First abstract setup: two random variables: X and Y

Let X - (Source) and Y (Destination) be two random variables ranging over collections. Both can be interpreted in many ways, but for cognitive science applications Source will be an external (internal) source having some variability H (entropy) and Destination a collection of possible objects, such as types, actions, etc.

In any abstract setup there always is symetrical measure of information relation between the two. Mutual information $I(A;B)$ as reduction in uncertainty

$$I(A;B) \; = \; H(A) - H(A|B) \; = \; H(B) - H(B|A)$$

Mutual information is the drop in entropy of one variable once the other is known.

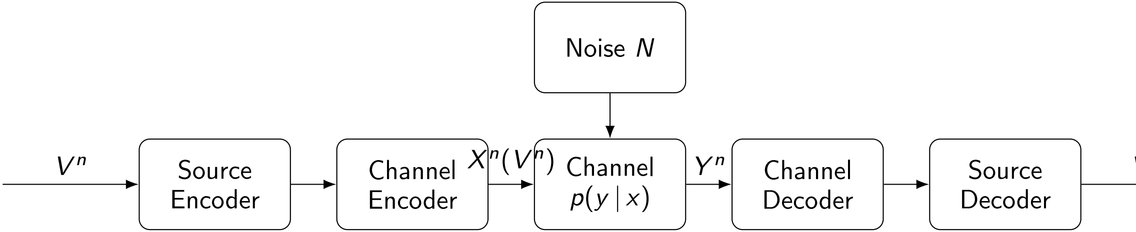
This way of speaking about introduces the psychological aspect of theory of information (uncertainty , surprise, knowledge) Mutual information as expectation over the joint distribution

$$I(A;B) \; = \; \sum_{a \in \mathcal{A}} \sum_{b \in \mathcal{B}} p(a,b) \log \frac{p(a,b)}{p(a)\, p(b)}$$

Computed directly from the joint and marginal probabilities of the variables.

Shannon pipeline with source and channel coding separation

The Shannon pipeline with source and channel encoding / decoding parts: communication model



Cover and Thomas, 2006