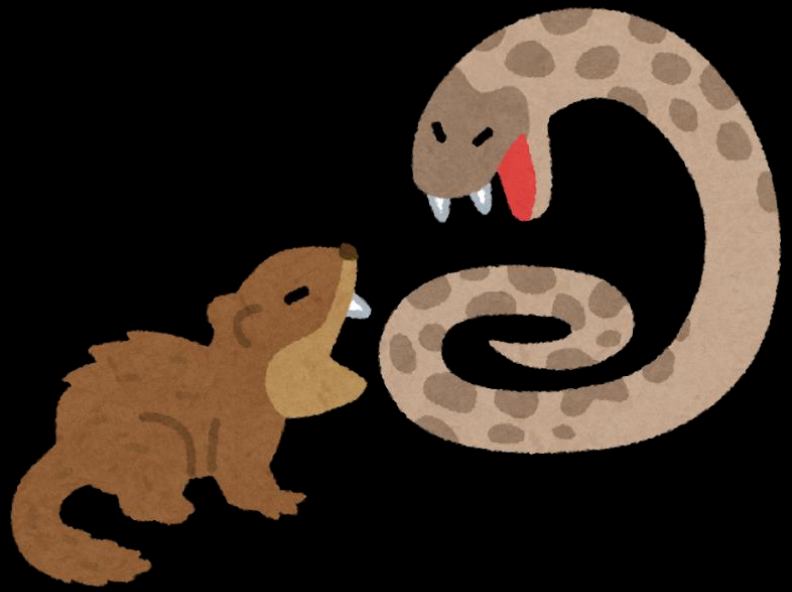
Raven Paradox

(Hempel's ravens)

Psychology of misunderstand

Complete solution



Raven Paradox (Hempel's ravens)

Contrapositive

"If A, then B"

"All ravens are black"

Contrapositive

“If not B, then not A”

"All non-black things are not ravens"

If you examine all the things in the world
that are not black and find that they do not include ravens,
then you can prove that ravens are black.

I find it strange that you can prove the color of ravens
without examining a single one.

A great detective completely solves Raven paradox (Hempel’s ravens).
He not only explains what is correct, but also the psychology of why it is wrong.
The story is about trying to prove the proposition "All ravens are black".
The contrapositive of "If A, then B" is "If not B, then not A".
I'm sure you learned in math class that if the contrapositive is true, then the original proposition is also true.
If the contrapositive "All non-black things are not ravens" is true, then "All ravens are black" is also true.
If you examine all the non-black things in the world and find that they do not include ravens, you can prove that ravens are black.
However, it seems strange that you can prove the color of ravens without examining a single crow.
This is Hempel’s raven paradox.

Raven Paradox (Hempel's ravens)

Contradiction

Assume there are no ravens in the room.

Search the room for everything that isn't black. → Proof that "the ravens in the room are black"

contradiction?

Search the room for everything that isn't white. → Proof that "the ravens in the room are white"

The only thing that was proven was the color of the 0 ravens present in the room.

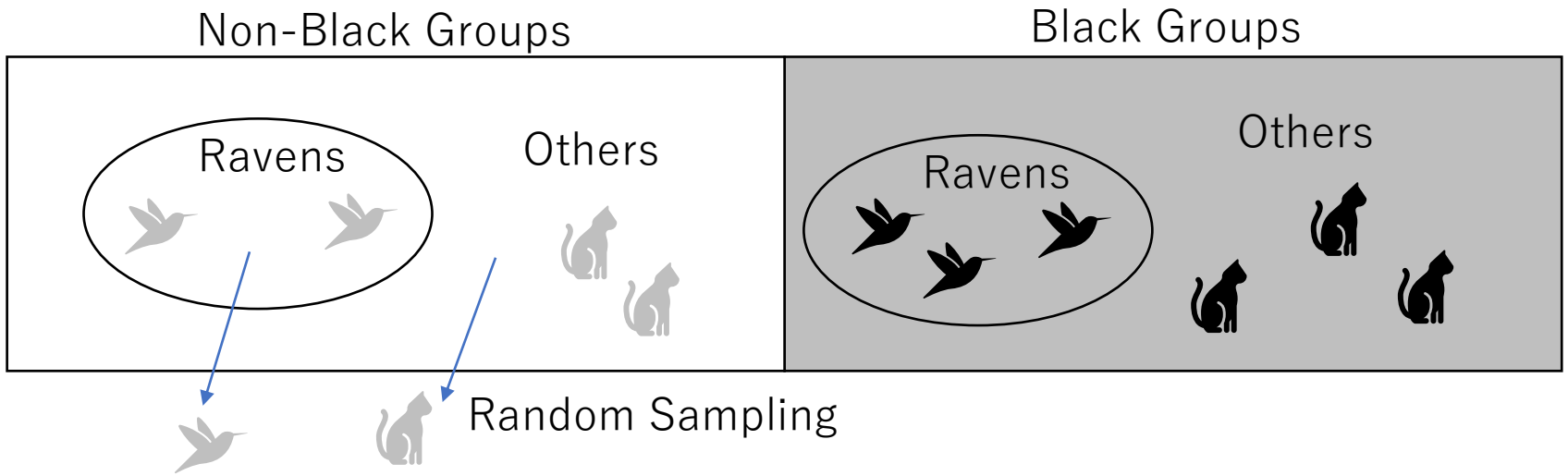
There is no contradiction no matter what color the 0 ravens are, so both proofs are correct.

Assume there are no ravens in the room.
If we examine all the objects in the room that are not black, we can prove that "the ravens in the room are black".
If we examine all the objects in the room that are not white, we can prove that "the ravens in the room are white".
It seems like black and white is a contradiction.
If there were ravens in the room, what color would they be?
Only the color of the 0 ravens in the room has been proven.
There is no contradiction regardless of the color of the 0 ravens, so both proofs are correct.
If one or more ravens are added, there is no contradiction as we have not proven anything about their color.

Raven Paradox (Hempel's ravens)

If you can’t examine everything

Would it be fair to say that the more non-black objects
we observe that are not ravens, the higher the probability that ravens are black?



The ratio of ravens to other things in the "non-black" group can be estimated.

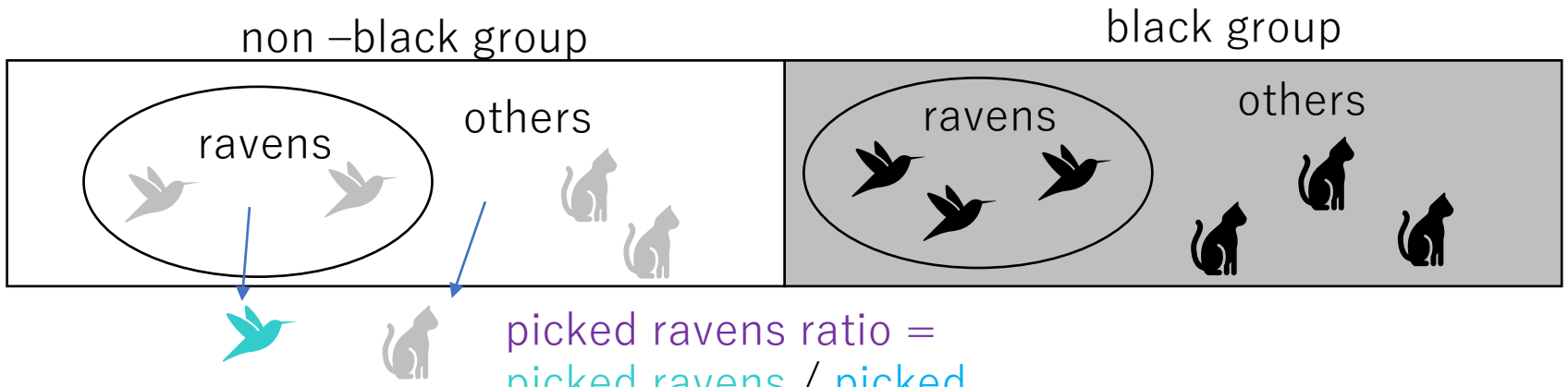
In reality, it would be difficult to examine all objects.
Can we say that the more non-black objects we observe that are not ravens, the higher the probability that ravens are black?
Suppose all objects are separated into two groups, "black" and "non-black".
We don't know how many ravens are in each of the two groups.
Our goal is to find the proportion of ravens in the "black" group.
We will randomly select objects from the "non-black" group and examine them to see if they are ravens.
We can then estimate the ratio of ravens to other objects in the "non-black" group.

Raven Paradox (Hempel's ravens)

If you can't examine everything

- total "non-black"
- total ravens

Necessary for estimating the color ratio of ravens



picked ravens ratio =
picked ravens / picked

total non-black ravens =
picked ravens +
(total non-black - picked)
× picked ravens ratio

total black ravens
= total ravens – total non-black ravens

If we know the total number of "non-black" and the total number of ravens, we can estimate the ratio of ravens color.
If we know the total number of "non-black", we can find the remaining numbers that were not randomly selected.
The number of "non-black" ravens is the number of ravens picked plus the number of "non-black" ravens remaining.
The number of remaining ravens can be calculated from the total number of "non-black" ravens and the ratio of ravens picked.
Meanwhile, the number of "black" ravens can be found by subtracting the number of "non-black" ravens from the total number of ravens.
Now we know the ratio of "non-black" to "black" ravens color.

Raven Paradox (Hempel's ravens)

Required Number

To infer from the contrapositive, we need two numbers.

(1) The total number of things we want to infer.

(2) The total number of things included in the contrapositive, including things other than the things we want to infer.

There is an exception if, after checking everything, there is not a single thing we want to infer.

I found that there were zero "non-black" ravens.

The ratio of "non-black":"black" is 0:X.

As long as we know that the total number of ravens in (1) is not 0, we can see that the ratio of "black" is 100%.

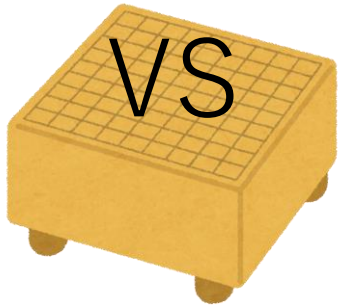
We have seen that to make an inference from a contrapositive, we need the following two numbers.
(1) The total number of things we want to infer.
(2) The total number of things included in the contrapositive, including things other than the things we want to infer.
However, there is an exception if, after checking everything, there is not a single thing we want to infer.
Checking everything means that we know the number in (2).
I found that there were zero "non-black" ravens.
The ratio of "non-black":"black" is 0:X.
As long as we know that the total number of ravens in (1) is not 0, we can see that the ratio of "black" is 100%.

Raven Paradox (Hempel's ravens)

Undefeated Legend

Habu master

Shogi



Mongoose master

Lose 1 out of 3 times

I played against famous master 3 times.

Me

Undefeated

Which is stronger?

By the way, I have played three unofficial matches against a very famous shogi master.
Amazingly, I am undefeated against the famous Habu master, even though these are unofficial matches.
Even the famous Mongoose master has lost to Habu master one in three matches.
When comparing myself to the Mongoose master, I seem stronger because I am undefeated.
This is the paradox.
I only said that I have played against a very famous master three times, but I did not say that I played against the Habu master.
That's all.

Contact Information

For inquiries,

please contact us here.

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