

# Evaluation of Static vs. Animated Views in 3D Web User Interfaces

Jacek Jankowski

Digital Enterprise Research Institute, NUI Galway, Ireland

## 1 Introduction

3D viewing applications (e.g., VRML/X3D browsers) often provide a viewpoint menu in order to allow easy navigation for users, so they can navigate from one point of interest to another simply by selecting a menu item. The viewpoint menu plays an important role in 3D interaction [Jankowski 2011]; it turned out to be an important navigation tool in our recent study [Jankowski and Decker 2012].

Such viewpoints are usually static - a viewpoint is simply a specific camera position and orientation defined by a pair of  $x, y, z$  coordinates, that is, a specific view of a 3D scene. While very useful, we believe that static viewpoints often do not show "3D-ness" of virtual objects - as Andy van Dam mentioned: "if it ain't moving, it ain't 3D". Therefore, inspired by [Burtnyk et al. 2006] and some UI features we know from computer games, in our Dual-Mode User Interface implemented in a wiki-type authoring environment called Copernicus [Jankowski and Decker 2012], we provide users with a list of viewpoints that they can use to navigate to and see the 3D data presented not as a static image but using motion.

On the one hand, intuition suggests that animated viewpoints can have significant benefits on user interaction satisfaction and, as the literature suggests, may be useful in 3D object assessment [Todd 2004] and help users build mental representation of spatial information [Bederson and Boltman 1999]. Another issue is that, as navigation around objects in 3D space is complex, thanks to the use of animated viewpoints users can focus on the task at hand instead of continuously managing the camera position and orientation.

However, evidence also suggests that if animations are not designed carefully, they can disrupt user performance and lead to frustrations [Nielsen and Loranger 2006]. From a design standpoint, implementing viewpoint animations also requires more development effort. Additional algorithmic complexity also means that designers need to consider the user's hardware capacity. Therefore, to understand whether the benefits that animated viewpoints may provide outweigh the described drawbacks, we decided to study the effects of animated viewpoints on usability and appeal of 3D Web UIs.

## 2 Evaluation Setup

12 students and researchers (4 female) participated in the study. The participants ranged in age from 27 to 33. All but 4 either did not play 3D games or played them sporadically. The experiment was conducted on a laptop with a standard 3-button mouse. The test application used for the evaluation was a modified version of the system used in [Jankowski and Decker 2012]. We also re-used three virtual exhibitions featuring races, creatures, and weapons from the Warcraft game. These virtual worlds were simple single-floor museum-like environments, populated with 3D objects and images. The exhibitions could be accessed through the "Hypertext UI" and the "3D UI" [Jankowski and Decker 2012]. To show "3D-ness" of the virtual objects, we created animated viewpoints by using static viewpoints as key frames for the animation of the camera (see the "Copernicus - Author Interface" video at <http://copernicus.deri.ie>).

For each exhibition-UI combination we asked the participants to set the orbiting animation speed that they consider useful, aesthetic, and not distracting for all animated viewpoints; they were asked to select between  $n = 9$  angular velocities and navigate through a museum using a viewpoint menu to test their choices. The available selection option ranged from 0.17 to 14 degrees per second ( $\omega_n = 4.32 * (n/5)^2$ ). Our subjects could also disable animated views. After being presented with all 6 tasks (2 UIs \* 3 exhibitions), where

we measured selected angular velocities, the users were given a questionnaire, where we measured their subjective impressions on usefulness, aesthetics and distraction level of animated viewpoints.

## 3 Results and Discussion

Figure 1a illustrates the results for each exhibition and each user interface with respect to selected angular velocity (error bars denote 0.95 confidence intervals). All users clearly preferred navigating in 3D using a menu with animated viewpoints than with static ones (there was not even a single user that disabled animated views during the study). Simple comparisons of means for each exhibition revealed that the participants preferred faster animations in 3D UI than in the Hypertext UI. Another interesting finding is that the users selected slower animations for a more complex environment.

The average subject ratings with respect to usefulness, aesthetics and distraction level of animated viewpoints are illustrated in Figure 1b, together with standard deviations. Analysis of the ratings revealed that animated viewpoints in the 3D UI were perceived as more useful, aesthetic, and less distracting than in the Hypertext UI.

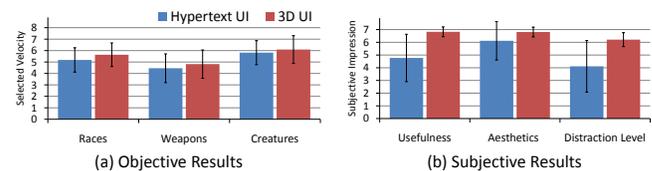


Figure 1: Overall results.

Some users noted that orbiting animation (and even provided "walking" navigation mode) does not allow them to easily get desired views of objects. They indicated the need for a complementary navigation technique that allows them to move around an object while keeping the object centered in the field of view (dragging the mouse left/right over the object should move the camera around the path of the animated view; scrolling should move the camera toward/away from the object; see [Tan et al. 2001; Khan et al. 2005]). Others commented that Back and Forward buttons should allow them to return to previously visited objects - the usage of the viewpoint menu should be saved into the navigation history of web browsers. Moreover, animated views should be based on real world analogs: they should start from the best possible position (e.g., for a 3D statue the camera should start animation from its face), etc. One user stated that animated views invite exploration.

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