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Towards Designing Out Helplessness: AI Interventions for Videogame Learnability

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Abstract

I research how we can utilize artificial intelligence (AI) techniques to make videogames more effective teachers of their own internal complexities. I focus on exploring how we can design more graceful tutorials by finding inspiration from the learning sciences and inclusive design domains. Towards this end I study theories of failure in videogames, build tools that emphasize best learning practices and develop AI systems that improve videogame learnability.

Introduction

My mother told me that she didn't like playing videogames. She explained how, as I was growing up, she wanted to play videogames with me, but it had never worked out. "When I first tried to play a game with you, I couldn't figure out what to do. The game made me feel incompetent and I felt ashamed."

Games are an essential part of millions of players' lives. Yet many others are excluded from playing due to the assumptions the games make about what players know and don't know, what players can and can't do. By making games "better teachers", we can fight this unintentional exclusion. My research aims to do this by improving the effectiveness and inclusiveness of tutorial levels through utilizing artificial intelligence (AI) techniques.

I propose modeling our players as learners. The idea that play and learning is linked has been around for more than a century (Cook 1917). Crawford however, takes this idea one step further and claims that "...the fundamental motivation for all game-playing is to learn." (Crawford 1984) Similarly Koster, in his seminal book A Theory of Fun for Game Design, claims that the core component of videogames is fun, and goes on to define fun as "the emotion that is about learning puzzles and mastering responses to situations." (Koster 2013) By ensuring that our players are constantly learning what the game has to offer we can make the play experience more engaging and effective.

One report on mobile gaming statistics shows that, on average, over 70% of the players stop playing the game within the first day. (Udonis 2019) The report describes the game being too complex for users to understand as one of the major reasons for this low level of retention. While I am personally not interested in focusing on maximizing retention numbers it is an undeniable fact that whenever we create media, we would like people to engage with it. Data shows that most people's engagement will be, for better or worse, constrained to the initial areas of the game and as such the tutorial segments carry a significant amount of weight in deciding the long term success of any game.

Most importantly, studying how players learn to play games also allows us to identify the barriers to learning. By recognizing and dismantling those barriers, whatever they might be, we can make games more inclusive. (Pitaru 2008)

Even though these potential benefits exist, tutorial design for commercial games is currently not a very active research area. (Green et al. 2017) also reaches a similar conclusion with in paper that "surveys the (scant) literature on game tutorials". The game design industry also seems to recognize that there is room for improvement when it comes to designing tutorials (Graner Ray 2010) (Wiltshire and Man 2017) (Jamieson) (Gdc 2019) with (Pooley 2019) even stating that great tutorials are hard to come by, and bad ones are unfortunately in over-abundant supply. With my research I hope to contribute to filling this gap.

Past Work

Most tutorials in video games do not consider the skill level of the player when deciding what information to present. This makes many tutorials either tedious for experienced players or not informative enough for players who are new to the given genre. In order to combat this I developed a dynamic tutorial framework called Talin (Aytemiz et al. 2018). It is implemented as a package for the Unity game engine. With Talin it is possible to create a mastery model of an individual player's skill levels by operationalizing Dan Cook's skill atom theory (Cook 2007).

A dynamic tutorial implemented with Talin results in the player receiving information only when they need it, whenever they need it. While the novice player is given all the information they need to learn the system, the expert player is not bogged down by tooltip pop-ups regarding mechanics

they have already mastered.

However, I believe that a dynamic tutorial modeling the player skill level isn't enough to address the complaints surrounding tutorials. We also need to reach a deeper understanding of failure in games. A thorough understanding of types of failures can allow designers to be more precise in deciding which failures act as barriers to enjoyment (and so should be removed) and which failures are essential for the game experiences (and so should be preserved).

In some of my other past work I have tried to expand our understanding of failure by contributing a taxonomy of failures (Aytemiz and Smith forthcoming). In this paper I describe that players can fail in a variety of different ways while playing games. Some failures will be expected and be part of the main loop of the game, whereas others will take players out of the experience and would preferably be avoided. For example if a player touches a Goomba and dies while playing Super Mario Bros (Nintendo Entertainment 1985), that is not a design problem. Whereas if the player dies because they pick up a poison mushroom they couldn't identify due to their colorblindness, then this is a huge issue.

To differentiate these two types of failures I suggest the terms in-loop and out-of-loop failure. Even though in both cases in our Mario example the player has "died" the former is an in-loop failure, expected by the design of the game, whereas the latter is an out-of-loop failure, pointing to an accessibility problem that should be resolved.

Future Work

In the past few years improvements in (AI) techniques resulted in major progress in how well we can algorithmically play videogames (Justesen et al. 2020). Unfortunately this increased proficiency in being able to play games has not directly translated into improving the game-playing experience of players. My current research focuses on repurposing game-playing AI techniques not to beat the player, as is traditionally done, but instead to support them in engaging with the game. I believe utilizing game-playing AI agents to help players overcome the barriers is one way how we can utilize the recent advances in game-playing.

In my future work I want to keep exploring how we can use game playing AI systems to enhance the player experience, especially focusing on reinforcement learning techniques. One area that I am excited about is using our AI agents as coaches, allowing the players to learn from them.

Another avenue that I am excited about is bringing insights from learning sciences back to game design. For many years domains such as learning and motivation studies have looked into games via game based learning (Abdul Jabbar and Felicia 2015) and gamification (Deterding et al. 2011). I claim it is time for games to look at these domains to learn from them–one might say it is time for Learning for Games.

One difference between game design and learning sciences is how they treat the learner. While in the game design domain we design our tutorials assuming an individual player, the learning literature has been acknowledging that learning doesn't happen in isolation but it is a part of a social process (Gee and Hayes 2012) I am interested in designing tutorials that recognize this fact and put learners in conversation with one another.

Furthermore there are a lot of theories and techniques that might be effective when applied into a tutorial context such as zone of proximal development (Chaiklin and Others 2003), spaced repetition (Kang 2016), productive failures (Anderson et al. 2018) and peer-instruction (Crouch and Mazur 2001).

I am excited for the potential of using AI techniques to operationalize the aforementioned theories. My hope is that this strand research can contribute to making games more inclusive by making games better teachers.

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