Why Player-AI Interaction Research Will Be Critical to the Next Generation of Video Games

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Abstract

Video games are changing, new limits (such as processing power, memory and network speeds), also new technologies and ways of interacting with games (Cognitive Interfaces, Haptics and XR) but most importantly Artificial Intelligence (AI). The technological development of AI around the world is proceeding at an unprecedented pace. This article briefly illustrates the emerging need for more Player-AI interaction research in Video Games to ensure an appropriate and cohesive integration strategy of AI for aspects of engineering, user experience and safety.

Keywords: Technologies, Artificial Intelligence, Video Games, Human-AI, Player-AI Interaction

Introduction

Video game sales, research and development today is at an all-time high. If there is one theme that permeates all recent trends in the game industry recently, it is the increasing use of artificial intelligence (AI). It is difficult to overstate just how prevalent discussions involving AI have become across the entire spectrum of video game capabilities. While the speed of research into the technology of AI is clearly increasing, research in Player-AI interaction does not appear to be keeping pace. Issues such as usability, interaction modalities, visualization and knowledge representation techniques are vital parts of a coherent technology integration strategy. While it is critical that the game industry keeps pace by developing advanced technologies, it is also vital that these technologies are developed in ways that players can understand and use appropriately. This article discusses two principal reasons why research in the psychology of Player-AI interaction and user-centered design work needs to keep pace with technology development in video games: to ensure AI systems are fun, safe and reliable for players to use, and to ensure these systems are integrated in ways that do not inject new kinds of error and risk [1,2,3].

Contribution

The key contributions of this article are the elaboration and discussion of some main area AI will impact the game industry over the next few years as we push the limits of technologies (specifically Player-AI interaction).

Effective Player Centered AI

Conflicts between players and advanced technologies always have the potential to arise in complex socio-technical systems. Examples of these conflicts can range from errors in player perception that originate from poorly designed interfaces, to errors in player judgment and decision making that are introduced when player interactions with said systems confuse, distract, or disrupt the experience and game play [6]. Decades of research has taught us that the potential for these conflicts increases exponentially in relation to the complexity of the system, and the degree to which subsystems are tightly coupled to one another. Technologies being developed for video games today, such as many autonomous characters, and systems that provide advanced data analytics and decision support are amongst the most sophisticated and technologically complex systems ever brought to bare. Compounded by the black-box nature of many of these systems, whose intricate dimensionality renders a quick explanation of system behavior often impossible, the potential for significant user factors conflicts to occur as these systems begin to come online in the games is tremendous. Contrary to popular opinion, however, these conflicts are seldom the result of technological failures. Instead, these **conflicts in Player-AI interaction tend to originate in a far more variable and lesser understood system the user's brain**. How players use and react to complex technologies is a delicate dance between perception, sense making, decision making, and acting, with sticky ingredients such as trust thrown in for extra measure. Preventing these conflicts takes deliberate and careful design work to ensure games that are safe, enjoyable and reliable enough to be employed in video games. This is why Explainable Artificial Intelligence is so vital to the development and integration of AI into the video games.

Explainable AI seeks to develop methods to make machine learning models more understandable to players. Creating explainable AI is especially important for video games whose stochastic nature can sometimes produce baffling and confusing behavior that is difficult to understand. Building tools that help players to understand and effectively use AI is an example of the type of research that will need to keep pace with technology development, especially

as autonomy becomes a larger and more prevalent component of video games.

Uncertain Road Ahead for Player-AI Interaction

There are a number of ongoing challenges ahead that will need to be addressed to ensure the appropriate and effective implementation of AI in video games is successful. One is the use of automated planning algorithms to aid players in making complicated and time-critical decisions. Planning in any domain is a time-consuming and labor-intense process, largely dictated by the specific domain and operational level in which the process occurs. Game studios invest a considerable amount in developing computer-automated planners with the goal of making the traditional planning process faster and less resource intensive. These planners, however, have proven less useful than hoped, largely because **computers are currently unable to incorporate higher-level reasoning and constraint consideration** into their planning process [7]. Developing techniques that expand the ability to represent these higher order dependencies and context-specific intents in automated planning are needed to help realize the promise of intelligent automated planning under complex constraints. Alongside the algorithmic development, there is also need for efforts that enable players to provide feedback to the algorithms in ways that are natural, flexible, and that result in appropriate updating and future learning of the algorithm. This concept is often referred to as “closing the loop.” In this context, the loop begins with an intelligent algorithm having learned from training data, and providing an output in the form of a prediction or recommendation to the user [8]. Currently, the user is unable to provide meaningful feedback or coaching to the algorithm regarding its output; the only way to update the model is to go back and retrain it which can be a very time consuming process, and requires specific expertise. New generations of intelligent algorithms will need to possess the ability to receive feedback from players, and update their models to reflect the needs and expectations of those players . This will greatly increase the utility of automated planning algorithms and other intelligent decision support systems. Large body of research currently exploring these problems to provide feasible solutions.

Another open challenge for AI in video games today is the use of predictive data dashboards feeding back information to the player. Dashboard analytics have garnered immense attention from the highest levels of planning in recent years. Video games use dashboards to provide information for a variety of activities, including navigation, game player, and communication. The vision of these dashboards is to provide players with a more natural interface. There are a number of sensitive issues that need to be carefully considered in conjunction with the building of these dashboards. These concerns include addressing the ethical use of behavioral predictions, methods to detect and deter bias in both the algorithm, as well as the player’s decision making component to ensure that individuals cannot be unfairly targeted or discriminated against based solely on algorithmic predictions of their behavior. Research needs to address these sensitive concerns in order that adaptive dashboards can be developed using techniques that ensure they are fair, accountable, and transparent.

Careful Consideration

Another reason that research in Player-AI interaction needs to keep pace with technology development is because failing to do so essentially guarantees that we will integrate AI into video games through adhoc approaches, where we try to shoehorn new technologies into existing processes and workflows. The injection of advanced technologies into video games will have an impact while creating new forms of errors and complications. At the same time, new technologies can make older tasks easier or even render them obsolete. A classic example is the QWERTY keyboard, a design that was originally developed to input control information to the game. Today there are several more efficient alternatives (gamepads to motion controllers), while computer keyboards do not have the same physical limitations of their counterparts, the use of the QWERTY keyboard is still used today in many PC games (testament to habit).

AI has the potential to change nearly every aspect of how we play games in the future. Rather than asking “what else can we automate?” and proceed by trying to fit new technology into old, clumsy processes, we need instead to adopt a strategy of accommodation. Accommodation, in this case, would mean developing new processes that carefully consider how to best leverage the advantages of AI in ways that support and blend with the strengths of players, while also compensating for limitations. This is the cornerstone of the concept of user–computer interaction. The principal goal of identifying the right balance of task and function allocation between advanced technologies and players in order to synergize the

strengths of both. Efforts in user–computer interaction explore how players interact with technology, especially in immersive interactive scenarios where decision speed and accuracy can be critical. Without this game designers are forced to make broad assumptions about how players will respond to and interact with autonomous elements in video games. History has unfortunately demonstrated that **assumptions about user interactions can often be drastically incorrect**, which can lead to deadly consequences. Using cognitive modeling techniques, we are working to model interactions between players and advanced intelligent systems so that we can build video games that are fun, engaging, safe - and are easier for players to use, understand and trust.

Conclusion

The game industry requires a strong commitment to always having players in the loop when developing AI technologies for games (e.g., autonomous agents [4], adaptable interfaces [5], and so on). Studying how players perceive, comprehend, and make decisions while interacting with AI, therefore, remains an absolutely necessary component of current and future games. Research in Player-AI interaction is vital if we are to consider seriously how best to capitalize on AI in games in ways that improve engagement and success. Failing to do so only perpetuates a strategy that asks players to fit into uncomfortable and ill-fitting technologies rather than designing it for their principal benefits strategy that increases the likelihood that these future “disruptive technologies” may end up disrupting only ourselves.

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