

New version of Neotrie VR for the virtual reality device Meta Quest

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SUMMARY

We present a new version of Neotrie VR adapted to the Meta Quest virtual reality device. Among the most important new features, we highlight the incorporation of a universal menu, which makes the interaction with the user more friendly, with access to configuration, help guides, galleries of figures and tools, and blocks of educational activities distributed throughout the scene.

Keywords: Virtual reality, dynamic geometry software, 3D geometry, Neotrie VR.

1. Use of Neotrie VR in Education

Neotrie VR (or Neotrie) is a dynamic geometry software in fully immersive virtual reality, developed by the spin-off Virtual Dor, in collaboration with the University of Almeria. In October 2018, the first version was released on the popular video game platform STEAM. Said version, compatible with previous virtual reality systems, such as HTC Vive, Oculus Rift/S, Windows Mixed Reality or Valve Index, required a videogame computer, which has been a handicap, due to its high acquisition cost, for many educational centers, which have not been able to implement VR in mathematics classrooms. In (Rodríguez, Romero, Codina, 2021) the effects produced in both teachers and students in the teaching and learning process of geometry, thanks to the use of Neotrie, are explored. A summary of the results on student learning, carried out

by a collaborative work team, can also be seen in the European platform Scientix (Cangas et al., 2021).

Since March 2021, we have been adapting the software for the Oculus Quest 2 (currently Meta Quest). This device, based on Android, is a product of Facebook Reality Labs, which was launched in October 2020, and is currently undoubtedly the most widespread, for its value for money. A beta version of Neotrie for this device, was released last November 2021, and is accessible for free from the Neotrie website (see Rodriguez, 2021).



Image 1: Neotrie now available on Quest devices.

This work of adaptation and development of new functions in the software, takes place in the framework of an Erasmus KA2 plus project "Geometrician's Views" (March 2021-February 2023), in which interactive geometry activities are being developed, related to the artistic-scientific work of the participating students. In parallel, a UAL-FEDER research project is being carried out (2021-2023), entitled 'Immersive virtual reality in the mathematics classroom with NeoTrie VR', which aims to introduce its use, with the new Quest devices, in real classrooms in the last levels of Primary Education and first levels of Secondary Education, to work on plane and spatial geometry contents. Neotrie is expected to be an accessible tool for students and to stimulate visual skills and spatial reasoning applications. At the same time, it is expected to have a favorable affective impact on students and to have a positive impact on their learning.

Users can access the first versions of these activities directly in the game, thanks to the new interface that we have implemented and that we describe below.

2. New user interface

The new menu that appears in the VR scene, is designed to provide the user with a more enjoyable experience when navigating through the many options offered by Neotrie. In it we have not only incorporated the typical functions of a configuration menu, but we have given access to options that were already implemented in the game and to which the user could access externally, following manuals and instruction videos on our website. Below, we show some options of this new menu, available in both the PC and Quest versions.

Once registered on the Neotrie website, we will be able to access our user and content from within the game, as shown in Image 2.



Image 2. Neotrie web user access.

As for customization, we can change all the parameters of our avatar, guide, language and graphic environment. As we can see in Image 3, we now have a generic keyboard, which will accompany us in all editable texts in the game.



Image 3. Customizing your avatar. New keyboard in the VR environment.

In Image 4, we can see that some of the menu options of the previous PC versions are now found in this universal menu, in a clearer way. We can modify variables such as hiding certain components of the figures or selecting the type of edge we want to work with.

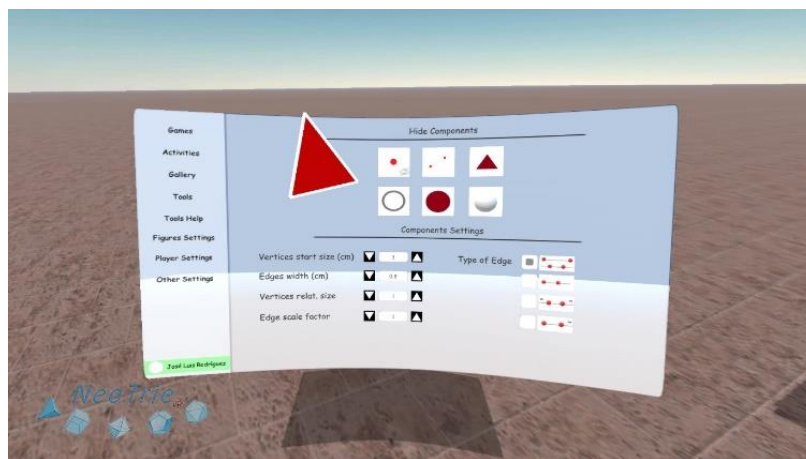


Image 4. In figure settings we can hide, for example, the vertices.

One of the most awaited updates, incorporated in this menu, is undoubtedly a gallery that collects figures from the usual families (prisms, pyramids, platonic and archimedean solids, etc.). By simply touching the corresponding button with the hand, the selected figure will be created, ready to be manipulated. In addition, some of these have algorithms to generate the desired figure, such as prisms and antiprisms, with any number of edges at the bases, as shown in Image 5.

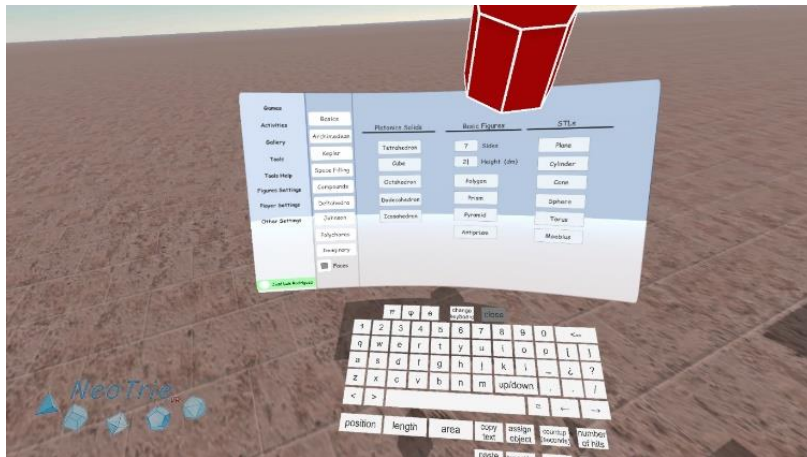


Image 5. Creating a regular prism with 7 sides and 2 dm height

Another new feature is that we now have a list of tools, accessible from the menu. By clicking on the image of the tool, it will be displayed for use, as shown in Image 6.



Image 6. Choosing the tools needed.

Now, a short help text for each tool will appear in the help tab of Image 7. It is only necessary to grab the corresponding tool to display a help text.



In cases where the help text is not enough, by clicking on the video button in Image 7, we will access a video explaining the tool, as shown in Image 8.

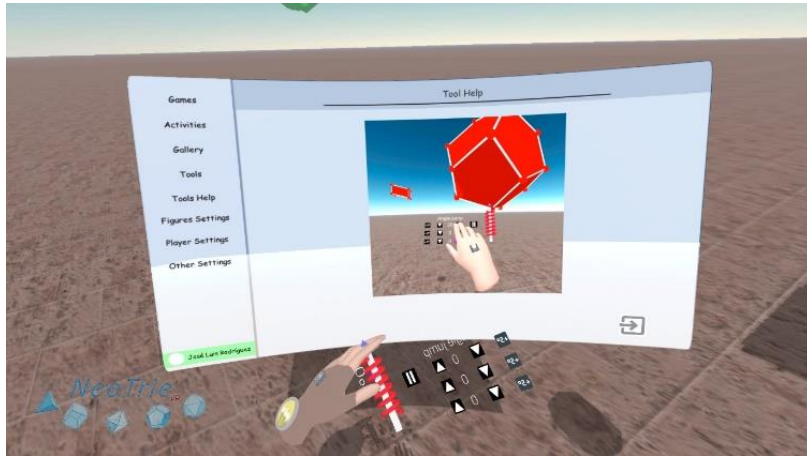


Image 8. Explanatory videos on the use of the tools

Finally, we have included a tab for other settings, at the request of users. These settings were previously accessible by modifying a game configuration file and copying it to the device via USB cable, which was a bit cumbersome. In Figure 9, we can see how now, quite a few configuration options are available to change in-game, and can be saved in each scene.

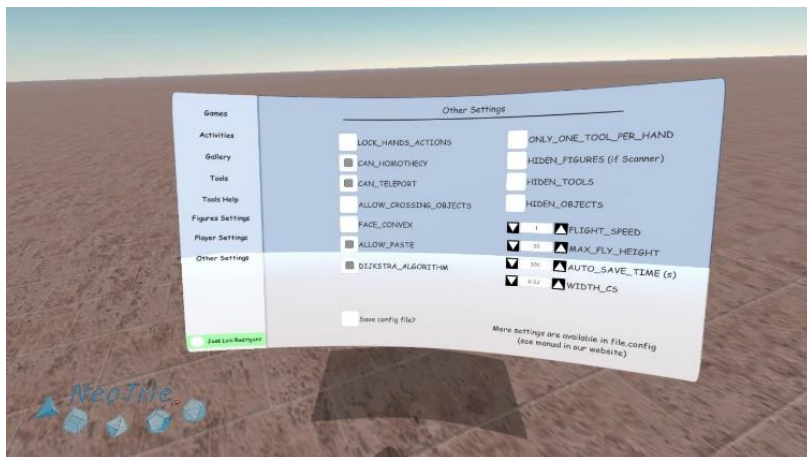


Image 9. Other settings available in Quest.

We plan to keep adding more features, to make it more user-friendly to interact with the menu. Finally, we will talk about one of the latest features: the activity blocks.



Image 10. Access block to activities in preparation.

These small cubes (see Image 10) scattered around the scene serve as a direct link to the Neotrie website. By touching them, the corresponding activities are automatically downloaded from the web. This is a great advantage for the user, who previously had to use a USB cable to connect the Quests to the computer.



Image 12. Access to web activities from within the scene.

The activities are presented in an ordered way, in the activities tab of the universal menu, as we can see in Figure 12. Then, once loaded, any of them can be accessed just by clicking on the corresponding image, from any part of the scene.

In the future, these blocks will allow access to personalized activities saved in your user or community tab on our website, and can be published for other users to download as well.

Conclusions

The popularity of Quest 2 globally is enabling the use of quality virtual reality not only for entertainment, but also for education. In particular, the dynamic geometry software Neotrie VR, already adapted to this new device, covers topics related to Geometry, which are taught from Primary Education levels onwards. In this souk, participants will be able to immerse themselves in the world of Neotrie, browse the new menu and try out some of the activities already available from the educational projects, in which we are participating.

References

Cangas, D. et al. (2021). Using NeoTrie VR for STEM Education in Virtual Reality. *Filodiritto Editore – Proceedings of the 11th International Conference the Future of Education – Virtual Edition*, 511-517.

Rodríguez, J.L. (2021). *Neotrie VR - Quest Edition*. <https://www2.ual.es/neotrie>

Rodríguez, J.L., Romero, I. y Codina, A. (2021). The Influence of NeoTrie VR's Immersive Virtual Reality on Teaching and Learning of Geometry. *Mathematics*, 9(19), 2411.

Rodríguez, J.L. (2022). Exploring dynamic geometry through immersive virtual reality and distance teaching. *Capítulo en libro “Mathematics Education in the Age of Artificial Intelligence”, de la serie “Mathematics Education in the Digital Era”*. Berlin, Germany: Springer.