Rhythm is all around us. We find it in music, our heartbeat, the way we walk, and even the way we speak. We can easily clap along to a simple melody, but what happens when our brain faces a much more difficult task—coordinating several different rhythms at the same time? This challenge, known as polyrhythm, is a daily reality for jazz drummers and masters of African drums, but for most of us, it represents a nearly insurmountable barrier. To this day, science does not fully understand how we learn such complex motor skills.

Our research project confronts this challenge head-on, using the latest technologies to investigate the mechanisms of learning complex rhythms. We have created an innovative, immersive training environment in virtual reality (VR) that functions like an interactive game. Instead of traditional, often tedious exercises, participants are challenged to guide a single point of light using both hands at once—one hand controls its up-and-down movement, the other controls it left-to-right. Their goal is to make this point of light perfectly trace a designated path, which visually represents a complex polyrhythm like "three against four".

A key goal of the project is to see how we can optimize the learning process. We will systematically compare how different combinations of sensory stimuli affect training efficiency. We want to answer the question: if we add precisely synchronized sounds and vibrations from the hand controllers to the visual information, how does it impact learning? Our goal is to find the "sweet spot"—the combination of senses that most effectively helps the brain master this difficult skill.

However, our project goes beyond simply measuring the precision of movements. We are also interested in the subjective experience of our participants, especially the psychological phenomenon known as "flow". This is a state of complete immersion in a task, where we lose track of time and our actions become fluid and almost automatic. What's more, throughout the training, we will be monitoring physiological signals like heart rate variability (HRV) and breathing. This will allow us to check if the state of "flow," described by participants, has an objective reflection in our body's functions.

The final, crucial question we seek to answer is about skill transfer. Will mastering a polyrhythm in virtual reality translate into the ability to perform it in the real world, using different tools? A positive answer would open the door to broad practical applications.

The results of our research could have significance not only for musicians and music educators but could also be applied in neurorehabilitation—for example, in therapy for patients recovering from a stroke or those with Parkinson's disease, who struggle with motor coordination and attention. Our project is a step toward creating technology that not only investigates the human mind but also actively supports its incredible potential to learn.