

# COMMUNICATION THEORY & INFORMATION THEORY

## Systems Analysis

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# Outline

1 Communication

2 Information Theory



# Outline

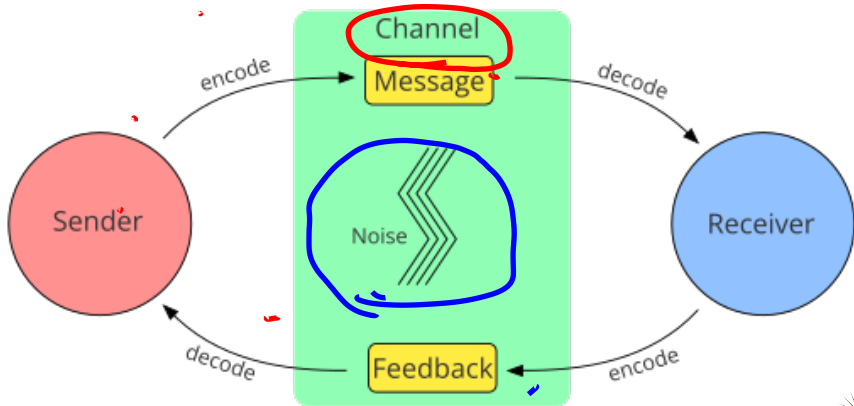
1 Communication

2 Information Theory



# Communication Theory

**Communication theory** defines the amount of transmitted information in terms of the conditional probabilities.



# Communication Model

The **communication model** involves next elements:

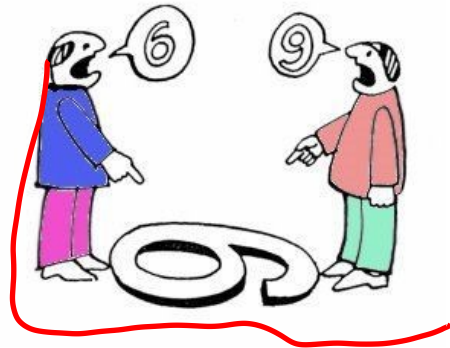
- **Sender**: the source of the message.
- **Receiver**: the destination of the message.
- **Channel**: the medium used to transmit the message.
- **Message**: the information to be transmitted.
- **Noise**: the interference in the communication process.
- **Feedback**: the response from the receiver.
- **Context**: the situation where the communication occurs.
- **Code**: the language used to encode the message.



# Misinformation

The **false information** is a problem due to the lack of verifications.

→ NO verification  
→ NO feedback



# What if ...?

The **probability** of failures is pretty tricky.

$$P(\text{fail-channel}) = x$$

$$P(\text{Fail-encode}) = y$$

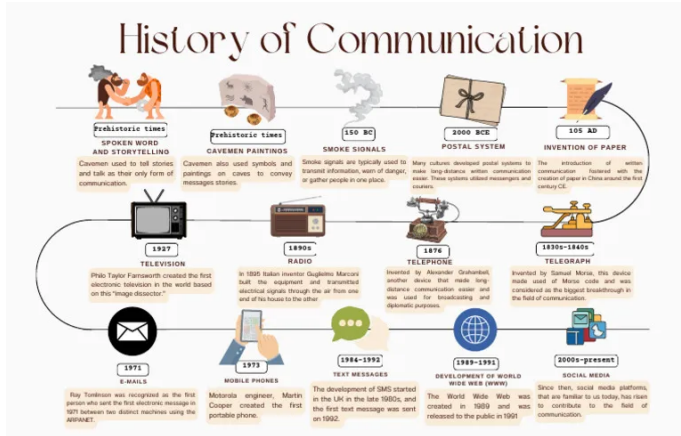
$$P(\text{fail-decode}) = z$$

$$P(\text{fail-misunderstood}) = a$$



# History

S.F. Scudder proposed **Communication Theory** in 1980. The main idea is: *all living beings existing on the planet communicate.*





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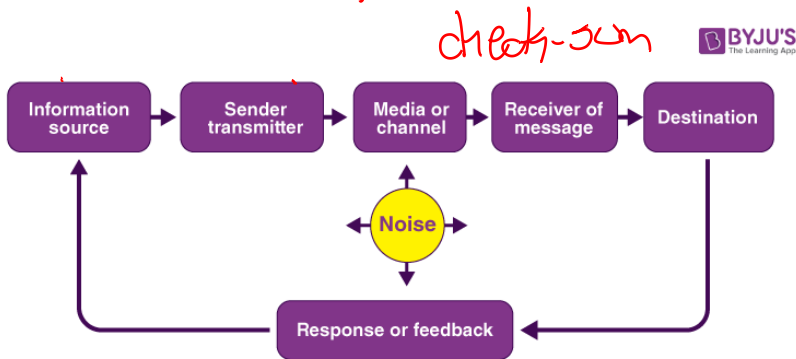
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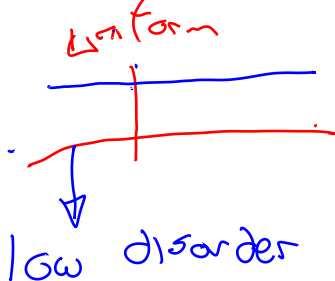
# Definition

**Information theory** is a mathematical point of view related to quantification, storage, and transmission of information. It supports the **communication theory**.



# Entropy

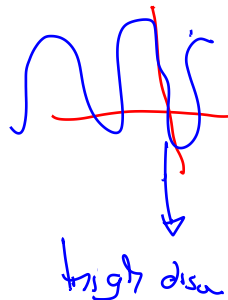
- **Entropy** is the measure of the uncertainty of a random variable.
- It is the average amount of information produced by a random variable.
- It is the measure of the disorder of a system.



low entropy



entropy good



high entropy



# Use Cases of Entropy in Information Theory

- **Data Compression:** the entropy is used to compress data efficiently without losing information.
- **Cryptography:** the entropy is used to generate secure keys for encryption.
- **Machine Learning:** the entropy is used to measure the uncertainty of a model.
- **Signal Processing:** the entropy is used to measure the information in a signal.

~~AAA BABAA~~

AD BABD

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# Thanks!

## Questions?



Repo: <https://github.com/EngAndres/ud-public/tree/main/courses/systems-analysis>

