

## **A Usability Comparison for Scenario Development Tasks**

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### **ABSTRACT**

Simulation-Based Training is a force multiplier that contributes to the success of our Warfighters. Software and hardware tools available today present critical visual and auditory cues to provide opportunities to integrate traditional training methods, gaming techniques, and emerging technologies. Two software applications at the forefront of the industry are Bohemia Interactive's Virtual Battlespace 2 (VBS2) and Crytek's CryENGINE®3. The present research investigated the usability of the VBS2 Editor Interface and CryENGINE®3 Sandbox; thus, the experiment focuses on the experience of a scenario developer as the user, rather than a trainee. Questions related to sustainment costs were derived from human performance assessments by focusing on scenario development (i.e., object placement and scene alteration). Following introductory training, 30 participants completed a set of pre-assigned scenario development tasks within each application. Accuracy scores and response time were tracked. Participants were characterized by five sub-groups (i.e., full sample population; males, females, technical and non-technical only), who completed several assessments. One of the assessments included a usability questionnaire that addressed general fidelity, operation within the graphical user interfaces, and additional inquiries from subject-matter experts. Subjective information concerning each user's experience was also captured in order to identify favorable functions and describe features considered difficult to use. Results from paired t-tests revealed significant differences in Task 1 response time between the platforms for the full sample population. In all cases, users completed tasks faster using CryENGINE®3. Independent-sample t-tests showed statistically significant differences for VBS2 overall accuracy scores as well as VBS2 Task 1 accuracy scores whereby males scored higher than females. However, the practical significance of these results is questionable as the Operations and Maintenance savings for developing scenarios using CryENGINE®3 is estimated to be at most \$4000 per site.

### **ABOUT THE AUTHORS**

**Dr. Stephanie Lackey** earned her Master's and Ph.D. degrees in Industrial Engineering and Management Systems with a specialization in Simulation, Modeling, and Analysis at the University of Central Florida (UCF). Her research focused on prediction, allocation, and optimization techniques for digital and radio frequency (RF) communications systems. Dr. Lackey conducted high-risk research and development aimed at rapid transition of virtual communications capabilities to the Field and Fleet as a computer engineer with the United States Naval Air Warfare Center Training Systems Division (NAWC TSD). She joined UCF Institute for Simulation and Training's (IST) Applied Cognition and Training in Immersive Virtual Environments (ACTIVE) Lab in 2008, and assumed the role of Lab Director in 2010. Dr. Lackey leverages her experience in advanced predictive modeling to the field of human performance in order to develop methods for improving human performance in simulation-based and immersive training environments and human-robot interfaces. Dr. Lackey has a proven track record of delivering research and development products to the Warfighter training community through the skilled application of systems engineering principles, and her efforts have been recognized by the National Training and Simulation Association, the United States Navy, and internationally by the Joint Forces Simulation and Training community.

**Ms. Crystal Maraj** is a Graduate Research Assistant (GRA) at the Applied Cognition and Training in Immersive Virtual Environments (ACTIVE) lab since summer 2010. She has attained her Bachelor's degree in Psychology and M.S. degree in Modeling and Simulation (M&S) from the University of Central Florida (UCF). Previous research and work experience focused on improving pilot training for the operation of automated aircrafts under the Federal Aviation Administration (FAA). Concurrently, she also worked and gained experience in the Mental Health field. Currently, Ms. Maraj is attaining her PhD in the Human Systems track within UCF's M&S program. Her research interests center on Virtual Environments for training, specifically the design of technical attributes including improvement in trainee performance and training system utility.

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**Mr. Irwin L. Hudson** is the Science & Technology Manager responsible for leading STTC's Unmanned Ground Systems Research. This research focuses on Human-Robot Interaction, Physiologically-based Interaction, Unmanned Ground Vehicles, Remote Weapon Systems, Virtual Combat Profiling, and STEM Outreach. Mr. Hudson is Contract Officer Representative (COR) for The HRI Analysis for Training Simulations and Operational Neuroscience (HATS-ON) program. He also serves as the Assistant Contract Officer Representative (ACOR) to Dr. Neal Finkelstein for the Research Academic and Operational Support (RAOS) Indefinite Delivery, Indefinite Quantity (IDIQ) contract, which supports a large percentage of the research and development budget for STTC's Blended Systems Research Branch (BSRB). Mr. Hudson earned his Bachelor of Science degree in 1991 from Mississippi State University in Computer Engineering with minors in Math and Human Factors. He is currently pursuing his Ph.D. in Modeling and Simulation at the University of Central Florida.

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### **INTRODUCTION**

In any industry, the selection of software applications must be conducted with care and diligence. Balancing stakeholder needs, implementation requirements, and sustainment efforts plays a critical role in the acquisition of infrastructure applications such as enterprise resource planning. For training our Armed Forces, the simulation software platform represents core training infrastructure required to execute simulation-based training (SBT). Training system evaluations typically focus on trainees. This is critical, but in order to more fully analyze a simulation platform's impact upon implementation and sustainment costs, issues pertaining to training support staff must be assessed.

The purpose of the present research effort was to better understand performance and perceptions of individuals responsible for scenario development within relevant simulation platforms. Specific objectives of the research were to (1) investigate the scenario development capabilities available in the Virtual Battlespace 2 (VBS2) and CryENGINE®3 platforms; (2) quantitatively and qualitatively assess user performance and perceptions of VBS2 and CryENGINE®3; (3) gain insight into user characteristics that impact performance of scenario development tasks. Ultimately, the research results presented are intended to inform procurement decisions and influence requirements and designs for emerging systems. By focusing on the scenario developer perspective, this research serves as an empirically derived "data point" in the platform evaluation process.

### **Simulation Platforms**

Two simulation platforms dominate the military simulation and training market: VBS2 and CryENGINE®3. Each platform offers scenario developers the ability to simulate a variety of operationally relevant environments for training and mission rehearsal, and support PC-based/desktop and physically immersive virtual reality systems. Both platforms rely on gaming technology, but obvious and subtle differences in their respective development histories provide context related to the technological capabilities offered.

### **Bohemia Interactive's VBS2 v.2.0**

Three core elements comprise VBS2: training, simulations, and development. VBS2 was developed and distributed by Bohemia Interactive in 2007 and has capabilities for first-person SBT applications. VBS2 uses game engine methods and technologies to simulate combat training scenarios and mission rehearsal techniques in a virtual environment (VE). The VBS2 platform is currently used by multiple military and law enforcement organizations throughout the world to train military tactics, techniques, and procedures for small and large team exercises (e.g., room clearing, patrol protocols, and leadership skills) (Bohemia Interactive, 2013). The VBS2 environment is a virtual sandbox developed for individual and collective training applications (Bohemia Interactive, 2013) and is designed to replicate real-world operations in high-fidelity immersive VEs. VBS2 allows simulation viewing from a first-person or third-person perspective. This feature allows users to perform dismounted and room-clearing tasks and also the opportunity to study a city's layout for convoy drill operations. The platform is a reconfigurable VE

utilizing the Real Virtuality game engine as a standalone simulator for training purposes or packaged within other simulation-based training environments (e.g., flight simulators and tank trainers) (Bohemia Interactive, 2013). This enables high-fidelity visual features developed in the VBS2 environment to correspond with accurately portrayed physics or weapons ballistics of other simulation suites.

As a development platform, VBS2 allows for the creation of a wide range of content from pre-existing fictional terrains to real-world geo-specific environments (Bohemia Interactive). The simulation architecture in VBS2 offers real-time, large-scale terrain renders, and accurately portrays multiple simulation variables (e.g., physics, weather, ground/vegetative cover, and day and night lighting effects). Developers can draw from content libraries consisting of over 1000 civilian and military 3D assets including humans, land and sea vehicles, unmanned vehicles, buildings, and terrains (Bohemia Interactive, 2013). All player and non-player characters can interact with each other and the environment based upon behavior templates that are adjustable in accordance with scenario context. A VBS2 3D character's artificial intelligence (AI) capabilities are incorporated according to user requirements and are controlled using waypoints in defined behavior algorithms (e.g., move, search and destroy, hold-fire, and open fire). Developers can also import customized 3D assets from other third-party 3D software applications, such as 3dsMax or Maya, using the VBS2 development suite. This feature allows users to develop training content according to specific mission needs or protocols.

### **Crytek's CryENGINE®3**

CryENGINE®3, developed by Crytek (2012), is their premier first-person shooter game engine powering many of today's most popular gaming titles (e.g., Far Cry and Crysis) (Crytek, 2013). Founded in 1999, Crytek received numerous awards for game engine technological advancements. However, the CryENGINE®3 gaming engine is not solely intended for commercial game applications, but also learning, development, and training. RealTime Immersive (RTI) serves the exclusive North American reseller of CryENGINE®3, and aims to advance the methods and technologies employed by the serious games and simulation industries (RealTime Immersive, 2013). RTI currently uses CryENGINE®3 technology in a variety of government, military, and commercial applications including marksmanship training, nuclear power plant simulators, serious games training, and prototyping.

The CryENGINE®3 engine is currently used across multiple domains such as video games, movies, simulations, and interactive applications. CryENGINE®3 introduced photo-realistic indoor and outdoor real-time special effects that are tied to 3D character behaviors, physics, and animation systems. The sandbox option in CryENGINE®3 was redesigned and features a layering system similar to many art programs. This feature allows developers to work in conjunction on separate aspects of a game level without adversely affecting the developmental pipeline. CryENGINE®3's evolution as a game engine limits the availability of 3D assets within the content library. However, developers can import a variety of 3D assets from third party software applications (e.g., 3dsMax or Maya).

### **Human-Computer Interaction Evaluation**

Functional requirements naturally drive design specifications; however, during the development of a complex software application such as a simulation platform iterative design and development often deliver the best results. Both simulation platforms under review successfully demonstrate this point, and provide rich environments and compelling interfaces for scenario developers.

Assessment of the user-experience traditionally includes some combination of laboratory or field-based user evaluation and/or expert analysis (Dix, Finlay, Abowd & Beale, 2004). Empirical methods assess an interface in a manner similar to behavioral studies by conducting an experiment to test the effect design features, levels, or differences have upon the users' performance and perceptions. This systematic approach employs the fundamentals of the scientific method to compare alternative designs or systems and provides quantitative and qualitative results (Eberts, 1994) intended to inform decision-makers and stakeholders (Dix, et al., 2004). In order to understand the impact that VBS2 and CryENGINE®3 have upon scenario development task performance, a lab-based empirical assessment provided data collected in a controlled environment to assess how well a user can accomplish typical scenario development tasks such as constructing an everyday object within an operationally relevant environment.

Results from this type of study directly compare objective performance metrics between platforms to facilitate cost benefit analyses, and inform functional and design requirements by interpreting subjective user perception data.

## **Present Research**

Given the advanced simulation capabilities described above, it is clear that the simulation and training community is better equipped now than at any time in history to provide compelling training experiences for the Armed Forces. Scenario development plays a crucial role in the life-cycle of any platform. However, it is not possible to fully assess the scenario development tools provided by each platform without empirical investigation. Thus, quantitative and qualitative usability assessments needed to be performed and reported. This effort accomplished that goal for assessing scenario development interfaces within the VBS2 and CryENGINE®3 platforms. The overarching research questions included: (1) What is the average time required to create a set of pre-determined scenarios within VBS2 and CryENGINE®3? (2) On average, how accurately do users perform scenario development tasks in the VBS2 and CryENGINE®3 platforms? (3) What are the strengths, weaknesses, and capabilities of the VBS2 and CryENGINE®3 platforms?

## **METHOD**

### **Participants**

Thirty participants from the University of Central Florida (UCF), and the surrounding area, were recruited to participate in this experiment using the Institute for Simulation and Training (IST)-SONA System. The inclusion and exclusion criteria included: 18 years of age or older, U.S. citizenship, normal or corrected vision, and no sign of color blindness. Experience level did not impact the inclusion/exclusion criteria. The current trend toward relying on small unit leaders to manage and conduct training regardless of technical or scenario development experience motivated the decision to include non-expert developers. The participants' ages ranged from 18 to 30 with  $M=20.78$ ,  $SD = 2.59$ . Each individual was monetarily compensated \$10.00 per hour for up to three hours of participation.

### **Experimental Design**

This experiment was a within-subject design. The simulation platform (i.e., VBS2 and CryENGINE®3) represented the independent variable. Dependent variables included performance (accuracy and response time) and subjective survey responses.

### **Procedure**

This experiment was conducted at UCF-IST. The lab space was an enclosed room which consisted of an experimenter and participant station, each having two desktop computers. The experimenter and participant stations were separated by a cubical wall. Each participant was greeted by the experimenter and escorted to the experimental space. The platform conditions (VBS2 or CryENGINE®3) were randomized upon arrival of each participant. The participant was seated, read the informed consent, and completed a series of subjective questionnaires. Upon completion of the questionnaires, the participant viewed training slides and then followed directions to complete a set of pre-determined object placement tasks (Task 1) within 20 minutes. Following the completion of Task 1, the participant was asked to complete the Usability Questionnaire based on their experience using the software. This was followed by Task 2 training (alter scene setting), where the participant was given 10 minutes to complete the second set of tasks. The individual was then asked to complete the Usability Questionnaire. After completing the first platform condition, the participant was given a five minute break. The experimenter used this time to set up the second experimental condition and followed the same procedure as the first condition. Following the completion of the questionnaires, the participant was debriefed and dismissed. Compensation was provided at a designated date.

### Scenario Development Tasks

Participants performed a series of pre-defined scenario development tasks. Using the assigned scenario development software, desktop computer, keyboard, and a computer mouse, participants placed objects (i.e., virtual 3D models) into designated areas of the scenario scene. A pre-defined area was created to control for external variables that could affect data. Examples of objects added within the designed area included: people, animals, consumer goods, vegetation, and building features. Task 1: Object Placement was broken into 3 levels of complexity: Low, Medium and High. Object placement with low complexity required no rotation of objects, but simple, specific placement (e.g., tree placement). Object placement with medium complexity included placing and rotating objects, such as creating an animal pen. Object placement with high complexity involved placing, rotating, and elevating objects such as creating a market place with a list of specific items (e.g., covered awning, wooden table, baskets, and fruits). See Figures 1 and 2 for sample images of Task 1.



Figure 1. Sample 3D objects placed within the VBS2 environment

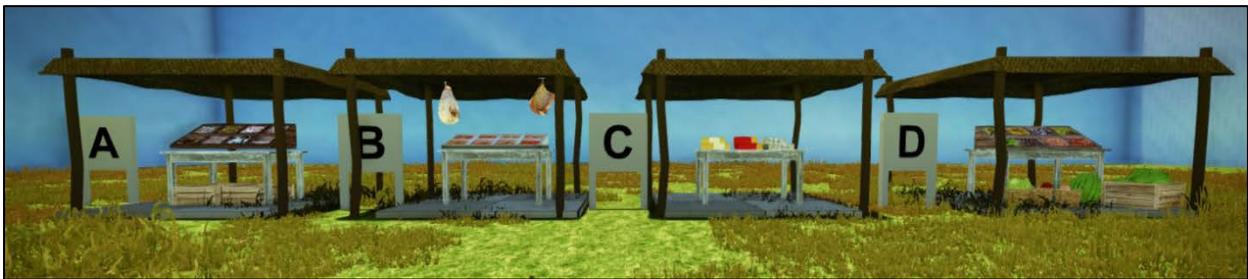


Figure 2. Sample 3D objects placed within the CryENGINE@3 environment

In Task 2: Scene Setting, participants manipulated the environmental and atmospheric settings of a previously developed scenario. Specific tasks included changing the weather condition (e.g., rain and fog) and time of day. See Figures 3 and 4 for samples of before and after images of Task 2.



Figure 3. Sample "before" and "after" atmospheric manipulation within VBS2 environment



**Figure 4. Sample “before” and “after” atmospheric manipulation within CryENGINE@3 environment**

### Measures

Two quantitative measures were assessed: accuracy and response time. The accuracy assessment consisted of a post-hoc evaluation (e.g., yes/no) of the models built within each environment. Evaluations were completed by experimenters trained to assess whether the models were accurately placed by reviewing each video for VBS2 and CryENGINE@3. Response time measured the time to complete a task (e.g., minutes and seconds). That is, the experimenter reviewed the time taken to place an object from start to finish. Final analyses reported response time in seconds. One qualitative measure was used to assess subjective data – the Usability Questionnaire, which included a modified version of a Systems Usability Scale, Usability Heuristics Questionnaire and those provided by the U.S. Army, which were reworded in-house to assess the perceptions of the graphical user interface.

### RESULTS

Descriptive statistics were used to confirm statistical test assumptions were met. The full sample population included all 30 participants, and subpopulations were derived based upon gender and technical expertise. This was done to determine if these variables had a statistically significant impact on performance between the two platforms. The male subgroup was comprised of 19 participants, and the female subgroup included 11 participants. Preliminary results from the frequency tables showed missing values for technical and non-technical participants. To compensate, an analysis of the biographical data was used to categorize participants into technical and non-technical groups. The data classified individuals who were deemed proficient with computer technology and placed each individual accordingly. The results then showed the technical group had 11 participants, and the non-technical group had 19 participants.

### Quantitative Analysis

Hypothesis testing revealed one significant difference between the VBS2 and CryENGINE@3 platforms in performance of scenario development tasks. A statistically significant difference was identified for the response time to complete Task 1: Object Placement. For the full sample population, participants completed Task 1 an average of 11.2 seconds faster using CryENGINE@3 compared to VBS2. A paired samples t-test revealed a statistically significant difference in the time to complete Task 1 in VBS2 ( $M=51.50$  seconds,  $SD=32.1$  seconds) compared to CryENGINE@3 ( $M=40.30$  seconds,  $SD=20.95$  seconds),  $t(29)=11.2$ ,  $p<.05$ . In addition to comparing performance between the two platforms, within platform comparisons revealed two significant differences related to VBS2. Independent-sample t-tests showed a statistically significant difference in VBS2 overall accuracy scores between males ( $M=38.94$ ,  $SD=9.70$ ) and females ( $M=29.82$ ,  $SD=5.81$ ),  $t(26)=3.11$ ,  $p<.01$ . For VBS2 Task 1, there was a statistically significant difference in accuracy scores between males ( $M=35.94$ ,  $SD=9.70$ ) and females ( $M=26.82$ ,  $SD=5.81$ );  $t(26)=3.11$ ,  $p<.01$ . See Table 1.

**Table 1. Quantitative Results Summary**

Between Platform Comparison						
Sample Population	Task	Dependent Variable	Independent Variable	Mean	Standard Deviation	p-value
Full Sample Population	Object Placement	Response Time	VBS2	51.50 sec	32.10 sec	p < .05
			CryENGINE®3	40.30 sec	20.95 sec	
Within Platform Comparison						
Platform	Task	Dependent Variable	Independent Variable	Mean	Standard Deviation	p-value
VBS2	Object Placement & Scene Setting	Accuracy	Males	38.94 sec	9.70 sec	p < .01
			Females	29.82 sec	5.81 sec	
VBS2	Object Placement	Accuracy	Males	35.94 sec	9.70 sec	p < .01
			Females	26.82 sec	5.81 sec	

### Qualitative Analysis

Subjective open-ended questionnaires allowed participants to describe their experiences using VBS2 and CryENGINE®3 where they listed the most positive and negative aspects of each software platform.

### Males

Males listed the ease of use, realism, clarity, and the variety of options within the scenes as advantages for VBS2. Some of the disadvantages within VBS2 according to males included difficulty assessing weather scales, number of clicks required by the selection tool, lack of realism for weather settings, and difficulty selecting and moving objects. Males listed ease of learning, realism (objects and weather), the look and feel of the camera movement, and system responsiveness as advantages for the CryENGINE®3 software. Males reported difficulty rotating objects, disappearing objects when placed within the environment, difficulty with navigating due to the number of clicks required, and time consumption as disadvantages for the CryENGINE®3 software.

### Females

Females reported ease of use, clarity, and realistic graphics as advantages for the VBS2 platform. Disadvantages of the VBS2 platform reported by females included unclear weather aspects, difficulty selecting/deselecting/moving/rotating objects, and difficulty placing objects in the desired position. Alternatively, females found that within CryENGINE®3, rotating and moving within the environment was easier, more enjoyable, and had a higher realism. Females listed the disadvantages within CryENGINE®3 as difficulty in finding some objects, camera movement proving to be bothersome, difficulty getting the camera to the desired angle, and adjusting objects with camera.

### Technical Group

The technical group reported ease of use, simplicity, realism, clarity, and the straightforward nature of VBS2 to be the advantages of the software. The technical group found the weather scale to be difficult to assess and believed the software contained glitches within VBS2. Nevertheless, the technical group reported the ease of learning to rotate and place objects, realism (especially weather conditions), graphics, and the smoothness in terms of moving within the environment as advantages of the CryENGINE®3 platform. Objects failing to appear within the environment after placement occurred, and difficulty rotating objects because the center did not rotate proved to be disadvantages in CryENGINE®3 according to the technical group.

## Non-Technical Group

Finally, the non-technical group reported VBS2 was logical, realistic, movement was easy, and the software provided many objects to use/rotate/place within the platform as advantages. The non-technical group found that within VBS2 the weather scale was difficult to assess, objects tended to be grouped together, which made the single object difficult to move, and some objects did not appear in the scene as disadvantages of the software. However, the non-technical group listed the high quality graphics, entertainment, ease of learning, and ease of rotating/moving within the environment as advantages within CryENGINE@3. Objects not appearing when placed within the environment, the excessive steps to place an object, and difficulty moving the camera proved to be disadvantages within CryENGINE@3 for the non-technical group.

## DISCUSSION

Overall, user performance of scenario development tasks demonstrated nearly equivalent results between the platforms assessed. Accuracy and response time represented two critical performance parameters for this study. The platforms performed equally well with regard to accuracy, and overall, there was very little difference in response time between the two platforms. Statistical analyses revealed only one statistically significant difference for response time, but the practical significance of this difference is questionable due to the estimated impact upon O&M costs. A survey of U.S. Army training sites reported that the number of training scenarios developed per year ranged from 200 to 1000. Table 2 shows the estimated scenario development cost savings of using CryENGINE@3 per scenario. These calculations account for the development of between 50 and 100 marketplace stalls, and assume a burdened hourly rate of \$48.17 (\$60,000.00 annual base salary). If a given site developed 200 scenarios per year, the annual O&M cost savings would range from \$374.68 to \$749.36. Assuming 1000 scenarios were developed in a year, the estimated annual O&M cost savings would be less than \$4000.00 per site.

**Table 2. Estimated O&M Cost Savings using CryENGINE@3 to develop scenarios**

Per Scenario		200 Scenarios		1000 Scenarios	
50 Stalls	100 Stalls	50 Stalls	100 Stalls	50 Stalls	100 Stalls
\$1.87	\$3.75	\$374.68	\$749.36	\$1,873.40	\$3,746.79

User observations offer insight into the interface features users valued and found challenging to manage. Participant's reported that both platforms were easy to use and learn. Both platforms rated high in visual realism; however, participants preferred CryENGINE@3's graphics capabilities over VBS2's. Although it is unclear whether such subjective opinions impacted performance, the lack of significant differences in task performance appears to be supported and indicates that the interfaces are well designed overall.

Recommendations resulting from user perception data analysis focused on detailed operations of each platform. Participants noted that both platforms required a greater number of clicks than expected to complete common tasks. Streamlining common processes such as entity alignment would benefit performance and perception assessments. A specific feature, weather manipulation, provides an illustration of user preferences for discrete quantities when defining the intensity of less tangible aspects. Within VBS2, the weather was changed by using a slider scale whereas in CryENGINE@3 the weather was changed by entering a numeric value. Another difference between the two platforms involved controlling individual entities. For example, participants had issues with selecting one entity at a time. In several instances, multiple entities were selected when located within close proximity on the screen regardless of their actual distance apart within the game world. This participant feedback indicates individuals found VBS2 to be inconsistent with their expectations of the system capabilities, and users anticipated a greater level of control of individual entities. Another inconsistency described by participants involved a serious entity placement problem. At times within CryENGINE@3, participants were unable to successfully drag and drop entities within the pre-defined area and the entity would seemingly disappear. In actuality, the entities would appear outside the pre-defined area and/or below the surface of the ground. Such inconsistencies can negatively impact user confidence,

and points to a need for improved scenario development workflow for those with limited simulation or game development experience.

In addition to maintaining consistency, this study resulted in the following overall recommendations for improved scenario development performance. Ease of use and learnability play a critical role. Logical interface layouts and menu structures based upon familiar graphical user interface metaphors and industry standards reduce user confusion and improve user confidence. Users prefer discrete metrics for continuous physical phenomena such as weather. Furthermore, it is important that objects remain visible once placed; individual objects are separable from grouped objects, and rotate upon the central axis. One option to improve visible placement involves ground clamping. This snaps an object or entity to a surface and ensures visibility within a VE.

Finally, camera operations are equally important as object placement. VBS2 and CryENGINE®3 platforms share similar industry standards when operating camera's within the VE such as the focus of the lens and zooming levels. However, most game engines and 3D modeling software packages do not follow a standard for camera manipulation (e.g., pan, tilt, and rotate). Future recommendations may include a detailed training module for camera control based upon the software used and the target audience. Most expert developers have experience using multiple software packages and understand camera manipulation within VEs, while many novices may have limited exposure to the many camera options available.

## **LIMITATIONS**

One limitation of this experiment stems from the sampled population. Specifically, data from certain subgroups (i.e., the technical and female groups) were limited due to a small sample size ( $n=11$ ). A larger sample size could increase the power analysis, which could add to the significance criterion and calculation of a sample size for the technical group and females. Additional research is required for future evaluation of each platform to gain greater insight into its usefulness for the SBT training community.

## **CONCLUSION**

This experiment focused on two types of scenario development tasks: (1) creating a structure/entity from foundational simulation objects and models; and (2) modifying the atmospheric of an existing scenario. Many other tasks are required to develop SBT scenarios, but studying these tasks provides compelling insight into the functional differences between VBS2 and CryENGINE®3. Three practical observations resulted from this research. First, the magnitude of scenario development cost savings is as important as the cost savings itself. Second, several factors outside the scope of this effort must be considered when choosing a simulation platform for research, development, or training system acquisition. These factors include but are not limited to how well a simulation platform addresses: training requirements and objectives, availability and functionality of entity models and data, availability and functionality of after action review tools, licensing structure and fees, support staff, sustainment costs, etc. Third, the level of visual fidelity resonates with scenario developer. All participant subgroups emphasized the importance of graphics displayed during open-ended interviews. It is unclear whether differences in visual fidelity impacted performance, but these findings indicate a desire to increase the current visual fidelity requirements in SBT applications from the scenario developer perspective. Ultimately, the choice of simulation platform requires a variety of tradeoff analyses, the intended purpose of this effort was to provide insight to research, development, and acquisition decision-makers. The results presented arm the reader with empirically derived results and recommendations for assessing VBS2, CryENGINE®3, and other simulation platforms.

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