

"THE LOSS OF GENERALITY"

A PLAY

by

ERIC MERCHANT

A THESIS

Presented to the Department of Mathematics
and the Honors College of the University of Oregon
in partial fulfillment of the requirements
for the degree of
Bachelor of Arts

October 1996

APPROVE

Dr. Richard Koch

An Abstract of the Thesis of
Eric John Merchant for the degree of Bachelor of Arts
in the Department of Mathematics to be taken October 1996
Title: "THE LOSS OF GENERALITY": A PLAY

Approved: _____
Dr. Richard Koch

A dramatic work that deals with the philosophy of
mathematics held by Bertrand Russell and Ludwig Wittgenstein.
Also included is a brief history of the collaboration of the two men,
as well as their later conflicts.

ACKNOWLEDGMENTS

I would like to thank the members of my comittee, Dr. Richard Koch, Dr. Frances Cogan, and Dr. Will Davie for their unwavering support of what, no doubt, initially appeared to be a bizaare thesis. I would also like to thank Dennis Campbell for his numerous proofreadings, Jen Metzger for her wonderful drawings, and Rob Denunzio for his musical compositions. I am especially indebted to my partner Stephenie Frank for her continuous moral support throughout many sleepless nights and drunken ramblings. Without her, this project would have doubtless ended up as just another crazy idea I carried around in my head for a while.

TABLE OF CONTENTS

Chapter	Page
I. THE HISTORY.....	1
II. THE JUSTIFICATION.....	16
III. "The Loss Of Generality".....	21
APPENDIX: Character sketches.....	61
BIBLIOGRAPHY.....	66

The History

After the turn of the century, many academic disciplines were in a state of change. Art, Literature and Political Science were all affected by the shift to modernist thought. Less well known, however, is the debate that centered around the field of mathematics. Innovations of the nineteenth century, such as Boole's algebraic notations, and Cantor's discovery of the transfinite numbers had caused many thinkers to examine questions such as : what mathematics is, whether mathematical ideas are real, and why we believe mathematical truth to be so infallible. Two of the most influential thinkers in this subject were Bertrand Russell and Ludwig Wittgenstein. The answers they found to these questions sharply contrast the different ways of thinking that were prevalent in this era. By examining the works of these two men, we are able to see why such questions are vitally important to the field of mathematics, and what they say about the future development of mathematical thought.

^ Bertrand Russell was born a British Lord in 1872. He belonged to the last generation of Victorians, and was raised as such. He spent his early life at a large country estate, Penbroke Lodge, which was given to his grandparents by Queen Victoria in the 1840's (Auto I pg.13). His early education consisted mostly of private tutoring, paid for by his grandmother.

In 1890, Russell went to study mathematics at Trinity college in Cambridge. Under the supervision of Lord Alfred North Whitehead (his later collaborator on Principia Mathematica) Russell qualified for a minor scholarship. By 1892, Russell had been admitted to the

secret organization known as "The Society" which was an elite group of Cambridge intellectuals. Through this group he met such luminaries as G.E. Moore, Lytton Strachey, and John Maynard Keynes.

Despite Russell's early successes at mathematics, it wasn't until he attended a Congress of Philosophy in Paris during July of 1900 that he became inspired to do original work within the field. It was there that he met Peano, an Italian mathematician who had created a logical framework (known as "Peano's Postulates") which both defined the natural ("counting") numbers, and provided analytical tools to compare disparate infinite sets and establish their cardinality. After talking with Peano, Russell immediately read everything the man had written, and adopted his notation. With these new tools in his repertoire, Russell devised his own logical technique, and applied it to "regions formerly abandoned to the vagueness of philosophers" (Auto. I pg.233).

The basic motivation of Russell's early writing rests on the idea that regular language is too imprecise to describe much of the phenomena that concerns philosophy. The way to avoid this is to devise a symbolic calculus that has both the rigor and precision of mathematical notation, and within this symbolism derive a set of logical rules which can be used to analyze any meaningful statement. Although formal logic had existed since the time of the ancient Greeks, Russell planned to use more rigorous methods of inference than those of classical logic (with its emphasis on the linguistically-dependent syllogism), and use this system as a foundation for all of mathematics.

To ground this ambitious system, Russell started with what he called "elementary propositions". A proposition of this type "does not involve any variables, or [in other words]..., does not involve such words as 'all', 'some', 'the', or equivalents" (P.M. pg. 95). With these propositions, he defined three basic operations used to structure these propositions. The first is assertion (p) which merely states that a proposition is considered true. The second is negation ($\neg p$) which corresponds to "p is false". An elementary proposition must be either true or false, but could not be both. The third operation, called disjunction, links two propositions together in such a way that if either or both propositions are true, the disjunction is true, if both are false, the disjunction is false. The disjunction of propositions p and q is written as $(p \vee q)$, and corresponds to the sentence "p is true or q is true" (P.M. pg. 97).

In addition to these three logical operations, Russell adds the calculus of classes and the calculus of relations. Classes are made up of objects or of other classes, and the notation allows us to express both membership in a class (ϵ), as well as the concepts of all ($\forall$) or some ($\exists$) things belonging to a certain class. Relations are used for ordering objects. This is an extremely important concept in mathematics, which is so often concerned with series, and relationships such as less than or greater than. An important difference between the calculus of relations and the propositional calculus is that relations occur between "two terms not acting as concepts" (Prin. pg. 95). These terms are necessarily not propositions, and do not have truth-values. In other words, the proposition $(p \vee q)$ is not a relationship between p and q . To keep

this clear, Russell's notation uses earlier letters to denote terms in a relationship. A typical relationship is written as aRb , which signifies "a has the relation R to b".

Armed with these three tools of Symbolic Logic, Russell aimed at reconstructing all of mathematics, and thereby guaranteeing a solid philosophical foundation for all mathematical discoveries. His theory of proofs was based on the assumption that every true mathematical statement could be shown to be a logical tautology. A tautology is a logical statement that is always true regardless of the truth-values of its component propositions. A simple example of tautology is $(p \vee \neg p)$, which is true whether p is true or false. Asserting that mathematics is a collection of tautologies is fundamental to Russell's philosophy, as it implies that whatever happens in the empirical world does not affect the character or validity of mathematical reasoning. In other words, mathematical truth really is discovered by mathematicians, not in any way dependent on experience.

One of the most ingenious constructions in Russell's system is his definition of number. Other mathematical systems (such as that of Peano) accepted numbers as undefinable, whose properties could only be listed axiomatically. Under such a system, one would accept some starting number, such as zero, and then define a "successor map" which would basically add one to any number. This would then generate a series of numbers: 0, 1, 2,... and deduce the existence of all integers from that. Russell viewed such constructions with disdain, since they held that so many properties of numbers were undefinable. To construct his system of numbers, Russell appealed to

the primitive notion of one-to-one correspondence. Two classes are said to be in one-to-one correspondence if there exists exactly one member of the second class for each member of the first, and vice-versa. A number then, is the class of all classes which can be put into one-to-one correspondence with each other. We then use "numerals" (the notation) to denote a class which can be put in correspondence to all these other classes which constitute the number, and no other classes. For example, when I say "five eggs", I mean that you can put these eggs in one-to-one correspondence with any other group of five objects, and not other groups. In this way, Russell managed to create a workable definition of number without having to appeal to the vague notion of series.

By the end of 1900, Russell had been working at a feverish pace for three months, and had finished a manuscript of The Principles of Mathematics, which was to be his first book on logic. Principles was not an actual logical work, as it was written mostly in English, not symbolic notation. That being said, it did provide a blueprint for his later Principia Mathematica, which was written in his notation, but strayed little from the ideas of his original version. However, before he could get it published, he discovered an inconsistency in his system, which would haunt all of his later writings in the field, and go down in history as "Russell's Paradox". He published Principles in 1902, with an appendix explaining the nature of the problem in great detail. That same year he wrote to the German logician Gottlieb Frege, since the paradox also applied to Frege's logical system put forth in the short paper "Begriffsschrift". Russell had read Frege in Cambridge as early as 1894, but admits "I

did not understand it [Begriffsschrift] until I had myself independently discovered most of what it contained" (Auto I. pg. 96). Frege replied to the letter very calmly, especially when one considers that he was just about to publish the second volume of his Foundations of Arithmetic. As Russell wrote later in 1962: "he responded with intellectual pleasure clearly submerging any feelings of personal disappointment" (Van Heijenoort, pg. 127).

In terms of logic, a paradox is a statement which if true, implies its own falseness, and vice-versa. The most famous example, from the ancient Greeks, is the Cretan who states "all Cretans are liars" (Auto I. pg. 236). Russell's Paradox concerns his notion of classes being not only collections of objects, but also of other classes. This is necessary, since numbers themselves are classes, and often in mathematics we need to examine classes of numbers. So, it also makes sense to think of classes which contain themselves, such as the class of all classes which contain more than one member. Since this class itself contains more than one member, it belongs to itself. Most classes, however, do not contain themselves, such as the class of all prime numbers, which is not itself a prime number. So, given this dichotomy, it makes sense to group all of the latter classes into one big class of all classes which don't contain themselves. The next question, of course, is: does this new class belong to itself? If it does, it shouldn't be there, and if it doesn't, it belongs in itself.

If Russell were to provide a foundation for all of mathematics in his system, such a paradox would have to be dealt with. This task occupied most of Russell's work between 1902, when The Principles

of Mathematics was published, and 1910, when the much larger Principia Mathematica went to press. The central idea that resolved the paradox in the later book was called the Theory of Types, which Russell discovered in 1906 (Auto I. pg. 244).

The Theory of Types refutes Russell's paradox, as well as other paradoxes of similar form by not allowing the "self-referencing" that occurs in such statements as: "the class of all classes". Russell makes this explicit in the introduction to the Principia when he states that "whatever involves all of a collection must not be one of the collection" (pg. 40). To insure that this will not happen, Russell created within his system a hierarchy of "type" for classes and functions. Simple variables are defined as having type one, being lowest on the hierarchy. Any class which contains only simple variables is said to have type two, and a class which has members which are type two classes (and possibly simple variables as well) is then considered a type three class. To determine the type of any given class, take the highest type that occurs within its members, and add one.

To see how this theory resolves paradoxes, let us consider the case of the Cretan who says that "All Cretans are liars". The paradoxical nature of this statement occurs when it is interpreted as meaning "All my statements, including this one, are false". However, according to Russell's theory, "statements about this totality, ... must lie outside the totality" (van Heijenoort pg. 154). Therefore, the statement about the lies is of a higher type than the lies themselves, and does not refer to itself. The Theory of Types abolishes Russell's Paradox in a similar manner, since the paradox

hinges on the notion of a class that contains itself. Such a class would never occur in this system, since a class cannot contain members of the type as itself.

Although the Theory of Types did indeed insure a consistent system for the Principia, it was not without its faults. On a purely aesthetic level, having all these types of functions and classes led to W.V. Quine's later criticism of "a needless proliferation of notation" (van Heijenoort pg. 152). On a deeper level, however, Russell's Theory of Types seems like a quick fix for what may be a deeper problem. Since the Principia is a book about logic, one expects to only have to take for granted the very simple rules of logical inference. Although the Theory of Types is useful, and may even seem intuitively correct, it is obviously much more complicated a rule than the rules about assertion, negation, etc. By forcing the reader to take the Theory of Types for granted, Russell undercuts his own objective of formulating a logical system pure enough to serve as the foundation for mathematics.

Despite these shortcomings, Russell published the book, with the hope that someone could later polish and simplify the system it presented. This hope came to rest squarely on the shoulders of Ludwig Wittgenstein, who came to Cambridge to study logic with Russell in 1911. Wittgenstein had been born in 1889, the youngest son of a wealthy Austrian steel magnate. Wittgenstein's first exposure to mathematics came through studying aeronautic engineering at Manchester, in 1908. He was then made aware of the writings of Russell and Frege, and became more and more interested in the philosophical issues surrounding mathematics. In the summer

of 1911, Wittgenstein met with Frege, and discussed his ideas on logic. Frege suggested that Wittgenstein go to Cambridge and meet with Russell, advice that was to change the course of both men's lives (Monk pg. 36).

When Russell first met Wittgenstein, he was overwhelmed by the man's passion, and took him to be a bit of a lunatic.

Wittgenstein attended all of Russell's lectures on logic, and followed him afterwards, hounding him with questions about the logical ideas being presented. One infamous moment occurred at a lecture when Wittgenstein would not admit that there was not a rhinoceros present in the lecture hall. Besides being a humorous story, this example serves to illustrate the difference in the philosophies of the two men. Russell had conceived of a logical system that could be used in conjunction with empirical knowledge, in order to make sense of the world. Wittgenstein, however, took a much more metaphysical approach, asserting that the subject matter of logical analysis had nothing to do with sense-data or the "facts" of the outside world. The tautologies of logic were true given any set of circumstances, and could therefore never meaningfully reject the existence of a rhinoceros or anything else.

Despite these differences, Russell soon recognized in Wittgenstein a brilliant and ambitious student. By 1913 Russell was writing letters describing him as "the most apostolic and the ablest person I have come across since [GE.] More" (Auto I. pg. 364). After the publication of the Principia, Russell felt as though he was finished with his significant work in logical philosophy, but obviously there was still much work to be done in the field. Also, he

had left his wife of ten years, Alys, and started a passionate affair with Lady Ottoline Morrell, the wife of a politician. So, with all this weighing heavily on his mind, Russell passed the torch of mathematical logic over to Wittgenstein during his years of study at Cambridge.

By the fall of 1913, Wittgenstein had decided to travel to a small village in Norway, where he could write undisturbed by the pressures of academic life. However, he stayed there for less than a year, and by the following summer he had volunteered to fight in the First World War for Austria. While serving on the front, and later imprisoned in an Italian war camp, he worked on what would be the first and only book of his published within his lifetime: Tractatus Logico-Philosophicus. The Tractatus is as different a book from the Principia as can be imagined. It is short, less than eighty pages, and does not construct a logical system in the way that Russell's does. It consists of short, ambiguous paragraphs, numbered in an ornate decimal sequence which tells the reader how the statements relate to each other. For instance, pp. 4.21 is the first statement referring to pp. 4.2, which is in turn the second about pp. 4.

The subject matter of the Tractatus, although ostensibly about logic, tends towards large subjects such as man's place in the universe, and the existence of the mystical. Whereas Russell had made logic the foundation on which understanding rests, Wittgenstein asserts that logic is merely a way of picturing the world, and that logic could only clarify, but not inform, our notions of the world. Russell saw tautology as the central justification of mathematics, but in the Tractatus Wittgenstein states unequivocally

that "tautology follows from all propositions: it says nothing" (pp. 5.142). For instance, if a weatherman says: "it is either going to rain or it is not going to rain", he is not making an informative prediction, he is just stating something that will always be true.

As to the relationship between logic and mathematics, the Tractatus is very clear. Wittgenstein says of mathematical equations that they are "pseudo-propositions", which "express no thoughts" (pp. 6.21, 6.211). The role which these equations play is primarily that of translation; they show us what expressions are identical and what are not, but they cannot make any decisions for us. Both mathematics and logic are seen as descriptive, rather than prescriptive, methods of reasoning. The real philosophical questions, such as those that deal with ethics, beauty of religion, are outside the realm of this kind of thinking. The answers to these types of problems cannot be meaningfully stated, they belong to "the inexpressible, [which] shows itself; it is the mystical" (pp. 6.522).

One of the tenets of the Tractatus "is the existence of atomic facts" (pp. 2) which underlie the structure of every logical statement. These atomic facts were difficult to define, since no atomic fact could contradict another, they were simply supposed to "hang one in the other, like links in a chain" (pp. 2.03). One of the obstacles to this idea was the theory of color. To say that an object is blue seems to imply that this object cannot be red or green. That this is a plausible implication meant that either Wittgenstein needed to radically change his system of analysis, or admit that statements about color could not be elementary propositions about atomic facts. Of these two options, Wittgenstein chose the latter,

stating early in the work that "Roughly speaking: objects are colorless" (pp. 2.0232).

After writing the Tractatus, Wittgenstein felt he had solved all the useful questions of philosophy, and decided to retire from the academic world altogether. In addition, he took the drastic measure of distancing himself from his wealthy family, and giving all of his inheritance to his sisters. In 1920 he moved to the rural village of Trattenbach in Lower Austria, to teach elementary school (Monk pg. 193). By 1926 he had been removed from this post, due to charges of excessive disciplining of young children who could not learn algebra. He then applied to a monastery, was rejected, and worked as a gardener near Vienna for a few months. In 1927 he was invited to a series of lectures by a group of mathematical philosophers known as the Vienna circle, whose membership included such famous mathematicians as Hans Hahn, Kurt Godel, and Karl Popper. They had been greatly influenced by the Tractatus, and had spent a year discussing it (Sigmund pg. 23). Wittgenstein, however, was firmly against talking philosophy, until March 1928 when he attended a lecture by the Dutch mathematician L.E.J. Brouwer. In the discussion section afterwards, Wittgenstein "incredibly, started to talk philosophy again. It was as if flood-gates had been opened" (Sigmund pg.23).

To understand why Brouwer's lecture had such a startling effect on Wittgenstein, we must analyze his views on mathematics. Brouwer had earned his reputation as a serious mathematician by proving some important results in the relatively young field of algebraic topology, and by the time of his lecture in Vienna, he had

published over 150 research papers on the subject (Barrow pg. 194). However, by this time Brouwer had also achieved a considerable degree of infamy as the founder of a philosophy of mathematics known as intuitionism, or finitism. To Brouwer, the series of natural numbers was considered to be an obvious starting point for the foundations of mathematics. Brouwer then stated that all mathematical truth could be constructed "using a finite number of steps" (Barrow pg. 185) derived from these natural numbers. Under such a system, mathematical truth is said to be created by human beings, rather than discovered. However, the mathematics that was regarded as legitimate by the intuitionists is a much smaller field than that of classical mathematics. Intuitionists deny the possible analysis of infinite sets, since "infinitely proceeding sequences outrun the human capacity for apprehension of the particular" (Korner pg. 148). This greatly truncates the field of modern mathematics, since it does not allow for the existence of irrational numbers (which had been previously banished by Pythagoras for altogether different reasons), much less a working differential calculus. This did not bother Brouwer, since he held that math's "application to the world [is] an evil parasite" (Barrow pg. 245) which hindered true knowledge.

Although Wittgenstein was certainly inspired by Brouwer's lecture, and considered the points brought up to be worthy of study, it is wrong to think that he was converted to the intuitionist school of thought. Indeed, during a lecture at Cambridge in 1939, he says "intuitionism is all bosh - entirely" (L.F.M. pg. 237). The questions that Brouwer brought up were very interesting to Wittgenstein, but

he found the intuitionist answers too simplistic. To claim that our knowledge of mathematical truth rests on "the Kantian notion of a 'basic mathematical intuition'" (Monk pg. 249) implies that someone could, by himself, figure out many truths of mathematics without being taught any system of proof or logical deduction.

To illustrate his problems with this notion of self-taught mathematics, Wittgenstein considers the case where we teach children to calculate "as long as they listen to their inner voice and obey it. Calculating in this way would be something like composing" (R.F.M. pg. 418). But this is not the way we teach math, and we certainly do not want our way of calculating to be anything like composing. Instead of this internal justification, Wittgenstein posits that math is learned as a way of following a rule, where the rules convey how they are to be used by example. Eventually, with enough training, a student can abstract from this rule and become convinced that this rule will always hold. For instance, one can merely count two sets of five objects to become convinced that $5 + 5 = 10$. After enough familiarity with this process, one becomes certain that $500 + 500 = 1,000$ even though we would never count such large quantities. However, this abstraction that we accept is a vague thing, and Wittgenstein would assert that it is not one single thing, but a collection of many ideas and beliefs. He states: "mathematics is a **MOTLEY** [his emphasis] of techniques of proof" (R.F.M. pg.176).

The notion of mathematics as a motley collection (also referred to as "language games" or "family resemblance's") is a direct antithesis of Russell's notion of logic providing a foundation

for mathematics. According to Wittgenstein's later philosophy, mathematics didn't have a foundation that rested on any one singular thing; rather the meanings of mathematics hung together in an unrealizable way. The best that one could say is that people do know when they are doing mathematics and when they aren't, but this difference may not boil down to one single thing that characterizes mathematical thought.

The progression of Russell and Wittgenstein from appealing to logic as the final judge for human reason to Wittgenstein's final refutation of all "atomistic" logical reasoning took place over the 40 years following the turn of the century. This split, I believe, is indicative of many of the reactions to the pressures of the 20th century, specifically the growth of science and its devastating effects during the two World Wars. We are not close to answering many of the questions that these men struggled with, and advances in computer technology have, if anything, made the questions themselves less clear. However, I contend that the issues that divide mathematics and philosophy still deserve attention, and that the story of Russell and Wittgenstein sheds much light on these elusive questions.

The Justification

Philosophy of mathematics is a much neglected discipline, as it falls in a sort of gray area between the two subjects. Philosophers generally find the subject dry, feeling that more important questions are to be found in topics such as the mind's ability to communicate, ethics, or more spiritual metaphysics. Mathematicians, by contrast, seem to feel that the subject is unworthy of rigorous analysis, and is better suited to weekend conversation than to the real work of mathematical investigation. Due to this split, there is very little dialogue between the two camps. This causes a number of important questions to go unanswered, such as the question of why we believe mathematical truths to be less in doubt than other propositions. For instance, if someone says to me: "that table which looks brown to you is really green" I would understand what he is saying. Perhaps one or both of us is wearing tinted glasses, or maybe the table is under a light that makes it appear brown. However, if that same person said to me: " $2 + 2$ isn't really 4, it's 6," I would not understand him. I could not imagine a set of circumstances that would lead me to believe that $2 + 2$ could be anything but 4. In this case I would conclude that this person is either using words in a very different way than I do, or is completely mad. Where this certainty comes from is, I believe, an important question, especially when one considers how dependent modern man is on scientific discoveries. All of science is judged by how well it can be quantified in a mathematical way. The fact that most people do not understand even the rudiments of mathematical

proof, or how it is used in science, seems very strange to me, considering how influential it is.

These thoughts led to my decision to write a play as my thesis. The play depicts the struggles of two men, Russell and Wittgenstein, trying to come to grips with the question of what mathematical truth really is. As detailed in the chapter above, the men came to this question from very different perspectives, and ultimately produced very different answers. The struggle between these two men, each emotionally attached to the topic, makes for very interesting and challenging dramatic conflict. I believe that theater is the ideal mode of representation for this conflict, since it seems to be not just a story about logic, but one of feelings of betrayal, confusion, and loss. Biographical material (specifically Russell's Autobiography and Monk's Wittgenstein: The Duty Of Genius) certainly reaffirms the idea that Russell felt betrayed by Wittgenstein's abandoning the pure logicist programme, while Wittgenstein in turn felt that Russell's method of analysis trivialized the notion of human understanding.

However, that is not to say I don't acknowledge that this story does not perfectly lend itself to classical dramatic modes. It has no love interest (other than the brief appearance of Lady Ottoline Morrell in I.vi), and neither Wittgenstein nor Russell emerge as a clear protagonist or tragic hero. To date, history has given both men mixed reviews. Mathematicians never hear of Wittgenstein (at least not in math classes), since he did not put forth a constructive system with which to do analysis, while Russell's work is considered a somewhat dated (but still valid) classic of

mathematical logic. Philosophers, on the other hand, consider Wittgenstein to be one of the most influential of early 20th century philosophers, since he posed many of the questions modern philosophy still grapples with, specifically in the area of philosophy of language. Russell, however, is rarely read in classes, and is considered to be dry and Victorian.

Given that the question of either character "winning" was unanswerable, I wanted to give both of them a chance to state their case, and keep the action moving. To accomplish this, my theatrical techniques tend to be fairly abstract. Most of the action takes place on a nearly bare stage, with minimal furnishings. What furniture there is is simple and not specific to any particular time period. This serves not to distract the audience, and underscores the point that I believe these philosophical issues to be equally pertinent today. However, I do not want to imply that these men were not grounded in a specific cultural history. So, I do have historical references rear their heads occasionally, such as when Lady Ottoline reads the newspaper, or the Soviet insignia appears on the blackboard in II.iv. These references should feel invasive to the audience, I want to convey the idea that Russell and Wittgenstein are secure in their academic lives, and see the outside world as distracting at best, and possibly dangerous.

This selective inclusion of history underscores another technique, which is to make the characters have very different amounts of agency or will-power during the course of the play. After the two beginning monologues, Russell and Wittgenstein confront the Greek philosopher Socrates and overpower him both

verbally and physically. This corresponds to the historical need to reinvent logic around the turn of the century and correct the mistakes of the Ancient Greeks. Also, their rapid dialogue underscores the fact that both men acknowledge that their field of study seems dry and pedantic, but that they both consider it the only legitimate way to ground knowledge. I believe tempo and rhythm are crucial indicators of dramatic tension. This scene with Socrates is probably the quickest of the play, and is meant to indicate mutual success on the part of both characters, as well as draw the audience into the action.

After this initial burst of action, the tempo as well as the character's agency dwindles, with Wittgenstein realizing the destructive power of logic in I.v and saying that logic is "a kind of fear". By the end of the first act, Russell is still enjoying popularity and respect, while Wittgenstein's encounter with the wood seller reflects his own confusion about the validity of mathematical reasoning. By utilizing a split stage, which switches back and forth between the two scenes, I meant to offset not only the two personalities, but also the two tempos of the men. Russell is strong and speaking with momentum, while Wittgenstein's dialogue with P1 is peppered with awkward pauses and misunderstandings. This is almost reversed during the final scene of the play, when Russell is alone in the snow, while Wittgenstein is lecturing in Cambridge. However, this scene concludes with Russell being comforted by reader, while Wittgenstein's final line reveals that he has doubts about whether he will be understood or even remembered.

As for the intended audience, my hope is that both mathematicians and non-mathematicians will get something out of the play. My hope is that people with some knowledge of mathematics will question their beliefs as to what constitutes mathematical proof, and whether we can ever say that a piece of mathematics is valid. The opening scene with the peanut vendor, as well as I.vii. where Wittgenstein talks to the woodcutter, emphasizes this idea that different people may have different ideas about what constitutes proof or exactness. By physically representing people who are confused about these subjects, and having them speak in non-technical language, I believe that live theater can pose these questions in a way that has more impact than a dry philosophical conversation.

Similarly, I think people with no previous expertise in the field of mathematical logic will find the play interesting. I am aware of the stereotype of mathematicians as dry, unemotional calculators, and I hope my play confronts that image. To show two men gripped with confusion and hope while considering these problems greatly reinforces the notion that these are human beings attached to their work as much as anyone else. The idea that there could be such a thing as a "mathematical controversy" is probably foreign to readers whose only experience with math is the rote memorization in elementary and secondary education. Hopefully my play will serve the purpose of demonstrating this kind of controversy.

In terms of artistic influences I feel indebted to the works of Samuel Beckett, who is thought of as the father of the Absurdist

movement in theater. Absurdism can best be summed up as "the conviction that life is illogical, and the more someone tries to impose logic on it, the more illogical it becomes" (Watson, pg.474). In his own words, Beckett says that his ideal form of theater "will be of such a type that it admits the chaos and does not try to say that the chaos is something else" (McMillan, pg. 14). What is different about my work, I think, is that my two main characters are not able to deal with the chaos. They never become resigned to it. It may seem paradoxical to frame a play about logic in an illogical world, but I contend that such a staging is the only way to illustrate the difficulties these men experienced in trying to create a feasible approach to logical analysis. When Wittgenstein says of logic "It's a kind of fear" in I.v., I want the line to convey that both these men are scared of the modern world they've inherited, and are trying to find something solid to hang on to. I have also been influenced by later absurdist, such as Harold Pinter and David Rabe.

Act I

Scene i: Lights up on a mostly bare stage. Upstage center stands a blackboard with a diagram of two rectangles, one three dots wide and six tall, the other six dots wide and three tall. Ludwig Wittgenstein reclines down stage right, propped up on one elbow, methodically playing jacks and muttering to himself. The rhythm of the bouncing ball is heard throughout the following dialogue. Enter stage right P1 dressed as a vendor carrying a box filled with bagged peanuts.

P1: Three for a bag! Get your roasted peanuts, only three for a bag!
[Enter stage left Bertrand Russell, engrossed in thought. He is staring at the wedding ring on his left hand, apparently trouble. He nearly walks into P1.]

BR: [Looking up, startled] What? Oh, right. I'll take six then.

P1: Coming right up sir. [Takes out bags]

BR: Three per bag makes 18. [Counts out money] Here you are.

P1: [Nervous laugh] Um, no package deals sir, just three for a bag, nice and simple.

[pause]

BR: Well that's what I've got.

P1: [Clearly agitated] I'm just trying to do my job sir.

BR: [Perplexed, but not angry] Fine, fine, we can do it your way.

[They do the transaction slowly, Russell handing over three bills for each bag, while P1 repeats mantra-like "3,...3,...3,..." When they are

done, Russell has his six bags of peanuts and, of course, his stack of bills is gone. By now, P1 is gripped with fear.]

P1: [Stammering] I-I'm sorry sir. I guess I should've... well I've never seen anything like... excuse me. [Quick exit Left, warily watching Russell the whole way]

[Russell stares at his empty left hand for a moment, then looks back to where P1 has exited. Wittgenstein rises, leaving the jacks on the ground, approaches Russell, who gives him a bag of peanuts. They eat in silence for a while.]

LW: Frustrating, isn't it?

BR: [flat] I just wish I'd had some time. I could have explained, instead of scaring the poor guy off.

LW: A stranger came up to me the other day. He looked up at the sky and said "I think it's going to rain,... therefore I exist".

[Pause. Russell says nothing at first, then cracks a slight smile and chuckles softly. Blackout.]

Scene ii: Lights up on the stage empty except for a simple card table, upstage left with a small heap of pebbles on it. On the blackboard backstage is written "Russell's paradox" written in functional notation. Enter stage right P2, dressed in blue workers coveralls with a patch on the left breast, reading simply "A". P2 moves slowly and deliberately. He spots the table and considers it for a moment before speaking.

P2: [Sharply] Block!

[Enter stage right P3 dressed identically, except his badge reads "B". He is carrying a large wooden block, about two feet cubed.]

P3: [resigned] Block. [exits right]

[P2 positions the block carefully at about center stage.]

P2: Block! [drill is repeated]

P3: Block. [P2 positions the second block about three feet to the right of the first.]

P2: Board! [P3 enters with a wooden board about 5' x 1']

P3: Board. [After P3 leaves, P2 balances the board on the two blocks]

P2: Bookends! [P3 enters with two heavy looking bookends]

P3: Bookends. [P2 uses a measuring tape and places the bookends a fixed distance apart]

P2: Books! [P3 enters with the three volumes of Russell's

Principia Mathematica. The books appear to be very heavy, heavier than the blocks]

P3: Books. [P2 takes the books one at a time, and sets them, spines facing the audience, between the bookends. However, much to their surprise, the builders notice that there is still empty space between the bookends.]

P2: Book? [P3 shrugs his shoulders]

[The tension is interrupted by the entrance of Russell stage left.]

BR: [Calm but commanding] Thank you gentlemen, that will be all.

[P2 & P3 stare at Russell expectantly] Oh, sorry. [Russell takes money from pocket, hands a bill to P2 & P3. They nod, and lumber off stage right.]

[As Russell does the following monologue he will occasionally go to the table and move a pebble from the pile to the side of the table, forming a new pile. This will be done quickly and efficiently, as if marking time.]

BR: An important thing in philosophy is knowing when to stop.

After you've hit your head against a particular wall enough times, it becomes habit. So, you have to take a step back and ask yourself if it's still worth it. I stopped here. [Indicates bookshelf, then moving a pebble.] It all started, oh, around the turn of the century, following the death of the queen [beat pause]. I had been sort of rooting around, unhappily married to an American Puritan. [Leans in, conspiring with audience] Her brother turned out to be a homosexual. Rotten affair, really. [Regains composure, moves pebble] Enough of that. Well, what we had wasn't working. Mathematics had gotten huge, but no one knew where it all came from. We didn't want to say "God" anymore. [pebble] Many people

were working with telescopes... but some of us chose to work with microscopes, and we didn't like what they saw. The foundations were weak, yes, say that: "the foundations were weak". [pebble] Let me say that I never thought it would take this long. We, Whitehead and I, thought the solution was just around the corner. Many have made that mistake before. It's always tempting to believe that all you need is one more piece and everything will become totally clear. And, of course, it never ends up being that simple at all. But here's what we had. You can assert propositions, you can negate them, and you can say "this or that". That's about all you need to really get a system going. [pebble] Add to that some very primitive notions about classes and relations between objects and boom, we've got mathematics, completely devoid of the outside world. Math could exist, in this place without people, without information. Purity. Beyond that, you've got everything you can possibly know for sure. Something to hold on to, you might say. [Pebble] But, language had lulled us to sleep. So, $2+2$ "is" 4, and this "is" a table. Totally different statements, but we use the same word. Which is fine for just talking, meaning is usually robust in these circumstances. When clarity is needed, we can't use them. [Pebble] So that's the true test, to uproot meaning from the language that had plagued it since the Ancient Greeks. I'm sure you think I'm reinventing the wheel, but what I'm really doing is checking the wheel. Grounding the wheel. [pebble] But I'm not doing it anymore. This [pats books] is enough. [Russell looks down at the books for a few moments, and then walks slowly offstage left].

Scene iii: Lights up on the stage exactly as it was left. Bookshelf with the three volumes of the **Principia** is still there, as well as the table with two piles of pebbles. The chalkboard still has "Russell's Paradox" on it, but underneath in large letters is written "1.2: The world divides into facts." Enter stage right P2, still dressed in workers coveralls.

P2 [has regained his authoritative composure after last scene's fiasco]: Book!

[P3 enters stage right holding a copy of **LW's Tractatus**. This is a small book, obviously much lighter than any volume of the **Principia**. P3 hands the book to P2.]

P3: Book.

[Now P2 can't figure out where to put this book. It is too small to serve as the fourth volume of the **Principia**, but the bookshelf has only one shelf. Enter LW stage right carrying a clarinet case.]

LW [Taking the **Tractatus** from **P2**]: Here, I'll take that.

[P2 and P3 exit left, obviously relieved, without waiting for a tip.

LW looks at the bookshelf for a moment, then presses the bookends together so they support the three volumes of the **Principia**. He then leans the **Tractatus** against them.]

LW [sets clarinet case on table between piles of pebbles. He opens the case and begins to assemble a clarinet while he speaks. His tone is initially calm, almost smug.]: I'm not from here originally. I was sent here by a man named Gottlieb Frege. I caused a bit of a scene when Prof. Russell [nod offstage left] asked me if I really disbelieved the statement "there isn't a rhinoceros in this room". [By now, he has assembled most of the clarinet, and taps the keys to make sure they

don't stick.] But that isn't the point. We are not scientists. If you want to do logic, do it. Don't pretend to help the physicist or the zoologist. [grin] They should come to us. [By now, the clarinet is assembled. LW plays a drawn out arpeggio, very simply. He then looks up at the audience, and walks promptly upstage, where he sets the clarinet down near the blackboard. He walks back down stage.] So the problem is: how do we deal with matter, or objects? [Looks down, runs left hand through hair distractedly] Well, we don't. Whether objects exist, and what they do if they exist cannot be our focus. If we want to describe the world, we can only do it with facts, not matter. [Pause as he picks up some pebbles off the table.] I'm sorry, that wasn't said well. If someone says to me "there are tulips growing on the north pole" , I know what he means, even if I don't believe it. But, when that person says "the world is four-dimensional, not three" then I can't understand him. I understand the words, but not the meaning. [P3 enters stage right, carrying a chair, which he places behind LW.] So, these facts and their expression give us limits as to what can be said and what can't. [LW sinks back into the chair, head in his hands. His tone becomes more desperate.] And it's so odd that these things become so slippery. The structures that surround us all suggest things, guide us. Nothing can confirm anything. There is always room for doubt. Where I am certain, I know someone may be uncertain. Color nearly brought me down. I want to say that two different colors cannot exist simultaneously in the same point of a visual field. That seems to me to be a law of the logic of color, whether it is a scientific law or not. But logic seems to work so differently. Facts can never imply one

another, but they present a picture. But I seem to think that it is a picture without color, or a different kind of color. [Looks directly at audience] I am not so different from you. I don't want a world without color. [Blackout]

scene iv: (Biographical note: until Russell's interruption, all the dialogue is adapted from Fowler's **Mathematics of Plato's Academy**) Lights up on four of the players re-enacting the "Meno" dialogue from Plato. Around the chalkboard are Socrates, who has on a large, obviously fake beard, and an ostentatious toga, Meno who does not have a beard but does wear a toga, and the Slaveboy, who is dressed in rags and has dirt smeared over his face. In the corner down stage right sits Plato, frantically writing down the dialogue on a yellow legal pad, conspicuously using a Bic ball point pen. He also has a beard and a toga. All four speak in a comically grand style, with gestures that border on campiness. On the chalkboard is a grid of four squares, with a fifth square inscribed within it. Socrates and the Slaveboy are referring to the diagram, while Meno looks on, admiring the scene.

Socrates: And how big is this figure, then?

Boy: Eight feet

Socrates: On what base?

Boy: This one, the diagonal.

[Enter BR and LW stage left. They stroll upstage and then stop to observe, backs to the audience]

Socrates: What do you think, Meno? Has he answered with any opinions that were not his own?

Meno: No, they were all his.

Socrates [gesturing grandly]: So a man who does not know has in himself true opinions on a subject without having knowledge.

Meno: It would appear so.

Socrates [triumphant]: At present these opinions, being newly aroused, have a dreamlike quality.

BR [suddenly interrupting]: Yes, well that's putting it mildly.

Socrates: Whatever does that mean?

BR: Well, we've certainly convinced ourselves of quite a bit in a short time. Take this chalkboard for instance. What part does that play?

Socrates [indignant]: It doesn't play any part at all! These diagrams could be written anywhere, large or small, the argument would be the same.

BR [peers around the back of the board]: Are we sure this board is flat? [To the boy] What do you think, is the board flat?

Boy: It certainly seems so, sir.

BR: Things would be different if it wasn't flat, wouldn't they?

Boy [intimidated]: I suppose so.

BR: If we were writing this on a ball or something, we might get lines like this. [Takes chalk out of his pocket and draws some hyperbolic lines tangent to the square.] Or even like this. [freehands an ellipse circumscribing the square.]

Socrates: This, sir, is completely beside the point. We have an idea of what flat is. We have an idea of line, which your drawings do not adhere to. This diagram shows us how they are related in such-and-such a way. Your petty grievances are completely incidental to our understanding.

BR: So this boy is supposed to have remembered all that too?

LW: How about this then. [to the boy] Suppose I have one cup of popped popcorn and one cup of water. I add them together and get what?

Boy: I'm not sure I understand, sir.

LW: What do I get when I put my cup of popcorn and my cup of water in the same container?

Boy [nervous giggle]: You get mush, I guess.

LW: But we don't get two cups of anything, then.

[At this last comment Plato throws down his pen and pad of paper and comes storming over to join the argument.]

Plato: Look, before the two of you came along, we were trying to make some sense out of things. Big things like virtue and truth. And then the next thing I know, I'm writing down things about curved chalkboards and popcorn balls. [desperate, stammering] This is not helping anyone. This does not bring us closer to any sort of knowledge.

BR: But shouldn't your "knowledge" encompass all these things if it really is as big as you say it is?

Socrates: I am shocked, gentlemen, that you pretend to know less about what we are speaking of than this young boy. Can't you appreciate the simplicity of these ideas?

LW: Well, I think we can all appreciate the simplicity of the language, and will probably continue to appreciate it for quite a while. But what can you offer us besides pictures? Where is this true? Just on a perfectly flat board with perfectly flat straight lines?

Socrates [serious, almost preaching]: This is true everywhere and for all time. These facts that this boy has laid out are obvious to anyone who thinks about them.

[At this remark BR and LW move to either side of Socrates and each place a hand on his shoulders. BR is on the left, LW on the right. During the following dialogue, which should be very snappy and up tempo, they gradually force Socrates down to his knees and his expression slowly distorts into one of fear.]

BR: I'm sorry, you must think we're being pedantic.

LW: Picky.

BR: Sarcastic.

LW: Relativistic.

BR: Purposefully obscure.

LW: Unenlightened.

BR: Deterministic.

LW: Faithless.

BR: Stifling.

LW: Boorish.

BR: Cretins with no sense of perspective.

LW: Distorting.

BR: Muffling.

LW: Completely extraneous to the real search for truth.

[By this point, Socrates is on his knees, and BR and LW throw him forwards, onto his stomach, and he rolls over on his back, gasping for air.]

BR [Squatting down, so his face is right above Socrates]: You know, the bottom line is that it's easy to talk about pure reason when

you're lying on a remote Mediterranean Island, wearing sandals and bed sheets, without a care in the world.

LW [Also squats]: Try doing it surrounded by steam engines. Relativity. Atomic power. Things aren't so clear cut anymore.

BR: You probably haven't even told that kid that the line he multiplied by isn't a fraction. It would be a little difficult to have him "remember" all that.

LW: That probably wouldn't fit in too well with this sort of ideology, would it?

BR [Stands up and brushes off his hands]: But go ahead. No, really. Set up the rules of geometry, confuse everyone for thousands of years with these axiomatic notions.

LW: You think maybe this is the way it has to begin?

BR [Shakes his head slowly]: I hate to think it.

[Sudden Blackout]

Scene v: Lights up on P4 and P5 sitting cross-legged facing one another down stage center. They have a board game between them, on which they are concentrating. Occasionally one of them will move a piece or exchange pieces, most of which resemble small, flat pebbles. Behind them is a table with two chairs set up across from one another. Upstage, as always, is the blackboard. On it are written various contradictions. In the center: p implies $\neg p$, and around it: p and $\neg p$, $\neg(p \text{ or } \neg p)$, etc.

P4 [makes a move and takes a stone]: Ah-ha!

P5 [startled]: Good show!

P4: Got you back for that last one, eh?

P5: Quite right!

[Enter LW stage right. He is casually strolling, and whistling. He sees the players and watches them for a bit.]

LW: What game is this?

P4 [not looking up]: He invented it the other day.

LW [watches for a bit]: What's the object?

P5: I want him to take the last pile. So if I move things around enough, I can keep him guessing. That's my plan anyway.

LW: I see.

[The game continues for a bit. LW walks back to the board, erases half of it, and does some simple drawings of points in groups. He thinks for a moment, then draws a few circles around some points. Meanwhile, the players mutter appropriate remarks as they keep playing. Finally, LW turns around with a look of triumph.]

LW: I've got it!

P4 [not looking up]: What's that?

LW: Whoever goes second should take exactly three stones from the left hand corner. Then he can keep the other player on the run.

P5: That's a good strategy, eh?

LW: Not just that, it's unbeatable.

[At this, the game stops and both players slowly turn towards LW. They remain in silence for a few moments.]

P4: Unbeatable?

LW: That's right. The other player will be stuck.

[The players look at each other, then collect their stones in a pile. They fold up the board and stand up.]

P5 [addressing the audience]: Come to find out it isn't a game at all.

It may have been a game yesterday, but it isn't today.

[P4 and P5 walk off stage left, LW watching them. When they are out of sight, LW goes to the table and sits down, brooding a bit. Enter BR stage left, walking briskly.]

BR: Oh good, I was hoping to find you here.

LW: Hmmph. I seem to be a bit poisonous today.

BR [sits opposite LW]: Sorry to hear that.

LW: Nothing in common with God or man. [begins tapping table nervously]

BR [calmly]: Yes, well, enough about sins, I think. Lets talk logic.

LW [genuine interest]: Oh, that sounds all right.

BR: I must say I'm a bit distressed about all this slandering of science you've been doing recently.

LW: Slandering? I wouldn't go that far. It's just not what I do. That's all.

BR: I'm not going to tell you how to think. It just seems to me that if we're laying foundations, they should be for something.

LW: I guess that's what I object to.

BR: How's that?

LW: We could be laying the foundations for anything, really anything.

BR: But the reality is our system will be a guideline for science, now and in the future.

LW: You tell me I can infer anything from a false proposition, am I right?

BR: Yes.

LW: So, if I want to say $2 + 2 = 5$ implies the capital of England is Paris, that's a true proposition?

BR: Given the constraints of logic, that is a true statement.

LW [squints]: Doesn't that bother you a bit?

BR: No, no it does not. We can infer anything from a false proposition, but without such a rule it would be impossible to have a logical calculus at all.

LW: Yes. Yes I agree with all that, but I want to say that your calculus doesn't imply our science, it implies anything at all.

BR I don't see the point.

LW: Even if water flowed upstream, we could create a science that would deal with that.

BR: Of course we would. It's human nature if anything is.

LW: And such a science would still be in keeping with our logical rules.

BR: Absolutely.

LW: So what good is our study of logic if it adapts itself to all kinds of systems? How can we say it clears up anything?

BR: It clears things up because it brings us back to the basics, back to what is strictly knowable.

LW: But there's still a place for fallibility at every turn. Human thoughts are too varied, too complex. I want to say that the complexity of the human body is a reflection of the complexity of its thoughts.

BR: We cannot let the supernatural creep into this debate. We define clear lines of thought and follow them whatever the consequence.

LW: It's a kind of fear.

BR [chuckles briefly]: Well, it's in your hands now. I'm getting too old for this game. Good-bye. [he rises and leaves stage left]

LW [grimly]: It's a kind of fear.

Scene vi: Lights up on a bed at stage left. Lying on the bed, propped up on the pillows is Lady Ottoline Morrell, face obscured from the audience by a large newspaper which she is reading. LOM is the only woman to appear in the play, and her costume is in stark contrast to the simple outfits of the men, in that it is a gaudy, flapper-style dress, with bright feminine colors. A large brimmed hat and ostentatious jewelry complete the look. Her bare feet are crossed in front of her, and she jiggles them out of boredom throughout the scene. At stage right, BR writes hunched over a desk, his back to the bed, profile to the audience. He appears disheveled, and his speech is somewhat unfocused, exhausted.

BR [slamming down his pen]: No one had put forth a solid theory for the existence of matter. That's the bottom line. Trying to rectify sense data with science. It's all a big shell game.

LOM [still behind paper]: Death. Yes indeed, quite a bit of death. [Turns page] Look there, disaster.

BR: Husserl, Spinoza, a put up job. So can we take our sense-data, our empirical hints, and make them into equations?

LOM: Oh look, my husband got elected again. Bully for him. I should send a card.

BR: Can we bring ourselves to understand these forces? Forces that surround us. We must know.

LOM: Here's an interview with a woman whose nephews are fighting for the Germans. She still maintains that they should be killed if that's what it takes. Is that what it takes, Bertie?

BR: Light travels like waves. Action happens at a distance. Straight becomes curved. It's no wonder people still go to church. Meeting the world on your knees is not such a bad idea at this point.

LOM: Oh, we have faith. You're still a patriot for all your protests.

BR: I had a calling. Now I just feel tired. I can't retake rigor.

LOM: Will your books still be valid if no one reads them?

BR [mutters]: Of course.

LOM [turning the page]: Oh here's an interesting item. Bertrand Russell dead at age thirty-two.

BR [Finally turns around to face her]: What?

LOM: Yes, apparently the missionary society is quite thrilled about the whole thing. [She tears out the newspaper page and begins to wad it into a ball] Maybe it's rigor mortis you're trying to find. [She throws the newspaper ball at BR's head].

BR [finally stands and picks up the ball]: All right, you win. [BR breaks into a large grin and is about to lunge at LOM when there is a sudden blackout.]

Scene vii: Lights up on the left half of the stage. BR is standing to the right of a large podium which faces offstage left. He has a stack of notes. Sounds coming from offstage (rustles, coughs, etc.) indicate that he is lecturing to a large crowd. He reads from the last chapter of **Problems of Philosophy**.

BR [Clears throat, takes a sip from glass of water]: Philosophy, like all other studies, aims primarily at knowledge. The knowledge it aims at is the kind of knowledge which gives unity and system to the body of the sciences. But it cannot be maintained that philosophy has had any very great measure of success in its attempts to provide definite answers to its questions. If you ask a mathematician, a mineralogist...

[At this point BR's voice trails off, and the lights dim on stage left. BR is still somewhat visible, and continues to lecture silently. Lights up on stage right, revealing P1 dressed as an older workingman, sitting in a rocking-chair, smoking a simple pipe. Enter stage right LW, apparently coming in from the cold.]

LW: Excuse me, is this where I can buy some firewood?

P1: Yes, come right in. [looks LW up and down] Student from the university, eh?

LW: Yes, that's right.

P1: Well, the woods out back. Need some help carrying it?

LW: No, no, I'll be fine.

P1: Just come back in when you find what you need.

[As LW exits, lights dim, and then rise back on BR stage left.]

BR: Philosophy, though unable to tell us with certainty what is the true answer to the doubts which it raises, is able to suggest many

possibilities which enlarge our thoughts and free them from the tyranny of custom. Thus, it removes the somewhat arrogant dogmatism of those who have never traveled into the region of liberating doubt, and it keeps alive our sense of wonder by showing familiar things in an unfamiliar aspect.

[Lights switch again, LW enters with his arms full of firewood.]

P1: Found what you needed then?

LW: Yes, is there a scale you want me to set this on?

P1: No, no, just set it down on the floor there. [LW does so, with some strain.] Here now, let's measure this. [P1 gets up from his chair and picks up two yardsticks. He arranges the wood in a pile, then sets the yardsticks on the floor at right angles to each other and measures the length and width of the pile.] Let's see, 13 by 18, that make 234 square, so you owe me about 3 bills and some change.

LW: Are you sure?

[Lights go back to stage left.]

BR: The free intellect will see as God might see, without a here and now, without hopes and fears, without the trammels of customary beliefs and traditional prejudices, calmly, dispassionately, in the sole and exclusive desire of knowledge - knowledge as impersonal, as purely contemplative, as it is possible for man to attain.

[Lights switch again]

P1: Well, I guess I'm sure. You figure I multiplied wrong?

LW: No, that seems fine, I just think, shouldn't you weigh the wood, or take the height into account?

P1: Don't you think it's a fair price?

LW: Oh, I'm sure the price is fair, it just isn't the way things are measured. I want some volume of wood not just... [Sudden thought] Wait a second, I'll be right back.

[LW exits again, as lights switch back to BR]

BR: The mind which has become accustomed to the freedom and impartiality of philosophic contemplation will preserve something of the same freedom and impartiality in the world of action and emotion. Thus contemplation makes us citizens of the universe, not only of one walled city at war with all the rest.

[Lights return to stage right, as LW re-enters with a few more pieces of firewood.]

LW: Let's say I want to buy some more wood. Now, if I place them here [places wood alongside pile] you're going to charge me more, right?

P1: Seems only fair.

LW: Certainly. But if I place the wood here [LW moves the new wood on to the top of the pile] I get charged the same amount.

P1: Well, um, the wood's not worth as much then, I guess.

LW: But it will still burn the same for me. Don't you want a more exact method of measuring? Aren't you afraid someone might cheat you?

P1 [thinks for a moment]: Naw, I been measuring wood this way for years. Besides, no matter how you do it, firewood isn't all that expensive anyway. Most of my income comes from doing other odd jobs around here. [Places hand on LW's shoulder] Look son, I know you're trying to be helpful, but I'm getting by just fine.

LW [embarrassed]: I, you're right, I'm sorry. Here, let me pay you.
[As LW reaches for his wallet, lights go back to BR finishing his lecture]

BR: Through the greatness of the universe which philosophy contemplates, the mind is also rendered great, and becomes capable of that union with the universe which constitutes its highest good.
[There is wild applause from stage left, and flashbulbs go off as BR smiles, absorbing it all.]

Act II

Scene i: Lights up on P1 dressed in rags, sitting cross-legged in the left corner of the stage. He is drinking heavily from a large bottle of something, and playing dominoes. Throughout this scene he will attempt to build simple structures by stacking the dominoes, but they will fall down, much to his drunken consternation. Enter stage right BR and LW, conversing.

BR: So you're saying we can slip right by the whole theory of types altogether?

LW: Right, if we define the functions around the objects they describe, this theory becomes irrelevant...

P1 [mumbling to himself]: Rubbish, you logicians got it all backwards and what not...

BR [to P1]: Pardon?

P1 [indignant]: I said: I'm thinking of a number.

LW [intrigued]: Really? What kind of number?

P1 [nearly yelling]: What kind of number! An integer dammit! A nice, simple, good for counting, plain old integer!

BR: Well, that narrows it down a bit.

LW: Could you give us another hint?

P1 [lost in a reverie]: Oh, it's a big number. A big prime number. And you know what's so special about this prime number? If you subtract two from it, you get another prime number.

BR: Well, there certainly are a lot of those.

P1: Yes, but I'm thinking of the biggest, the absolute biggest one. And if there isn't a biggest one, then I'm just thinking about the number one. Just one. What do you think of that?

LW: I'm not sure what to think.

BR: Wait, are you sure you're thinking of a number?

P1: Well, I'm either thinking of a big number or I'm thinking of the number one. And I can't be thinking about both.

BR: Yes, but you haven't proved...

P1 [suddenly in a rage, sweeps his dominoes over and flies to his feet]: Of course I haven't proved anything! I haven't calculated anything! You [points accusingly at BR and LW] tell all of us about existence and the excluded middle and here I am thinking with nothing to show for it. If I don't have the number, and you don't have it, where is it? What is it?

BR [After recovering from the outburst, BR grabs P1 roughly by the collar and slaps him hard across the face]: Get a hold of yourself man!

P1 [still defiant]: The construction is an art. [Spits on BR's shoe] The application is an evil parasite.

BR [eyes narrow]: Oh, I see. You're one of those, those, ...Marxists. You want to take out all our laws of reasoning. [BR shoves P1 to the floor, where he lies on his stomach] Let's go Ludwig. We can't waste any more time listening to this.

LW [Completely confused]: Well, um, it seems he's just confused just confused. I mean, he defined something, he just couldn't calculate it, it's a matter of terms, that's all.

P1 [still on floor]: Terms, nothing! How can you define what you can't calculate! You're all blind! Your castles are in the air, no foundation. [manic laugh] You're looking for a cat that isn't there!

BR [gestures towards P1 with contempt]: Disgusting. It's useless trying to reason with this rabble. Though they have the tongues of angels, no one may speak against the law of the excluded middle. Let other disciplines take care of this lunacy, we have no time.

[BR exits stage right, and LW follows reluctantly. P1 remains on the floor, mumbling incoherently.]

Scene ii: Lights up on the stage littered with the detritus of previous scenes. The bookshelf has been moved backstage right, the table with pebbles on the left. Scattered backstage are the dominoes, jacks, and bottles. There are also a few pieces of wood mixed in, as well as LW's clarinet. Enter LW, right, holding a folding chair and a book tucked under his arm. He sets up the chair in the center of the stage, clearing away some of the props in the process, and begins reading. The book is a pulp paperback, and as he reads, a voice over a loudspeaker narrates the text, which is clichéd detective fiction. After a few paragraphs of this, P1 and P2 enter left, dressed like college students and carrying barstools. They set the stools down upstage left, and sit. As they begin talking, the loudspeaker voice slowly fades away.

P1: We speak of going through time as though it were a tunnel.

P2: What if the scientists are right and time is just like space?
Except that it's another dimension.

P1: Well, we treat it like space. I mean a clock just moves through space, but we say it tells time.

P2: And that telling is simply relative to position, speed, etc.

[By now, LW is distracted. He still holds the book in front of his face, but has ceased reading, and the voiceover ceases.]

LW: We used to think the world was flat and unmoving.

P1: Pardon?

LW [book still in front of face]: Just a flat sheet of earth, on the back of a turtle or some such thing.

P2 [a bit annoyed]: Well, that's the way it feels.

LW [deliberately lowering book and setting it on the ground next to him]: So how would it feel to be on a huge rotating sphere?

P1 [slight chuckle]: I'm not sure I get it...

[At this LW stands and begins gyrating with his hands above his head. This goes on for a few seconds, and he abruptly sits down again.]

LW: So you tell me that you "feel" like the world is three dimensional and that time is a fourth dimension. What would it feel like the other way?

P1 [defensive, ruffled]: Well, I shouldn't say that I feel these three dimensions, it's just a fact.

LW: Really? And how do we teach this fact?

P2 [takes three pencils from his breast pocket]: We just go like this. Here's one dimension [holds pencil flat], here's another [holds pencil vertical], and then this one [points pencil away from him]. Simple.

LW: What about a fourth pencil?

P1 [smug]: We can't put it anywhere. We're out of right angles.

LW [Looks closely at P2's pencils]: Indeed, we are out of right angles. But what if we make right angles look like so [indicates acute angle with his fingers]. Then we should have more dimensions running about.

P2: Ridiculous. We know what a right angle is.

LW: Of course! We know what a right angle is, because this is the way we use right angles. When we ask what right angles are good for, this is exactly what we talk about. They are good for diagrams like this.

P1: So, you're saying that the definition is circular?

LW: But that's fine. It might be circular, but we know what we mean when we say it. But what do we mean when we say that time is another dimension? Where does the pencil go?

P2 [stammering]: Well, it, uh, goes with us.

P1: That's right, it goes with us, but it can go all over in space.

P2: Or maybe the eraser is with us, and the point is always out of reach.

P1: Or it's invisible, because it's traveling so fast.

LW [slightly ironic]: Good, good, I'm glad we've cleared this one up.
[He raises his book up again]

P2 [still flustered]: Wait, isn't there something we should know?

LW: What do you mean?

P2: Some piece is missing. I feel like if we just had a little more information, we could make sense out of these questions.

LW: The difficulty - I might say - isn't one of finding the solution, it is one of recognizing something as the solution.

P1: Feh, this is all buddhist nonsense.

LW: I'm not trying to be a mystic. I just think a wider look round is best. That's all. Sorry to bother you.

[LW returns to his book, and the loudspeaker resumes its recitation of the books contents. P1 stomps off angrily, but P2 remains, lost in thought.]

P2 [abruptly]: So what do we do?

LW [matter-of-fact, while loudspeaker continues]: Manual labor.

Scene iii: Lights up on P1 center upstage, sitting with his bottle as in (II. i.). He is hunched over, apparently dozing. On the blackboard behind him is written: $(p \vee \neg p)$, the law of the excluded middle, and under it an isosceles right triangle with a sawtooth pattern over the hypotenuse. Enter stage left LW.

LW: Oh good, I was hoping I'd find you here.

P1 [cutting him off]: Hush, hush, I'm doing something important!

LW: Oh, um, sorry.

LW stands in awkward silence for a few moments. Finally, P1 claps his hands twice. On cue, enter P2 stage right, and P3 stage left. They approach each other, meeting at center stage. They recite their lines flatly, as if by rote. They both appear a bit nervous.

P3: I'm concerned about calculation.

P2: There's nothing to it really.

P3: How do I know my answers are correct?

P2: Just concentrate, all the truths are there for inspection.

P3 [squints up his face for a moment]: There, I've added two numbers. [He appears relieved]

P2: Are you sure?

P3: Yes, I mean, hold on.

[P3 begins to count off on his fingers silently, and is interrupted by P1.]

P1: Hold it! Cut, cut, cut! Now you know that isn't allowed!

[P1 staggers to his feet, livid, as P2 and P3 cringe in shame.

P1: Well, I talk and talk and you just don't listen. The outside justifications, by which I mean specifically your fingers, and generally sense-data at large are mere afterthoughts to the great

intuition. If you can't trust yourselves, how can you trust your fingers?! Now let's try that again, from the top.

[P2 and P3 slink offstage, and P1 sits down and drinks from his bottle. After a short pause, he claps twice, again prompting the entrance of P2 and P3, who are much more hesitant in their movements now.]

P2 [stammering, close to tears]: I, I want to calculate.

P3: Good, um, that's good.

P2: So, um, good-bye.

P3: Bye. [P2 and P3 scurry offstage in opposite directions. LW is still upstage, stunned by what he has seen.]

P1 [sighs]: Well, it's a start. Anyway, what were you saying?

LW: I wanted to ask you a question about those infinite prime numbers you mentioned the other day. Who were those fellows.

P1: Oh, just some students of mine. You know it's very difficult teaching mathematics these days. People don't seem to have the heart for it. Aesthetics is such a difficult thing to convey.

LW: I couldn't agree more. [Shouting offstage right] Could we get something to drink over here?

[Enter stage right P5, dressed as a butler. He carries a large tea tray and moves slowly, very cautious. As he gets close to the two men, he begins to lose his balance. However, his face does not reflect anything accidental about this, and with his continued gestures of caution, drops the entire tray. Without any hint of embarrassment he bows curtly to the men, walks to the blackboard and draws a large "S" on it. He then turns and exits stage right.]

P1 [now on the defensive]: What was that all about?

LW: Oh he's just a guy I've been teaching. Wants to be a butler.

P1: Got a long way to go, I imagine.

LW: Oh no, I trust him completely. No real time to be judgmental when faced with that amount of earnestness.

[P5 re-enters holding a large push-broom. Still deadpan, he sets up the broom and leans on it.]

LW [not directly addressing P5]: No, not like that.

[P5 lets go of the broom, letting it fall to the floor. He then lies down on it, curling up on it as if to go to sleep.]

LW: Not a piece of furniture.

[P5 quickly rises, standing very straight and picks up the broom. He begins sweeping in swift deliberate movements, completely missing the tea-set and other spilled things.]

P1 [sinking back down to the floor, reaches for his bottle]: Humans can do this internally. The construction is all about coming from the inside and not letting the outside corrupt it. We must remain pure if we are to reason at all. Appealing to a higher metaphysic undermines everything, pure and simple. Just because something is not the false does not mean it is the true.

LW [walks to the board, gestures at the triangle]: I am going to say that I see this as a diagonal line. [he draws a bit] And if I had a compass, I could certainly cut this other line right about here. Now tell me when I get too metaphysical.

P1 [near tears]: I just can't convey it. I know I mean something big! [Breaks down into loud sobs].

LW: Oh well, there's no need for that. Now, now.

[LW awkwardly kneels and pats P1's head as lights fade.]

Scene iv: Lights up on BR pacing nervously down stage. Behind him is P3 seated at a desk, apparently writing down notes. Behind the desk is a blackboard, with some equations written down in Brouwer's notation, as well as a drawing of a hammer and sickle insignia from the Soviet flag.

BR: Well, I have to say I'm worried.

P3: Worried? About what?

BR: I'm worried about Wittgenstein. I saw him talking to that drunken communist again. I have to say, some of his latest works tread very close to downright blasphemy.

P3: How do you mean?

BR: These theories about pictures and "logical spaces". Interesting, sure. But so damn slippery. Are we to abandon **all** notions of clarity? I can't imagine a color like reddish-green, now I must throw up my hands?

P3: Well, write about it.

BR: I know, I know, re-enter the fray. Bertrand Russell, strident rationalist, quelling doubts at every turn. It just seems futile.

P3: Look, it's not as though you've been lost to obscurity. Your books are read all over the world. Your theory of types is still hotly debated, and people still use your notation in mathematical and philosophical works everywhere. What are you complaining about?

BR: It still feels like a slap in the face. I can't think of it in any other way. I left this business because I had made my contribution, and I thought things were in good hands. I admit, I was a bit of an optimist back then, thinking the big truth was right around the corner, just a matter of ironing out a few details, dotting i's, crossing

t's and so on. No sooner do I close up the old shop when it burns to the ground.

P3: Look, nothing's burning down. Besides, you're doing plenty of good work now in other areas. Let it go.

BR: Don't you wonder how we'll be remembered? If we'll be remembered? If there will be anyone left to remember?

P3: I really think you're making a mountain...

[P3 suddenly stops, as he sees LW enter stage right. There is an awkward silence.]

P3: Well, I guess I'd better be going. [he exits left]

LW: Sorry, did I interrupt?

BR [goes to table and collects papers left by P3]: No, no, just talking shop is all.

LW: How's that book on matter going?

BR: Round and round. Can't seem to get off the ground.

LW: It's not your fault, I think.

BR: How's that?

LW: We can't walk on ice. We have to have some friction to get momentum.

BR: Well, I just want to get things as simple as possible, that's all. Take nothing for granted.

LW: We make these tricks in logic, but who are we tricking? We're just tricking ourselves. [BR shoots him a sideways glance] You think I'm lost.

BR: Yes, I think you've gone astray. With such doubts, how can we ever calculate? How can we put ourselves in a position to make sense of the world?

LW: The same way we always did. Calculation has gone on for thousands of years. Without your gleaming gridwork of pure logic to support it. Were these early calculations entirely false?

BR: They ran the risk of running against paradox, into nonsense.

LW: Paradox that would infect the system, render all calculations unusable.

BR [exasperated]: Oh, I thought that was your job.

LW: The word 'noun' is a noun, but the word 'wolf' isn't a wolf. This is the virus we must exterminate? The danger lurking in the shadows, waiting to destroy our well-laid plans.

BR: You're making fun because your system is unusable! You would leave us groping in darkness, grasping at your amorphous meanings.

LW: You tried to have it all. Bring everything into your vision of scientific clarity. That's not how the world works. That's not how people think. It's a method that simply does not apply to everything.

BR [head down, reaches into his jacket for a small group of pebbles which he sets on the table]: Fine. Take it. Try to do what you can with any other system. [Looks up] I wish you luck. I really do.

[At this BR turns around and exits stage left as LW looks at the pebbles and the lights dim]

Scene v: Lights up on a split stage, similar to the stage at the end of Act I. The podium is set up facing offstage left, but instead of Russell, it is Wittgenstein who is lecturing. The text of his speech comes from his **Lectures on the Foundations of Mathematics Cambridge 1939**. Intermittently, flashbulbs go off at his face, and the sounds of a large crowd can be heard offstage.

LW [takes a sip from a glass of water on the podium and clears his throat]: if we think like this, we think at once: "then there mustn't be any contradictions in logic." But this is queer. For that there must be no contradictions in logic ought itself to be a logical law. This not having contradictions characterizes a peculiar technique of ours.

[Lights down on the left half of the stage, and up on the right portion.

BR is sitting on a bench reading a newspaper, with a large headline about nuclear testing. It is snowing lightly, with obviously fake snow. Russell appears to be shaking slightly from the cold. Enter stage right **P4**, dressed as a ships officer. He approaches **BR** slowly.]

P4: Excuse me sir, I don't mean to bother you.

BR [Lowers his paper, his face looks much older than it has in previous scenes]: Hmm? Oh no, no bother at all.

P4: I was speaking to some of the passengers and they mentioned that you were some sort of scientist.

BR: Well, I'm a bit of a fake scientist. I'm a mathematician and logicist really.

P4: Do you have business in England?

BR: Yes, I'm going to lecture at Cambridge.

P4 [he is impressed]: Well I'm glad you're onboard sir. I've just read a book titled "The ABC's of Relativity" and I was wondering if you knew of it.

BR [smiles]: Yes, in fact I wrote it.

[The lights go down again and resurface on LW. A voice from offstage asks him a question.]

Voice: Doesn't this come to saying that counting that counting by making tautologies is more unreliable than counting in the ordinary method?

LW: It is not a question of its being unreliable. For all I know it may be perfectly reliable. We introduce new principles. And it is not enough to say that we can make our principles agree with Russell's principals.

[Lights switch again to BR and P4 as before.]

P4: Well, I must say it's an honor to meet you Lord Russell. Your book has completely changed the way I look at things.

BR [sincere]: Really?

P4: Absolutely, it just shook me. You dressed down these complex ideas and made them seem just so... real. [embarrassed] I'm sorry. I'm going on and on. I'm sure you have better things to do than listen to me babble.

BR: Not at all. [BR looks around at the bleak landscape around him] I assure you I have nothing better to do.

P4: I, um, have a son attending college in the states. He'll be thrilled when I tell him I've met you. He's planning on becoming a physicist.

BR [suddenly suspicious]: Are you teasing me?! I won't have you teasing me. I won't stand for it! [He points a shaky finger at P4 as the lights switch back to LW at the podium.]

LW: I am speaking against the idea of a "logical machinery". I want to say there is no such thing. The idea of logical machinery would suppose that there was something behind our symbols. One might say that the logical machinery is made out of parts that can't be bent. They are made of infinitely hard material - and so one gets infinitely hard necessity.

[Lights back to BR still pointing his finger at P4.]

P4 [taken aback]: I'm sorry sir, I had no idea. I assure you I meant no harm, merely wanted to strike up a bit of conversation.

BR [sinks his head into his hands]: No, no, I'm sorry. I've been short with you. It's just, I've been under a lot of pressure lately, I'm not sure where to turn. I was in jail you know.

P4: No, no I didn't know.

BR: Well, it's true. My political ideals are seen as too controversial, my philosophy has made gibberish out of a once fine discipline. Godel has rendered my works insignificant. I shouldn't take it out on you...

P4: That's not true. You are a great man. You've inspired lots of people. I, I don't know what to say.

BR [rueful grin, as he lays on the bench, curled up. Snow is still falling, almost covering him.]: If a postman is to deliver letters, he must knock on everyone's door that's on is street. However, if someone else did this, it would be an annoyance, and that person would be persecuted. I've just tried to do my duty.

[There is a sudden flash of back lighting from stage right, illuminating P4 and the stage around him.]

P4 [his voice is deeper and more confident]: You will be remembered. Your words will last.

BR: I just wanted to be a good soldier.

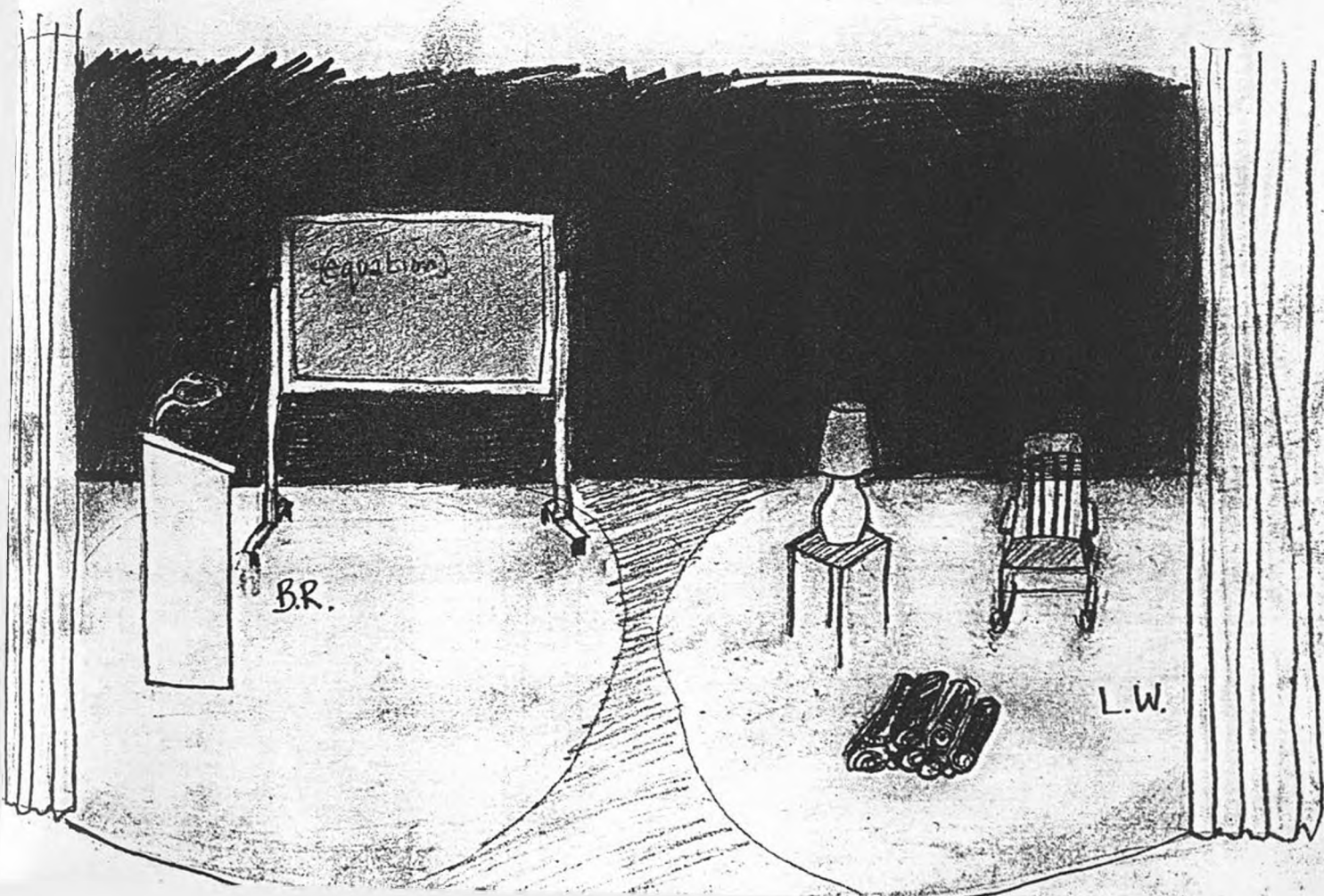
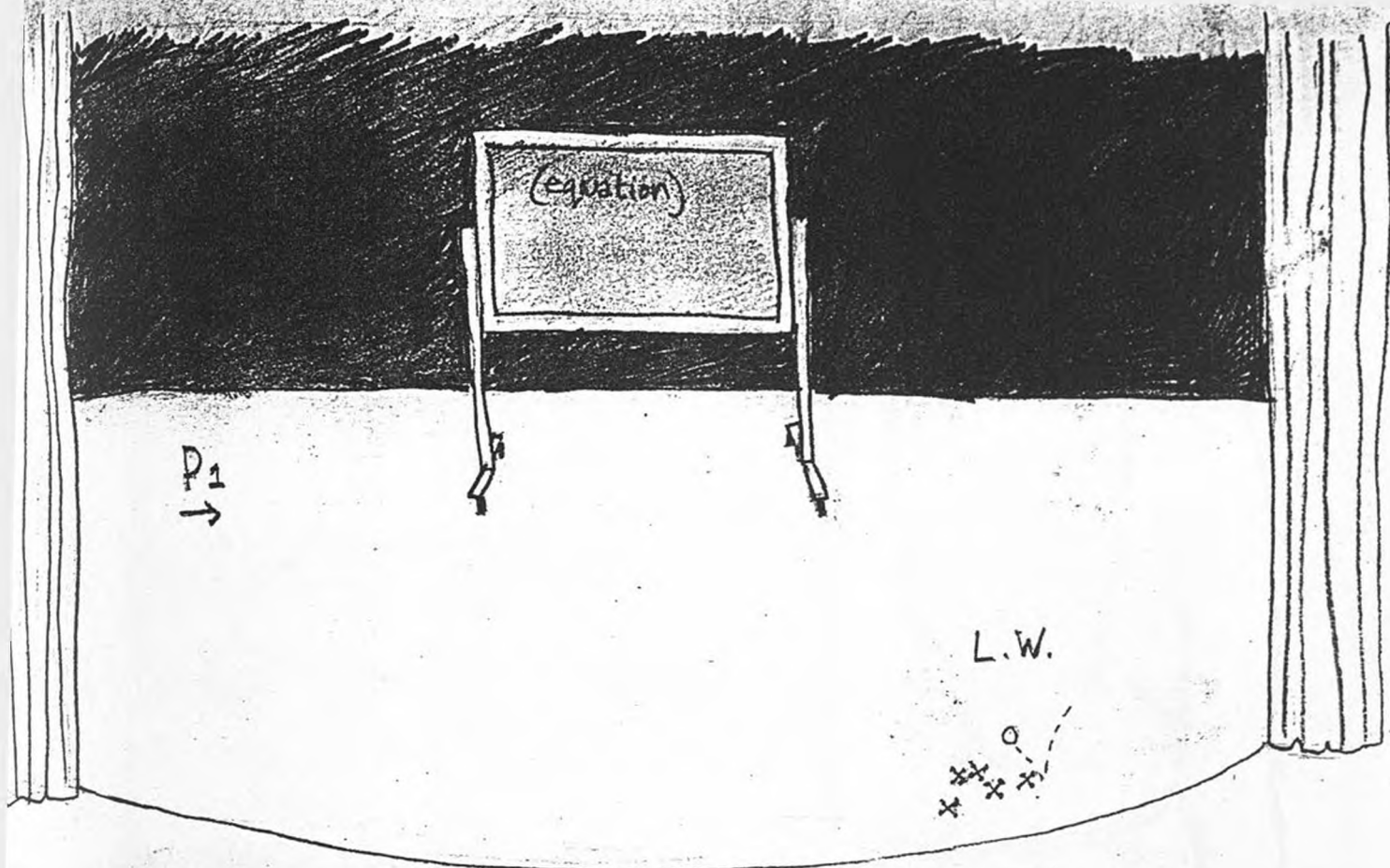
[Blackout, then dim lights on LW at the podium. Light fades during his final speech.]

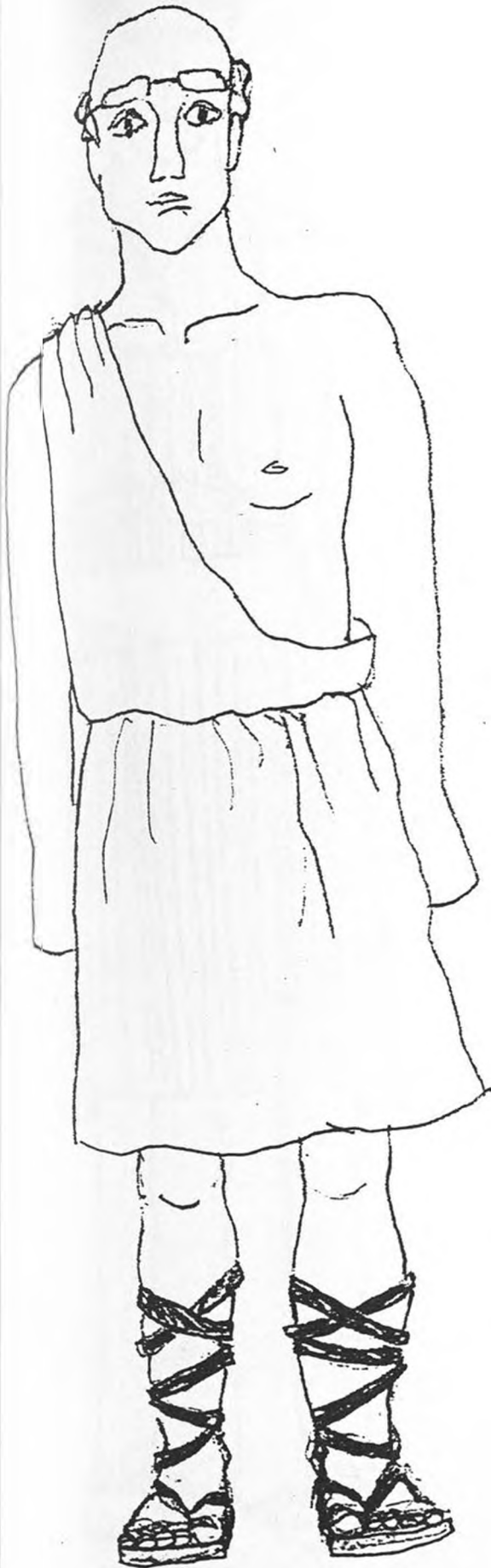
LW: We take calculations with fingers, or with numbers which have a particular face, which the number 10,000 doesn't have. You can give the number 10,000 a face, arrange points, etc. You might have a case where a calculation made by digits and calculation made by a face wouldn't agree.

[Blackout, silence for two beats]

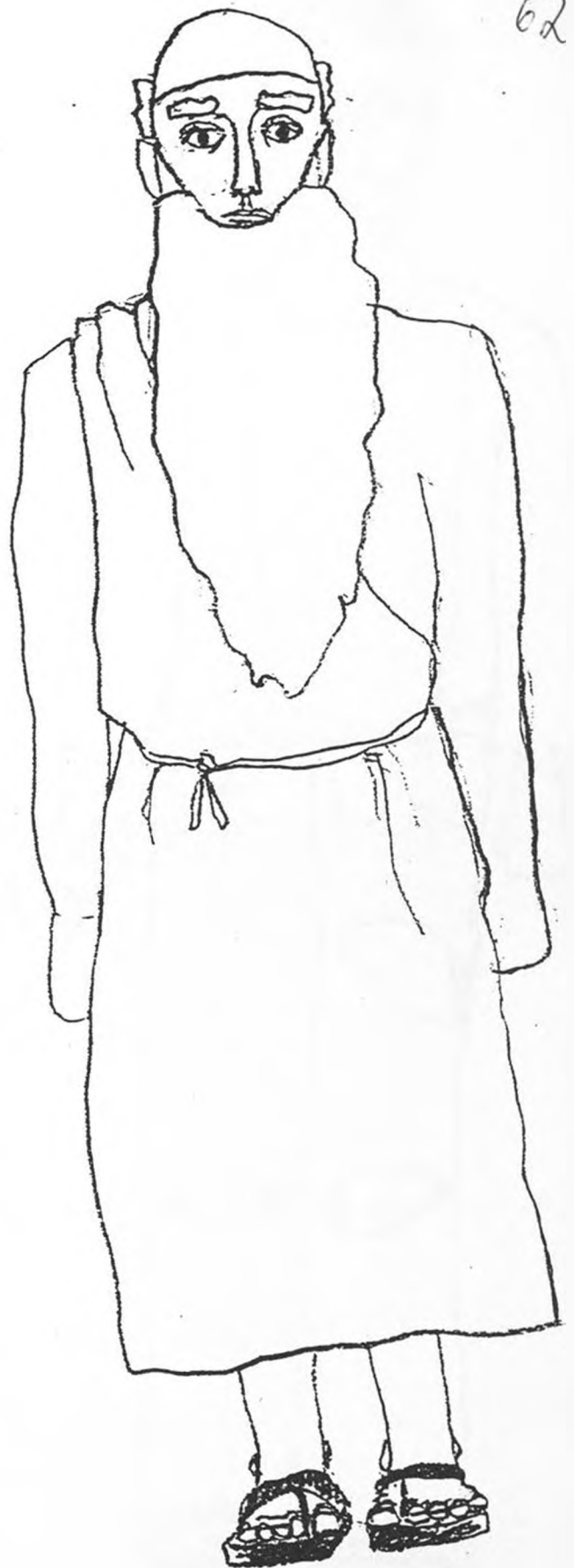
LW: The seed I'm most likely to sow is a certain jargon.

[Curtain]





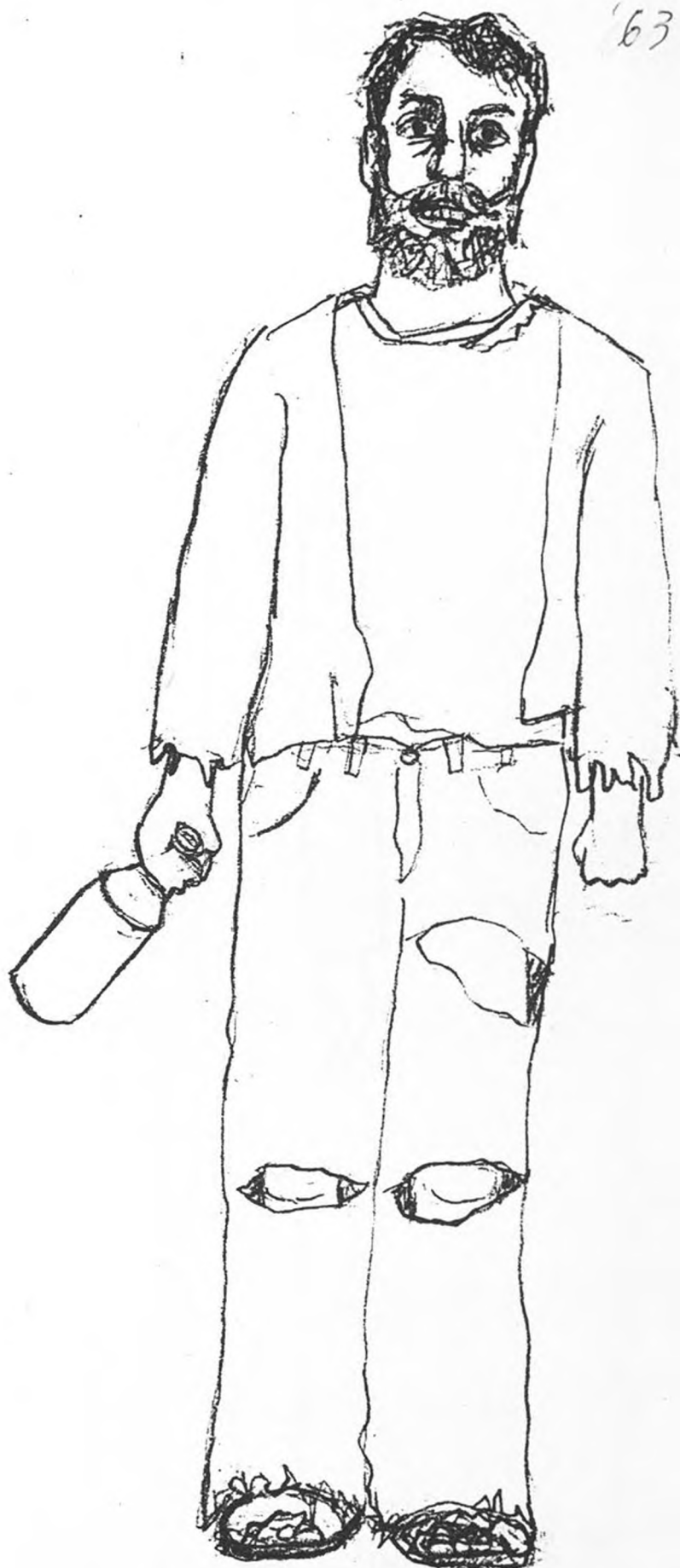
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Socrates

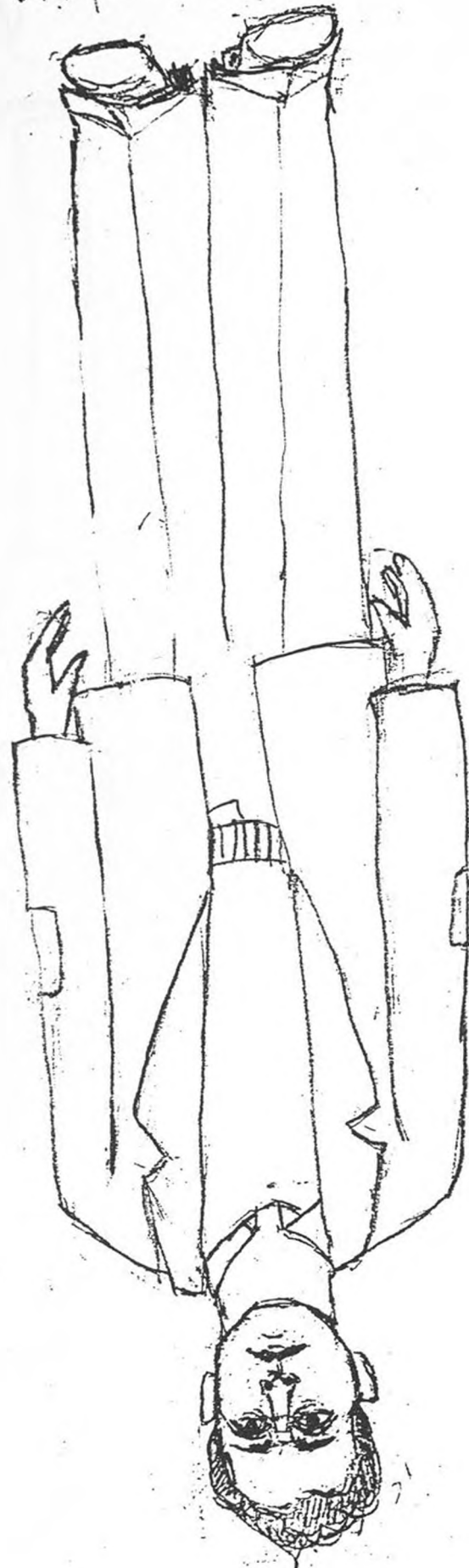


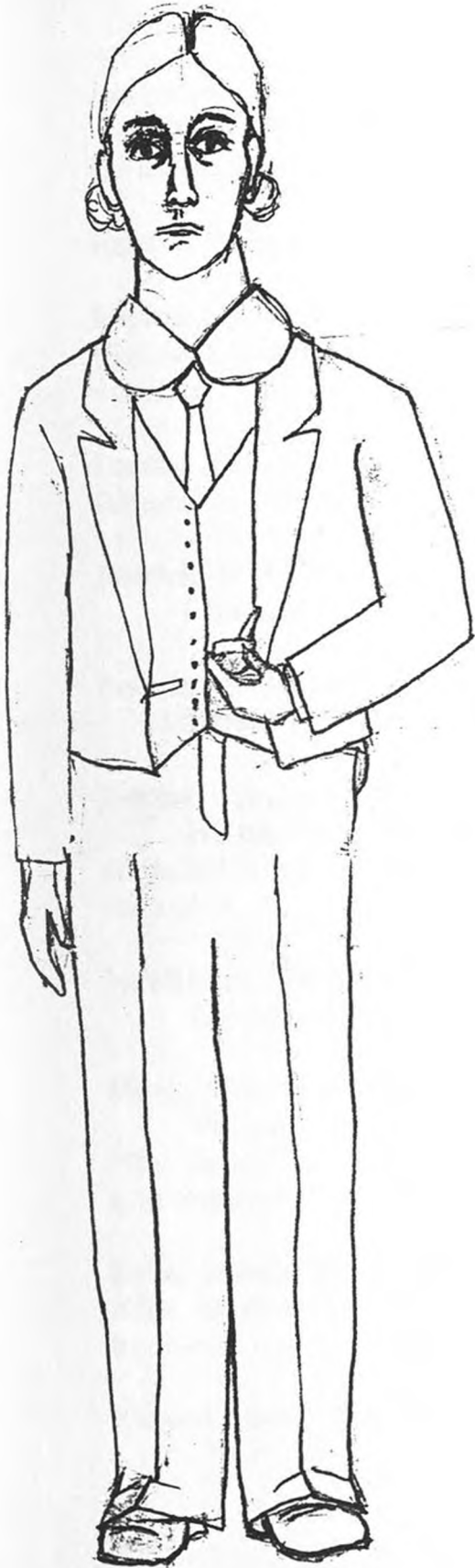
Peanut Vendor



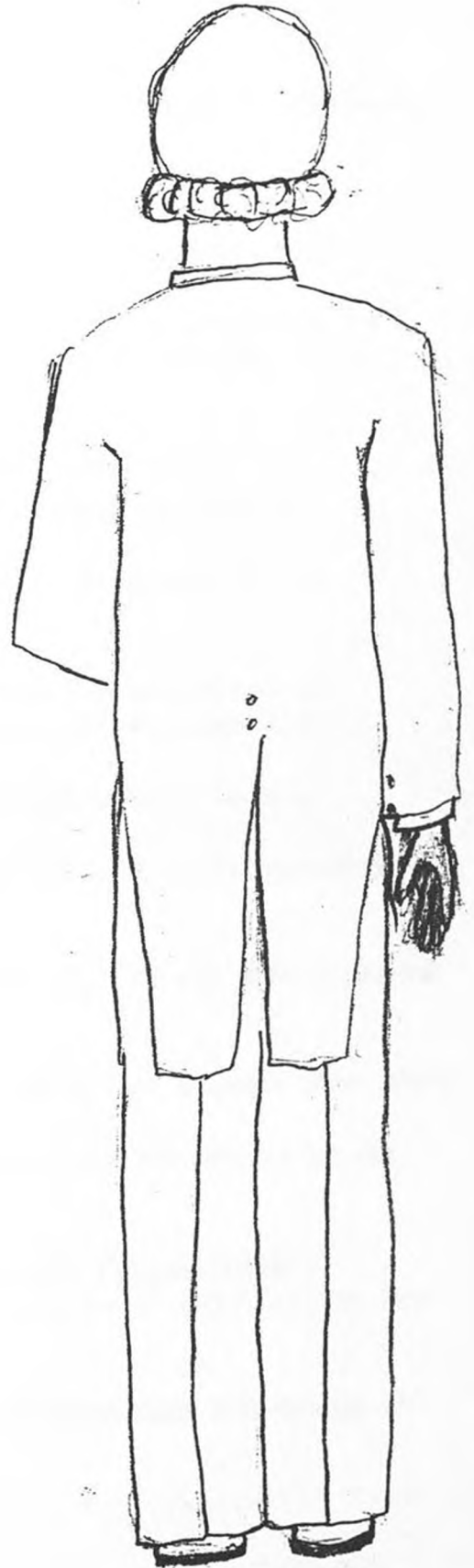
Drunk.

WITOLD WITOLD





Bertrand Russell
(front)



(back)

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