Toward Game Aware Streaming Interfaces

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Abstract
Recently, members of our lab have been exploring the design and implementation of Game Aware Streaming Interfaces, which provide contextual overlay to game streams that can leverage live feeds of in-game metadata to augment the viewer experience and create novel spectator interactions. In this extended abstract we describe some prototype examples of Game Aware Streaming Interfaces and introduce an ongoing project to map out some of the design constraints for these types of interfaces.

Introduction
Game streaming services have become wildly popular in recent years. This has lead to a number of investigations into the novel relationships between streamers and viewers afforded by these systems [2], including the rise of esports [3]. distributed crowd play [4], and audience participation games [1]. In recent years our group has begun to explore a new space of Game Aware Streaming Interfaces that can make use of contextual game information to augment the viewer experience of streams. In this paper we provide a look at some of our early prototype systems and describe an ongoing study to map out a design space for these systems.

Game-Aware Streaming Interfaces

Game Aware Streaming Interfaces make use of metadata emitted from a streaming game to provide contextual information that can drive novel viewer interactions. While some examples of these kinds of novel interactions exist within the literature (most notably HelpStone [5]), these approaches have been purpose built for specific games. Our goal is to explore a game general approach and develop a toolkit to enable these kinds of interactions to work across games.

Within our lab we have been developing an initial toolkit to prototype game aware interactions. Our goal at this stage has been to make use of publicly available example games (in this case the Unity Tower Defense Template [6]) to demonstrate the feasibility of our approach. To date, we have developed several prototype interactions that highlight interesting portions of the design space of game-aware streaming interfaces.

Our game aware streaming system records designer-defined metadata at regular intervals during gameplay. This metadata is broadcast to an intermediary server along with a frame code, which is rendered into the scene to be visible to viewers. On the viewer side of the interaction the frame code can be used to access the relevant meta-data from the intermediary server and provide the information to adaptive overlays. In the remainder of this sections, we provide some details on how the system works and the kinds of interactions it affords.

The first example interaction (Figure 1), provides viewers with on-demand information for in-game entities using a hover interaction over the video stream. In this case the meta-data being broadcast is the type of each tower currently placed in the scene as well as the 2D screen-space coordinates of the tower. These coordinates can be used to trigger contextual overlays when the mouse hovers over a virtual hitbox of the tower. This type of interaction provides spectators with the ability to quickly access individual pieces of game relevant information without relying on the streaming to provide it.

Figure 1. An example of tower stats being rendered over the top of a video stream by a hover gesture.

A second example interaction (Figure 2), makes use of the tower meta-data but in this case renders the attack radius of each tower to help a viewer to better understand the players' strategic coverage of the scene. Unlike the mouse hover interaction this overlay is controlled by a global toggle that can be turned on and off by the view. These types of interaction can help spectators see the global game state and understand the current situation in the scene.

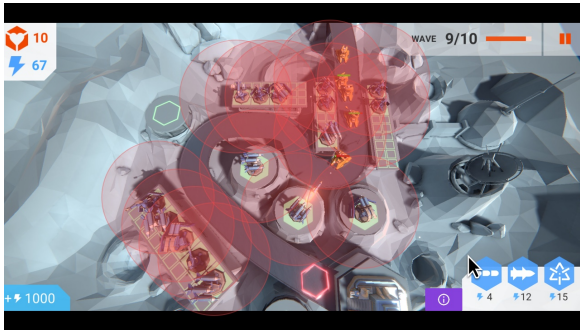

Figure 2. An example of a togglable overlay of individual tower information.

A final example overlay (Figure 3) shows viewers a list of what types of enemies will be coming down the path next. A particularly interesting aspect of this meta-data overlay is that it makes use of information that the player themselves would not normally have access to. We see these types of overlays as a particularly fruitful space for augmenting the spectator experience in games as they highlight a unique affordance of having access to time coded meta-data.

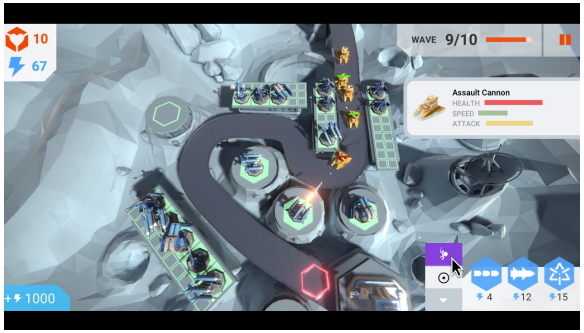

Figure 3. An example of a game-aware overlay showing information not available to the player.

While we have demonstrated several unique interactions afforded by the use of game-aware metadata, a number of technical challenges remain. For example, the current system is not robust to the scale that is achievable in game streaming contexts. Looking toward future work we plan to iterate on our current implementation and explore integrating it into other kinds of games (e.g., games that make use of non-static cameras such as first-person shooters).

Beyond continuing the technical work, we have also begun to map out the design space of the kinds of metadata available in games and interactions they could afford. In this effort we have been randomly sampling video content from Twitch and are developing a qualitative coding process to categorize the kinds of information presented in video, as well as the kinds of information that could be made available through metadata.

We believe there remains a rich space of game-aware streaming systems to be built and look forward to future developments in this area.

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