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USING LEVELS OF INTERACTIVITY FOR ANALYSIS OF AUGMENTED REALITY PROJECTS

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The analysis of projects that provide opportunities for interaction begins with their distribution and requires objective criteria. Various levels of interaction are presented that can be used for project distribution, including message levels and structure/content levels. Using real augmented reality projects as examples, the correlation between different interaction possibilities and levels of interactivity is demonstrated. It is found that using levels of interactivity helps to objectively distribute and compare projects.

Key words: *project classification, interactive levels, Rodz and Azbel levels, AR, objective project comparison.*

INTRODUCTION

Interaction is a component of many modern design products across various genres that contain digital components such as multimedia installations, games, websites, augmented reality projects, and so on. The characteristics and qualities of interaction can vary greatly, and users refer to the interaction process (and the product as a whole) as interactive or non-interactive not only based on objective properties but also based on their subjective feelings during such interaction. Interactivity is a characteristic that requires specification for analysis.

PURPOSE

To objectively evaluate the quality of interaction and compare it across different products, it was necessary to divide interactivity into levels and consider how they relate to augmented reality projects.

RESULTS AND DISCUSSIONS

Often, the basis for distribution is taken as levels of information exchange between messages borrowed from information disciplines: linear interaction (1:0), where the message is not related to previous messages; reactive interaction (1:1), which is only related to the previous message; multiple or dialog interaction (1:m), which is related to numerous previous messages and their relationships. For example, interaction levels based on messages for animated video will look like this: linear (1:0) - viewing animation; reactive (1:1) - playing or stopping animation when clicking on a "hot" zone, transitioning to fragments; multiple (1:m) - animation of a physical model of an object, where the system allows the user to change certain parameters, which changes the behavior of the system.

The author argues that the use of interactivity levels, borrowed from information technologies, is not optimal for analyzing interactivity in multimedia products. Despite the initial persuasiveness of this division, it raises several questions. For instance, what should be considered a message in a multimedia project, and who sends them? Depending on the answers to these questions, different projects can be classified into various levels, and the linear level may not make sense at all. For example, augmented reality applications, by their nature, respond to input information from the environment. Moreover, this division has a very abrupt transition between levels, where the linear level is not interactive, the reactive level is very simple, and most products with any settings fall into the multiple level.

One possible alternative option for interaction is the use of levels of interactivity, according to D. Rhodes and J. Azbell [1]: reactive, coactive, and proactive. Let's consider them using the example of augmented reality projects, which vary greatly in terms of user control capabilities.

The lowest level, reactive, involves interaction with the structure or content. The list of possible actions is limited. For example, the Belvedere Museum in Vienna, Austria, has eight works by Egon Schiele in its permanent collection at the Upper Belvedere, for which augmented reality has been created [2; 3]. When a smartphone is pointed at the works, X-ray, infrared, and macro images created by the museum's restoration department are synchronized with the painting's position. All objects are prepared in advance, and the user's capabilities are limited to choosing a painting to view and the ability to zoom in on a specific area.

In 2013, students from Columbia University and Parsons School of Design in New York collaborated to develop an augmented reality showcase for the Hermès fashion house museum as part of the "Sophisticated Design Strategies" class. The showcase was housed in a specially made box and featured exhibition pieces, with a tablet attached to the top of the glass surface that could be moved along it. Through interaction with the tablet, users could automatically display information about the current product focused on by the camera, with the ability to browse photos and sections of information. In all of the examples provided, users interacted with pre-prepared objects and information, choosing one of the proposed options.

According to Rodz and Azbel, the average level of interactivity is co-active, which means that users can make changes to either the structure or content, but not both simultaneously. In the "Quattro coaster" project [5], carried out by the POL and DVA Studio from Sweden in 2018 for Audi, the user could view three-dimensional car models and take a test drive after building their own virtual track using a smartphone in their own space and examining all the details of the trip throughout the four seasons. Although this example is not as information rich as the previous ones, the ability to independently enter parameters, upload their own data, or, as in this example, set the trajectory of a future track, expands the user's freedom of action and, accordingly, the level of interactivity.

The highest level, proactive, allows for changing both content and structure. In the "PaperBots" project [6], developed by Peter Jago, children could independently build bot shapes using available tools, create their own design for the

appearance (color the bot layout at their discretion), perform visual programming of the bots, and view in augmented reality how these created bots behave. This project offers the widest range of actions for experimentation and freedom of self-expression.

CONCLUSIONS

The distribution of products according to their levels of interactivity is a strategy used for classification and comparative analysis, which serves as a reference point for designing such products. Instead of using message-based levels, it is more optimal to apply Rodz and Azbel levels. Projects at each level have diverse properties, so determining the level is only one step in further consideration of each group. Most interactive augmented reality projects are focused on the reactive or coactive level, while the proactive level, which involves extensive editing capabilities, is much less common and usually found in various creation or design programs. Overall, the distribution by levels allows for a focus on interaction principles specific to each level, promoting a more objective comparison of projects.

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ФОМІНА К.

ВИКОРИСТАННЯ РІВНІВ ІНТЕРАКТИВНОСТІ ДЛЯ АНАЛІЗУ ПРОЕКТІВ ДОПОВНЕНОЇ РЕАЛЬНОСТІ

Аналіз проектів, які надають можливості для взаємодії, починається з їх розподілу і вимагає об'єктивних критеріїв. Представлено різні рівні взаємодії, які можна використовувати для розповсюдження проекту, включаючи рівні повідомлень і рівні структури/вмісту. На прикладах реальних проектів доповненої реальності продемонстровано співвідношення між різними можливостями взаємодії та рівнями інтерактивності. Встановлено, що використання рівнів інтерактивності допомагає об'єктивно розподіляти та порівнювати проекти.

Ключові слова: *класифікація проектів, інтерактивні рівні, AR, об'єктивне порівняння проектів.*