

The Cat and the Squirrel: Fundamentals of Communication

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Three Cases of a Radio Path:

- 1. The physical detection of a signal**
- 2. Unidirectional information transfer**
- 3. The dialog**

1. The physical detection of a known signal

There is no decision at the receiving end between different possible outcomes of a demodulator or decoder.

The physical detection of a signal and its identification is a one-bit gain of information at the receiving end but this information is not transferred via the radio path

2. Unidirectional digital information transfer

Information is communicated by using different signals.

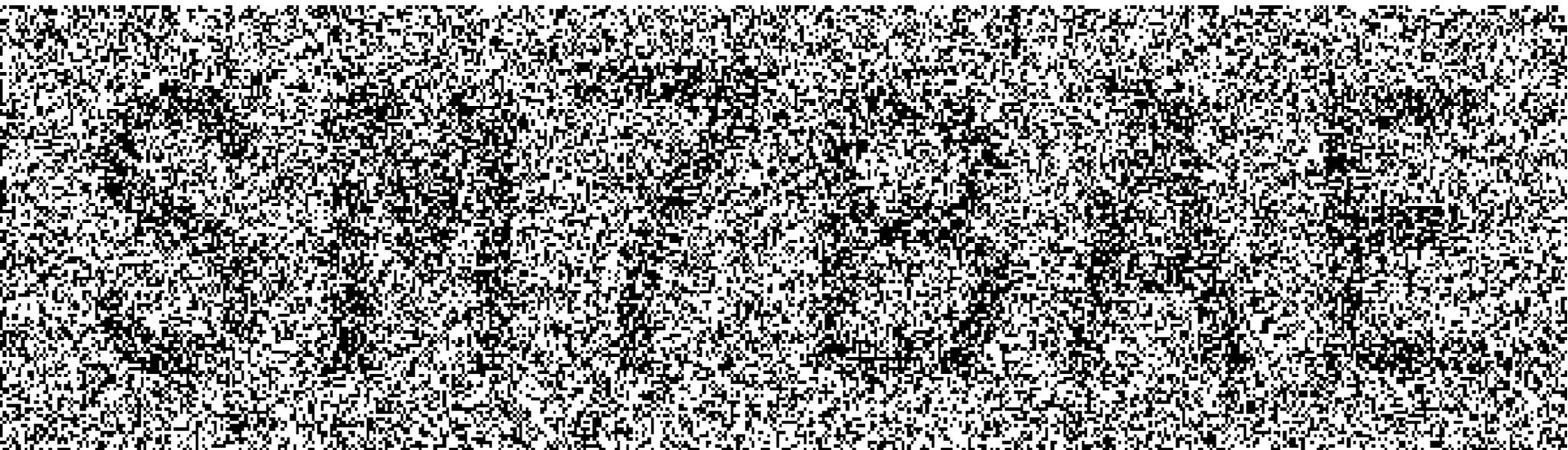
The receiving station, in principle, knows these signals, but it does not know which signals actually are sent.

The information is received by making decisions, which of the signals most probably is sent.

The amount of information is not larger than the base-two logarithm of the number of possible choices.







The number of different symbols is 37

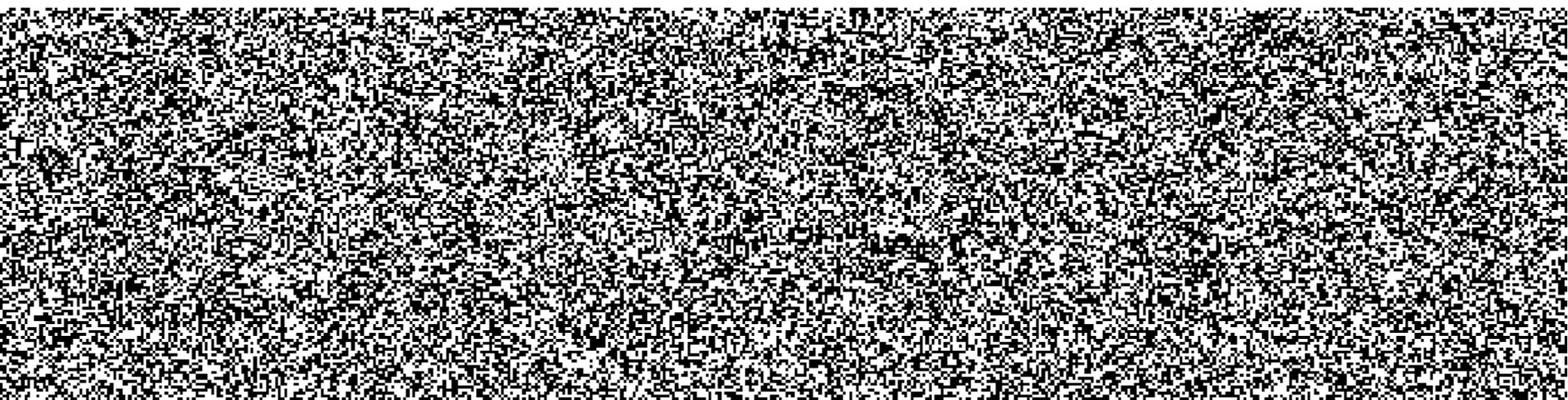
Therefore the information content of a symbol is

$$\log_2(37) = 5.2$$

The number of different combinations of 6 symbols is 37^6

Therefore the information content of a callsign is

$$\log_2(37^6) = 6 \log_2(37) = 31.2$$



Can you read the callsign?

If you know that it is either "EA3DXU" or "SM7BAE" then the correlation says that it is "EA3DXU" at a confidence of 99.9%

In the latter case we do not receive "Echo Alpha Three ..."
We only receive the one bit information that the symbol
"EA3DXU" fits better than the symbol "SM7BAE"

3. The dialog

*A squirrel searched for nuts on the ground three meters away from any tree.
The cat saw it and sneaked nearer and nearer.
But just at a critical distance, the squirrel saw the cat.
It only raised up and looked at the cat.
The cat immediately raised up too and started to lick it's leg.
The squirrel, seeing this, resumed searching for nuts.*

C tries to hide (inverse CQ de C)
S says: Now I know that you want to catch me (C de S)
C says: Now I know that you know that I am here (S de C)
S says: Now I know that you know that I will escape (RRR)

This is a basic dialog

Meta-Knowledge

Meta-knowledge is knowledge of **A** about the knowledge of **B** :

I know that you got my callsign and report

It is this meta-knowledge which steps the QSO forward

A dialog is founded on meta-knowledge

state message

state message

(A1) CQ AAAAA

(B1) AAAAA BBBBB

(A2) BBBBB AAAAA OOO

(B2) AAAAA BBBBB RO

(A3) BBBBB AAAAA RRR

(B3) AAAAA BBBBB 73

The OOO, RO, RRR, and 73 are codings for the state. They are solely sent to increase the meta-knowledge at the other end. The information on the state of the contact at the other end is the basic QSO-information which must be communicated.

If state information is communicated on a bypass (internet, telephone etc.) then the dialog runs on that bypass, and the radio contact is degraded to a physical experiment without information transfer.

If there is no decision on the state at the other end then there is no chance to make wrong decisions.

The EME-operator's skill is his ability to make reliable decisions.

Patience as the ability to endure the lack of any knowledge, what's going on at the other end, is quite different from the patience of two operators who wait for a signal to come up out of the noise while they are intensively communicating via the internet.

QSO-Rule

- (1) Both callsigns have to be transferred over the radio path in both directions.*
- (2) A report – of which kind whatsoever – has to be transferred in both directions.*
- (3) Both stations must get a confirmation from the other end about (1) and (2).*

This rule claims for *two types of basic requirements* (my personal reading):

- (a) **The transfer of a considerable non-trivial message** in either direction for mutual identification (requirement 1)*
- (b) **The successful realization of a dialog exclusively via the radio path** with at least four very simple transmissions in sequence to satisfy requirements 1 ... 3 .*

Conclusion

A radio contact that is assisted by a bypass to communicate state information is not a two-way radio QSO.

It is based on a dialog via the bypass.

The radio waves only are subject to a physical experiment.

The most important part of the communication, the handshake, then is done via the bypass.