

# NICOLAUS COPERNICUS UNIVERSITY IN TORUŃ

## The computer game “Kalkulilo” as a cognitive training method for children with developmental dyscalculia and its application value in the mathematical education

Stępińska J.<sup>1,2</sup>, Goraczewski Ł.<sup>2</sup>, Matulewski J.<sup>2,3</sup>, Gut M.<sup>1</sup>, Finc K.<sup>2</sup>, Bałaj B.<sup>2</sup>, Dreszer J.<sup>1,2</sup>, Majewski J.<sup>2,3</sup>, Bendlin E.<sup>2,3</sup>, Cholewa, P.<sup>2,3</sup>, Ignaczewska, A.<sup>1,2</sup>, Szczypiński, J.<sup>1,2</sup>, Kmieć, M.<sup>1,2</sup> and Duch W.<sup>2,3</sup>

<sup>1</sup> Faculty of Humanities, Nicolaus Copernicus University, Toruń, Poland;

<sup>2</sup> Centre for Modern Interdisciplinary Technologies, Nicolaus Copernicus University, Toruń, Poland;

<sup>3</sup> Faculty of Physics, Astronomy and Informatics, Nicolaus Copernicus University, Toruń, Poland

[julia.stepinska94@gmail.com](mailto:julia.stepinska94@gmail.com)

### Literature background:

Developmental dyscalculia is a specific learning disability that affects the acquisition of mathematical skills in children, all crucial for basic competences in mathematics. The results of several studies describe the beneficial effect of computer-assisted interventions on mathematical abilities.

### A purpose:

The computer mathematical game “Kalkulilo” developed in the NeuroCognitive Lab of Centre for Modern Interdisciplinary Technologies is our proposal of an educational tool that could be very useful for development and strengthening the processing of spatial-numerical association (both in the left-right horizontal and down-up vertical orientation) as well as the access to mental representation of numbers processed in different formats (Arabic digits and dot arrays).



### The practical application of the game:

The game is expected to improve the development of so-called Mental Number Line, which seems to be crucial for number representation processing, counting, simple arithmetic abilities and magnitude comparison skill.

We hope that this game will become a good method for early cognitive intervention for children with special educational needs in mathematics but also it could be helpful for teachers in training of Mental Number Line and the operations on different formats of number representation (symbolic vs. non-symbolic).

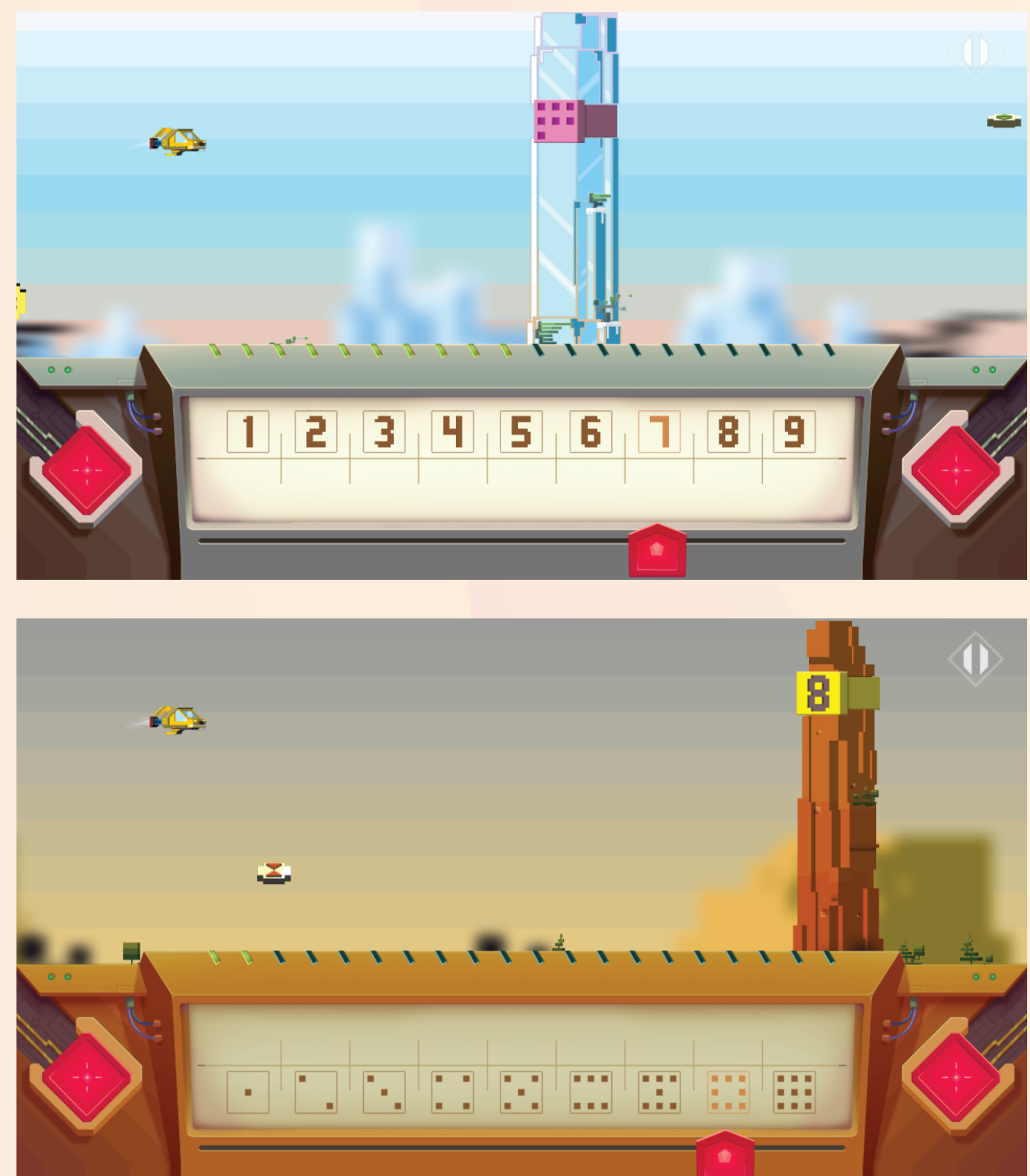
### A target group:

Game is dedicated for children aged 6-9 years old.

### Training – the player’s quest (task) in the game:

The task for player is to control the movement of the spaceship (in the vertical orientation) in order to overcome obstacles consisted of magnitudes presented in different formats. This movement is possible when the player assigns the numbers recognized on obstacles to the proper spatial localization by moving the slider on the horizontal axis on the bottom of the screen.

The goal could be achieved when the player can recognize numbers (displayed in two different formats: symbolic and non-symbolic).



### The advantages of the game :

- it adjusts to the level of a player (action-effect delay)
- the sounds used in the game: in accordance to the relationship between the frequency of the sounds and the space representations
- “boosts” (power-ups) – e.g. some of them make the game faster or slower

### The results of the pilot study with the use of “Kalkulilo”...

...are presented during this conference on the other poster of our research team (see a poster next to this one, by Kmieć et al.).