

Comparison Mode

A tool designed for educators and learners to analyze and compare Scratch projects, highlighting strengths and weaknesses; supporting continuous project evaluation, helping users track improvements and understand if their design choices can be improved or not.



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Introduction

In Scratch programming, having the possibility to analyze and compare projects is crucial for both educators and learners.

For that reason, we created a new tool called **Comparison Mode** which provides an in-depth view of the projects, highlighting their strengths and weaknesses in order to allow users to learn and improve their own programming skills.

Goals

With this mode we aim to achieve the following goals:

- **Quantify and Compare Project Complexity:** This mode aims to detect and compare potential quality issues such as the Bad Smells of both projects. By highlighting these issues, the tool helps users understand areas that requires improvement, foster better coding habits and promotes cleaner and more efficient project designs.
- **Evaluate Project Similarity and Differences:** By comparing two Scratch projects we are able to determinate how similar or different they are from each other, which can be very useful for understanding the impact of different design choices and how the users are using the different functionalities of Scratch in their projects.
- **Enhance Continuous Project Evaluation:** This mode allows users to periodically evaluate and compare different versions of a same project in order to be able to track changes across various iterations. Thanks to this tool, users can monitor their progress, identify areas that have been successfully addressed and areas that need improvement.

How it works

Upload of the Scratch Projects

To begin the comparison, users need to upload the Scratch projects they want to analyze. In order to do that this mode requires to upload two types of project: the **Original project** and the **New project** and to do that there are three different options to upload those projects:

- **Original Project and New Project Scratch URLs:** Users can simply introduce both URLs of their Scratch project which is a very easy and quick method to analyze a project.
- **Original Project and New Project .sb3 Files:** Users can upload both .sb3 files which can be useful when the user prefer to evaluate two specific versions of the project.
- **One URL and One .sb3 File:** Users can provide a combination of a Scratch project URL and one .sb3 file. This option offers flexibility to the users resulting in a wide range of comparison scenarios.

Additionally, users should indicate whether the **New project** is a newer version or not from the **Original project**. This information will be relevant in order to present the information with the appropriate feedback.

Visualization of the Results

Once both projects are uploaded, this mode processes the files and generates a detailed analysis, which has the following presentation:

Main Section

This section provides a visual overview of the comparison between both projects, which includes the following information of both projects: **Score**, **Sprites and Block Usage** and **Bad Smells**. Additionally, regard to the information shown in the New project, it is shown in 3 different colours depending on:

- **Green:** The new project has less Bad Smells, a better Score or less use of Blocks and Sprites.
- **Black:** Both projects have the same amount of Bad Smells, the same Score or the same use of Blocks and Sprites
- **Red:** The new project has more Bad Smells, a lower Score or more use of Blocks and Sprites.

More Information Section

For users who seek a deeper analysis can click the button of *Show more* in order to open this section which includes the following information:

- **Similarity Percentage:** This percentage who similar are both projects between themselves by comparing the sequences of blocks that build each project.
- **Block Types Distribution:** In this part, we show in a *Doughnut Diagram* the percentage of each type of block (Motion, Looks, Sounds, Events, Control, Sensing, Operators, Variables and My Blocks) from Scratch interface for each one of the projects previously uploaded.
- **Bad Smells:** In this section we show more in detail which bad smells have each project.
- **Score:** Similar to the Bad Smells, in this section we provide a more detailed score presentation, as we display the scores for each dimension of the two projects being compared.

Usage Examples

Access from Main Page

In order to be able to use this mode, one of the options you can choose to do is to find the section in Dr.Scratch Main Page (Figure 1) and click the button of *Compare Projects*.



Figure 1: Comparison Mode Section in Dr.Scratch Main Page

Once you click that button you will be redirect to the Project Up-loader Page (Figure 2), where you can upload both projects, Original and New, via the three different options mention before.

Figure 2: Project Up-loader Page

When the two projects are submitted, depending if the score in the new project is higher, lower or it is the same as the score of the original project, you will find the following cases:

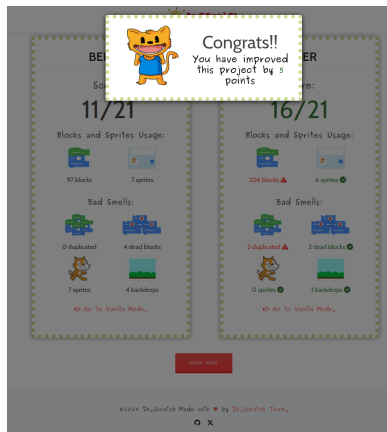


Figure 3: Higher Score in the New Project

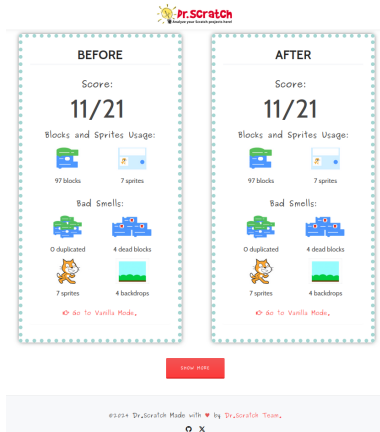


Figure 4: Same Score in both Projects

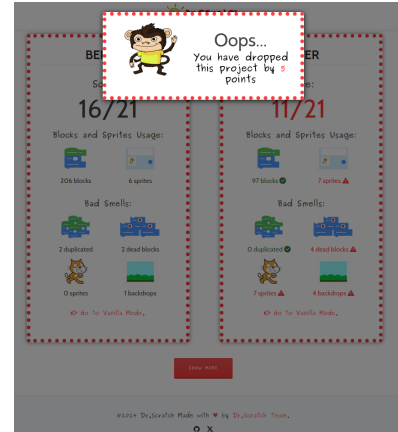


Figure 5: Lower Score in the New Project

Finally, if you have a higher or a lower score in your new project compare to your original one (Figure 3 and Figure 5), you will need to click the screen in order to be able to see the main section of the comparison mode feedback (Figure 6) and if you click the *Show More* button you will see the more information section (Figure 7).

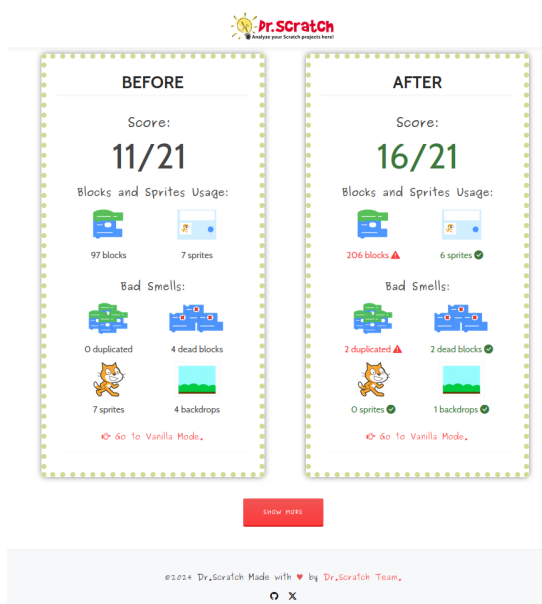


Figure 6: Main Section

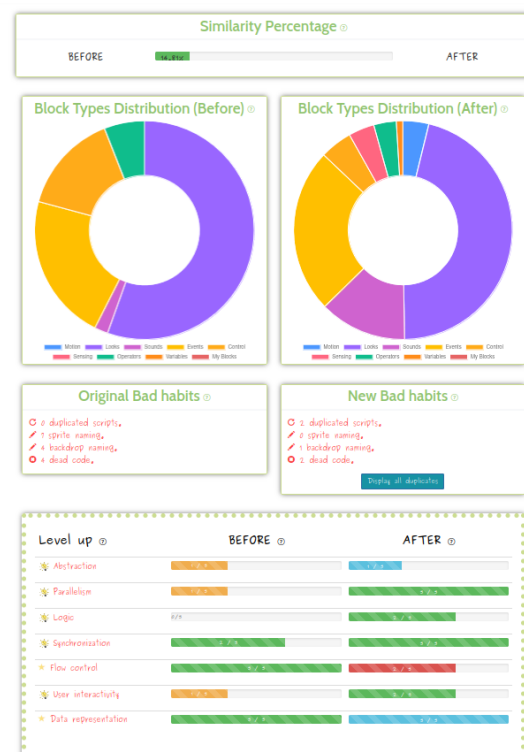


Figure 7: More Information Section

Access from Evaluated Scratch Project (Default/Personal)

Another way of using this tool is comparing a project from the Dashboard of the **Default Mode** or the **Personal Mode**. The only thing you will need to do is to upload the Scratch URL in the section of Compare Project (Figure 8), indicate if the project is an update from the project evaluated in the dashboard and click the button of *Compare Projects*.

The screenshot shows the Dr.Scratch dashboard interface. At the top, there's a header with the Dr.Scratch logo and a navigation bar with 'Vanilla Mode' and 'Extended Mode' buttons. The main content area is divided into several sections:

- Score: 11 / 21** (with a 'Post' button)
- The level of your project is... DEVELOPING!** (with a message: 'You're doing a great job. Keep it up!!!' and a link to 'Come back to your Scratch project.')
- Bad habits** (listing: 0 duplicated scripts, 1 sprite naming, 4 backdrop naming, 0 dead code).
- Project certificate** (with a URL: <https://scratch.mit.edu/projects/157167074/> and a 'Download' button).
- Compare project** (with a URL input field: http://scratch.mit.edu/projects/your_number, a question 'Is the new project an update from the original?' with 'Yes' and 'No' radio buttons, and a red 'COMPARE PROJECTS' button).
- Level up** (a table showing progress for various skills):

| Skill | Progress |
|---------------------|----------|
| Abstraction | 1 / 3 |
| Parallelism | 1 / 3 |
| Logic | 0 / 3 |
| Synchronization | 2 / 3 |
| Flow control | 3 / 3 |
| User interactivity | 1 / 3 |
| Data representation | 3 / 3 |

Figure 8: Comparison Mode Section in Dr.Scratch Dashboard Page

Once you click that button it will open a new tab, where it will show the same information as the one if you access from the Main Page.