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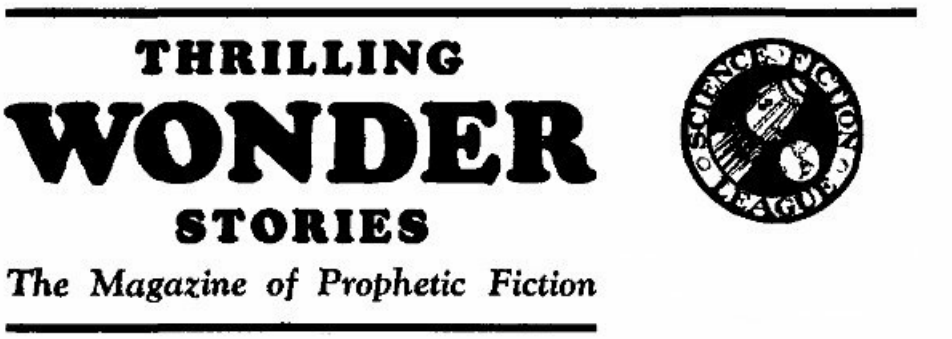

THE BRINK OF INFINITY

The Last Story Ever Written by

STANLEY G. WEINBAUM

Author of "The Circle of Zero," "The Worlds of If," etc.

THRILLING WONDER STORIES

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EDITOR'S NOTE: In presenting this, the last story ever to come from the facile pen of the late Stanley G. Weinbaum, we are aware that it will be greeted with unusual interest by the thousands of Weinbaum fans throughout the country. THRILLING WONDER STORIES considers it a privilege to be able to present this story, and wishes to thank Mrs. Weinbaum for her coöperation in securing it.

One would hardly choose the life of an assistant professor of mathematics at an Eastern University as an adventurous one. Professors in general are reputed to drone out a quiet, scholarly existence, and an instructor of mathematics might seem the driest and least lively of men, since his subject is perhaps the most desiccated. And yet—even the lifeless science of figures has had its dreamers—Clerk-Maxwell, Lobachewski, Einstein and, the rest. The latter, the great Albert Einstein himself who is forging the only chain that ever tied a philosopher's dream to experimental science, is pounding his links of tenuous mathematical symbols, shadowy as thought, but unbreakable.

And don't forget that "Alice in Wonderland" was written by a dreamer who happened also to be a mathematician. Not that I class myself with them; I'm practical enough to leave fantasies alone. Teaching is my business.

At least, teaching is my main business. I do a little statistical work for industrial corporations when the occasion presents itself—in fact, you'll find my name in the classified section: Abner Aarons, Statistician and Consulting Mathematician. I eke out my professional salary, and I do at times strike something interesting. Of course, in the main such work consists of graphing trends of consumption for manufacturers, or population increases for public utilities.

And occasionally some up-and-coming advertising agency will consult me on how many sardine cans would be needed to fill the Panama Canal, or some such material to use as catchy advertising copy. Not exactly exciting work, but it helps financially.

Thus I was not particularly surprised that July morning to receive a call. The university had been closed for some weeks; the summer session was about to open, without however, the benefit of my presence. *I* was taking a vacation, leaving in two or three days for a Vermont village I knew, where the brook trout cared not a bit whether a prize-fighter, president, or professor, was on the hither end of the line. And I was going alone; three-quarters of the year before a classroom full of the tadpoles called college students had thoroughly wearied me of any further desire for human companionship; my social instincts were temporarily in abeyance.

Nevertheless, I'm not unthrifty enough to disregard an opportunity to turn an honest penny, and the call was far from unwelcome. Even the modest holiday I planned can bite deeply enough into the financial foundation of an assistant professor's pittance. And the work sounded like one of these fairly lucrative and rather simple propositions.

"This is Court Strawn," the telephone announced. "I'm an experimental chemist, and I've completed a rather long series of experiments. I want them tabulated and the results analyzed; do you do that sort of work?"

I did, and acknowledged as much.

"It will be necessary for you to call here for your data," the voice continued. Strangely unctuous, that voice. "It is impossible for me to leave." There followed an address on West Seventieth Street.

Well, I called for data before. Generally the stuff was delivered or mailed to me, but his request wasn't extraordinary. I agreed, and added that I'd be over shortly. No use delaying my vacation if I could help it.

I took the subway. Taxis are a needless luxury to a professor, and a car of my own was an unrealized ambition. It wasn't long before I entered one of the nondescript brown houses that still survive west of the Avenue. Strawn let me in, and I perceived the reason for his request. The man was horribly crippled; his whole left side was warped like a gnarled oak, and he was hard put to hobble about the house. For the rest—stringy dark hair, and little tense eyes.

He greeted me pleasantly enough, and I entered a small library, while my host hobbled over to a littered desk, seating himself facing me. The deep-set eyes looked me over, and he chuckled.

"Are you a good mathematician, Dr. Aarons?" he asked. There was more than a hint of a sneer in his voice.

"My work has been satisfactory," I answered, somewhat nettled. "I've been doing statistical work for several years."

He waved a shriveled left hand.

"Of course—of course! I don't doubt your practical ability. Are you, however, well versed, in the more abstract branches—the theory of numbers, for instance, or the hyper-spatial mathematics?"

I was feeling rather irritated. There was something about the man—

"I don't see that any of this is necessary in statistical analysis of experimental results," I said. "If you'll give me your data, I'll be going."

He chuckled again, seeming hugely amused.

"As a matter of fact, Dr. Aarons," he said smirking, "the experiment isn't completed yet. Indeed, to tell the truth, it is just beginning."

"What!" I was really angry. "If this is your idea of a joke—" I started to rise, thoroughly aroused.

"Just a moment," said Strawn coolly. He leveled a very effective-looking blue-barreled automatic at me. I sat down again open-mouthed; I confess to a feeling of panic at the sight of the cripple's beady little eyes peering along the ugly weapon.

"Common politeness dictates that you at least hear me out, Dr. Aarons." I didn't like the oily smoothness of his voice, but what was I to do? "As I was saying, the experiment is just beginning. As a matter of fact, *you* are the experiment!"

"Eh?" I said, wondering again if the whole thing might not be a joke of some sort.

"You're a mathematician, aren't you?" Strawn continued. "Well, that makes you fair game for me. A mathematician, my good friend, is no more to me than something to be hunted down. And I'm doing it!"

The man was crazy! The realization dawned on me as I strove to hold myself calm. Best to reason with him, I thought.

"But why?" I asked. "We're a harmless lot."

His eyes blazed up with a fierce light.

"Harmless, eh, harmless! Well, it was one of your colleagues that did—this!" He indicated his withered leg with his withered arm. "He did this with his lying calculations!" He leaned forward confidentially. "Listen to me, Dr. Aarons. I am a chemist, or was once. I used to work with explosives, and was pretty good, too. And then one of you damned calculators figured out a formula for me! A misplaced decimal point—bah! You're all fair game, to me!" He paused, and the sneer came back to his lips. "That's simple justice, now, isn't it?"

Well, you can imagine how thoroughly horrified I was, sitting there facing a homicidal maniac with a loaded gun in his hand. Humor him! I'd heard that was the best treatment. Use persuasion, reason!

"Now, Mr. Strawn," I said, "you're certainly entitled to justice. Yes, you certainly are! But surely, Mr. Strawn, you are not serving the ends of justice by venting your anger on me! Surely that isn't justice."

He laughed wildly and continued.

"A very spacious argument, Dr. Aarons. You are simply unfortunate in that your name is the first in the classified section of the directory. Had your colleague given me a chance—any slightest chance to save my body from this that you see, I might be forgiving. But I trusted that fool's calculations!" He twisted his face again into that bitter leer. "As it is, I am giving you far more of a chance than I had. If, as you claim, you are a good mathematician, you shall have your opportunity to escape. I have no quarrel with the real students of figures, but only"—his leer became a very sinister scowl—"only with the dullards, the fakes and the blunderers. Yes, you'll have your chance!" The grin returned to his lips, but his eyes behind the blue automatic never wavered.

I saw no other alternative but to continue the ghastly farce. Certainly open opposition to any of his suggestions might only inflame the maniac to violence, so I merely questioned. "And what is the proposition, Mr. Strawn?"

The scowl became a sneer again.

"A very fair one, sir. A very fair proposition, indeed." He chuckled.

"I should like to hear it," I said, hoping for an interruption of some sort.

"You shall. It is just this: You are a mathematician, and you say, a good one. Very well. We shall put your claim to the test. I am thinking of a mathematical quantity, a numerical expression, if you prefer. You have ten questions to discover it. If you do so you are free as far as I am concerned. But if you fail"—his scowl reappeared—"well, if you fail I shall recognize you as one of the tribe of blunderers against whom I war, and the outcome will not be pleasant!"

Well! It was several moments before I found my voice, and began to babble protests. "But, Mr. Strawn! That's an utter impossibility! The range of numbers is infinite; how can I identify one with ten questions? Give me a fair test, man! This one offers not a chance in a million! In a billion!"

He silenced me with a wave of the blue barrel of his weapon.

"Remember, Dr. Aarons, I did not say it was a number. I said a numerical expression, which is a vastly wider field. I am giving you this hint without deducting a question; you must appreciate my magnanimity!" He laughed. "The rules of our little game are as follows: You may ask me any questions except the direct question, 'What is the expression?' I am bound to answer you in full and to the best of my knowledge any question except the direct inquiry. You may ask me as many questions at a time as you wish up to your limit of ten, but in any event I will answer not less than two per day. That should give you sufficient time for reflection"—again that horrible chuckle—"and my time too is limited."

"But, Mr. Strawn," I argued, "that may keep me here five days. Don't you know that by tomorrow my wife will have the police searching for me?"

A glint of anger flashed in the mad eyes. "You are not being fair, Dr. Aarons! I know you are not married! I checked up on you before you came here. I know you will not be missed. Do not attempt to lie to me; rather help me serve the ends of justice! You should be more than willing to prove your worth to survive as one of the true mathematicians." He rose suddenly. "And now, sir, you will please precede me through the door and up those stairs!"

Nothing to do but obey! The stubby gun in his hand was enough authority, at least to an unadventurous soul like myself. I rose and stalked out of the room at his direction, up the stairs and through a door he indicated. Beyond was a windowless little cell ventilated by a skylight, and the first glance revealed that this was barred. A piece of furniture of the type known as day-bed, a straight chair, a deep overstuffed chair, and a desk made up the furnishings.

"Here," said the self-appointed host, "is your student's cell. On the desk is a carafe of water, and, as you see, an unabridged dictionary. That is the only reference allowed in our little game." He glanced at his watch. "It is ten minutes to four. By four tomorrow you must have asked me two questions. Two questions, and have them well thought out! The ten minutes over are a gift from me, lest you doubt my generosity!" He moved toward the door. "I will see that your meals are on time," he added. "My best wishes, Dr. Aarons."

The door clicked shut and I at once commenced a survey of the room. The skylight was hopeless, and the door even more so; I was securely and ingloriously imprisoned. I spent perhaps half an hour in painstaking and fruitless inspection, but the room had been well designed or adapted to its purpose; the massive door was barred on the outside, the skylight was guarded by a heavy iron grating, and the walls offered no slightest hope. Abner Aarons was most certainly a prisoner!

My mind turned to Strawn's insane game. Perhaps I could solve his mad mystery; at the least, I could keep him from violence for five days, and something might occur in the interim. I found cigars on the desk, and, forcing myself to a degree of calm, I lit one and sat down to think.

Certainly there was no use in getting at his lunatic concept from a quantitative angle. I could waste all ten questions too easily by asking, "Is it greater or less than a million? Is it greater or less than a thousand? Is it greater or less than a hundred?" Impossible to pin the thing by that sort of elimination when it might be a negative number, a fraction or a decimal, or even an imaginary number like the square root of minus one—or, for that matter, any possible combination of these. And that reflection gave me my impulse for the first question; by the time my cigar had been consumed to a tattered stub I had formulated my initial inquiry. Nor had I very long to wait; it was just past six when the door opened.

"Stand away from the door, Dr. Aarons," came the voice of my host. I complied perforce; the madman entered, pushing before him a tea caddy bearing a really respectable meal, complete from bouillon to a bottle of wine. He propelled the cart with his withered left hand; the right brandished the evil automatic.

"I trust you have used your time well," he sneered.

"At least I have my first question," I responded.

"Good, Dr. Aarons! Very good! Let us hear it."

"Well," I continued, "among numbers, expressions of quantity, mathematicians recognize two broad distinctions—two fields in which every possible numerical expression may be classified. These two classifications are known as real numbers on the one hand, including every number both positive and negative, all fractions, decimals, and multiples of these numbers, and on the other hand the class of imaginary numbers, which include all products of operations on the quantity called 'e,' otherwise expressed as the square root of minus one."

"Of course, Dr. Aarons. That is elementary!"

"Now then—is this quantity of yours real or imaginary?"

He beamed with a sinister satisfaction.

"A very fair question, sir! Very fair! And the answer—may it assist you—is that it is either!"

A light seemed to burst in my brain! And student of numbers knows that only one figure is both real and imaginary, the one that marks the point of intersection between the real and imaginary numbergraphs. "I've got it!" The phrase kept running through my mind like a crazy drumbeat! With an effort I kept an appearance of calm.

"Mr. Strawn," I said, "is the quantity you have in mind zero?"

He laughed—a nasty, superior laugh that rasped in my ears.

"It is not, Dr. Aarons! I know as well as you that zero is both a real and imaginary number! Let me call your attention to my answer: I did not say that my concept was *both* real and imaginary; I said it was either!" He was backing toward the door. "Let me further remind you that you have eight guesses remaining, since I am forced to consider this premature shot in the dark as one chance! Good evening!"

He was gone; I heard the bar outside the door settle into its socket with a thump. I stood in the throes of despair, and cast scarcely a glance at the rather sumptuous repast he had served me, but slumped back into my chair.

It seemed hours before my thoughts were coherent again; actually I never knew the interval, since I did not glance at my watch. However, sooner or later I recovered enough to pour a tumbler of wine and eat a bite of the roast beef; the bouillon was hopelessly cold. And then I settled down to the consideration of my third question.

From Strawn's several hints in the wording of his terms and the answers to my first and second queries, I tabulated what information I could glean. He had specifically designated a numerical expression; that eliminated the x's and y's of algebraic usage. The quantity was either real or imaginary and was not zero; well, the square of any imaginary is a real number. If the quantity contained more than one figure, or if an exponent was used, then I felt sure his expression was merely the square of an imaginary; one *could* consider such a quantity either real or imaginary. A means of determining

this by a single question occurred to me. I scribbled a few symbols on a sheet of paper, and then, feeling a sudden and thorough exhaustion, I threw myself on the day-bed and slept. I dreamed Strawn was pushing me into a nightmarish sea of grinning mathematical monsters.

The creaking of the door aroused me. Sunbeams illumined the skylight; I had slept out the night. Strawn entered balancing a tray on his left arm, holding the ever-present weapon in his free hand. He placed a half dozen covered dishes on the tea-cart, removing the remains of the evening meal to his tray.

"A poor appetite, Dr. Aarons," he commented. "You should not permit your anxiety to serve the ends of justice to upset you!" He chuckled with enjoyment of his sarcasm. "No questions yet? No matter; you have until four tomorrow for your next two."

"I have a question," I said, more thoroughly awakened. I rose and spread the sheet of paper on the desk.

"A numerical quantity, Mr. Strawn, can be expressed as an operation on numbers. Thus, instead of writing the numeral '4' one may prefer to express it as a product, such as '2 × 2,' or as a sum, as '3 + 1,' or as a quotient, as '8 ÷ 2' or 8/2 or as a remainder, as '5 - 1.' Or even in other ways—as a square, such as 2^2, or as a root, such as $\sqrt{16}$ or $\sqrt[3]{64}$. All different methods of expressing the single quantity '4.' Now here I have written out the various mathematical symbols of operations; my question is this: Which if any of these symbols is used in the expression you have in mind?"

"Very neatly put, Dr. Aarons! You have succeeded in combining several questions in one." He took the paper from me, spreading it on the desk before him. "This symbol, sir, is the one used." He indicated the first one in my list—the subtraction sign, a simple dash!

And my hopes, to use the triviality of a pun, were dashed as well! For that sign eliminated my carefully thought-out theory of a product or square of imaginaries to form a real number. You can't change imaginary to real by addition or subtraction; it takes multiplication, squaring or division to perform that mathematical magic! Once more I was thoroughly at sea, and for a long time I was unable to marshal my thoughts.

And so the hours dragged into days with the tantalizing slow swiftness that tortures the condemned in a prison death house. I seemed checkmated at every turn; curious paradoxical answers defeated my questions.

My fourth query, "Are there any imaginaries in your quantity?" elicited a cool, definite "No." My fifth, "How many digits are used in this expression?" brought forth an equally definite "Two."

Now there you are! What two digits connected by a minus sign can you name whose remainder is either real and imaginary? "An impossibility," I thought. "This maniac's merely torturing me!" And yet—somehow, Strawn's madness seemed too ingenious, too clever, for such an answer. He was sincere in his perverted search for justice. I'd have sworn to that.

On my sixth question, I had an inspiration! By the terms of our game, Strawn was to answer any question save the direct one, "What is this expression?" I saw a way out! On his next appearance I met him with feverish excitement, barely waiting for his entrance to begin my query.

"Mr. Strawn! Here is a question you are bound by your own rules to answer. Suppose we place an equal sign after your quantity, what number or numbers will complete the equation: *What is the quantity equal to?*"

Why was the fiend laughing? Could he squirm out of that poser?

"Very clever, Dr. Aarons. A very clever question. And the answer is—anything!"

I suppose I shouted. "Anything! Anything! Then you're a fraud, and your game's a damnable trickery. There's no such expression!"

"But there is, Doctor! A *good* mathematician could find it!" And he departed, still laughing.

I spent a sleepless night. Hour after hour I sat at that hateful desk, checking my scraps of information, thinking, trying to remember fragments of all-but-forgotten theories. And I found solutions! Not one, but several. Lord, how I sweated over them! With four questions—two days—left to me, the solution of the problem began to loom very close. The things dinned in my brain; my judgment counseled me to proceed slowly, to check my progress with another question, but my

nature was rebelling against the incessant strain. "Stake it all on your last four questions! Ask them all at once, and end this agony one way or the other!"

I thought I saw the answer. Oh, the fiendish, insane cleverness of the man! He had pointed to the minus sign on my list, deliberately misled me, for all the time the symbol had meant the bar of a fraction. Do you see? The two symbols are identical—just a simple dash—but one use means subtraction and the other division! "1 - 1" means zero, but "1/1" means one! And by division his problem could be solved. For there is a quantity that means literally anything, real number or imaginary, and that quantity is "0/0"! Yes, zero divided by zero. You'd think offhand that the answer'd be zero, or perhaps one, but it isn't, not necessarily. Look at it like this: take the equation "2 × 3 = 6". See? That's another way of saying that two goes into six three times. Now take "0 × 6 = 0." Perfectly correct, isn't it? Well, in that equation *zero goes into zero six times*! Or "0/0 = 6"! And so on for any number, real or imaginary—zero divided by zero equals anything!

And that's what I figured the fiend had done. Pointed to the minus sign when he meant the bar of a fraction, or division!

He came in grinning at dawn.

"Are your questions ready, Dr. Aarons? I believe you have four remaining."

I looked at him. "Mr. Strawn, is your concept zero divided by zero?"

He grinned. "No, sir, it is not!"

I wasn't disheartened. There was just one other symbol I had been thinking of that would meet the requirement—one other possibility. My eighth question followed. "Then is it infinity divided by infinity?"

The grin widened. "It is not, Dr. Aarons."

I was a little panicky then! The end loomed awfully near! There was one way to find out if the thing was fraudulent or not; I used my ninth question:

"Mr. Strawn, when you designated the dash as the mathematical symbol used in your expression, did you mean it as the bar of a fraction or as the sign of subtraction?"

"As the subtraction sign, Dr. Aarons. You have one more question. Will you wait until tomorrow to ask it?"

The fiend was grinning in huge enjoyment. Thoroughly confident, he was, in the intricacies of his insane game. I hesitated in a torture of frenzied indecision. The appalling prospect of another agonized night of doubts decided me.

"I'll ask it now, Mr. Strawn!"

It *had* to be right! There weren't any other possibilities; I'd exhausted all of them in hour after hour of miserable conjecture!

"Is the expression—the one you're thinking of—infinity minus infinity?"

It was! I knew it by the madman's glare of amazed disappointment.

"The devil must have told you!" he shrieked. I think there were flecks of froth on his lips. He lowered the gun in his hand as I edged toward the door; he made no move to stop me, but stood in a sort of desolate silence until I gained the top of the stairway. Then—

"Wait a minute!" he screamed. "You'll tell them! Wait just a minute, Dr. Aarons!"

I was down the stairs in two leaps, and tugging at the door. Strawn came after me, his gun leveled. I heard it crash as the door opened and I slipped out into a welcome daylight.

Yes, I reported him. The police got him as he was slipping away and dragged him before an alienist. Crazy, but his story was true; he *had* been mangled in an experimental laboratory explosion.

Oh, the problem? Don't you see? Infinity is the greatest expression of number possible—a number greater than any conceivable. Figure it out like this:

The mathematician's symbol for infinity is a tipsy eight—so: ∞.

Well, take the question, ∞ + 6 = ∞. That's true, because you can't add anything to infinity that will make it any greater than it is. See? It's the greatest possible number already. Well then, just by transposition, ∞ - ∞ = 6. And so on; the same system applies to any conceivable number, real or imaginary.

There you are! Infinity minus itself may equal any quantity, absolutely *any* number, real or imaginary, from zero to infinity. No, there was nothing wrong with Court Strawn's mathematics.

[Transcriber's Note: The text incorrectly describes the square root of minus one as the quantity 'e'. This was left as printed. The correct term should be 'i'.]

[The end of *The Brink of Infinity* by Stanley G. Weinbaum]