SYM-AM-23-097

Excerpt from the Proceedings of the Twentieth Annual Acquisition Research Symposium

Acquisition Research: Creating Synergy for Informed Change

May 10–11, 2023

Published: April 30, 2023

Prepared for the Naval Postgraduate School, Monterey, CA 93943.

Acquisition Research Program
Department of Defense Management
Naval Postgraduate School

The research presented in this report was supported by the Acquisition Research Program at the Naval Postgraduate School.

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The Design and Development of a Defense Acquisition Workforce Virtual Environments for Asynchronous Collaboration (VEAC)

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Abstract

Asynchronous collaboration is an inevitable part of the global workforce. However, there is a gap in asynchronous collaborative research and solutions that integrates diverse groups engaged in a shared objective. This research demonstrates the process of designing and developing a novel virtual environment (VE) system interface to augment the defense acquisition community's asynchronous collaborative work. Using an ethnographic approach, the researcher methodologically conducts task analysis, comparative analysis, case studies, and a usability study to derive the best practices to implement in VE. The resulting insights inform the design of a prototype 3D user interface for asynchronous collaboration. In this 3D non-immersive user interface, a set of analytical tools—such as user-generated and in-session system guidance—that support the participants' asynchronous collaborative tasks is implemented. Based on these studies, the resulting VE is tested for its usability and the extent to which it brings value to the collaborative team in this research's next phase. This prototype user interface collaborative environment has the potential to be beneficial for a range of communities of practice including the Defense Acquisition workforce, industry, the medical domain, and educational domain.

Purpose

Though many 2D synchronous and asynchronous collaborative solutions exist—e.g., Slack, Skype, Microsoft Teams, or Miro—currently, there are no guiding principles on the type of system features needed to support asynchronous collaborative work in the VE systems. Similarly, there are no documented best practices with which to implement asynchronous virtual collaboration channels that enable diverse communities to conduct their daily work and to do that effectively and efficiently. This unexplored domain space creates a capability gap that hinders businesses with hybrid workers and industries in product development from implementing best practices in their asynchronous work. Currently, no existing framework informs diverse communities of practice, including the defense and industry acquisition community, on the criteria for, and instances in which to use, asynchronous VEs for collaboration, evaluation, testing, optimization, and prioritization of the work on innovative systems and critical solutions slated for the end-users.

The DoD acquisition community is an example of the large problem space and a diverse community of practice needing a superior 3D asynchronous collaborative tool. The acquisition community is a segment of professionals within the industry and the defense

domains who design, develop, produce, and procure systems or solutions for users. Though the defense acquisition workforce shares a common mission, they are often operating towards their objectives on different regulatory tracks. The lack of fidelity, horizontal cohesion, and collaboration in the decision space caused by using less-than-optimal collaborative tools undermines the adoption of various novel systems such as tactical vehicles, cyber operations tools, satellite communication systems, personal protective gear, and VEs over their life cycle (Argyris & Schön,1992,1974; Mankin et al., 2004; Thomas et al., 2007).

The study fills this gap by providing a novel theoretical and conceptual framework for asynchronous collaboration in VEs. This research identifies the instances where VEs have great potential in supporting various daily asynchronous collaborative tasks among heterogeneous communities of practice that need to operate with 3D artifacts. The research then uses a methodological approach to develop the guidelines for a 3D asynchronous collaborative tool to augment the defense acquisition workforce's daily work using the author's Theoretical Framework for Asynchronous Collaboration-Virtual Environment (TFRAC-VE).

Methods

This study uses a multistep developmental design approach to determine the design and developmental features to implement in the prototype VEAC user interface. First, an acquisition domain task analysis study was conducted to determine the purpose, goals, steps, standards of practice, experiences, tools, biases, challenges, and team structure to achieve asynchronous collaborative tasks in a sample population of acquisition professionals engaged in asynchronous collaborative work. Since the acquisition workforce comprises fourteen diverse communities that must work synchronously and asynchronously to deliver timely innovative solutions to support the warfighter, this research examined a sample of career fields—program managers, contracting officers, logisticians, and test and evaluation professionals—that may benefit from the enhanced capability of VR technology (Rendon & Snider, 2008, 2019). Within this step, an acquisition regulation and literature task analysis study was conducted to compare the user findings to domain standards of practice. Second, the resulting insights—along with an extensive literature review in asynchronous collaboration, acquisition research, and virtual environments—were gathered to form a theoretical framework for asynchronous collaboration in human activity. Third, a comparative analysis study was conducted to generate the necessary lessons to apply the domain and technology-agnostic theoretical framework to VE. Fourth, the new elements of the resulting VE framework and an additional comparative analysis study using acquisition research were conducted to demonstrate and implement the VE framework for the defense acquisition workforce. The resulting insights about the framework as well as the themes were derived from the comparative analysis studies. A subset of features that would produce the best results in 3D was implemented in the prototype user interface.

Resulting Design Features

The cumulative results of the user and comparative analysis studies generated the output processes to support asynchronous collaboration and the best tools to be implemented in 3D. A subset of those processes and tools are implemented in the VEAC as design features to improve the usability and likelihood of adoption. The resulting primary design features are aggregated into user-generated and in-session guidance or system-generated features. The first output of the task and regulation analysis studies produced the user-generated features. The second out of the comparative analysis studies and theoretical framework produced the in-session guidance or system-generated features. The subset of

primary features implemented in VE provides a novel mode of asynchronous collaboration for the defense acquisition workforce and supports VE domain scholars' standards of designing systems with adoption in mind (Sadagic et al., 2019).

Figure 1 depicts the primary features of a Defense Acquisition VEAC.

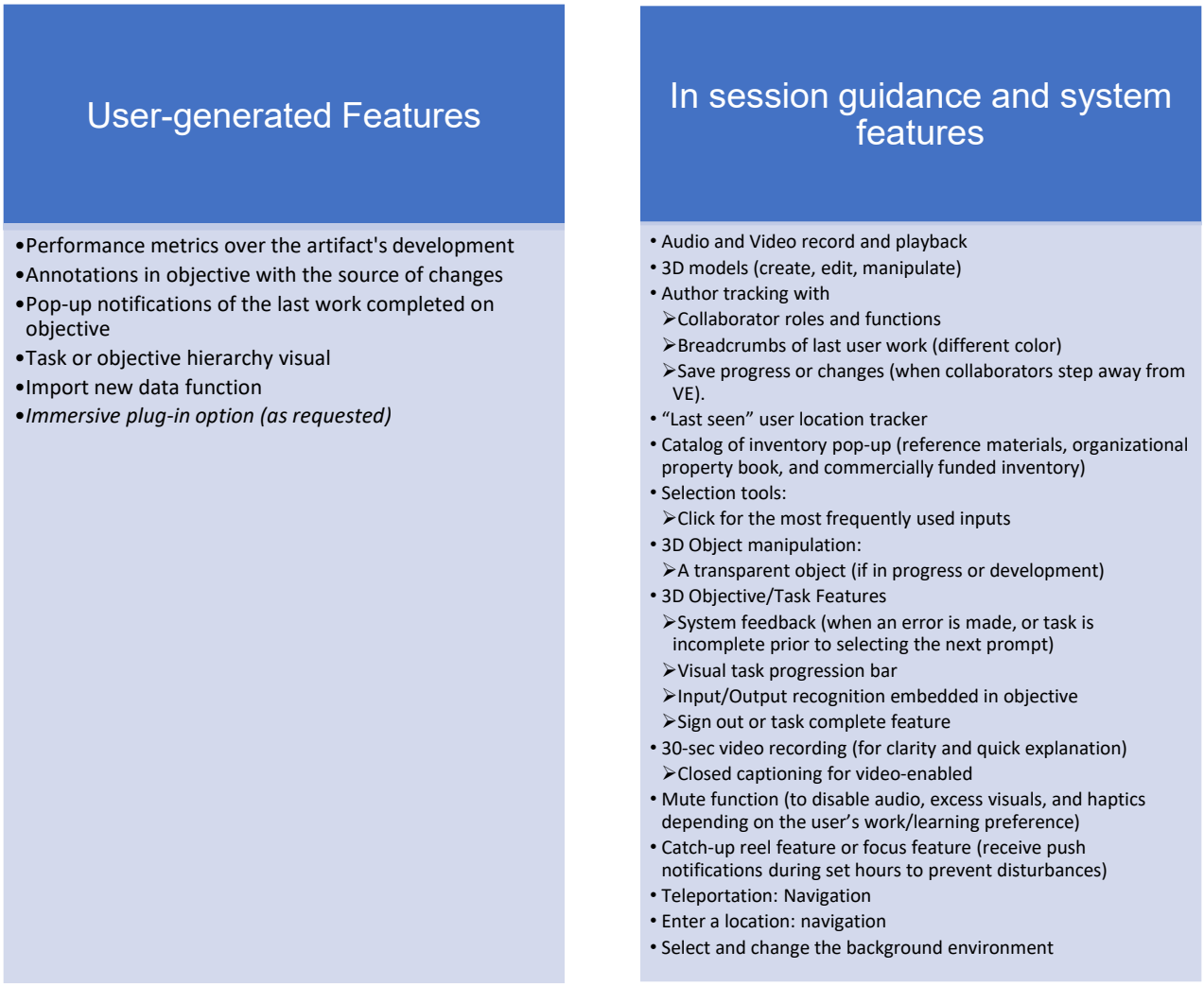

Figure 1. Primary Features of a Defense Acquisition VEAC

Conclusion

The prototype design provides a support mechanism to augment asynchronous collaborative work such as providing clarity to participants and stakeholders during preliminary and critical design review, automating and providing enhanced visuals of provider capabilities during source selection, and aiding stakeholders in finding novel solutions in market research. This capability provides an enhancement to current analog and 2D processes within the defense acquisition workforce and provides program managers, contracting officers, logisticians, and any other of the career fields who may want or need to view or manipulate 3D artifacts a new method of exploring the usability, sustainability, form, fit, and function of new systems or solutions.

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