Any historical discussion of Markov Processes must first focus on the russian mathematician, Andrei Markov, after whom the concept was named. In his early years, Andrei had to persevere through poor health, only being able to walk with the assistance of crutches during his childhood. Despite his handicap, during his schooling he was able to demonstrate an innate talent for math, writing his first paper in secondary school on the integration of linear differential equations. Such precocious work got the attention of two professors at St. petersburg university where Markov would go on to gain his doctorate and teach as a professor working alongside Pafnuty Chebyshev.

During his time at the university, Markov studied sequences of mutually dependent variables which led him to the topic for which he is particularly remembered, Markov chains. His work in this area gave way to a novel branch of probability theory and preempted the theory of stochastic processes. Following Markov’s work in the area, Norbert Wiener would be the first to rigorously develop a continuous Markov process where Andrei Kolmogorov would go on to lay the foundations of Markov random processes as a theory.

When markov processes are examined in discrete time, they may be referred to as markov chains. Markov chains are sequences of random variables where subsequent variables are determined by their immediate predecessor, but are independent of where the predecessor originated. In its simplest form, markov chains apply to a system where one of a number of states {S1, S2, · · · , Sn} can transition from one state to another. The probabilities associated with such a transition from Si to Sj is an n × n matrix (pij ) which is appropriately named the Markov transition matrix. The distinctive property where the following state depends on the current state can easily be seen in the transition matrix where any pair of states is associated with a specified probability.

When generalized to measure-theoretic perspective, markov processes can be defined as follows:

Given:



* A filtration on 
* State Space
* A stochastic process Xt is adapted to w.r.t. a filtration Ft

Then:

The stochastic process Xt on the state space is called a markov process if and only if



Given that, it may also be implied that





Where ps,t is the transition probability from state s to t

It can be seen that Markov process dynamics are entirely described through its transition function. This provides extreme convenience as new probability measures need only be conditioned on the previous state. This is in stark contrast to a general case where a new measure would have to be used for each period depending on all previous states.

Markov processes are a powerful concept and still remain an active area of research today. Common applications seen in the real-world may be found in various natural language processing applications, aspects of Google’s PageRank formula, , and especially areas of finance.

Bib:

J J O'Connor, and E F Robertson. “Andrei Andreyevich Markov - Biography.” Maths History, University of St Andrews, Scotland, Aug. 2006, mathshistory.st-andrews.ac.uk/Biographies/Markov/.

Debnath, Lokenath & Basu, Kanadpriya. (2015). A short history of probability theory and its applications. International Journal of Mathematical Education in Science and Technology. 46. 10.1080/0020739X.2014.936975.

Eberle, Andreas. Markov Processes. 15 Mar. 2015, wt.iam.uni-bonn.de/fileadmin/WT/Inhalt/people/Andreas\_Eberle/MarkovProcesses/MPSkript1415.pdf.

Daruich, Diego. Notes on Measure Theory and Markov Processes. 2014, ddaruich.weebly.com/uploads/3/8/1/2/38127151/measure\_theory\_notes.pdf.