hay notes by way of criticism:

> In order to give a convincing account of the justification of statements about the physical world Russell would need to show in terms of his postulates and the data two things. First he would have to show how we identify the contemporaneous properties of physical objects as belonging to one and the same object. Secondly, he would have to show how we identify regularities in the behaviour of any identified physical object.[40]

But in Russell's epistemology, the only property of a physical object that can legitimately be ascertained is structure; his postulates (excluding analogy) were supposed to provide generalizations concerning structure, requiring a priori probability in advance of evidence. As for the regularity in behaviour of an object, I believe that the quasi-permanence and causal line postulate were aimed

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[39] Ibid., p 487.

[40] Hay, "Induction", p. 273.

at securing identity or the biography of an object.

Salmon on Scientific Inference

Salmon[41] correctly analyzed Russell's position on induction:

> Human Knowledge, its Scope and Limits (1948) is Russell's attempt to carry out the promised investigation. He concludes that the principle of induction (by enumeration) is false, and that inferences conducted in conformity to that principle, even when they have true premises, will usually have false conclusions.[42]

Concerning Russell's position on certainty of scientific knowledge, Salmon states:

> Russell is thoroughly aware that such a goal is unattainable, and that the best for which we can ever hope are scientific results that are probable. Such probable conclusions require, of course, premises given by experience, but even then, according to Russell it is impossible to infer validly the probability of the derived conclusion without the aid of supplementary general premises....Thus, among the premises of knowledge are statements that are merely probable.[43]

Concerning Keynes' and Russell's response to the postulate of limited variety, Salmon notes:

> Keynes used the principle of limited independent variety in order to achieve suitable prior probabilities for

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[41]Wesley C. Salmon, "Russell on Scientific Inference", pp. 183-208.

[42]Ibid., p. 184.

[43]Ibid., p. 187.

> scientific hypotheses. Russell does not find this particular principle adequate so he introduces a set of postulates of his own. But they are invoked for precisely the same purpose, and they fulfil the same function.[44]

This interpretation is akin to the one I proposed above.

But Salmon continues:

> The crucial point at this juncture is that Russell is looking for a statement that will serve as a premise of arguments, not for a rule of inference to which arguments may conform. Russell apparently regards the deductive forms of arguments as the only acceptable ones. If scientific arguments are to be acceptable they must be cast into deductive form. This can only be done by finding suitable premises which can be used to render scientific inference deductively valid.[45]

My response to this is to the effect that Russell maintained two sorts of inference: The first is termed "demonstrative" and is synonymous with "deductive", while the second is non-demonstrative and renders a conclusion as only probable. Once again, the postulates of scientific inference provides the initial a priori probability which, coupled with data, will increase the probability of an argument to certainty as a limit as the amount of conforming data approaches infinity. Salmon states:

> If deduction is the only acceptable form of argument, we may easily wonder why Russell talks so much about non-demonstrative inference. It would seem that demonstrative inference is the only

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[44]Ibid., p. 194.

[45]Ibid., p. 195.

> admissible kind. The answer, I believe, is that Russell regards most of the inferences of common sense and science as enthymemes - as incomplete deductions that need additional premises to become valid inferences.[46]

This position is untenable. An example Russell uses of a non-demonstrative inference is the following:

> Probably all A is B;
> This is an A;
> Therefore this is probably a B.[47]

I cannot see how such an inference can be considered by Salmon as deductive. There is nothing in Russell's deductive logic that refers to either a premise or a conclusion being probable, and hence, I fail to see how Salmon saw Russell, in his later epistemology, adhering to "deduction is the only acceptable form of an argument". In this my interpretation of Russell's epistemology differs from that of Salmon.

Elsewhere Salmon re-examines Russell's position of scientific inference.[48] His major criticism concerning Russell's postulates is that:

> We have a choice between accepting Russell's postulates and a wide variety of other conflicting postulates. We cannot pretend to know, except by inductive reasoning, which ones are true.

Thus although Salmon suggests mutually exclusive postulates

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[46]Ibid., p. 195.

[47]Russell, Human Knowledge, p. 390.

[48]Wesley C. Salmon, Foundation, pp. 43-47.

as candidates for scientific inference, he fails to actually mention any. I therefore fail to see the thrust of his conclusion.

Bradie on the Structural Postulate

Bradie's article[49] traces the development of Russell's structural postulate (postulate(d)) in the above exposition. The bulk of his article deals with extractions of what Bradie perceives as postulates needed by Russell in justifying our knowledge of matters of fact. Bradie notes that in Russell's The Analysis of Matter (AM) Russell is quoted as stating: "AMP-1- When two relations have the same structure (or relation numbers), all their logical properties are identical ([12],p.251)."[50] Bradie responds to this as follows:

> It is clear, however, that it is a non-demonstratable principle of inference, in the same sense that the others are, AMP-1 might be, in Russell's view, a tautology. It depends on whether we take 'two relations have identical logical properties' to be part of the meaning of 'two relations have the same structure.'[51]

Bradie therefore suggests that in Russell's earlier work on postulation, at least one might have been a tautology.

Concerning Human Knowledge, Bradie's article

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[49]Michael P. Bradie, "The Development of Russell's Structural Postulate," Philosophy of Science 44 (September 1977): 441-463.

[50]Bradie, "Development", p. 443.

[51]Ibid.

essentially concentrates on the structural postulate (the postulate of the causal origin of similar structures ranged about a centre).[52] He questions Russell's contention that structure is the only aspect of the world that we can actually know. Bradie states:

> This is an extremely important question which needs to be thoroughly examined. Without a clear reason for preferring structural properties to qualitative properties, Russell's epistemological position seems highly arbitrary.[53]

Bradie does not define "qualitative". The term designates a broad range of occurrences, some of which are felt as subjective and devoid of external reference, while others are objective. Bradie's problem begins by not actually stating a meaning to "qualitative." In Russell's epistemology, occurrences such as colors, smells and so on, when viewed as a subject's response to the environment as a series of events, were noted as subjective or an aspect of experience. This is not to say that ultimately Russell denied the objective nature of such qualities. At best, it seems to me that Russell saw fit to remain agnostic concerning whether or not the source (or cause within a causal line framework) is in possession of secondary qualities. Also, his postulate of analogy is a postulate

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[52]Russell, Human Knowledge, p. 487.

[53]Bradie, "Development", p. 450.

that attempts to justify the existence of other minds,[54] and hence, under extreme limitations, a belief in qualitative features other than structure.

Bradie's central claim is that the structural postulate as is enunciated in Human Knowledge can be replaced in virtue of more primitive ones. He states:

> Despite his [Russell] occasional remarks to the effect that the postulates necessary for structural inferences could be reduced to 1 or 2, it is clear that even with pruning, the list of 15 here listed cannot be reduced that far. As a preliminary estimate, P1,P2,P4,P6 (or P12), P8, (or P15) and P14 [of the postulates Bradie puts forward] seem essential.[55]

Bradie's position is to the effect that in place of the single structural postulate assumed by Russell concerning certain features, the structural postulate presupposes more fundamental assumptions. Thus unlike my own positions required at justifying the scientific method, Bradie is preoccupied at multiplying such suppositions. I will currently list Bradie's perceived fundamental postulates:

P1.	AMP-1	Structual Identity Postulate.
P2.	AMP-2	DPDS Postulate.
P3.	AMP-3	AM-Continuity Postulate.
P4.	AMP-4	Causal Chain (Independence Postulate).
P5.	IMTP-1	A Version of the continuity postulate.
P6.	IMTP-2	Essentially, this postulate asserts. that if A and B are two distant events causally related, then there is a chain of events from A to B. Another version of the continuity postulate.

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[54] See statement on postulate (e).

[55] Ibid., p. 458.

P7.	HKP-1	Causal Chain Postulates. Asserts the existence of such chains. A consequence of AMP-4.
P8.	HKP-2	Structural similarity of the elements of causal chains. It is this postulate, in conjunction with AMP-1, which justifies structural inferences from percepts to their non-perceptual causes.
P9.	HKP-3	A version of the continuity postulate.
P10.	HKP-4	A version of the structural postulate.
P11.	HKP-5	The structural Postulate.
P12.	HKP-6	The Continuity Postulate.
P13.	HKP-7	The Natural Kind Postulate.
P14.	HKP-8a b c	Versions of the structural postulates.
P15.	HKP-9	A fuller version of HKP-2.[56]

The first aspect to note concerning the above list is that P1,P2, P4 and P6 are postulates enunciated in both The Analysis of Matter and An Inquiry into Meaning and Truth. They, therefore, have no direct bearing other than historical considerations concerning Russell's postulates of scientific inference dealt with in Human Knowledge. The latter ought to be viewed as a complete analysis of the given problem of justifying human knowledge. If Bradie could have sustained an argument as to their need (that is postulates P1,P2, P4 and P6) in explaining Russell's structural postulate, confined to Human Knowledge, I could have attempted a reply as to their need. But Bradie groups these postulates as assumptions of Russell's structural postulate without stating reasons other than historical considerations. This reduces his argument to the list

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[56]Bradie, "Development", p. 459.

contained in Human Knowledge.

Bradie's P12 postulate is the continuity postulate. He assumes that the structural postulate can be resolved to this postulate coupled with P8 (or P15) and P14. I previously tried to show in my criticism of Russell's position that any postulate assumed in Human Knowledge containing "event" presupposes the continuity of space-time since the very attribute of "event" assumes the continuity of space-time in the Russellian sense. The causal line postulate is just such an example that I see as fundamental and as referring to events.

My criticism applies equally to Bradie's position concerning P8. This postulate is just the quasi-permanence postulate explicitly stating similarity of structure of members of a series of events. I therefore see no reason in stating it since it is explicitly stated in Russell's Human Knowledge.[57]

P14 states the following:

> HKP-8a When a group of complex events in more or less the same neighborhood all have a common structure, and appear to be grouped about a central event, it is probable that they have a common causal ancestor. ([14]), p/ 464)
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> HKP-8b When a number of structurally similar complex events are ranged about a centre in regions not widely separated, it is usually the case that all belong to causal lines having their origin in an event of the same structure at the centre. ([14], p/

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[57]Russell, Human Knowledge, p. 488.

492)[58]

HKP-8c Given two identical structures, it is probable that they have a causal connection of one of two kinds. ([14], p 468)[59] and P15 is:

HKP-9 If A and B are two complex structures and A can cause B, then there must be some degree of identity of structure between A and B.[60]

But P14 is just a rewording of Russell's structural postulate found throughout Human Knowledge. There is nothing fundamentally different in what is explicitly stated by Russell in postulate d., explained in my original exposition. It seems to be that in all three versions the assumed fundamental postulate is still the structural postulate. I tried to show that this postulate is but a modification of the causal line postulate that can be supplemented with physical laws to produce the desired effect of this single independent assumption. I therefore reject Bradie's contention of P14, as presupposed in Russell's structural postulate.

Finally, P15 is just the Russellian quasi-permanence postulate stated somewhat differently. It furthermore contains "cause", which, although contained in Russell's postulate of analogy, is not perceived by Russell as a fundamental feature. My conclusion is that in an attempt at explaining Russell's assumptions concerning our

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[58]Bradie, "Development", p. 454.

[59]Ibid., p 458.

[60]Ibid.

knowledge of matters of fact, Bradie often repeats identical postulates believing them to actually state categorical distinctions where in fact none occurs.

Eisler and Scientific Inference

Eisler[61] rejects Russell's contentions regarding inductive logic based on the postulates of scientific inference. He does not give detailed reasons other than simply to espouse Popper's Logic of Scientific Discovery, as the method of science. Eisler states:

> In 1934 the grass was cut once for all by Ocean's razor - never to grow again from under the feet of those who still believe in the existence of an 'inductive logic' in "inductive inference' and in the application of 'inductive method' by the various sciences. Hume has at long last been answered and the old superstition started by Francis Bacon 'who wrote,' according to the great physician Harvey; 'philosophically like Lord Chancellor' - was finally exploded.[62]

Eisler continues:

> All that has happened throughout the history of science, and which must continue so long as freedom of thought can be defended against all comers, is that hypotheses - i.e. universal propositions more confidently labelled 'scientific laws'- have been refuted, falsified and corrected, that is replaced by modified or entirely, new theory....Thus 'Hume's problem' which baffled the great Kant and all the later epistemologists has at last been solved most elegantly by professor K.P. Popper.[63]

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[61]Robert Eisler, "Scientific Inference According to Bertrand Russell, K.P. Popper and Felix Hausdorff," Hibbert Journal 47 (October 1948 - July 1499): 375-381.

[62]Ibid., p. 376.

[63]Ibid., p. 377.

Eisler's position is referred to as the hypothetico-deductive method.[64] This method essentially states that a scientist posits a hypothesis (universal affirmation) that is either corroborated by true predictions or refuted by contrary consequences of the hypothesis. The aim of science is to subject the given hypothesis to severe tests in an attempt at its falsification.

Eisler however does not give any concrete reasons for the rejection of Russell's views. The best that he does in terms of arguing is the following quote:

> We do no more and actually never needed the postulate, in no way to be derived from experience, that 'there are general laws of a kind' that can be discovered by induction. We need no 'logic of induction' such as Reichenbach has tried to elaborate on the basis of probability theory. We do not need Lord Keynes's wholly metaphysical principle of 'limited variety' and 'natural kinds'....[65]

The reason I assume Eisler rejects Russell's method based on the postulates of scientific inference is that it rests on purely arbitrary synthetic postulates. But to espouse any attempt at dealing with a methodology of science, must presuppose some general claim(s). For example, let h stand for any scientific hypothesis, P for a prediction logically implied by the hypothesis. To further state h→p (a

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[64]Jennifer Trusted, The Logic of Scientific Inference: An Introduction, (London: The Macmillan Press Ltd., 1979). p. 62.

[65]Eisler, "Scientific Inference," p. 379.

hypothesis implies predictions) is a generalization that is clearly non-empirical. In a sense, the hypothetico-deductive method is, itself, a postulate as to the methodology of science. I therefore see no reason in the rejection of Russell's method simply because it refers to a generalization concerning matters of fact; the hypothetico-deductive method adheres to at least one such generalization. In order to reject Russell's position, a more forceful argument would be needed which Eisler does not make.

Kneale on Inference

Kneale[66] begins by examining the relation between animal and scientific inference. He states:

> But his five postulates for the justification of scientific inference are not all on the same level, and it does not seem plausible to suppose that five corresponding dispositions have been established in us by nature during the course of evolution. Many animals behave in accordance with postulates 1 and 2 (which are weak versions of the old principles of substance and causality), but I doubt whether even men have distinct innate dispositions corresponding to postulate III, IV and V.[67]

He concludes:

> In order to explain the unreflective behaviour of men and animals we need to assume, I think, only one innate pattern of

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[66]William Kneale, "Critical Notices," Mind 58 (July 1949): 369-378.

[67]Ibid., p. 375.

> inference, that of forming expectations in accordance with experienced routines. For the difference between the principle of substance and the principle of causality, as they are presented in Russell's two first postulates, is only the difference between routines of persistence and routines of change; and I have seen no evidence which requires us to assume that our natures, let alone those of animals contain innate patterns corresponding to his other three postulates.[68]

Kneale seems to have assumed that Russell adhered to his postulates as based in, or as somehow related to animal disposition. Kneale concludes that he sees no such relation when it comes to the last three postulates. I do not see how Kneale extracted such a contention about Russell's postulates as somehow related to animal disposition. At best, Russell was of the belief that generalizations are aspects of habits. Broadly speaking given two event A and B, that were often associated, and of interest to an organism, the presence of A causes an animal to behave according to event B even when B is not present. An animal therefore behaves as though it believes that all A is followed by B. But I fail to see Kneale's view that the nature of animal dispositions were meant to relate to the five postulates enunciated in Human Knowledge.

Concerning the assumptions required to justify induction by enumeration Kneale states:

> The peculiarity of the solution he offers is the way in which he tries to provide

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[68]Ibid., p. 375.

> the initial probabilities required for the application of Bayes' theorem. I think that this approach is mistaken, and that the probability (i.e. approvability) of our generalization is derivative from the rationality of the method by which we reach them rather than the rationality of the method from the probability of the conclusion it yields.[69]

Kneale however does not explain "the rationality of the method by which we reach them". Without an outline of such a rational method I am unable to appreciate how we come to accept generalizat~~ions~~.

He concludes:

> Russell's list of the postulates of science seems at once too simple and too complex - too simple because he tries to justify together perceptual beliefs, beliefs of other minds, generalizations of primary induction and hypotheses of secondary inductions, too complex because he states separately propositions which could better be regarded as derivative from some more general principles.[70]

This is a summary claim in response to which the next section of this chapter is addressed.

Criticism of Russell's Postulates: Broad and Narrow

Their Breadth

Russell's line of argument in his epistemology, in an effort to ground the scientific method, is based on synthetic

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[69]Ibid., p. 376.

[70]Ibid., p. 377.

assumptions formulated by his five postulates.[71] The latter are meant to be sufficient, and to be substitutes for traditional assumptions enunciated either in the Law of Universal Causation and the Uniformity of Nature, or in Keynes's postulate of Limited Variety. I am inclined to believe that within a Russellian analysis, the five postulates can be reduced to the single postulate of separable causal lines, but in need of reformulation. The Russellian stance is, to repeat:

> It is frequently possible to form a series of events such that from one or two members of the series something can be inferred as to all the other members.[72]

Given, however, such a formulation, we fail to state explicitly, in a Russellian sense, the quasi-stability required of objects, people or physical processes. These, in common usage, are frequently of stable nature in a sense that we attribute their separation in space-time as constituted of the same object, person or process. We therefore specify the relative stability of members of the series as was carried out in Russell's postulate of quasi-permanence. The central criticism concerning Russell's formulation of his postulate of separable causal lines is that it fails to specify

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[71]"Synthetic" is defined "negatively as any proposition which is not part of mathematics or deductive logic, and is not deducible of any propositions of mathematics or deductive logic", Human Knowledge, p. 497.

[72]Russell, Human Knowledge, p. 459.

explicitly the method of series formation.

In an effort to reduce the number of assumptions as regards the scientific method (in a Russellian sense), we also considered the spatio-temporal continuity between members of a given series. This, in my opinion, is necessary in the denial of action at a distance. I noted that any postulate that refers to "event" as defined by Russell presupposes the continuity of space-time by definition. This commitment made, there is no going back at a reformulation; nor will it do to state that, given similar events separated in space-time that are not contiguous, we must assert an intermediate link as to the formation of causal line, to ensure continuity between separate events of the series. We state by the very formulation of a causal line, that the series presupposes that given an event A, it frequently happens that there is at a neighboring space-time an event similar to A, and given the Russellian conception of "event", it necessarily follows that space-time is continuous.

The proposed reformulation of Russell's postulate of causal line is to state:

> Given an event A, it frequently happens that at a neighborhood time and place there are events similar to A, such that a series can be formed where something can be probably inferred about any member or members of this series.

This single postulate, I believe, secures our assumptions of the postulates of quasi-permanence, causal line and continuity of space-time incorporated in Russell's three

separate postulates. It ensures the nature of a series of events as being an object, person or process, in so far as it relates the members of the series as explicitly stating the relation of similarity of membership. It furthermore secures the notion that given data of an aspect of the series, we may infer by the relation of similarity and some causal law, the nature of any aspect of the remaining series. Lastly, given that the reformulated postulate refers to "events" as constituents, it presupposes the continuity of space-time. It remains to be seen whether in fact the reformulated postulated satisfies both the structural postulate and the postulate of analogy.

The Russellian structural postulate states:

> When a number of structurally similar complex events are ranged about a center in regions not widely separated, it is usually the case that all belong to causal lines having their origin in an event of the same structure at the center.[73]

The above Russellian formulation explicitly refers to the postulate of separable causal lines having one added feature, namely, a single common member as an origin. But it was pointed out that the nature of a series of events was defined in virtue of similarity of membership. Given that we have two or more separate causal lines of similar structures does not add to the intrinsic nature of the postulate of causal lines, but only to the multiplication of such lines. Yet

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[73]Ibid., p. 492.

these have a common member, which seems to add a feature to the proposed reformulation of Russell's postulate of separable causal lines. I am inclined to believe that the structural postulate can be reducible to the reformulated causal line postulate coupled with established laws of nature.

The structural postulate was meant to give the a priori probability in justifying the physical processes required of individuals seeing and hearing the effects of a common occurrence. It seems to me that given an assumption of a physical process, i.e., as causal lines, physical laws further explain such occurrences. Thus, assuming only a causal process (stated in the reformulated postulate), if we further add laws of nature as to behaviour of both sound and light, I believe that we can obtain the desired effect of the structural postulate. The physical equation for the displacement of a periodic sound wave (along x-axis) seems to me to presuppose a causal process, but in conjunction with the reformulated postulate would explain the desired effect of Russell's structural postulate.[74] Similar considerations would apply to light. We would also require laws of both physiology and biochemistry that would explain how two or more people can experience similar occurrences in virtue of a

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[74]J.S. Marshall, E.R. Punder and R.W. Stewart, Physics (Toronto, Macmillian Company of Canada Ltd., 1967) p. 652 state this equation as $y=Ar^{-1} \sin 2\pi(\frac{t}{T} - \frac{r}{\lambda})$.

source as a cause of their experiences. This further presupposes that other individuals exist to begin with. The issue seems to me to be fundamentally more complicated than I presently wish to develop, but does presuppose a causal process which is assumed throughout. The mere fact that causal processes initiate at a central occurrence is covered by established laws which presuppose only a causal process implicit in such laws.

The Russellian postulate of analogy states:

> Given two classes of events A and B, and given that whenever both A and B can be observed, there is reason to believe that A causes B, then if, in a given case A is observed, but there is no way of observing whether B occurs or not, it is possible that B occurs; and similarity if B is observed, but the presence or absence of A cannot be observed.[75]

The critical term is "cause". Elsewhere Russell states: "The conception of 'cause' as we have been considering it, is primitive and unscientific. In science it is replaced by the conception of 'causal laws'".[76] Concerning causal laws Russell states:

> a general principle in virtue of which, given sufficient data about certain regions of space-time, it is possible to infer something about certain other regions of space-time.

Given that 'cause' for Russell is replaced by 'causal laws' and causal laws denote the causal process enunciated, in

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[75]Ibid., p. 493.

[76]Ibid., p. 308.

part, by the reformulated postulate of separable causal lines, I maintain that Russell's postulate of analogy is a tautology, since by the very nature of our reformulation, the postulate ensures that given data of an aspect of the series we may infer as to any other aspect of the same series.

Their Limitations

Russell's five postulates are meant explicitly to state assumptions that justify scientific inference concerning the generalities of scientific theories. This required a solution to the general problem of induction, along the line of Keynes's mathematical proof, that assumes a finite apriori probability of a generalization; subsequent confirmatory instances increase this probability. The five postulates, unlike Keynes's postulate of limited variety, were intended to confer such a probability. The author's view is that certain of Russell's postulates were noted as tautologies, and hence reducible to more primitive postulate(s). But I also maintain that Russell's postulates do not suffice for all assumptions of science.

For instance, Russell's postulates for scientific inference do not suffice to serve us with a basis of establishing Einstein's principle of relativity. This principle states:

> We advance a step further in our generalization when we express the tenet thus: If, relative to K, K' is a uniformly moving co-ordinate system devoid of rotation, then natural

> phenomena run their course with respect to K' according to exactly the same general laws as with respect to K. This statement is called the principle of relativity (in the restricted sense).[77]

and concerning the postulate of special relativity Einstein writes:

> Experience had led to the conviction that, on the one hand, the principle of relativity holds true, and that on the other hand the velocity of transmission of light in vacuo has to be considered equal to a constant c. By uniting these two postulates we obtain the law of transformation for the rectangular co-ordinate x,y,z and the time t of the events which constitute the process of nature.[78]

Einstein's principle of relativity refers to the fact that laws of nature in mechanics are covariant. Moreover the principle of special relativity refers to the constant velocity of light. I fail to see how we can ever logically infer Einstein's principle of relativity from Russell's postulates of scientific inference. And yet these postulates were meant to state sufficient assumptions as to scientific inductions. I also maintain as a thesis that Russell's postulates of scientific inference are not sufficient. Concerning Einstein Special Theory of Relativity, we require added postulates or principles, in establishing the theory.

Russell's five postulates state that, (a) an object, a

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[77]Albert Einstein, Relativity: The Special and the General Theory, (London, Methuen & Co., Litd., 1979), p. 13.

[78]Ibid., p. 42.

person or a process is a series of events, (b) that we can infer with probability an aspect of this series given data of some aspect of this series (c) the continuity of space-time for a causal process, (d) that a physical process (such as sound and light transmission) can spread over space-time and, (e) that we may infer other minds having similar experiences. But Russell's postulates attempted to ground all scientific theories; they do not however explain Einstein's principle of relativity.

The underlying problem at attempting to justify scientific theories is a belief that they can be reduced to a minimum set. Given any scientific theory, assumptions of the postulates and coupled with confirming experience, a scientific theory is rendered more probable based on the quantity of confirming experiences (and reduced amount of non-confirming). I am inclined to believe that this procedure, or bias, is a valid approach to scientific inquiry. Without this procedure, we could not accept scientific theories as knowledge since all presuppose general aspects of the world. The observation I wish to make is that Russell's postulates are (a) too broad, in a sense of being repetitive, and (b) too narrow because they do not account for Einstein's principle of relativity. I suspect also that they do not sufficiently take account of the concepts of interaction of microscopic events.

Knowledge

The discussion above leads us to investigate two fundamental notions; on the one hand there is a need to analyze the sense in which Russell's postulates can be said to be known, and on the other hand this, in turn, reintroduces the topic of knowledge for a final analysis.

Russell's position concerning human knowledge is that it is imprecise. However, contained in this loose category are two fundamental subtopics: "What passes for knowledge is of two kinds: first, knowledge of facts; second, knowledge of general connections between facts."[79] Concerning the two subclasses of knowledge, according to Russell some were viewed as inferred and others as fundamental and non-inferential: "Our inquiry in connection with probability has shown us that there must be non-inferential knowledge, not only of facts but also of connections between facts."[80]

Russell regarded the sources of non-inferential knowledge of facts as confined to sensation and memory.[81] But he notes that although sensation is a source of knowledge, it is not knowledge, since it fails to distinguish between knowing something and something known:

> When we speak of 'knowledge', we generally imply a distinction between the knowing and what is known, but in

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[79]Russell, H.K. p. 421.

[80]Ibid., p. 422.

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sensation there is no such distinction.[82]

Perception does display the dichotomy Russell required of knowledge, but only in so far as we must assume non-inferentially the connections between facts that true perception denotes, given that perception adds to sensation collateral data.

Of memory as a source of knowledge Russell declares:

> Memory is the purest example of mirror knowledge...In regard to memory, the definition of 'truth' and therefore of 'knowledge' lies in the resemblance of present imagining to past sensible experience.[83]

A memory is true:

> ...in so far as it has the resemblance which an image has to a prototype. And if an image is felt as a memory, not as mere imagination, it is 'knowledge' in the same degree in which it is 'true.'[84]

We are thus led to the view that knowledge is, in part, true perception and memory.

Russell furthermore states:

> Since every case of knowledge is a case of true belief, but not vice-versa, we have to inquire what must be added to truth to make a true expectation count as 'knowledge.'[85]

An expectation is"...'true' when it is followed by a 'quite

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[82]Ibid.

[83]Ibid., pp. 422-423.

[84]Ibid., p. 424.

[85]Ibid., p. 428.

so' feeling."[86] To this, however, Russell adds a feature of complexity. He affirms:

> Knowledge, I maintain is a matter of degree. We may not know "Certainly A is always followed by B," but we may know "Probably A is usually followed by B," where "probably" is to be taken in the sense of "degree of credibility."[87]

This leaves open the determination of the degrees we are to admit as knowledge or as non-knowledge of the general connections of facts.

As to generalities about connections between facts, i.e., "A is usually followed by B", Russell states:

> But when I say that they are 'general', I do not mean necessarily that they have no exception, I mean only that they are true in such a large majority of instances that in each particular case there is a high degree of credibility in the absence of evidence to the contrary as regards that particular case.[88]

I interpret this passage to mean that given, say, the generalization "A is a B", we maintain that the frequency of As are Bs is true in most though not all cases. This implies that frequency means probability in a mathematical sense. But given any particular instance, we may further state that there is a high degree of rational belief or credibility to be associated with such an instance. It is in virtue of the degree of credibility Russell associated with unique

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[86]Ibid.

[87]Ibid., p. 427.

[88]Ibid., p. 431.

instances of the generality, that we attribute to the generality a degree of credibility. But this still leaves the issue as to what degree of credibility is to constitute knowledge as regards connections of facts. That is to say, given the generalities involved in connection of facts, it seems to me that the Russellian solution lies in his handling of the problem of induction.

Russell rejects the principle of induction as a premise of knowledge.[89] In place of this principle he proposes his five postulates of scientific inference (i.e., non-inferential knowledge of connections of facts) that are supposed to confer such a priori probability that induction by enumeration increases the probability of a generalization to certainty as a limit as the number of conferring instances increases to infinity. Therefore, the degree of credibility required of the expression "probably A is usually followed by B" approaches certainty as a limit given, (a) that the postulates of scientific inference can be said to be known, (b) that in virtue of the postulates being known, induction by enumeration will increase the degree of credibility to certainty as a limit.

Russell's position concerning the knowledge of his postulates is as follows:

> I think, therefore, that we may be said to 'know' what is necessary for scientific inference, given that it

[89]Ibid., p. 433.

> fulfills the following conditions: (1) it is true, (2) we believe it, (3) it leads to no conclusion which experience confutes, (4) it is logically necessary if any occurrence or set of occurrences is ever to afford evidence in favour of any other occurrence. I maintain that these conditions are satisfied.[90]

His reply as to degrees of credibility associated with knowledge is:

> 'Knowledge' as we have seen is a term incapable of precision. All knowledge is in some degree doubtful, and we cannot say what degree of doubtfulness makes it cease to be knowledge, any more than we can say how much loss of hair, makes a man bald....'Knowledge' is a subclass of true beliefs.[91]

It therefore seems that the conclusion Russell reached concerning the degree of credibility associated with generalities about connections of facts is that no measurable quantity can render such demarcation as knowledge or non-knowledge. Secondly, although every item of knowledge is a true belief, not every true belief is knowledge; it is in virtue of this that Russell states that 'knowledge' is a subclass of true beliefs.

Certain aspects of knowledge were noted as uninferred and where confined to "(1) knowledge of particular facts, (2) premises of deductive inference, (3) premises of non-deductive inference."[92] But since most derived knowledge is

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[90]Ibid., p. 496.

[91]Ibid., p. 497.

[92]Ibid., p. 498.

based on non-demonstrative inference; such conclusions are more or less uncertain (have only a degree of credibility). If the degree of credibility can be measured, Russell states:

> The conclusion has a degree of credibility measured by p, and we may say that we have 'uncertain knowledge' of the conclusion, the uncertainty herein, measured by 1-p. Since all knowledge (or almost all) is doubtful, the concept of 'uncertain knowledge' must be admitted.[93]

Criticism of Russell on Knowledge

Very little critical literature is to be found on these broad lines of Russell's final epistemology. Eames' analysis of Russell's conception of knowledge states:

> Knowledge is there defined as a sub-class of true beliefs. The differentia narrows the class to those beliefs which, as well as being true (and we have no way of telling from the nature of the belief whether it is true or not), are believed on the basis of sound evidence. Sound evidence is taken to mean, in the common sense interpretation, what we believe on the basis of matters of fact, known perception and memory, and on the basis of principles of inference, both induction and deduction...Russell concludes that knowledge is a vague term requiring us to specify degrees of knowledge in analogy to the term of 'baldness'.[94]

In addition to knowledge being classified as a subclass of true beliefs, Eames could have added that generalities derived by non-demonstrative inference are only probable, in

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[93]Ibid., p. 498.

[94]Eames, Russell, p. 157.

a sense of credible, that knowledge is also uncertain, and that there is no limit to demarcate it as knowledge or non-knowledge. Also she offers no criticism concerning any features of Russell's conception of knowledge.

Fritz's article[95] offers an excellent account of Russell's developmental philosophy of science but does not criticize any aspect of it.

Grover Maxwell[96] states the following passage concerning Russell on induction:

> Russell's gradually evolving new views on induction - or confirmation theory - or the relation between evidence and what is evidenced - on what he called 'non-demonstrative inference' - that drastically altered his former views and brought about his later views on the nature of philosophical activity. Here I can only give a bare summary of his later thinking of these matters.[97]

But Maxwell offers no generalized account of Russell's

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[95]Charles A. Fritz, Jr., "Russell's Philosophy of Science," Bertrand Russell, A Collection of Critical Essays, ed. D.F. Pears (New York, Anchor Books, Doubleday and Company, Inc., 1972), pp. 147-167. Conrad J. Kochler, "Studies in Bertrand Russell's Theory of Knowledge," Revue Internationale de Philosophie 26 (1972): pp. 499-512, offers a clear exposition of Russell's theory of knowledge, but without criticism; and George W. Roberts, "Some Aspects of Knowledge (I)," Bertrand Russell Memorial Volume, ed., George W. Roberts (London, George Allen and Unwin, Co., 1979) pp. 348-383, offers an analysis of Russell's earlier work in epistemology but does not refer to Human Knowledge.

[96]Grover Maxwell, "The Later Bertrand Russell: Philosophical Revolutionary," Bertrand Russell Memorial Volume, ed. George Nakhmkian (London: Gerald Duksworth & Co., Ltd., 1974), pp. 169-181.

[97]Ibid., p. 179.

position on knowledge.

Ayer's account barely covers non-demonstrative inference and knowledge. In the only relevant passage Ayer says that:

> ...in Human Knowledge, a rather summary account of the distinction between differential equations, statistical regularities, and what he calls the law of quasi-permanence.[98]

Ayers fails to develop either a clear exposition or criticism regarding probability, non-demonstrative inference and Russell's final position on knowledge.

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[98]Ayer, Russell and Moore, p. 117.

Appendix I

Russell's conclusion that there is nothing in the mathematical theory of probability that warrants a belief in either particular or general induction is based on the following considerations.

Assuming the universe as being finite and n A's were all noted to be B's and no A's as not B's, we can, according to Russell then assume that the inductive principle is probably true provided n is sufficiently large. This to Russell proves to be inadequate, in virtue of the fact that in practice we observe only a small fraction of A's as B's. The tested A_n are usually disproportionately small relative to the B's.

Russell assumes a class A as having N members and of these m members are also members of a finite class B; of these a fraction say n members were tested as to the validity for a particular inductive inference. In this example,[99] to Russell the total number of ways of choosing n_s members from N is,

$$\frac{N!}{n!(N-n)!}$$

The total number of ways of selecting n members from m

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[99] Ronald E. Walpole, Raymond H. Myers, Probability and Statistics for Engineers and Scientists, (New York, Macmillan Publishing Co. Ind., 1922) state as follows concerning the expression n! "In general n distinct objects can be arranged in n(n-1)(n-2)...(3)(2)(1) ways. We represent this product by the symbol n! which is read 'n factoral'. Three objects can be arranged in 3!=(3)(2)(1)=6 ways. By definition 1!=1..."

members is stated as,

$$\frac{m!}{n!(m-n)!}$$

and he concludes that the total way of selecting n members that are all A's is

$$\frac{m!(N-n)!}{N!(m-n)!}$$

In this example, the probability of m members of A as being B's is some fraction. Russell refers to this as the a priori probability P_m. The ensuing probability after experience that the first n members of A's are B's is stated as

$$p_m \cdot \frac{m!(N-n)!}{N!(m-n)!} \Big/ \sum_{1}^{N} p_m \cdot \frac{m!(N-n)!}{N!(m-n)!}$$

This expression refers to the probability that after n tries, all were observed as belonging to B. Russell terms this probability q_m. Thus, given that classes A and B have m members in common, and that after n tries we are left with m-n members that are B but N-m that remain non B; the probability that the next member of A will be a B is,

$$q_m \cdot \frac{m-n}{N-m}$$

The total probability that the general induction is valid is stated as,

$$\sum_{m=n}^{N} q_m \cdot \frac{m-n}{N-n}$$

To Russell therefore a particular and general inductive principle must have a probability that is based on the value

q_m. This probability is in turn derived by assuming some a priori probability as to m members belonging to A and B, i.e., P_m in the above. In actuality there is no way of estimating the initial value of P_m. Moreover, if we are to arrive at a probability that approaches certainty as a limit as n increases to infinity, both particular and general induction require the following:

> We need therefore some hypothesis which makes P_m large when m is nearly N. This will have to depend upon the nature of the classes A and B if it to have a chance of validity.[100]

We thus require, in a Russellian sense, knowledge as to the nature of classes A and B in order to justify the inductive principle and this to Russell seems tenuous if ever possible.

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[100] Ibid., p.407.

SUMMARY AND CONCLUSION

The central purpose of this thesis was an interpretation of Russell's epistemology enunciated in Human Knowledge. Chapter I dealt with the knowledge in an elementary form. It was noted that according to Russell "knowledge" was defined as "a subclass of true beliefs". The Russellian conceptions of truth and beliefs were critically analyzed.

Belief for Russell is a wide generic term applicable to numerous life forms. It was viewed as a state of an organism having an external reference. The term "belief" was designated as doubly vague due to, (a) the numerous states that comprise this class, i.e., physical or mental or both and, (b) the lack of sharp separation that would segregate and constitute the actual class. Knowledge as a subclass of true beliefs has therefore two sorts of imprecisions.

An examination of Russell's conception of truth and falsehood showed that (a) truth is a property of beliefs and sentences expressing such beliefs and, (b) truth is a

relation between a belief and one or more facts. A belief which lacks this relation was characterized as false. The relation between a true belief in a pictorial form and fact(s) is that of similarity of structure. Unlike Russell, I maintained that true beliefs need not have similarity of structure to one or more facts since many of our beliefs are non-pictorial. Furthermore, the nature of similarity of structure is imprecise and subject-dependent.

Chapter II was an analysis of Russell's conception of data confined to experience. A double definition of "data" was noted as "these matters of fact of which independently of inference we have a right to feel most certain"[1], and "a 'datum' as a proposition which has some degree of rational credibility on its own account, independently of any argument derived from other propositions."[2] Under the class of data as experience are sensation, perception and memory.

Russell defines "sensation" as "a mental occurrence of which the proximate cause is physical"[3]; and perception as "the filling out of the sensational core by means of animal inference."[4] The physical processes of both

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[1]Russell, Human Knowledge, p. 171.

[2]Ibid., p. 392.

[3]Ibid., p. 456.

[4]Ibid., p. 109.

sensation and perception were noted as causal. Memory to Russell falls under two headings termed immediate and true memory. Immediate memory occurs shortly after a perceptive experience while true memory occurs at a later time after the perceptive experience.

Under the criticism of Salmon, the Russellian concept of memory was amplified. The nature of propositional memory as symbolic representation was noted as dispositional. Practical memory was further stated as also dispositional towards a remembered physical act while only retrospective image memory retains the Russellian role of a phenomenal image of an object or event, followed by a conviction of past occurrence. Lastly, retrospective verbal memory was viewed as a verbal memory experience of an object or event.

The Russellian conception of both visual sensation and perception is essentially passive. That is to say, from an external series of events, there follows a biological process, e.g., when we perceive an object, the object in the presence of visual light causes a physical process (light reflection) and in contact with an eye, an additional process to the brain occurs, which is then associated with the actual psychological occurrence of perception. The Russellian conception of perception is in fact an event that is preceded by a series of events from an object to the brain. There is, however, in the above account, a failure to appreciate that the observer is, in a sense, an

interacting physical series of events with its environment, and that what we perceive is a perception of the external world in the presence of an interacting observer. The perceiving individual is not merely responding passively to external stimuli, but affects the immediate surroundings which are perceived. That is to say, what we in fact observe in perception is an external world (or better yet, the effect of an external world) in relation to our presence, where sometimes the presence of the observer has an effect on what is actually being observed.

In Chapter III the subject of scientific ontology, was introduced as a preparation for scientific inference more fully developed. The general topics of events, causal lines and laws were formally analyzed. Events were noted as the fundamental apparatus of both physics and psychology. The only attribute Russell states of events is that they occupy a finite continuous portion of space-time. Two events may spatially overlap or be contiguous, and can have the temporal relations of earlier-and-later or temporal overlap. Point-instant, to Russell, is logically constructed out of events and the relation of compresence, i.e., a point instant is a complete complex of compresence.

The distinction between mental and physical events is that the former are uninferred while the latter are inferred. Our knowledge of the physical world is of structure only; of qualitative features we remain agnostic.

Space-time order was further viewed by Russell as constructed out of his notion of causal line as "a series of events...if, given some of them, we can infer something about the others without having to know anything about the environment."[5] A causal line is expressed by a causal law or principle. Russell's position regarding events, causal laws and lines seems to be logically consistent with early twentieth century physics. I am uncertain, however, whether or not modern science does require the continuity of space-time, or whether the notion of space-time itself is dated.

Causal laws as a Russellian principle state that, given data about certain regions of space-time, it is possible to infer probably regarding events of at other regions of space-time. Chapter IV discussed Russell's conception of probability as a characteristic of inference. Broadly speaking, for Russell probability is an ambiguous notion having two associated connotations: on the one hand it has the mathematical meaning of finite frequency that is expressed as a rational number between zero and one inclusively. On the other hand it also means the degrees of credibility associated with propositions. Degrees of credibility is sometimes synonymous with mathematical probability and sometimes not; it is a wider and vaguer concept than mathematical probability and means the degrees of credence to propositions.

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[5] Ibid., p. 316.

Russell's study of inference depends on the study of probability. An aspect of inference is associated with Russell's notions of demonstrative and non-demonstrative inference. Demonstrative or logical inference is dealt with briefly in Human Knowledge. It means that, given true premises and correct reasoning, the conclusion of the inference is true. Non-demonstrative inference renders a conclusion only probable. The very nature of non-demonstrative inference thus presupposes a conception of probability.

The dual nature of probability has continued since the time of Parcal and Fermet to preoccupy both mathematics and philosophy. This duality is maintained by Russell. Given the requirements of mathematical probability and probability as degrees of rational belief or credibility, I fail to see any escape from the above duality.

Chapter V dealt with the subjects of induction, scientific inference and knowledge. Induction, for Russell, as an aspect of non-demonstrative inference states that, given a finite number of members of A all known to be members of class B, (i) it is probable that the next A is a member of B and, (ii) it is probable that all members of A are members of B. The term probable is therefore incorporated into the nature of inductive inference. It was pointed out that Russell rejects the inductive principle, unless it is severely restricted, since it often leads to

false conclusions. Moreover, the principle of induction cannot be mathematically proven (along Keynes's method) unless we assume some a priori probability in advance of evidence. Additional evidence increases this initial probability to certainty as a limit when supportive evidence approaches infinity, and contrary observation approaches zero as a limit.

Nevertheless, if there exists a method of determining an initial a priori probability, induction by simple enumeration can be validly maintained. In place of Keynes's postulate of limited kinds, Russell proposes his postulates of scientific inference. I showed that Russell's postulates of quasi-permanence, causal lines and continuity can be reduced to a single reformulated postulate of separable causal lines. It is stated as follows: Given an event A, it frequently happens that at a neighborhood time and place there are events similar to A, such that a series can be formed where something can be probably inferred about any other member or members of this series. The structural postulate can be explained in terms of established laws of nature while assuming only the nature of separable causal lines. Lastly, Russell's postulate of analogy was shown to be spurious, given that it is nothing more than his definition of "causal laws" which assumes only the ontology of causal lines.

In the discussion of Russell's conception of the

postulates of scientific inference, I also noted that although they may be reduced to a single postulate coupled with established laws of physics, they nevertheless remain insufficient at stating all assumptions of science. They fail to imply logically Einstein's principle of relativity and hence are non-sufficient.

There is nevertheless credibility concerning an increased probability of scientific theories based on the procedure of postulation coupled with confirming data. Without this procedure, we could not accept scientific theories as credible in any sense of the term. But a note of caution is advocated concerning the belief that assumptions of science can be reduced to any finite or minimum number. The view maintained is to state assumptions of science of the day with a provision that such assumptions change and others are added as science evolves. A reductionist stance narrows our ontological commitment, but an "open ended" approach is advocated in order to accommodate new requirements of science.

I concluded with a discussion of Russell's overall conception of knowledge. Given that knowledge, according to Russell, is a subclass of true beliefs, and the fact that belief is an imprecise concept, knowledge for Russell is therefore imprecise as well. Positively, however, it is stated as comprised of two aspects; first, knowledge of facts and second, knowledge of general connections of facts.

Concerning these subgroups, some were viewed as inferred and others as uninferred or fundamental.

Two sorts of non-inferential knowledge of facts are confined to sensation and memory. But sensation is not quite knowledge; perception and memory constitute non-inferential knowledge of facts and connection of facts. True expectations are aspects of human knowledge provided we know sentences of the form "Probably A is usually followed by B." The term "probable" refers to degrees of credibility while the term "usual" refers to probability in a mathematical sense. Knowledge therefore is imprecise in so far as it is associated with a variety of probabilities, both inferred and uninferred. The degrees of credibility associated with "Probably A is usually followed by B" can be obtained mathematically provided we know Russell's postulates of scientific inference. These are said to be known when, (i) they are true, (ii) they are believed, and, (iii) experience does not contradict conclusions based on them. Given, however, that degrees of credibility often cannot be measured, and when measurable, the value varies, the degrees of credibility associated with inferred and uninferred knowledge is imprecise.

The Russellian conclusion that knowledge is a subclass of true beliefs was subjected to criticism, of both beliefs and truth. According to Russell, to repeat, "beliefs" is a wide generic term that refers to any state of

an organism having an external reference. Excluding impulses for action, Russell maintained a pictorial view of beliefs. The conclusion reached is that some beliefs are non-pictorial and are not merely impulses for action. By enlarging the scope and characteristics of beliefs, we enhance the Russellian conception of knowledge as well.

Similar considerations apply to truth. According to Russell, truth is a relation of similarity of structure between a belief and fact(s). Under the above criticism, I pointed out that by the very nature of vagueness associated with "similarity of structure" there is no sharp line segregating true from false beliefs. The consequences of this consideration is to further add a reason in support of a Russellian contention that knowledge is imprecise.

The above investigation further showed a double definition of "data" and hence introduces an ambiguity in a term so vital in Russell's epistemology. This can be rectified if we note this ambiguity, and select one definition which is the most consistent with Russell's overall epistemology.

On the subject of scientific inference, I was able to reduce Russell's five postulates to one single assumption that bestows the desired a priori probability. Moreover, I pointed out that Russell's position of space-time continuity is a tautology which is presupposed in any other postulate. More importantly, however, I showed that the postulates fail

to state all assumptions of science. The implication is to the effect that Russell's epistemology is incomplete. To remedy this situation would require a reductionist approach at stating all assumptions of both science and common sense.

Nevertheless, the Russellian claim that knowledge is a subclass of true beliefs and that it is also imprecise remains unchallenged. His theory of probability is sound; and his theory of scientific inference based upon it is both more elegant and more developed than its competitors.

SELECTED BIBLIOGRAPHY

Ayer, Alfred J. Russell and Moore: the Analytical Heritage. Cambridge Massachusetts: Harvard University Press, 1971.

Bennet, Thomas L. The Sensory World: An Introduction to Sensation and Perception. Monterey: Brooks/Cole Publishing Co., 1978.

Boodin, John E. "Metaphysics." In The Philosophy of Bertrand Russell, pp. 477-509. Edited by Paul A. Schlipp. Evanston: The Library of Living Philosophers, 1946.

Bradie, Michael P. "The Development of Russell's Structural Postulate." Philosophy of Science 44 (September 1977): 441-463.

Britton, Karl. "Truth and Knowledge." Analysis 8 (January 1948): 39-43.

Broad, Charles D.B. "Hr. von Wright on the Logic of Induction." Mind 53 (January 1944): 1-24.

Brownstein, Donald. "Denoting, Correspondence and Facts." Theoria 48 (1976): 115-138.

Bunge, Mario. Causality and Modern Science. New York: Dover Publishing Co., 1979.

Carnap, Rudolf. "The Two Concepts of Probability." Philosophy and Phenomonological Research 5 (June 1945): 513-533.

Eames, Elizabeth R. Bertrand Russell's Theory of Knowledge. London: George Allen and Unwin, 1979.

_____. "Russell on What There Is." Revue Internationale de Philosophie 26 (1972): 483-498.

Einstein, Albert. Relativity: The Special and the General Theory. London: Methuen and Co., 1979.

Eisler, Robert. "Scientific Inference According to Bertrand Russell, Karl Popper and Felix Hausdorff." Hibbert Journal 47 (October 1948-July 1949): 375-381.

Encyclopedia of Philosophy, revised ed. S.v. "History of Logic," by C. Lajewski.

Fraassen, Bas C. "Russell's Philosophical Account of Probability." In Bertrand Russell's Memorial Volume, pp. 384-414. Edited by George W. Roberts. London: George Allen and Unwin, 1979.

Freed, Bruce, "Beliefs about Facts." Philosophical Studies 24 (May 1968): 41-47.

Fritz, Charles D., Jr. Bertrand Russell's Construction of the External World. London: Routledge & Kegan Paul, 1952.

_____. "Russell's Philosophy of Science." In Bertrand Russell: A Collection of Critical Essays, pp. 147-167. Edited by D.F. Pears. New York: Doubleday and Co., 1977.

Grene, Marjorie. "Causes." Philosophy 38 (April 1963): 149-159.

Habash, Keith. "A Critical Examination of Russell's View of Facts." Nous 5 (1971): 395-409.

Hacking, Ian. The Emergence of Probability. London: Cambridge University Press, 1975.

Hay, W.H. "Bertrand Russell on the Justification of Induction." Philosophy of Science 17 (July 1950): 266-277.

Jeffreys, Harold. "Bertrand Russell on Probability." Mind 59 (July 1950): 314-318.

Karrant, Janet, A. "Memory." Journal of Philosophy 62 (August 1965): 387-398.

Keynes, John Maynard. A Treatise on Probability. London: Macmillian and Co., 1929.

Kneale, William. "Critical Notes." Mind 58 (July 1949): 369-378.

Kochler, Conrad. "Studies in Bertrand Russell's Theory of Knowledge." Revue Internationale de Philosophie 26 (1972): 499-512.

Kultgen, J.H. "Operation and Events in Russell's Empiricism." Journal of Philosophy 53 (February 1956): 157-167.

Lipkind, D. "Russell on the Notion of Cause." Canadian Journal of Philosophy 9 (December 1979): 701-720.

Marshal, J.S.; Pander, E.R.; and Stewart, R.W. Physics. Toronto: Macmillian and Co., 1967.

Martin, R.M. "Truth, Belief and Modes of Perception." In Bertrand Russell Memorial Volume, pp. 253-263. Edited by George W. Roberts. London: George Allen and Unwin, 1979.

Maxwell, Grover. "Russell on Perception: a Study in Philosophical Method." In Bertrand Russell: A Collection of Critical Essays, pp. 110-146. Edited by D.F. Pears. New York: Doubleday and Co., 1972.

_____. "The Later Bertrand Russell: Philosophical Revolutionary." In Bertrand Russell's Memorial Volume, pp. 169-181. Edited by George Nakhnikian. London: Gerald Duckworth and Co., 1974.

McLendon, H.J. "Uses of Similarity of Structure in Contemporary Philosophy." Mind 64 (January 1955): 79-95.

Milne, E.D. "Review." Hibbert Journal 47 (October 1948-July 1949): 297-299.

Myers, G.E. "Perception and the 'Time Lag' Argument." Analysis 17 (April 1957): 97-102.

Nagel, Ernest. "Mr. Russell on Meaning and Truth." Journal of Philosophy 38 (May 1941): 253-269.

_____. "Probability and Non-Demonstrative Inference." Philosophy and Phenemonolgical Research 5 (June 1945): 485-507.

Nakhnikian, George., ed. Bertrand Russell Memorial Volume. London: Gerald Duckworth and Co., 1972.

O'Connor, D.J. "Russell's Theory of Perception." In Bertrand Russell's Memorial Volume, pp. 304-319. Edited by George W. Roberts. London: George Allen and Unwin, 1979.

Palter, Robert. "Physics and Structure." Philosophical Review 65 (July 1956): 371-384.

Pears, D.F., ed. Bertrand Russell: A Collection of Critical Essays. New York: Doubleday and Co., 1972.

Pearson, C.I. "The Status of Inferred Entities." Philsophical Quarterly 11 (April 1961): 158-164.

Perkins, R.K. "Russell on Memory." Mind 82 (October 1973): 600-601.

Popper, Karl P. The Logic of Scientific Discovery. New York: Harper and Row, 1968.

Quine, Willard V.O. "Russell's Ontological Development." In Bertrand Russell: A Collection of Critical Essays, pp. 290-304. Edited by D.F. Pears. New York: Doubleday and Co., 1972.

Roberts, George W., ed. Bertrand Russell Memorial Volume. London: George Allen and Unwin, 1979.

Russell, Bertrand. Human Knowledge: Its Scope and Limits. New York: Simon and Schuster, 1960.

_____. An Enquiry into Meaning and Truth. London: George Allen and Unwin, 1980.

_____. Principia Mathematica. 3 vols. Cambridge: The University Press, 1968.

Salmon, Wesley C. The Foundation of Scientific Inference. Pittsburg: University of Pittsburg Press, 1966.

_____. "Memory and Perception in Human Knowledge." In Bertrand Russell's Philosophy, pp. 139-167. Edited by George Nakhnikian. London: Gerald Duckworth and Co., 1974.

_____. "Russell on Scientific Inference or Will the Real Deductivist Please Stand Up." In Bertrand Russell's Philosophy, pp. 183-208. Edited George Nakhinikian. London: Gerald Duckworth and Co., 1974.

Scalls, Ronald. "A Russellian Approach to Truth." Nous 11 (May 1977): 169-174.

Schlipp, Paul A., ed. The Philosophy of Bertrand Russell. Evanston: The Library of Living Philosophers, 1946.

Tarski, Alfred. "The Semantic Conception of Truth." Philosophy and Phenomeonlogical Reserach 4 (March 1944): 341-375.

Trusted, Jennifer. The Logic of Scientific Inference: An Introduction. London: The Macmillian Press, 1979.

Walpole, Ronlald E., and Myers, Raymond H. Probability and Statistics for Engineers and Scientists. New York: Macmillan Publishing Co., 1972.

Will, Fredrick L. "The Concern about Truth." In Bertrand Russell's Memorial Volume, pp. . Edited by George W. Roberts. London: George Allen and Unwin, 1979.

Wittgenstein, Ludwig: Tractatus Logico-Philosophicus. Translated by D.I. Pears. London: Routledge and Kegan Paul, 1977.