

Issac Asimov

Getting the Combination

I ought to go through my mysteries and count up all the times I've had my characters choose a particular combination out of a number of alternatives. It just fascinates me and I'm not very good at it in real life.

Intelligence tests frequently stick you with a series of numbers and ask you to reason out what the next number ought to be. This is Mensa stuff (and Mensa is an organization of high-IQ people). To be sure, I'm a member of Mensa—the International Vice-President, in fact (a purely honorary position)—but I still have trouble with it.

In any case, I suppose all my Mensa readers will solve the following puzzle immediately—but I don't care.

Baranov arrived when the rest of us were already at the Union Club. He sat down with a triumphant air. "Is Griswold asleep?"

I looked in Griswold's direction and shrugged. "As asleep as he ever is."

"Well, forget him. Remember the time when he told us about solving a mystery by knowing that there was no number under a thousand which, when spelled out, contains the letter 'a'?"

Jennings and I both nodded.

"That got me to thinking. Look, there is an infinite array of numbers. Suppose you spell them out—the whole infinite array—"

"Can't be done," said Jennings. "How can you spell out every one of an infinite number?"

"In imagination," said Baranov impatiently. "Now arrange them all—the whole infinite set of them—in alphabetical order. Which number is first in line?"

Jennings said, "How can you tell unless you look at all the numbers? And how can you look at all of an infinite number?"

"Because there's a pattern to number names," said Baranov. "There may be an infinite set of numbers, but there are only a small number of ways in which their names are formed. The number first in line, alphabetically, is 'eight.' Nothing comes ahead of it. There's no number in the entire infinite array that starts with 'a,' 'b,' 'c,' or 'd,' and how do you like that?"

"What about 'billion'?" I said.

Baranov sneered at me elaborately. "That's not a number name. If you write the number 'one' followed by nine zeroes, that's not 'billion' starting with 'b'; that's 'one billion' starting with 'o.'"

And at this point, Griswold, without seeming to interrupt his soft snore, said, "And what's the last number in line?"

I thought rapidly and was the first to answer. "'Two.' There are no numbers

starting with any letter after 't,' and nothing past the 'w' in second place. The other 'tw's,' like 'twelve' and 'twenty' have an 'e' in third place and come ahead of 'two.'"

I felt that to be an excellent analysis considering that I did it so rapidly, but Griswold's eyes opened and he looked at me with infinite contempt. "You get zero," he said. "Let me tell you a story."

I have a friend [said Griswold] who likes to play with numbers. He's not a mathematician and has no talent for mathematics, any more than I have. Still, playing with numbers is fun even if you have no talent for it.

This friend of mine—his name is Archie Bates—used his hobby, in part, as a defense against boredom.

All of us, I suppose, have been trapped in an audience with a speaker delivering a particularly boring address, or with an orchestra playing some piece that does not grip us, or with a play turning out to be unexpectedly maladroit.

What do you do in such a case?

You might fall asleep, but that could be fraught with embarrassment if you are with others before whom you don't want to seem a clod. You might think deep thoughts, but suppose none come to mind?

Well, then, you might do as Bates would and play with numbers. He would count the chandeliers, or the lights, or the ornamental repetitions on the walls and ceilings and ring all the permutations upon the matter that he could. He found it (he frequently told me) the perfect antidote to boredom.

Or he would work up odd sequences of numbers according to some system and ask people to work out the system and predict the next number. He was never profound, you understand, but he was sometimes amusing. For instance, he once presented me with the series of Arabic digits, 8, 5, 4, 9, 7, 6, 3, 2, 0. He pointed out that every digit was included except 1, and asked me where 1 rightfully belonged.

It took me a while to realize he had placed the digits in alphabetical order, if each was spelled out, and that meant 1 belonged between 9 and 7. That was how I could so easily improve on Baranov's puzzle.

It was also possible for Bates's hobby to bring about discomfort and embarrassment, and at one time it did so.—Which brings up an important fact.

Most of the little cases I have presented you with are examples of high crimes: murder, espionage and so on. It is possible, however, to puzzle over something very small and insignificant—and even so that might annoy you and occupy your mind every bit as much as murder might. And, given friendship or interest, I have no objection to being of service in such cases, however minute in importance they might seem to outsiders.

Mrs. Bates called me one day in some agitation and asked me if I would be so kind as to come over at once. She had a problem and thought I might be able to help her. She doubted that anyone else could.

I am not proof against that kind of invitation.

When I arrived, she took me into Bates's study and showed me a safe. It was moderately large, strongly and sturdily made, and had a combination lock that included four dials, each with all the digits from 0 to 9. If each dial were turned so that the central row of the three that were exposed read some appropriate number, one to which the safe was keyed, the door would open. Otherwise it would not.

I said, "What is the problem, Mrs. Bates?"

Mrs. Bates said, "Archie got this safe last week. Why he wants it is more than I know, unless it amuses him to play with the combination. We have no valuables that wouldn't be better off in a bank vault, and we have no secrets that must be hidden away. But there it is."

"Well?"

"He has all our family records inside. I have to make out a check for something I should have made out a check for a month ago, but forgot. I have to get the check into the mail, and postmarked by midnight, or we will be involved in serious complications. The trouble is that I don't know the exact amount, or even the name and address of the people I must make it out to. Not offhand. For that matter, the checkbook is in the safe, too."

"Why is everything in the safe?"

"Because he's safe-happy, that's why. He's got the safe and he has to use it. It's so embarrassing."

"You've forgotten the combination, I suppose?"

"I never knew it. He never told me. I can't even call the company that made the safe, because Archie set up the combination himself."

"Why don't you telephone Archie?"

"I would, if I knew where he was. He's in Baltimore, but I don't know where. He usually writes up his itinerary and gives it to me, but this time, I think he just shoved it into the safe along with everything else."

"But what can I do, Mrs. Bates? I don't know the combination."

She said, "There's a hint. On the floor, right next to the safe, was a slip of paper. He must have dropped it and didn't notice that he had. On it is one of those series of numbers he plays with. You know the way he does that!"

"Yes, I do."

"Here it is, then."

She handed me a slip of paper on which seven numbers were written in a vertical column: 1, 2, 6, 12, 60, 420 and 840. Underneath the 840 was an asterisk and I knew that it was Bates's habit to use an asterisk to indicate the number that was to be guessed.

"What I think," said Mrs. Bates, "is that the next number in the series is the combination to the safe. He was probably working out one of his series—you know the way he is—and that gave him the idea of making the next number, whatever it is, the combination. The trouble is I don't know the next number. If you start with 1, you must multiply it by 2 to get 2, and that by 3 to get 6, then 2 again to get 12, then 5, then 7, then 2 again. I don't know what you're supposed to multiply 840 by."

I smiled a little and said, "It doesn't matter, Mrs. Bates. Just multiply 840 by each number from 2 to 9, and then try each product. It will take you only a few minutes. In fact, if you start with 0000 and try each number in order up to 9999, you will surely open the door eventually. If you try only one combination each second, you will go through the entire list in 2 3/4 hours and will probably open the door within an hour and a half. Then you can make out the check. This combination system is not a very good one, you see."

Mrs. Bates looked exasperated. "Oh yes, it is. Archie explained that to me. In this make, he said, if you set any combination *except* the right one, and try to open the door, the little number things freeze and can't be moved again until they are

unfrozen with a special magnetic key. Archie says that without the key the safe has to be blown open with an explosive.”

I said, “And your husband has the key with him, wherever he is, I suppose.”

She nodded. “That’s right, so I have to figure out the correct combination right off. I just don’t have the nerve to make a guess and try. If I’m wrong, then I have to call a locksmith. And even if a locksmith is willing to come right over and blow it open and I make out the check—which I should have done a month ago—the safe will be destroyed. I guess Archie would just about kill me.”

“But then what do you expect *me* to do?”

She sighed. “But isn’t it obvious? You’re always telling Archie about all the clever ways in which you solve crimes when the police and FBI are stuck, so can’t you just look at the series of numbers and tell me what the combination is?”

“But suppose I’m wrong. I may be clever but I’m not a superman,” I said, for as you gentlemen all know, if I have a fault at all, it is the possession of a certain excess of diffidence and modesty.

“I’m certain you’re not,” said Mrs. Bates coolly. “If you freeze it, however, Archie will have to take it out on you and what do you care?”

I wasn’t at all sure that it was safe for me not to care. Bates is a large man with a hair-trigger temper. I doubted that he would actually strike his wife, though he would surely storm at her and berate her mercilessly. I was not at all sure, however, that he might not grant me less consideration, and black my eye for me.

I will admit, however, that Mrs. Bates’s apparent certainty that I was not a superman rankled. *I* might say so, but I saw no reason for having her take the privilege. So I merely adjusted the four dials to the appropriate number, turned the handle and opened the door for her.

Then, with a rather chilly bow, I said, “Your husband will have no occasion for anger with either of us now,” and left.

Griswold snorted grimly at the conclusion of the tale and sipped gently at his scotch and soda. “I suspect you all saw the proper combination long before I completed the story.”

“Not I,” I said. “What is the combination, and how did you get it?”

Griswold snorted again. “Look at those numbers,” he said. “The larger ones look easy to divide evenly in a number of different ways. The first number, 1, can, of course, be divided only by 1 itself. The second number, 2, can be divided by 1 and 2. The third number, 6, can be divided evenly by 1, 2 and 3. In fact, it is the smallest number that can be divided by 1, 2 and 3, as you can easily check for yourself.”

“It can be divided by 6,” I pointed out.

“Irrelevant,” said Griswold. “I am speaking of the consecutive digits, beginning with 1, that will serve as divisors. The fourth number, 12, is the smallest number that can be divided by each of the first four digits, 1, 2, 3 and 4. It can also be divided by 6 and 12, but that is irrelevant.

“You see that the fifth number is 60. It can be divided evenly by 1, 2, 3, 4 and 5; and, as it happens, by 6 also. It is the smallest number that can be divided by each of the first six digits. The next number is divided evenly by all the digits from 1 through 7, and the final number 840, by all the digits from 1 through 8.

“The next number, which would be the combination, should therefore be the

smallest number that can be divided by all the digits from 1 through 9. If you multiply 840 by 3, the product is divisible by 9 and stays divisible by all the smaller digits. Since 840 multiplied by 3 is 2520, that is the combination. The number 2520 is the smallest number divisible by all the digits, 1 through 9, and, as a matter of fact, it happens to be divisible by 10 as well.—And there you are!”