Improving Real-Time Motion

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1) Introduction
Achieving believable motion in real-time is one of the biggest challenges faced by the video game industry. The interactive nature of the medium, combined with the need for hyperresponsivity leads to consistently compromised motion. This is particularly common in titles with large numbers of characters that are required to carry out specific tasks while interacting with others.

Adding to this challenge is the consumer’s inherent knowledge of human motion, acquired through observation and personal experience. This developmental education leads to a subconscious understanding of what real motion looks and feels like. Even if the average consumer is unable to identify the specific problems within a motion, they are invariably able to recognize that a problem exists.

With the advent of next generation video game platforms, many of the limitations preventing game developers from achieving believable motion have been lifted. Electronic Arts decided to capitalize on this opportunity. By focusing significant artistic and engineering resources toward the analysis of biomechanics, we were able to identify many of the fundamental problems plaguing our motion. This, in turn, enabled us to develop a new animation pipeline which, we believe, results in significantly improved character motion and a better game-play experience.

2) The ANT Tool
Critical analysis of our existing game motion led to the conclusion that we needed to overcome three main hurdles.

- Getting more control into the animator’s hands
- Procedurally generating as much of the motion as possible
- Implementation of existing techniques which previously exceeded our technological limitations

The foundation for this new pipeline is a proprietary tool called ANT (Animation Tool).

3) Allowing Animators More Control
In the past, the animator’s main responsibility was to edit motion capture data into individual clips which were then thrown-over-the-wall to software engineers who incorporated these clips into the game build. Not only does ANT allow the animator to incorporate motion clips into the build without requiring an engineer’s time, but the animator also has complete control over how and when transitions occur between these clips.

4) Generating Motion Procedurally
The standard video game technique of stitching motion clips together via transitions (a.k.a. blends) has a fundamental limitation; even the most advanced platform can only store a finite number of clips. Adding to this problem is the iterative nature of game production and the subsequent scheduling limitations that result. Even if the technology could support an unlimited number of motion clips, there are limits to the number of clips that can be created and tuned within a typical production schedule.

The result of these limitations invariably becomes evident in the motion. Although the number of clips stored in a game may be limited, the interactive nature of the experience generates unlimited situations requiring unique motion. This, in turn, leads to numerous situations where the motion fails to fit the context. By generating features such as foot planting, weight shifts and body leans procedurally via sliders with ANT, motion can be edited to fit new situations in real time. Not only does this achieve greater believability in the motion, but it also decreasing the team’s workload by reducing the amount of clips that need to be pre-generated.

Applying New Techniques
Many techniques, such as inverse kinematics, which have been common place in the computer graphics industry for many years, remained impractical to much of the video game industry due to their computational expense. The increased processing power and memory capabilities of next generation platforms have allowed us to begin implementing many of these techniques inside of ANT. The impact on motion quality has been significant. Fundamental problems such as foot sliding and improper phase matching are no longer an accepted byproduct of the medium.

Fig1. Ant Tool Interface.

Conclusion
As we move toward new levels of improved motion, we can not ignore the importance of game-play. Only by reaching a balance of satisfying game-play and optimum visual realism will any new pipeline be successful. This was always the unwavering goal of the ANT tool, but the results actually exceed our expectations. By adopting an approach which enables the game to break out of a motion clip at any point in the cycle, both visual quality and responsiveness improved.