

Sportions: An application for improving performance of fitness exercises using computational thinking and visualization

Shir Perkis & Sharona T. Levy

perkishir@gmail.com, stlevy@edu.haifa.ac.il

Faculty of Education, University of Haifa

Introduction of the idea and future research

We all know how important motor learning is in our lives. From the first stages as a fetus all the way to adulthood, we are learning new motor schemes, practicing and using them. Here, we focus on fitness exercises, such as pushups and crunches. In today's world, there are a variety of ways to learn movements, muscles, and exercises: academic education, physical education, professional trainers, apps, websites and more. All of them teach us the actions that need to be done, but do not explain the underlying muscles' functioning to make the specific exercise. In this project, we are developing an application that combines two ways of learning how to improve performance: constructing the exercise as a computer program and visualizing the muscle operation.

Constructing the exercise as a computer program with block-based coding that enables decomposing and creating an algorithm of the sequence of actions involved. The decomposition enables focusing on the segments of the whole exercise and perfecting them. Creating the algorithm enables understanding the sequences, the repeating "code" and exit conditions for a segment; and seeing repeating code across exercises.

Visualizing the muscle operation is another unique aspect of this application. When people are not aware of which muscles are leading, supporting or resting during a particular movement, they do not always use the muscles correctly for an exercise. Thus, each code block that is used will activate an animation of the particular muscles within the body that participate in making the action happen.

Imagine learning a new exercise by coding the sequence of actions as an algorithm, while the app you're using provides you with animations and information about the muscles behind the various movements. You can put together an exercise and from it learn about the core muscles, and the transitions between different muscle groups that you use.

Shir has initiated this project, and it will be used in her masters thesis. The research will observe how the application is used, and how performance of the exercise might improve through this use with respect to normative training. Shir has tested a cardboard version of the application and has found that the use of block-based coding encourages motivation and curiosity among users. It also allowed the user to understand that the exercise has many elements that need to be paid attention to, and that by changing one element, one changes the whole exercise. There was difficulty in identifying the angles; most of the participants were not able to be precise in the angles of the exercises.

Technical Introduction

Some details, before you see our draft design, which we will be glad to discuss with you and improve it together:

If you are not familiar with block-based coding, you can take a look at the following movie of the originators of this approach, the Scratch software from MIT:

https://www.youtube.com/watch?v=1jHvXakt1qw&ab_channel=ScratchTeam

To get the blocks, you can use [Google's Blockly](#).

We would like the application to work on a cellphone, tablet or computer; with different operating systems (Mac, Windows); and in English and Hebrew, with an easy way to make it also in Arabic in the future.

The movies of the muscle movements will hopefully come from [this site](#). Right now we will assume that we have the movies and you will be creating a place-holder for them in the software.

The Sportions software application initial design:

The application screen upon entry is divided into four panes (Figure 1):

1. Code blocks palette (left): One selects from among the blocks for assembling the code, all the elements that make the exercise; as well as adding an exercise in the more advanced stage of creating a sequence of exercise.
2. Scripts pane: Here, the code is assembled. The blocks from the code blocks palette are dragged into the scripts pane. .They lock together
3. Muscle videos pane: Here the muscles working while a particular code block is enacted are demonstrated. Upon dragging the block from the Code blocks pane to the Scripts pane, this movie plays in a loop until it is dropped. When

clicking on a particular block in the script, the movie is also enacted in a loop. One can also mark the whole exercise, and see the sequence of movies in this pane.

4. Information pane: identification of the working muscles, advice and common mistakes + an important feature: as the muscles are operated in one exercise, or in a sequence of exercises, the number of times each muscle is used is computer and presented in this pane. This is used to assess whether the whole workout is balanced in terms of the muscles that are operated.

The logo that shows up in the example screens (top right) is Shir's logo that we would like to include as well.

We also need an illustration of a circle with angles close to the programming board, as people have trouble with angles that are not multiples of 90 degrees, a conclusion from the preliminary research that was done by Shir.

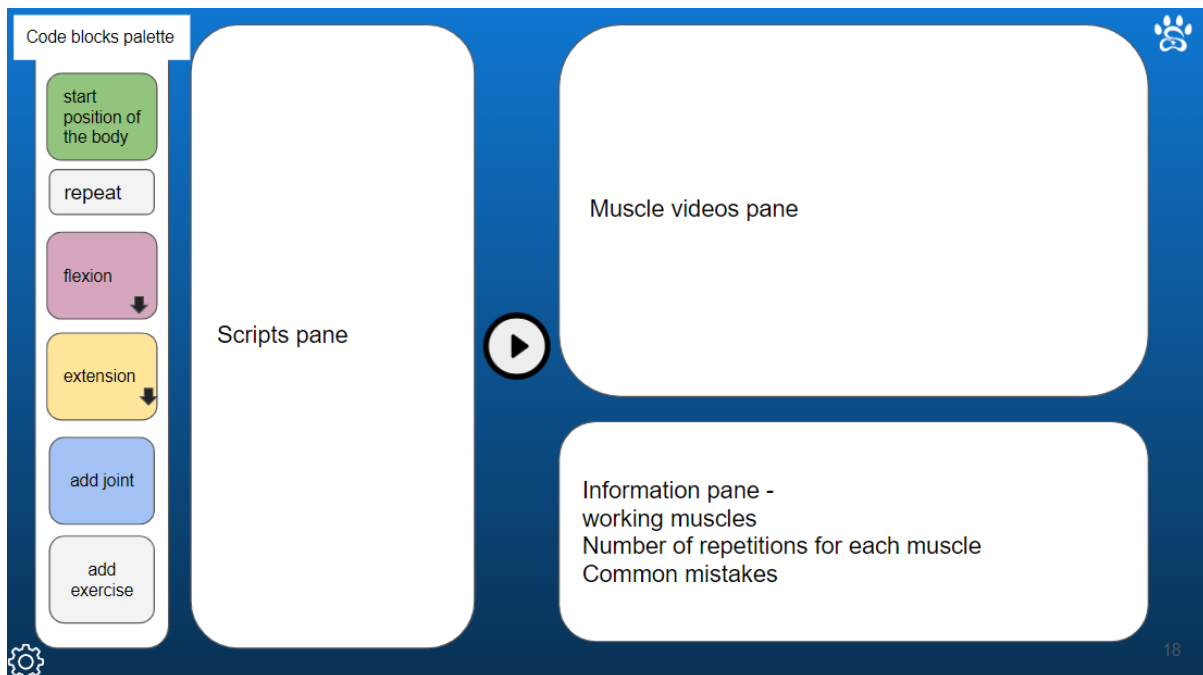


Figure 1: Example screen showing the structure

We would like to be able to code two kinds of exercises and a sequence of exercises: One-joint exercises, many-joint exercises, and building up a workout with a number of exercises.

The following Figure 2 is an example of one joint exercise:

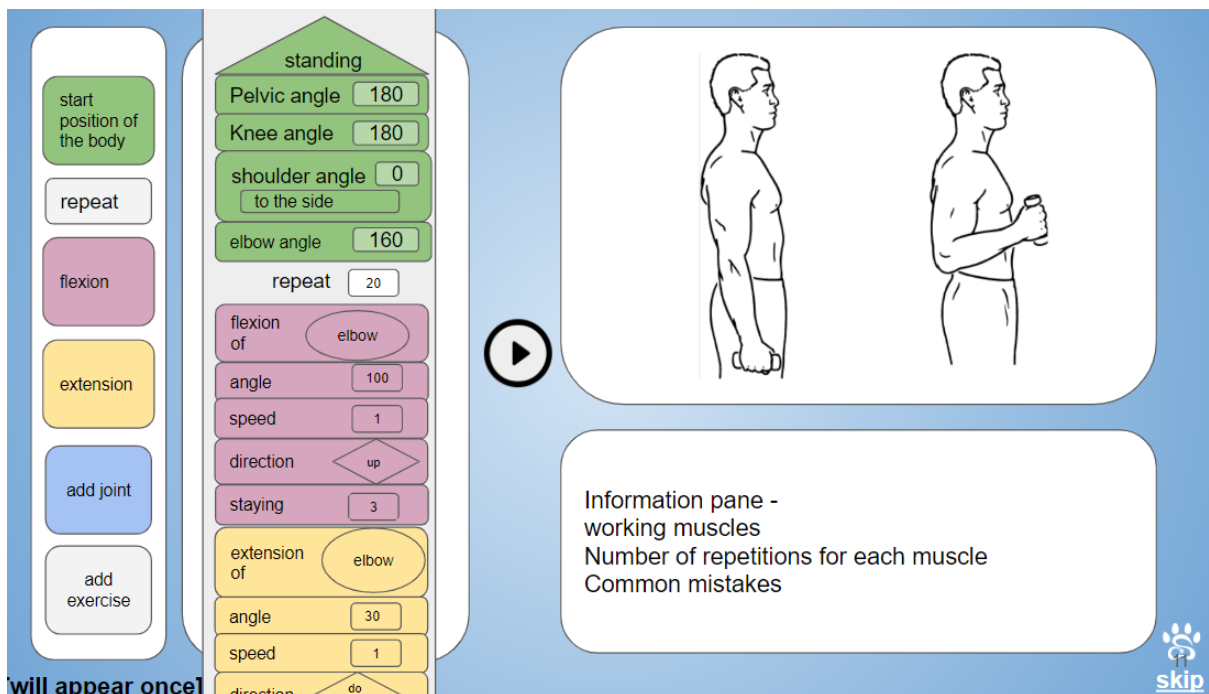


Figure 2: One-joint exercise example.

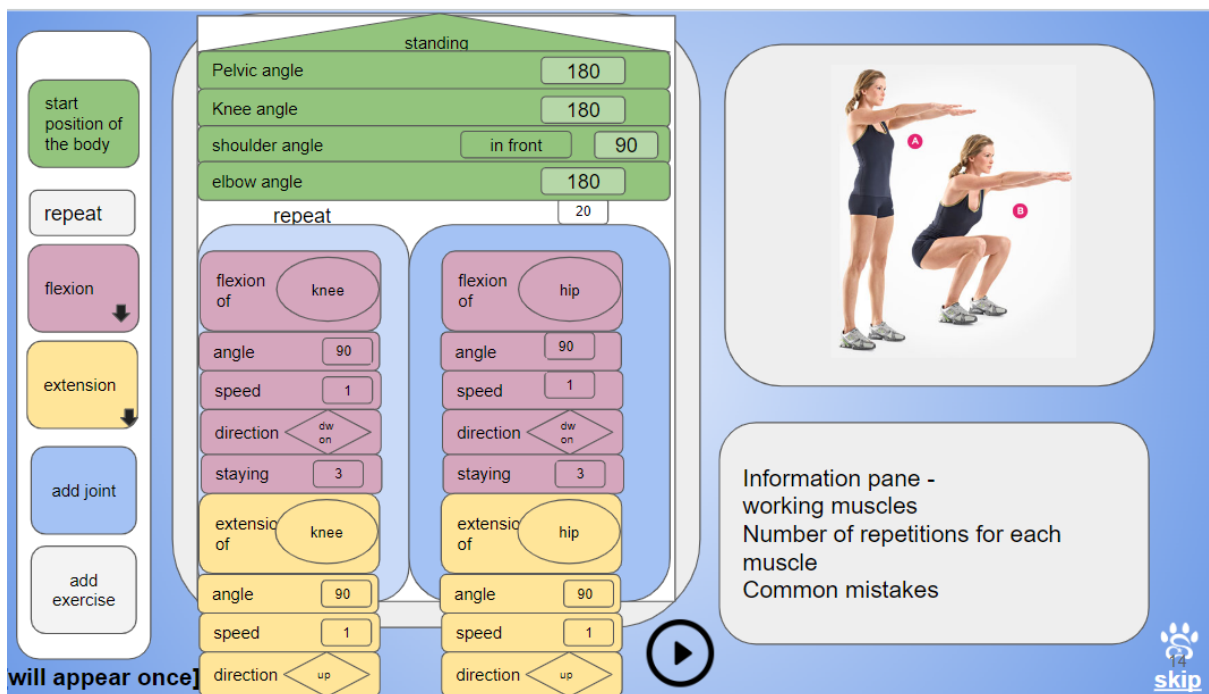
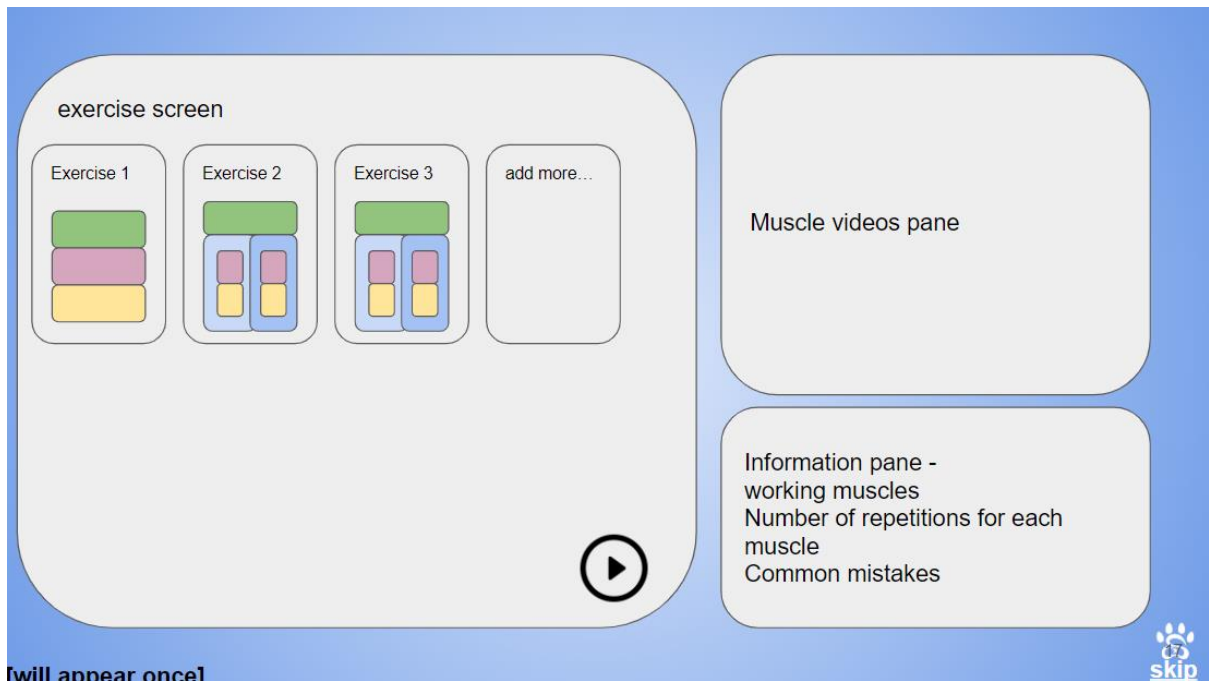


Figure 3: Many-joint exercise example.



will appear once

Figure 4: Full workout with several exercises.