

DOES SIMULATION NEED A REALITY CHECK?

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ABSTRACT

The military simulation community and entertainment community approach the simulation of reality in very different ways. Generally speaking, the military simulation community attempts to duplicate reality literally by reproducing real elements in a simulation. The entertainment community, on the other hand, creates the *appearance* of reality by bringing together a number of elements that *suggest* reality, but that may not be drawn from it. This paper examines these two approaches, gives examples of how the entertainment industry approaches the simulation of reality, and discusses some of the possible advantages that the entertainment industry's approach could have for military simulation.

INTRODUCTION

How can one best simulate reality? The military simulation community and the entertainment community take two very different approaches in answering this question. Generally, military simulation takes what might be called the literal approach to simulation. In this approach, one tries to create in the simulator an exact replica of the object being simulated. Thus, in the literal approach, a simulated helicopter cockpit would have all the switches, knobs, gauges and controls that one would find in a real helicopter. Often this is done by using in the simulator the same flight-qualified hardware that would be used in an actual helicopter. Similarly, the terrain databases that provide the out-the-window view for the simulator covers a large area represented at a uniform level of detail.

We see some important limitations to this approach. Using hardware from an actual vehicle in a simulator may significantly increase its cost while at the same time reduces its portability and ability to be reconfigured. If large areas of terrain are represented at a uniform level of detail, the graphical depiction of any particular part may not be very compelling due to processing limitations, even with today's powerful graphics engines.

In films, television and video games, the entertainment community also attempts to simulate reality--but using a very different methodology. Rather than trying to literally simulate everything, Hollywood begins by defining the ultimate objective. From their point of view these are criteria such as "What experiences should the audience have?" and "How should it feel." Once these goals are understood, they can guide how much effort is put into creating different aspects of the simulation. Some parts may be only roughly sketched, others represented very close to reality, while in some cases the simulation may be hyper-real, exaggerating reality for effect. For example, explosions in film and television are deliberately extended several times their normal clock time through a process called double-cutting. Another example: in the new movie, "Gladiator" only the lowest part of the Coliseum was actually built. The upper tiers and the thousands of screaming Roman participants were all done with CGI. If done skillfully, the audience is not be aware of the different levels of simulation used.

In this paper we will describe some of the techniques used by Hollywood to simulate reality selectively, and we will raise some questions: (1) When is it appropriate to use these techniques in military simulations and how could they contribute or detract from pedagogical goals and (2) Can training be equal or even more effective in a less real environment, where the participant can more easily suspend disbelief?

CASE STUDY: DIFFERENTIATING REAL AND ALMOST REAL

In personal communication with the authors, Alesya Paschal of STRICOM recounted an experience she had during the development of a simulator for the UH-1 helicopter. For the most part, the simulator cockpit was constructed using actual components from the UH-1. However, the contractor was unable to obtain the actual Air Speed Indicator used in the UH-1 (shown in Figure 1) due to availability. Instead, a commercially available indicator (shown in Figure 2) was used. The major differences are that the markings for the simulator indicator are equally spaced, while those on the indicator in the real helicopter have unequal spacing between 0 to 40 knots. On the real



Figure 1: Air Speed Indicator from actual UH-1

aircraft, the marking for 10 knots is very close to zero, but much more widely spaced on the indicator used in the simulator.

When experienced pilots were debriefed after using the simulator, they stated that the indicator used in the simulator was *exactly* the same as the one they were accustomed to in the actual aircraft. They were quite surprised when they were shown photographs of the two obviously different gauges. One pilot told Alesya Paschal that the reason he did not notice the difference was that the major differences between the gauges are with their markings for slow speeds and he rarely went that slowly.

The lesson we take away from this case is that even very experienced users of a piece of equipment may have difficulty distinguishing between a real object and something that is close to the real thing, particularly if the major differences occur in areas that are usually not operationally relevant.

VERISIMILITUDE VS. REALITY

Whereas military simulations try to create realistic simulations by using actual components from real equipment, the entertainment industry attempts to create verisimilitude, or the appearance of reality, by weaving together a number of different elements, some of which may be real, while others may be completely synthetic. The key difference between the two approaches is that one attempts to *duplicate reality* to the highest fidelity possible, while the other attempts to *create an apparent reality*.



Figure 2: Air Speed Indicator from Simulator

To create verisimilitude, the entertainment industry begins by asking some questions:

- What is the critical situation or story element that the user/viewer/participant should experience?
- How can we direct attention toward this element (and away from the irrelevant ones)?

The answers to these questions help direct effort and guide the process of creating verisimilitude. Depending on how the questions are answered, different degrees of reality may be required:

1. **Sketched reality.** If an element is not critical to the story or experience, it may be possible to just sketch it, leaving out much of the detail.
2. **Apparent reality.** If an element is central to the story it needs to appear as convincing as possible.
3. **Hyper-reality.** If an element is critical, but in real life it may escape notice or occur so quickly that it lacks impact, it may be necessary to exaggerate reality to create the appropriate impact.

In the next section we give examples of how these different approaches to reality are used in the entertainment industry and when each is useful.

DEGREES OF REALITY: EXAMPLES

Sketched Reality

A *cloze* is a “test of reading comprehension in which the test taker is asked to supply words that have been

systematically deleted from the text” [American Heritage Dictionary]. People can successfully take such tests because they use the surrounding context to fill in the blank. The ability of people to supply missing details isn’t limited to text. If one draws an almost complete circle on a blackboard, most people will call it a circle, even though it is in fact an arc.

Hollywood uses this trait and people’s imaginations to fill in gaps similarly. For example, in the famous shoot-out in the office tower in the movie “Matrix” only the ground level was actually built. The remaining part of the impressive multi-story atrium was a painting. Another famous example can be found in Disneyland or Disney World, where the upper stories of the building on Main Street are built at a reduced scale.

By relying on the mind’s ability to fill out missing details (as with painted upper stories) or correct erroneous information (as with upper stories at a reduced scale) it is possible to create perceptions that are effective and convincing, but at a much lower cost than would be required if all the details were constructed.

Apparent Reality

When greater fidelity is required to create a convincing environment, there still may be a number of possible ways to do it, each with its own set of tradeoffs. For example, consider the familiar movie scene of a couple driving down a road in a car.

The most straightforward, but also most difficult way to film such a scene is to use what is called a *tow shot*. The cameras are mounted on a truck or other vehicle that tows the actor’s car down the street. This approach can provide very realistic results, but it can be difficult to execute. The street needs to be cleared of traffic.. If one of the actors blows a line, the whole parade needs to be moved back up the street before the shot can be started again. These complications make such shots expensive and cumbersome.

Another approach is the *process shot*. In this approach, the car is mounted on rockers and placed in front of a rear projection screen. While the scene is filmed a moving street scene is projected on the screen, so even though the car is stationary it appears to be moving. To make the motion of the car more convincing, grips may bounce the car while it is filmed to simulate going over a bumpy road. To be convincing, this shot must be done carefully. For example, at night the car must be illuminated with light that has the same color and direction as the light that illuminated the street scene when it was filmed. This approach also requires

a considerable investment in equipment. The advantage of this approach is that the logistics are much easier. It is not necessary to close a city street, and re-taking a shot is simple. .

A third approach, sometimes called the *poor man’s process shot*, provides many of the benefits of the process shot, but with almost no investment in equipment. The one restriction is that this shot must be set at night.

The car is set up on rockers as before, but because the scene is at night, there is no need for a rear projection system — it’s supposed to be dark in the background, after all. As the scene is filmed, grips carry lights past the car to cast reflections on it and simulate driving at night down a lighted street. This shot can be extremely effective and very inexpensive.

These three different approaches to creating apparent reality represent different tradeoffs. The tow shot is similar to the approach used in military simulations: it incorporates real elements to create verisimilitude, but it is also the most expensive and cumbersome. The other two approaches move increasingly farther away from directly incorporating reality into simulations, with correspondingly reduced cost. But the latter approaches (particularly the poor man’s process shot) are applicable in more limited circumstances. The lesson we take away from this is that by thinking carefully about the context in which a simulation will take place, it may be possible to significantly reduce its cost.

Hyper-reality

Sometimes it is necessary to exaggerate an event because a direct filming of the real event lacks the impact of actually experiencing the real event. One example of this is an explosion. In reality, it occurs very quickly and then is over. But it also has a major impact because it assaults all the senses (particularly if one is too close). In a direct filming of an explosion, one can see and hear the blast, but duplicating the chest-shaking thump is difficult. To compensate, filmmakers make the experience more intense by exaggerating the reality. One way to do this is to use slow motion so that the explosion lasts for a longer time than it does in reality. The audience has a longer time to see and hear the impact of the explosion and it intensifies the experience.

Another approach is to use a technique called *double-cutting*, which involves filming a critical scene (like an explosion or car wreck) from several different viewpoints simultaneously using multiple cameras. When the film is edited, the cuts from multiple cameras are used and spliced together in sequence, with some temporal overlap between

the end of one cut and the beginning of the next. In this way, a viewer sees the same explosion from multiple points of view, and because the cuts are overlapped, the event lasts longer than it would in reality, increasing its intensity.

Movie soundtracks provide a number of examples of reality that has been altered or exaggerated for effect. In fact, in most major feature films, very little of the sound that was recorded when the film was shot ever makes it into the final cut. Instead, the soundtracks of most films are carefully constructed from sound effects, music and voices dubbed in after the fact. One example of this comes from the opening titles of the famous TV series *Hawaii Five O*. In one of the shots of the montage, a jet airliner lands on a runway. As it touches down, the tires squeal. This provides a nice punctuation for the landing. However, when a real jetliner lands, it is not possible to hear the tires squeak because the noise from the engines completely drowns it out. Nevertheless, the squealing-tires-on-landing effect, which started in *Hawaii Five O*, is now almost a sonic cliché. One rarely sees an airplane land in the movies today without hearing the tires squeak.

Another example of Hyper-reality is evidenced in the movie "Terminator II." Everyone who saw the movie remembers the famous scene where the kid on his motorbike is being chased by the bad Terminator in a 18 wheeler. The scene takes place in the concrete channel they call the L.A. River. Arnold, the good Terminator is on his motorcycle on the rim of the channel, and sees what is happening. He guns his hog, races along the rim and then leaps the fence and lands perfectly in the channel, placing himself between the boy and the bad Terminator. It is an exciting shot, and an impossible stunt. No one could do it, not even a Terminator.

How was it done? In one of the first uses of digital manipulation, director James Cameron had Arnold and the bike slowly lowered by wire into the channel. Then all the wires and apparatus to do this were digitally erased. When speeded up and enhanced with digital sparks and other effects, the impossible became possible. And no one in the audience complained that it was phony.

NON-REALITY: A CONJECTURE

The greatest words in literature are "Once Upon a Time" (or "a long time ago in a Galaxy far, far away.") Once the reader accepts this, he or she suspends disbelief.

Although military simulations generally try to be as realistic as possible, some of the most effective stories and films have been made about worlds that are completely made up. Film history is replete with works such as *Toy*

Story and *Star Wars* (all of them) that take place in worlds that are imaginary. The fact that the story takes place in a fictional world is a great strength, because once the audience accepts that the world is fictional, they suspend disbelief and it is no longer necessary or expected that the world will duplicate our own. On the other hand, if a story is supposed to be set in the real world, then much more attention must be paid to getting all the details right.

What is most important, however, is that even though these stories may be set in imaginary places, it is still possible to learn from the stories and transfer these lessons back to the real world. Indeed, throughout history, people have written allegorical stories set in unreal situations that are intended to teach lessons. An interesting question to explore is whether or not it would be possible to create military simulations that were set in unreal worlds, and use them to achieve pedagogical goals. Taking such an approach might make it possible to create effective simulations at a low cost.

SUMMARY

The point of this paper is to point out that for the entertainment industry, the most compelling experiences are not created by directly mimicking reality, but instead by using a wide variety of techniques that may be only loosely coupled to the underlying reality to be conveyed and potentially altering reality depending on the message that is to be delivered. The process of designing such an experience consists of answering a number of questions:

- 1) What are the objectives? What should the audience learn? How should they feel?
- 2) What techniques are available for achieving the desired objectives? Are they obtainable?
- 3) Are they affordable in terms of time and dollars? What is the acceptable trade-off that will do the job effectively?

In our view, military simulations could benefit from such an approach. Rather than using terrain data that renders thousands of square miles at the same level of resolution, consider first what the pedagogical goals are for a simulation system. Does all of the data need to be present? Is some more important than others? It may be possible to render the scene selectively, and draw attention to just the most relevant parts. While the specific techniques that we have outlined here may not be directly applicable to military simulations, we believe the general approach of altering reality to create a compelling experience will help us create simulations that are more effective and less costly.

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