

# Human Factors Challenges in After-Action Reviews in Distributed Simulation-Based Training

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## Summary

This paper discusses human factors issues in designing methods to develop and deliver After Actions Reviews (AARs) in the Navy-sponsored Debriefing Distributed Simulation-Based Exercises program (DDSBE). DDSBE is intended to develop and test methods for collecting, analyzing, presenting, and distributing performance data in the emerging Navy distributed simulation training environment. In addition to research-driven AAR design, the program includes considerable software development – building a simulation testbed, developing and integrating automated and semi-automated data collection tools, designing and implementing automated analysis methods, and the like. Thus, considerable data will be collected automatically, so trainers are not required to actually observe an aspect of performance to include it in an AAR. Although AARs are used after actual military actions and after live training, we confine our discussion to simulation-based training, the focus of DDSBE.

## Background

To set the context, we identify AARs' basic goals, outline the basic stages in AAR preparation and delivery, and review aspects of future distributed configurations.

**The AAR:** The nature of warfare has changed considerably over the past decade, as have the technologies available to the warfighter in general and for training in particular. Yet, despite the differences between Naval aviation and Army ground combat, a clear and compelling definition of the purposes of the AAR comes from an Army "training circular" from the early 1990's (Combined Arms Command, 1993). We italicize key concepts.

An after-action review (AAR) is a professional *discussion* of an event, focused on *performance standards*, that enables soldiers to *discover* for themselves *what happened, why it happened, and how to sustain strengths and improve on weaknesses*....

*Feedback* compares the actual output of a process with the *intended outcome*. By focusing on the task's standards and by *describing specific observations*, leaders and soldiers *identify strengths and weaknesses* and *together decide* how to improve their performances. This *shared learning* improves task proficiency and promotes unit bonding and esprit.

**Stages in AAR preparation and delivery:** A training scenario or situation must be defined; simulation-based training can require substantially more detailed specification

than live training, depending on the nature of the simulation technology. Training must take place and data on training performance must be collected and interpreted, typically within an hour or two of training completion. The AAR must be organized and planned. And, of course, the AAR must be delivered to the trainees. In some cases, records of the AAR are also kept, to support further training of the people involved and to build a knowledge base that can generate "lessons learned" and help to enhance training more broadly.

**Distributed Training:** Advances in simulation and communication technologies mean that training will not require that learners and instructors be co-located. In the simplest example, distinct elements (such as F/A-18, E-2C, etc.) participating in training will be distributed but each element will be in one place with a trainer. Individual elements might also be distributed, possibly without an on-site trainer at each location. In the limiting case, each trainee might be in a different location, with a few trainers in yet other places.

**During the Exercise:** We observed several live exercises and AARs at the Naval Strike and Air Warfare Center in Fallon, NV; this defines the "gold standard" for AARs in the Navy. A team of trainers observes the training, supported by extensive technology to monitor multiple communications channels and the positions of all entities in the training. An "overall" is based behind a podium, but frequently walks the dozen steps to a console where other personnel (approximately 20 of them, both other trainers and support staff) focus on particular comms channels or participating elements.

There are some periods of quiet, but also considerable conversation, driven by observations or questions from the overall and/or other trainers. The overall appears to develop a rich understanding of the exercise as it is happening, informed, of course, by his extensive experience in general and by his understanding of the goals of the exercise in particular. The overall frequently shifts his attention – among displays, among colleagues, among comms channels – while the other participants are much more tightly focused on their particular threads. Thus, at Fallon, all data collection during the exercise is mediated through expert human consciousness. It appears that only the overall attempts to build comprehensive SA.

## **Human Factors Challenges**

We believe that **real-time information integration** will be a key human factors challenge in moving to a distributed training environment, particularly with fewer training staff. In the current prototype DDSBE testbed, there is no explicit role for an overall. In addition, participating trainers must allocate much of their attention to the VCAT tablet computer observation tool (Stretton & Wilson, 2004). This helps to ensure that they record key data elements on key events in the scenario, since the VCAT prompts them to make such observations. On the other hand, however, they have less attention available to allocate to *ad hoc* or other observations. Thus, DDSBE implicitly trades off more uniformity and detail of observation against more holistic and multi-dimensional expert human observation. The design challenge is to ensure that important

"value adds" of human expertise are not lost when training moves to a more distributed and more automated format.

Several approaches can be suggested to address this. First, most simply, *an overall could be designated*, who would have a specialized role during the actual run, during AAR preparation, and during debriefing as well. This would underscore the importance of such information integration but would not provide any tools to support it. Second, DDSBE could readily incorporate *explicit opportunities for higher-level assessment by raters*. Such observations could be prompted by the VCAT at predetermined points in the run (for example, when major mission phases are completed). And third, *explicit scaffolding for such integration* could be provided during debrief preparation itself.

A second human-factors issue comes from the **inherently more constrained nature of simulated training**. DDSBE requires a tightly scripted scenario with well-defined specifications of expert performance. These specifications enable DDSBE to make automated assessments of trainee performance. However, this also means that major deviations from the scripted flow of events, and certainly free play, cannot be effectively analyzed.

A particular example of this is context: at Fallon (or in other live training settings) a change in plans (for example, making a second pass over a drop zone if a first pass is delayed) can be readily accommodated. In DDSBE, such a change will be substantially more difficult to deal with, since a delay in one set of activities would delay all subsequent ones, which might throw their timing off from the expert performance represented in the computer-based assessment model and/or the time flow of data recording in VCAT.

**Preparing the AAR:** Trainers preparing an AAR must identify and come to a consensus regarding the key events to explore with trainees. In the AARs we observed at Fallon, the overall and the other trainers met soon after the exercise ended. They worked face-to-face in a room with access to a "bird's eye" tactical replay of the exercise and communications recordings. They spent under an hour, centered around fast-forwarding a videotape of mission entities on a map. At various points, the overall consulted his notes and paused the tape, seeking input from other trainers as to what had happened. The time was noted; occasionally, other trainers commented on aspects of the mission as the tape was rolling, without being prompted by the overall.

Trainers identified key events from memory of the exercise and using notes they had jotted down. (We mean "jotted down": no formal checklist or instrument was used during the exercise.) They discussed each identified event, sometimes using mission replay or communications recording to examine details of what happened, but often just using their memory and knowledge of what should have happened. They discussed why observed behavior might have deviated from expected. In DDSBE, recorded performance is compared with a detailed computer-based representation of expert performance. This will ensure that deviations from ideal performance are noted but may pose challenges for higher level synthesis.

Another human factors challenge derives from the simple physical distribution of trainers. Trainers in different locations, observing different aspects of the exercise, are likely to have less awareness of events from each other's vantage points than co-located trainers. This can lead to the identification of different performance areas by different trainers. In planning the AAR, the distributed trainers may have to spend substantial time reaching a common understanding of all the events and which are important to cover in the AAR.

Therefore, in designing a system to support distributed trainers, a key human factors challenge involves **supporting the process of reaching common ground** regarding events to cover in the AAR and what aspects of the trainees' behavior led to those events. *Automated mechanisms to organize performance* around stages in the mission, events, and training objectives will facilitate converging on this shared understanding, but the process will inevitably differ from the current one. Important system features include communication tools, exercise recordings, and the ability to explore events collaboratively or independently. The system will also have to support *formal documentation of the AAR plan* to aid in keeping trainers on the same page.

*Designating an overall*, as mentioned above, may also help to reduce this problem. This individual should step through events slowly, stopping at key events (as determined by both the software and by participating trainers) and inquiring to the rest of the group about important issues. The leader should document the list of issues, formulate them into an outline for the AAR, and broadcast the AAR plan to the trainees.

In addition, we recommend the development of an *AAR preparation protocol*, to be facilitated by DDSBE technology, that distributed trainers could follow to ensure that they converged on a consensus on major events to be covered.

*Trainer communication tools* should allow both audio and text chat. They should enable trainers to have group discussions to help them reach a common understanding and also "side conversations" when one individual needs to clarify information with another, without disturbing the flow of group discussion. The replay should allow trainers to review events with the entire group, but also enable them to individually drill down to investigate events they did not have knowledge about.

**Conducting the AAR:** The goal of conducting the AAR is to carry out a discussion about the training exercise that identifies performance strengths and weaknesses and specific ways that the weaknesses can be ameliorated. In the AAR, trainers lead a discussion about the events that will uncover problems and why they may have occurred.

The Army training circular cited earlier (Combined Arms Command, 1993) recommends that a trainer conducting an AAR use open-ended questions, which encourage trainees to participate in the discussion and do not put them on the defensive. In our observation at Fallon, trainers used similar techniques to engage the participants and explore the events. AARs were structured around key events that the trainers had identified earlier, but the

discussion surrounding those events was dynamic and much of it was driven by trainees reflecting on their performance. Trainers used questions such as “At this time period, what would you do differently?” to encourage discussion. The trainers used some mission recordings to facilitate the discussion, but they did not rely on them heavily.

The face-to-face configuration allows trainers to easily assess trainee engagement and understanding, both of which are critical to a successful AAR when the trainers are inquiring about events. They use eye contact and other non-verbal social cues to make this assessment. In training settings where trainers and trainees are distributed, both **achieving and assessing trainees' interest and comprehension** become difficult.

A critical human factors design challenge for a distributed AAR system involves **supporting and managing distributed interactive discussion**. The system must *provide communication and mission replay tools*, as described above. This will be addressed by technology. *Threaded text chat* (or a message board) structured around key events might alleviate some of the problems; it would encourage participation from multiple parties and engage more people. *Presence awareness visualizations* could show who is participating in the AAR, so trainers can begin to assess the participation levels of various parties. But we believe that *additional methods of interaction*, such as *turn-taking protocols, trainee polling, and some directive questioning* may be valuable as well. Such methods can be developed by working with experienced trainers in distributed settings and can leverage aspects of the technology.

**Conclusion:** Physically distributing trainers and trainees will pose a number of human factors challenges for system developers. Some of these challenges can be addressed by technology, but others will also require designing processes to support using the technology to assess training and develop and deliver debriefs. During the exercise, the system will have to present the right level of information to trainers and allow them to efficiently manage it, facilitating their development of both global and local awareness of the exercise. In planning the AAR, the system needs to give the trainers common referents to come to agreement on key events. For AAR delivery, the system needs to allow the trainers to engage and interact with the trainees to generate good discussion, rather than just presenting information to them. The computational support provided by DDSBE will help to address these challenges. In addition, some enhancements were suggested – both technological and process – that might add substantial value.

## References

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