

One of the most fundamental questions regarding the origins of human behavior is the question of whether people's actions are determined, predictable. For years searching for the answer was the domain of philosophy and theoretical psychics. However, with the development of experimental psychology in the early 1950s, it also became the area of interest for psychological research. Psychologists created a new paradigm to measure the ability to produce random series. In laboratory conditions, people were asked to create a series of random elements. The most popular experimental task was a thought experiment consisting of simulating a coin toss and reporting each of the subsequent results. However, despite the seemingly simple research design, it quickly became apparent that people did not perform well in such a task. Although they declared an intuitive understanding of the concept of randomness, they created strings that did not meet the mathematical description of the string derived from a random distribution.

Recent years brought the development of methods for measuring randomness based on algorithm complexity grounded in the randomness theory. It allowed looking at the ability to create random series of elements from the perspective of individual differences. Until now, most research focused on searching for boundary conditions that allowed random series production. The individual differences approach enables looking at the determinants of this ability. The first results show that the ability to create random series peaks in mid-twenties. It has a similar development curve as most cognitive skills. Therefore, the main goal of the planned project will be to find cognitive determinants of individual differences in the ability to create random series of elements. I plan to explore the relationship between fluid intelligence, cognitive motivation and working memory with the level of randomness of the human-generated series. Moreover, I will examine to what extent people can increase the level of randomness of the produced series.

Under objective 1., it is planned to conduct 2 studies and create a structural model explaining individual differences in the ability to produce random series. In Study 1., in experimental design, I will investigate the relationship between fluid intelligence, the need for cognition, the use of working memory, and the ability to produce random series. Participants in the computer-based study will complete a procedure of generating a 300 elements series of heads and tails, and later complete Raven's Matrices Test and the Need for Cognition Scale. Additionally, I will manipulate the visibility of already produced elements to test whether people use working memory while producing random series. Therefore, I will test hypothesizes regarding the relationship between fluid intelligence, motivation to engage cognitive resources in challenging tasks, and the level of randomness in human-generated series. Moreover, I will examine the hypothesis regarding the use of working memory in randomness production. In Study 2., in correlational design, I will investigate the relationship between processing and storage of working memory and the ability to produce random series. Participants in the computer-based study will complete a similar to Study 1. procedure of generating random series, and afterward, a Complex Memory Span Tasks to measure the capacity of their working memory. This way, I would like to examine the relationship between the capacity of the working memory and the ability to produce random series.

Under objective 2., it is planned to conduct Study 3. in the experimental design. It aims to verify the role of instant feedback on the ability to produce random series. The question of whether people are able to improve the level of randomness did not draw much attention in the literature. Under this objective, I will conduct one study in experimental design. Participants will play a specially designed zero-sum computer game, which will require to behave randomly to succeed. In four experimental conditions, I will investigate whether the origin of the opponent in the game moderates the effect of instant feedback.

The proposed project focuses on two aspects of the ability to produce random series of elements. First, it is meant to propose an answer to a more general question: 'What does make some people more predictable than others?' The structural model will help to better understand individual differences in the ability to produce random series of elements. Second, I will examine the possibility that people can improve their performance in random series generation tasks. The results of Study 3. might have a fundamental contribution not only to Psychology but also to Cryptography. The human-generated randomness is an attractive alternative for pseudo-random generators used in encrypting connections. Altogether, this project is going to not only broaden scientific knowledge on the topic of the ability to produce random series but also address more general questions regarding the nature of humans behavior.