

Tough Love Between Artificial Intelligence and Interactive Entertainment

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ABSTRACT

Burgeoning interest in Interactive Entertainment has led many computer scientists with roots in Artificial Intelligence toward the exploration of ideas in mass-market entertainment applications. Increasing numbers of workshops, journals, and funding programs for Interactive Entertainment indicate that AI researchers in this area have a good sense for following hot new trends, but are they vanguards of a fruitful science or misguided opportunists? In this IE2004 invited talk, I'll explore the relationship between AI research and the Interactive Entertainment field, from its seductive courtship through its rocky marriage, and offer some relationship advice for the future.

1. SEDUCTIVE COURTSHIP

Although it is extremely difficult to characterize the breadth of interests of Artificial Intelligence (AI) researchers, a unifying thread involves the exploration of human intelligence. The aim is to understand the processes of human reasoning to such a degree that it would be possible to author computer algorithms that operated the same way, or even better. While there are countless reasons why the field of AI continues to struggle as an engineering field, prominent among them is that nearly every engineering problem that exists across the broad scope of information technology applications is best addressed by solutions that do not require human-level AI. Rather than making devices and software smarter, it is almost always easier to improve the design of their use. As a result, AI has an uncomfortable home in engineering, where the core interest of its researchers is no longer so interesting to the traditional consumers of this research.

The engineering of Interactive Entertainment applications is a remarkable exception. Within this field, there is extremely strong interest in software systems that think, behave, interact in the way that real people do. Primarily, the need is for fully autonomous agents to serve in the myriad of supporting cast roles of contemporary Interactive Entertainment designs, from non-player characters with which to interact in virtual worlds to companions, collaborators, and opponents within the real world. From the AI researcher's perspective, the key feature of this interest is that there does not exist a simple non-AI solution that best solves the engineering problem: addressing the need for supporting cast in Interactive Entertainment will require progress in AI's core pursuits. Both sides in this relationship are comfortable with the match-up between a need for smarter supporting cast members and the desire to work toward this goal. The courtship between AI and Interactive Entertainment has been a successful one, with nearly every significant Artificial Intelligence research lab in the world conducting some research on Interactive Entertainment.

2. TOUGH MARRIAGE

In practice, however, AI researchers working in the field of Interactive Entertainment are immediately faced with some rather daunting challenges. Foremost among these is the remarkable differences in the pace of change between AI and Interactive Entertainment. AI is a mature field of study with roots in the birth of computer science, and is arguably still trying to recover from the crash in AI interest after its boon in the 1970's and 1980's. Progress in AI is slow – slower than it has ever been – and futurists have stopped predicting that human-level AI systems are just around the corner. In contrast, Interactive Entertainment is experiencing explosive growth as both an academic field and as a commercial industry. While academic prototypes continue to astound, industry has been able to sustain qualitative change in Interactive Entertainment forms on a yearly basis.

If not already, it will soon be evident that the slow progress of AI research will not keep pace with industry and academic interests. An obvious example is in the development of autonomous animated virtual characters, where research-level AI is just beginning to find its way into high-production quality virtual environments and commercial games. While graphics researchers have provided us with animated character bodies that can approach realism in visualization and animation, their capacities for autonomous planning, control, conversation, and interaction are just barely passable for most entertainment applications. AI researchers love this challenge, and have built entire research programs around the use of virtual reality environments with autonomous animated characters as a testbed to support the (slow) advancement of their work. Without the luxury of waiting for progress, the commercial entertainment industry has had to rely on fully scripted interactions with human players to support immersive interactions of any complexity besides combat. This disparity between the need for AI in entertainment environments and the state of AI research will continue to grow as Interactive Entertainment forms push in new directions.

A particularly good solution for satisfying the need for intelligent supporting cast members in Interactive Entertainment is to forget about AI altogether and have these roles played by real humans. In many ways, the rise of multiplayer and massively multiplayer Interactive Entertainment forms has removed the industry's need for human-level AI. From an entertainment perspective, interacting with other real humans – even in distributed online systems – is typically preferable to playing with the human-level AI systems that we may one day have, for social reasons. With this in mind, the interest that the Interactive Entertainment field has had with AI research may already be taking a backseat to research in sociology and social

psychology, where social network analyses and personality profiling may be more critical to the ultimate success of an entertainment product than the fidelity of non-player characters.

Rather than be jealous of Interactive Entertainment's newfound bedfellows, AI researchers should probably be grateful that some of the demands for human-level AI in entertainment applications have been subdued. Still, the trend toward multiplayer and massively multiplayer entertainment is going to have a significant impact on the type of AI systems built in Interactive Entertainment environments, and require that AI researchers broaden the scope of their expertise into the social sciences.

3. MONEY PROBLEMS

As in most relationships, some of the most significant problems revolve around money. AI researchers following the trend into the field of Interactive Entertainment are leaving one problematic funding environment for one that is even worse. The multi-billion dollar Interactive Entertainment industry has no history or intention of funding AI research. The reasons for this are probably rooted in the structured flow of software content from small developers through large publishers filtered through hardware manufacturers, where none of these entities has any financial incentive to support individual research projects. For the same reason, there is very little incentive for research-industry collaboration. The entities that could reasonably profit from AI technologies are the developers, but tight deadlines and slim margins don't mix well with the academic model of high-risk investigation. However, ideas cross over the academia-industry divide more easily than code, and we are likely to see increasing interest from industry in academic prototypes of new Interactive Entertainment forms. If this is the space that academic achievement is to be assessed, however, then significant research funding for prototype development is going to be necessary.

There has only been one consistent funding source for AI research throughout its entire history, namely the military. The incentives for military establishments to fund basic research in AI are clear when we consider the reliance that militaries have on automation and information technology superiority, and that they will continue to rely on this superiority for the duration of their existence. Interestingly, the AI researcher in Interactive Entertainment need not lament departing from this consistent funding source, as it appears that the military establishments have also decided to follow the Interactive Entertainment trend as well. Currently, the interest is strongly rooted in computer game technology for military simulations, training, and recruitment, but the existing comfort-level that the military has with AI research has allowed research efforts in these areas to have a strong AI bent. The strong demand for application prototypes, however, again favors large projects at well-funded research labs for successful continuation of funding.

4. MARRIAGE COUNSELING

I believe that there are some things that AI researchers can do to be successful within the field of Interactive Entertainment given the problems and possibilities that exist.

- *Fix smaller problems:* The long-term success of the collaboration between researchers in AI and Interactive Entertainment will require that each field gain something valuable from the other. Considering that multiplayer and massively multiplayer systems will obviate the need for human-level AI in the foreseeable future, the main contributions of research-grade AI systems are going to be in the automation of supporting cast member roles that no human would find entertaining to play.
- *Communicate:* Although many Interactive Entertainment designs are already pushing the limits of what research AI systems can support, this is not true in the AI subfield of computational linguistics. Unlike the measured progress of research in the rest of AI, computational linguistics has enjoyed a renaissance over the last decade fueled by empirical and statistical methods. Few researchers have yet capitalized on these advances in Interactive Entertainment prototypes, and industry appears to be unaware of the potential.
- *Propagate:* Rather than trying to entice the Interactive Entertainment industry to look for ways of adopting research AI technologies, AI researchers are probably better off raising knowledgeable students and sending them off into industry. The easiest way to perform a successful transition from academia into industry is to put ideas into people and move them from one place to another.
- *See other people:* Whereas many AI researchers are following their passion when moving into the area of Interactive Entertainment, they might also be wise to check out some sibling fields that are similar in many respects, particularly those that are wealthier. Interactive systems are also having a huge impact in the fields of educational technology, collaboration technologies, medicine, and design, among many other non-entertainment areas.

The marriage between AI and Interactive Entertainment is one that is full of promise, where each side brings remarkable yet different strengths and problems to the relationship. With some caution toward the rocky road that lies ahead, there is every reason to believe that a wealth of new research problems will arise, yielding innovative new designs and techniques that expand our understanding of intelligence, interaction, and entertainment.

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