The Ontology of Randomness

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INTRODUCTION

"Random" commonly is associated with determinism, order, prophecy, and the future. Starkly put by one philosopher, "Randomness is unpredictability" (Eagle, 2005), quoting mainstream logician Suppes in saying "Phenomena that we *cannot predict* must be judged *random"* (Suppes, *1984, p. 32).* People rely upon uncertainty (encryption and defeating bias). Tables of random numbers are based on the supposition that humans subconsciously create patterns and cannot generate randomness. Gambling casinos are about the "luck of the draw". Human survival depends on remembering patterns of past events in order to adapt to the changing environment, as well as on randomness in science.

Our focus is not only on considering whether randomness exists, i.e., ontology, but the reason for it. Turmoil in the field of experts is expressed by "… there is no such thing as a random number - there are only methods to produce random numbers..." (Von Neumann, 1951; Fiorini and De Giacomo, 2014, p. 5). How can one create something that cannot exist? Yet, at the most basic building block level of existence, Planck scale, there is inherent uncertainty (perhaps immanent in the macro world) with which persons have difficulty accepting.

A new view of randomness will be presented here, based on the often neglected philosophy of dialectics, apprehension of something in terms of what it is not, a process understanding, rather than one of identifying objects.

This short space allows only a small sampling of approaches to the ontology of randomness for the reader to explore in depth through cited references. If one can begin to think beyond the mechanics (as in random number generators) then this encyclopedia entry will have accomplished its purpose.

BACKGROUND

The Ontology of Randomness in this *Encyclopedia of Information Science and Technology*, focuses more on the thinking underpinning science, more specifically, whether randomness even exists, i.e., its ontology (Feibleman, 1951). Tests for randomness appear to assume what is trying to be shown, i.e., there is indeed randomness, begging the question of whether there is innate structure, or order, in the universe.

Because of very limited space, extended tutorials and discussions about ontology (the nature of existence), epistemology (how we know), the problems of induction (Hume, 1888; Mill, 1843; Russell, 1919; Ramsey, 1929; Keynes, 1921, pp. 305-314; p. 24 et seq.), stochastic analysis (series of random variables), and the problems of representation (Plato's cave allegory as the philosophical foundations of statistics) have been omitted. Also omitted is a discussion of the role of randomness in logical scientific exploration (Popper, 1934; hypothetico-deductive, 2015; Copi, 1979; Rosser, 1953; Mendelson, 1997; Whewell, 1847; Feyerabend, 1975), as well as discussions of Abraham de Moivre (bell curve), Pierre-Simon Laplace (calculus of probabilities), and martingales (Birnbaum and Lukas, 1980). There are many other conversations about the differences between probability, chance (Keynes, 1921; Eagle, 2010), and randomness that would enrich a more complete treatment of the subject. This says nothing of the hundreds of mainstream

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works of probability theorists and their views on randomness. Instead, given here is somewhat analogous to a brief literature search, with a focus on summarizing several main views of what people think randomness is and considering the implication of its existence status. If such can get the reader to think beyond technology, focusing more on the "why", then this chapter will have accomplished its goal.

A Historical Perspective

Prediction for an early hunter meant being able to survive any challenge in the wild, that ability being taught to others. One thinks of shamans, soothsayers, and prophets being among the more esteemed members of various cultures.

Randomness came in the form of early games (Wolfram, 2016), a symbolized way of acting out in anticipation of meeting unpredictable events. As societies became more organized, those more skilled in correctly anticipating events led the military. Athletic competitions and often games emerged as simulations of military combat (History of Sport, 2016). In modern times, sophisticated modeling and simulation techniques describe, analyze, and plan for unexpected situations (MSBOK, 2016).

Current Views of Randomness

For the general public, "random" and its derivatives are defined variously as:

- "...proceeding, made, or occurring without definite aim, reason, or pattern". (Random - Dictionary – Random House, 2016).
- "...the lack of pattern or predictability in events". (Randomness - Wiki, 2016).
- "...without definite aim, direction, rule, or method; lacking a definite plan, purpose, or pattern". (Random - Dictionary – Webster, 2016).
- "... Made, done, happening, or chosen without method or conscious" (Random - Dictionary - Oxford American, 2016).

More formally but non-exhaustive are the main areas of:

- Relative frequency concept of probability;
- Information complexity/compressibility of information – Chaitin-Kolmogorov-Smirnoff-Shannon;
- Predictability and probability;
- Energy – Boltzmann-Clausius – entropy;
- Observation about completeness and certainty – Heisenberg, Gödel.

All of these overlap but have in common the inability of discerning future specificity, i.e., uncertainty. Following is a brief sketch of these views.

Relative Frequency Concept of Probability

Von Mises probability centers on "relative frequency", the ratio of appearances of an attribute in an event to the total number of events (as in how a color of a flower varies in a seed type, the number of dots shown with each roll of dice, or the number of deaths in an age group) (Von Mises, 1957, p. 11). As more events are observed the ratio becomes more refined, or more stabilized (.5,.51,.519,.5196, etc.)(Ibid., pp. 14-15). A "collective" is a "sequence of uniform events or processes which differ by certain observable attributes, i.e., a set of events from which a certain characteristic is to be observed" (Ibid., p. 12). Probability is the likelihood of "...encountering a certain attribute in a given collective" (Ibid.). Further, it is the "...limiting value of the relative frequency in a true collective which satisfies the condition of randomness" (Ibid., p. 24).

A "true" or "collective appropriate for the application of probability" must indeed have