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Inspector Craig Visits Transylvania

A week after these last adventures, Craig was preparing to return to London when he suddenly received a wire from the Transylvanian government, urgently requesting him to come to Transylvania to help solve some baffling cases of vampirism. Now, as I explained in my previous book of logic puzzles, *What Is the Name of This Book?*, Transylvania is inhabited by both vampires and humans; the vampires always lie and the humans always tell the truth. However, half the inhabitants, both human and vampire, are insane and totally deluded in their beliefs (just like the mad inhabitants of the asylum of Doctor Tarr and Professor Fether)—all true propositions they believe false and all false propositions they believe true. The other half of the inhabitants are completely sane and totally accurate in their judgments (just like the sane inhabitants of the asylums in Chapter 3)—all true statements they know to be true and all false statements they know to be false.

Of course, the logic of Transylvania is much more complicated than that of the lunatic asylums, because in the latter, the inhabitants are at least honest and make false statements only out of delusion, never out of malice. But when a Tran-

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sylvanian makes a false statement, it could be either out of delusion or out of malice. Sane humans and insane vampires both make only true statements; insane humans and sane vampires make only false statements. For example, if you ask a Transylvanian whether the earth is round (as opposed to flat), a sane human knows the earth is round and will truthfully say so. An insane human believes the earth is not round, and will then truthfully express his belief and say it is not round. A sane vampire knows the earth is round, but will then lie and say it isn't. But an insane vampire believes the earth is not round and then lies and says it is round. Thus an insane vampire responds the same way to any question as a sane human, and an insane human the same way as a sane vampire.

It was fortunate that Craig was as well versed in vampirism as in logic (the general range of Craig's interests and knowledge was quite remarkable altogether). When he arrived in Transylvania, he was informed by the authorities (all of whom were sane humans) that there were ten cases with which they needed help, and he was requested to take charge of the investigations.

THE FIRST FIVE CASES

Each of these cases involved two inhabitants. In each case, it was already known that one of them was a vampire and the other was human, but it was not known which was which (or perhaps I should say, which was witch). Nothing was known, except in Case 5, about the sanity of either.

1 ♦ The Case of Lucy and Minna

The first case involved two sisters named Lucy and Minna, and Craig had to determine which one of them was a vampire. As indicated above, nothing was known about the sanity of either. Here is the transcript of the investigation:

Craig (to Lucy): Tell me something about yourselves.

Lucy: We are both insane.

Craig (to Minna): Is that true?

Minna: Of course not!

From this, Craig was able to prove to everyone's satisfaction which of the sisters was the vampire. Which one was it?

2 ♦ Case of the Lugosi Brothers

The next case was that of the Lugosi brothers. Both had the first name of Bela. Again, one was a vampire and one was not. They made the following statements:

Bela the Elder: I am human.

Bela the Younger: I am human.

Bela the Elder: My brother is sane.

Which one is the vampire?

3 ♦ The Case of Michael and Peter Karloff

The next case involved another pair of brothers, Michael and Peter Karloff. Here is what they said:

Michael Karloff: I am a vampire.

Peter Karloff: I am human.

Michael Karloff: My brother and I are alike as far as our sanity goes.

Which one is the vampire?

4 ♦ The Case of the Turgeniefs

The next case involved a father and son whose surname was Turgenief. Here is the transcript of the interrogation:

Craig (to the father): Are you both sane or both insane, or are you different in this respect?

Father: At least one of us is insane.

Son: That is quite true!

Father: I, of course, am not a vampire.

Which one is the vampire?

5 ♦ The Case of Karl and Martha Dracula

The last case of this group involved a pair of twins, Karl and Martha Dracula (no relation to the count, I can assure you!). The interesting thing about this case is that not only was it already known that one of them was human and the other a vampire, but it was also known that one of the two was sane and the other insane, although Craig had no idea which was which. Here is what they said:

Karl: My sister is a vampire.

Martha: My brother is insane!

Which one is the vampire?

FIVE MARRIED COUPLES

The next five cases each involved a married couple. Now (as you may or may not know), in Transylvania it is illegal for humans and vampires to intermarry, hence any married couple there are either both humans or both vampires. In these

cases, as in Problems 1 through 4, nothing was known about the sanity of either person.

6 ♦ The Case of Sylvan and Sylvia Nitrate

The first case in this group was that of Sylvan and Sylvia Nitrate. As already explained, they are either both humans or both vampires. Here is the transcript of Craig's interrogation:

Craig (to Mrs. Nitrate): Tell me something about yourselves.

Sylvia: My husband is human.

Sylvan: My wife is a vampire.

Sylvia: One of us is sane and one of us is not.

Are they humans or vampires?

7 ♦ The Case of George and Gloria Globule

The next case involved the Globules.

Craig: Tell me something about yourselves.

Gloria: Whatever my husband says is true.

George: My wife is insane.

Craig did not feel that the husband's remark was overly gallant; nevertheless, these two testimonies were sufficient to solve the case.

Is this a human or a vampire couple?

8 ♦ The Case of Boris and Dorothy Vampyre

"It is important," said the Transylvanian chief of police to Inspector Craig, "not to let the last name of the suspects prejudice the issue."

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Here are the answers they gave:

Boris Vampyre: We are both vampires.

Dorothy Vampyre: Yes, we are.

Boris Vampyre: We are alike, as far as our sanity goes.

What kind of couple are we dealing with?

9 ♦ The Case of Arthur and Lillian Sweet

The next case involved a foreign couple (foreign to Transylvania, that is) named Arthur and Lillian Sweet. Here is their testimony:

Arthur: We are both insane.

Lillian: That is true.

What are Arthur and Lillian?

10 ♦ The Case of Luigi and Manuella Byrdcliffe

Here is the testimony of the Byrdcliffes:

Luigi: At least one of us is insane.

Manuella: That is not true!

Luigi: We are both human.

What are Luigi and Manuella?

TWO UNEXPECTED PUZZLES

11 ♦ The Case of A and B

Inspector Craig was relieved that all these unpleasant cases were over and was packing his things for his return to Lon-

don, when quite unexpectedly a Transylvanian official burst into his room, begging him to stay just one more day to help solve a new case that had just come up. Well, Craig certainly did not relish the idea; still, he felt it his duty to assist where possible, and he consented.

It appeared that two suspicious-looking characters had just been picked up by the Transylvanian police. They both happened to be prominent persons, and Craig has requested that their names and sexes be withheld, so I shall just call them A and B. In contrast to the previous ten trials, nothing was known in advance concerning any relationship between them; they might both be vampires or both be human, or one could be a vampire and the other human. Also, they could be both sane or both insane, or one could be sane and the other insane.

At the trial, A stated that B was sane, and B claimed that A was insane. Then A claimed that B was a vampire, and B declared that A was human.

What can be deduced about A and B?

12 ♦ Two Transylvanian Philosophers

Happy that these weird trials were over at last, Craig was comfortably seated in a Transylvanian railroad station awaiting the train that would take him out of the country. He so looked forward to being back in London! Just then he overheard a dispute between two Transylvanian philosophers, who were eagerly discussing the following problem:

Suppose there is a pair of identical Transylvanian twins, one of whom is known to be a sane human and the other an insane vampire. And suppose you meet one of them alone and wish to find out which one he is. Can any amount of

yes/no questions suffice to do this? The first philosopher maintained that no number of questions could possibly accomplish this, since either one would give the same answer as the other to any question asked. That is, given any question, if its correct answer is yes, the sane human will know the answer is yes and will truthfully answer yes; whereas the insane vampire will believe the answer is no and then lie and say yes. Similarly, if the correct answer to the question is no, then the sane human will answer no and the insane vampire, thinking the answer is yes, will lie and also say no. Therefore, the two brothers are indistinguishable in their outward verbal behavior, even though their minds work entirely differently. So, the first philosopher argued, no questions could tell them apart—unless, perhaps, given with a lie detector.

The second philosopher disagreed. Actually, he did not present any arguments to support his position; all he said was, "Let me interrogate one of those two brothers, and I'll tell you which one he is!"

Craig was curious to hear the outcome of the dispute, but just then his train pulled in and the philosophers did not board it.

Inspector Craig sat in his carriage for some time pondering as to which philosopher was right. He eventually realized that it was the second philosopher: if you met one of the twins, you could indeed find out by yes/no questions which of them you were addressing, and no lie detector was necessary. This then leaves two problems:

(1) What is the smallest number of questions you need to ask?

(2) More interesting yet, just what is wrong with the first philosopher's argument?

♦ SOLUTIONS ♦

There is a principle that will apply in several of the solutions that follow and which we will establish in advance—namely, that if a Transylvanian says he is human, then he must be sane, and if he says he is a vampire, then he must be insane. The reason is this: Suppose he says he is human. Now, his statement is either true or false. If his statement is true, then he really is human, but the only humans who make true statements are sane humans so in this case he is sane. If, on the other hand, his statement is false, then he is really a vampire, but the only vampires who make false statements are sane vampires (insane vampires make true statements, just like sane humans), so again he is sane. This proves that when a Transylvanian claims to be human, he must be sane, regardless of whether he is really human or not.

Suppose a Transylvanian claims to be a vampire; what follows? Well, if his claim is true, then he really is a vampire, but the only vampires who make true claims are insane vampires. If his claim is false, then he is in fact human, but the only humans who make false claims are insane humans; so in this case he is also insane. Thus, any Transylvanian who claims to be a vampire is insane.

We trust that the reader can verify for himself the fact that any Transylvanian who claims to be sane must in fact be human, and any Transylvanian who claims to be insane must in fact be a vampire.

Now let us turn to the solutions of the problems.

1 ♦ Lucy's statement is either true or false. If it is true, then both sisters are really insane; hence Lucy is insane, and the

only insane Transylvanian who can make a true statement is an insane vampire. So, if Lucy's statement is true, then Lucy is a vampire.

Suppose Lucy's statement is false. Then at least one of the sisters is sane. If Lucy is sane, then, since she has made a false statement, she must be a vampire (because sane humans make only true statements). Suppose Lucy is insane. Then it must be Minna who is sane. Also, Minna, by contradicting Lucy's false statement, has made a true statement. Therefore, Minna is sane and has made a true statement; so Minna is human, and again Lucy must be the vampire.

This proves that regardless of whether Lucy's statement is true or false, Lucy is the vampire.

2 ♦ We have already established the principle that any Transylvanian who says he is human must be sane and any Transylvanian who says he is a vampire must be insane (see discussion prefacing the solutions). Now, both the Lugosi brothers claim to be human; therefore, they are both sane. Therefore, Bela the Elder makes a true statement when he says that his brother is sane. So Bela the Elder is both sane and makes true statements; hence he is human. Therefore, it is Bela the Younger who is the vampire.

3 ♦ Since Michael claims to be a vampire, he is insane, and since Peter claims to be human, he is sane. So Michael is insane and Peter is sane; thus the two brothers are *not* alike as far as their sanity goes. Therefore, Michael's second statement is false, and since Michael is insane, he must be human (insane vampires don't make false statements!). Therefore, Peter is the vampire.

4 ♦ Father and son agree in answering the question about their sanity. This means that they either both make true

statements or both make false statements. But, since only one of them is human and the other is a vampire, they must necessarily be different as regards their sanity: If they are both sane, the one who is human would make true statements and the vampire would make false statements, and they could never agree; if they are both insane, the human would make false statements and the vampire would make true statements, and again they could not agree. Therefore, it is really true that at least one of them is insane. This proves that both of them make true statements. Then, since the father says he is not a vampire, he really isn't. So it is the son who is the vampire.

5 ♦ Suppose Martha is the vampire. Then Karl is human, and also Karl has made a true statement; hence Karl in this case has to be a sane human. This would make Martha an insane vampire, since, as we have been told, Karl and Martha are different as regards their sanity. But then Martha, an insane vampire, would have made a false statement—that Karl is insane—which insane vampires cannot do. Therefore, the assumption that Martha is a vampire leads to a contradiction. So it is Karl who is the vampire.

We can also determine their sanity or lack of it: Karl has made a false statement; hence, being a vampire, he is sane. But then Martha has also made a false statement; hence, being human, she is insane. So the complete answer is that Karl is a sane vampire and Martha is an insane human; Karl is lying when he says that his sister is a vampire, and Martha is deluded when she says that her brother is insane. (Quite a pair, even for Transylvania!)

6 ♦ Now we are in the situation where either both are vampires or both are human. Therefore, the first two statements cannot both be right, nor can they both be wrong (for if they

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are both wrong, Sylvan would be a vampire and Sylvia would be human). So one of the two statements is right and one is wrong. This means that one of the two people is sane and the other insane (because if they were both sane, their statements would both be right if they were human, and both wrong if they were vampires). Therefore, Sylvia is right when she says that one of the two is sane and the other insane. This means that Sylvia makes true statements. Therefore her statement that her husband is human is true. This means that they are both human (and, incidentally, Sylvia is sane and Sylvan insane).

7 ♦ Gloria, in saying that whatever her husband says is true, is assenting to his claim that she is insane; in other words, Gloria is indirectly claiming to be insane. Only vampires can make such a claim (as we proved in the discussion preceding the solutions); hence Gloria must be a vampire. Therefore, they are both vampires.

8 ♦ Suppose they are human. Then their statements that they are both vampires are false, which means they are insane humans. That would mean that they *are* alike as far as their sanity goes; hence Boris's second statement is true, which is not possible for an insane human. Therefore, they cannot be human; they are vampires (and insane ones).

9 ♦ Suppose they are human. A sane human couldn't possibly say that he/she and someone else are both insane hence they would both have to be insane humans. Then you would have insane humans making the true statement that they are both insane, which is not possible. Therefore, they cannot be human; they are vampires. (They could be either sane vampires who lie when they say that they are insane, or insane

vampires making the true statement that they are insane. Remember that insane vampires always make true statements, although they don't intend to!).

10 ♦ Luigi and Manuella contradict each other; one of them must be right and the other wrong. Therefore, one of them makes true statements and the other makes false statements. Since they are either both human or both vampires, then it must be true that at least one of them is insane, because if they are both sane, then they would either both make true statements if they were human or both make false statements if they were vampires. So Luigi is right when he says that at least one of the two is insane. Therefore, Luigi makes true statements, and when he says that they are both human, he is right about that, too. This proves that they are both human (and, incidentally, that Luigi is sane and Manuella insane).

11 ♦ Let us call a Transylvanian *reliable* if he makes correct statements and *unreliable* if he makes incorrect ones. Reliable Transylvanians are either sane humans or insane vampires; unreliable Transylvanians are either insane humans or sane vampires. Now, A claims that B is sane, and also that B is a vampire. A's two claims are either both true or both false. If they are both true, then B is a sane vampire, which means that B is unreliable. On the other hand, if A's claims are both false, then B must be an insane human, which again means that B is unreliable. So in either case (whether A's claims are both true or both false), B is unreliable. Hence B's claims are both false and A is neither insane nor human; therefore, A must be a sane vampire. This also means that A is unreliable; so A's claims are both false, which means that B must be an insane human. So the answer is that A is a sane vampire and B is an insane human.

Incidentally, this problem is only one out of sixteen of a similar nature that could be devised and that all have unique solutions. The *combination* of whatever two statements A makes about B (one about his sanity and one about his human or vampire nature) with any two statements of B about A (one about A's sanity and the other about his nature)—and there are sixteen possibilities for these four statements—will uniquely determine the precise character of both A and B. For example, if A says B is human and B is sane, and B says A is a vampire and A is insane, the solution will be that B is a sane human and A is an insane vampire. Again, suppose A says B is sane and B is a vampire, and B says A is insane and A is a vampire. What are A and B? *Answer:* A is a sane human and B is a sane vampire.

Have you seen how to solve each of these sixteen possible problems and why each one must have a unique solution? If not, look at it this way: A can make four possible pairs of statements about B—namely, (1) B is sane; B is human. (2) B is sane; B is a vampire. (3) B is insane; B is human. (4) B is insane; B is a vampire. In each of the four cases, we can determine whether or not B is reliable. In Case 1, B must be reliable regardless of whether A's statements are both true or both false—because if both are true, B is a sane human and hence reliable; if both are false, B is an insane vampire, hence again reliable. Likewise in Case 4, B must be reliable. In Cases 2 and 3, on the other hand, B must necessarily be unreliable. So from A's statements we can always determine the reliability of B. In a similar manner, from B's two statements we can determine the reliability of A. Then, when we know the respective reliabilities of A and B, we know which of all four statements are true and which are false, and the problem is then solved.

I might also remark that if, instead of A and B each making

two statements about the other, each made a *conjunction* of them, the problem would be unsolvable. If, for example, instead of making two separate statements—"B is sane," "B is a vampire"—A said, "B is a sane vampire," we could deduce nothing about the reliability of B; this is because if A's statement is correct, B *is* a sane vampire, but if A's statement is incorrect, B could be either an insane vampire or a sane human or an insane human.

12 ♦ One question is enough! All you need ask him is, "Are you human?" ("Are you sane?" would also work, and "Are you a sane human?" as well.) So suppose you ask him, "Are you human?" Well, if the one you are addressing is the sane human, he of course will answer yes. But suppose you are addressing the insane vampire. Being insane, he will erroneously believe he is human and then, being a vampire, will lie and say no. So the sane human will answer yes and the insane vampire will answer no. Therefore, if you get yes for an answer, you will know that he is the sane human, and if you get no for an answer, you will know that he is the insane vampire.

Now, more interesting yet, what was wrong with the first philosopher's argument? The first philosopher was certainly right in that if you ask the two brothers the same question, you will get the same answer. What the philosopher didn't realize was that if you ask, "Are *you* human?" to each of the two brothers, you are not actually asking the same question but rather two *different* questions, because the question contains the variable word *you*, whose meaning depends on the person to whom the question is addressed! So, even though you utter the same words when you put the question to two different people, you are really asking a different question in each case.

To look at it another way: Suppose the names of the two

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brothers are known—John, say, is the name of the sane human, and Jim the name of the insane vampire. If I ask either brother, “Is John human?” both brothers will reply yes because I am now putting the *same* question to each; similarly, if I ask, “Is Jim human?” both brothers will answer no. But if I ask each brother, “Are *you* human?” I am really asking a different question in each case.