Planning a *Cosmopolis*: Key Features of an MMOG for Social Science Research

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ABSTRACT
A critical part of social science is the development of new theory to explain social interactions and the formation and uses of social networks. Paired with this problem is that of testing such theory to ensure its validity. These problems are hampered by a lack of operationalized concepts in human interactions (e.g. identifying a "unit" of knowledge) and the difficulty of conducting social science experiments on large populations and then extracting specific data from them. In order both to better test extant theoretical social models and to devise new theory we are developing *Cosmopolis*, a massively multiplayer online video game (MMOG or MMO). *Cosmopolis* is intended to be fun for its players but also contains affordances for conducting experiments and data analysis by researchers. While created to suit our own needs, the intent is for *Cosmopolis* to be versatile enough to be used by other researchers interested in social science experiments, behavioral modeling, and computer-mediated communication. During the development process, we've identified four salient features relevant to our own use of the game and the development of similar software: a foundation in theory, event-based data logging, isolated experiment frames, and large-scale in-game events. In this paper, we review the literature used in our development of the game and why these features are important in developing research-oriented games.

Author Keywords
Video Games, Experimental Design, Virtual Worlds

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INTRODUCTION
Our research has focused on the development of new social interaction theories and their verification. Our work is primarily based on the Construct theory of social interaction. This theory approximates relationships between different types of agents (human or technological) as a network within which knowledge is discretely transmitted between nodes [4,16]. Both information and beliefs are transmitted at different rates by different sources, and as the homophily of different agents increases and decreases, interaction patterns correspondingly evolve. Specific models are developed and tuned as called for by individual research projects. These models are then tested in virtual experiments by setting independent variables with specific values and observing the impact on identified dependent variables.

Virtual experimentation is often used to test phenomena for which it would be impossible to do so in a real-world environment; for example, it would be quite unethical to test a model of the spread of a disease within a major metropolitan area by intentionally giving city-dwellers different strains of the flu. Additionally, collecting data on the transmission of knowledge across large human social networks via experimentation is a hard problem; quantifying the exchange of abstract concepts such as "a unit of knowledge" is very difficult to do, and the challenge increases if you hope to observe the effects of such transfers across large networks of people. While virtual experiments can be a reasonable substitute, they suffer from some limitations. They are all bound by the constraints of the model fed to them, and correspondingly to the latent and explicit parameters contained within that are intended to approximate reality.

Two ways to address some of the issues present in developing new theory and conducting virtual experiments on designed models are: 1) developing new systems that can precisely track the exchange of abstract concepts such as knowledge, and 2) incorporating humans into virtual experiments to see if they make choices in accordance with those predicted by the model. To try and accomplish these goals, we've undertaken the development of *Cosmopolis*, an MMOG that incorporates aspects of a three-dimensional virtual world (VW), similar to those seen in *Second Life* or *There.com*.

A carefully-designed MMOG can address both of the above issues with theory development and experimental testing: such games traditionally allow for both the construction of

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elaborate scenarios in a virtual space and the precise analysis of logged user data. Indeed, in the few instances where data from corporate MMOGs has been made available to researchers, the problem has been refining the large quantity of provided data into reasonable segments. A virtual experiment designed in an MMOG based on a particular theoretical model can be used to provide feedback to improve the theory itself.

At this point in time, *Cosmopolis* is in its alpha version: it can be played in an experimental setting and principal gameplay features have been developed. As stated, the game is set in a 3D VW based around social interaction. The principal play dynamic is oriented around the construction and governance of cities. The outer game will support some combat with enemy AI, and a diverse economy.

Besides this outer environment, the game will also support a "subgame" structure: different buildings will serve as gateways to isolated games that are unrelated to outer-game activities. A player may enter a saloon to play a Poker game, or a park to access a first-person shooter. While subgames will have gameplay mechanics divorced from the outer game, success at a particular subgame will provide some sort of reward that can be used in the outer game environment. This is conceptually similar to the idea of creating restricted islands within *Second Life*, or the minigames available in the virtual worlds of *Puzzle Pirates* or *FreeRealms*. This is not to imply that *Cosmopolis* uses derivative design, but rather to suggest that we are attempting to access known interest groups and established play styles.

While intended to support our own purposes, *Cosmopolis* is linked to a long tradition of social scientists looking at the communities formed within MMOGs. In addition to providing us with a platform for experimentation and study, we hope that it can cater to these other researchers as well.

Cosmopolis has a variety of different features, and during the implementation process we identified a specific subset of them as key to the game's both being able to fit our specific situation and being flexible enough to fulfill the needs of others. While all are present to greater or lesser degrees in different online games, we believe that this specific combination is useful for facilitating our own ends (research and community usability), and should be borne in mind by any researcher also looking to develop an MMOG. These features are:

- A foundation in theory
- Event-based interaction logging
- Isolatable experiment frames
- Large-scale in-game events

The implementation of an MMOG that can be used as a research platform and host for data has significantly broader utility for several different research communities, notably social scientists, cognitive psychologists, modelers interested in conducting experiments that would be difficult to implement in reality, computer scientists interested in the humans interacting with virtual reality, and researchers specifically interested in the communities and characteristics of virtual worlds and their inhabitants. In the following sections, we review some of the literature and communities that have informed our development, why we consider these particular features important to ourselves and other researchers, and the main issues of setting up a game as an experimental platform.

BACKGROUND

In 2008, the National Research Council issued a report on behavior modeling and simulation in which it suggested that massively multiplayer online games (MMOs or MMOGs) should be investigated as a platform for the development of models of human social interaction [14]. This finding relates back to earlier work by Castronova suggesting that MMOs could be used as platforms for well-defined social science experiments [5,6], an idea that propagated with the outbreaks of several virtual game epidemics [1,11]. Cognitive modelers have leveraged this idea to use virtual environments as a way to introduce spatial relations to conceptual models [3].

This specific perspective on virtual environments as a microcosm of real world phenomena is informative, but also risks discounting the fact that online phenomena are distinct events in their own right. Despite the superficial resemblance of in-game and real-world phenomena, the two may actually function differently. In the case of in-game epidemics, for example, if your avatar gets sick you won't necessarily take time off work. Williams has described this tension in terms of a "mapping principle", and points out that the failure of identifying an adequate mapping between the real and the virtual will result in errors in experiment design and data analysis [17]. Some basic economic properties have been shown to map to real world economic phenomena, as have the reactions to virtual appearances of avatars to reactions to real-world physical appearances, but many other mappings have yet to be established [7,20].

Given that the ways in which different social phenomena map is not well understood, we looked to the practical experience of virtual world designers at imbuing their own worlds with specific social characteristics. Raph Koster, designer of the MMOGs *Ultima Online* and *Star Wars Galaxies*, collated a list of ideas contributed by different designers that should be kept in mind when designing an MMOG; a central point is that "[an MMOG is] a COMMUNITY. Not a game." This fact that has resulted in a variety of unplanned social phenomena and governance in different worlds and designers' asserting that it's impossible to make detailed central plans with any success [8,10,12]. That said, designers do intentionally develop games to try and encourage player perspectives that match their own attitudes, as noted by Malaby in his study of Linden Lab, the makers of *Second Life* [13].

Players have a variety of different goals, both social- and game-oriented, and these goals are all factored into their play habits online, a point explicitly suggested by Ducheneaut et al. in their study of players of *World of Warcraft* [9]. Bartle created an initial factoring of players of an early online game based on four competing interests, a categorization later refined by Yee into three interests that actually reinforced each other: Achievement, Social, and Immersion [2,19]. Both of these categorizations, however, have supported this idea that online games cater to multiple interests within the same user base, and thus different users compete for the same population. Pearce has performed an extensive ethnography of the players of the short-lived MMOG *Uru Live* who differ from conventional player demographics in terms of both age and interests, and notes how this community used the affordances provided by the virtual worlds *There.com* and *Second Life* to create spaces within them closer to their own play interests [15].

METHODOLOGY

In developing *Cosmopolis*, we've turned to prior work by both other game researchers and by game designers experienced with MMOG development. This method has primarily encouraged us to develop a game that fosters a long-term relationship with the player base. We do not want to make players feel manipulated, but rather as if they are coexisting with ongoing research. The game must deliver a fun player experience, and we must determine how to leverage the population of the game to improve theory without upsetting this relationship. To that end, during the development and research process we devised several features key to making *Cosmopolis* function in this manner: a foundation in our own theories on network relationships, event-based logging of player interactions, isolated experiment frames, and the ability to conduct large-scale in-world events. In the subsections below, we describe these ideas.

A foundation in theory

For a game to be useful for research, it should incorporate elements from the theory of interest within the design itself, as opposed to having the researcher make a post-hoc mapping of different behaviors to theoretical points. In the case of *Cosmopolis*, we made a point of grounding certain game elements in Construct theory to provide ourselves with specific data that we can test to determine how well that model applies in a game environment. We specifically incorporated certain in-game skills that can only be transmitted between players by active teaching, in imitation of our idea that knowledge can be quantified and learned. This helps to map the game's characteristics to developed theory, even if specific elements will still have to be studied. Player deviation from the expected mechanic (or by disregarding these skills) can be seen as evidence that the theory needs revision, while player action in accordance with the model will suggest that the theory is adequate.

Event-based interaction logging

All MMOGs require some method of logging player data; the most common method is to use a database. *Cosmopolis* is no exception to this, but our goal is to be catholic in terms of both the data logged and the data available for analysis. By logging all exchanges, it's easier for us to represent networks based around the transfer of game material, and thus further extract information about Construct theory.

Most research in games at this point has relied on ethnographic analysis, surveys, researchers leveraging game affordances to collect data, or a company making the data available for use. These latter two cases, however, are still rare: many researchers lack the technical ability to mine data from games, and companies are often unwilling to allow researchers access to proprietary player information. Our intent is to try and fill that void by making *Cosmopolis* data available and useable for researchers who would like to work with it. If new theory about online interaction is to be developed, it's important that we can test how different theories map across different platforms, and ready access to official game data in easily analyzable formats is key to that process.

Isolatable experiment frames

The subgames within *Cosmopolis* give researchers a way to conduct incentivized, isolated experiments. Provided that a researcher can describe an experiment as a game, with particular levels of the independent variable defined as gameplay elements, the experiment can be introduced to *Cosmopolis* as a subgame. While certain players may be more drawn to some types of subgames than others, the detailed data record should make it possible to control for demographic differences among players. Note that the definition of "subgame" is open-ended, and includes activities not conventionally thought of as games, such as nuanced conversations with cognitive AI models or classic economic games like the Prisoner's Dilemma. Furthermore, the subgame system, in conjunction with rewards tied to status in the main game, may also be a driver of subject participation. In the past, researchers have found that such rewards can be strong incentives for players to take the time out to complete lengthy surveys [18].

Large-scale in-game events

While subgames allow us to examine the impact of small scale treatments on portions of the player base and their responses, the game's support for macro events will allow us to experiment with much broader social impacts, and inject drama into the game. By making one part of the world controlled by a model fascist state, for example, and another portion controlled by a model republic, we will be able to look at the impact of different governance models on player economic behavior or social tie formation. Similarly, by occasionally allowing positive or negative events to affect large numbers of players, we will be able to examine the impact of such chance occurrences on information transference and willingness to collectively

share misfortune (lightening the neighbor's burden) or windfall (supporting the community with one's own good fortune).

DISCUSSION

In this paper, we've briefly discussed our use of the Constructional model of social interaction, our ongoing development of theory and use of virtual experiments, and how by developing an MMOG we can improve our research. We've taken this beyond mere theorization and have developed *Cosmopolis*, an MMOG that incorporates several specific features that we believe to be important for our own use of a research platform:

- A foundation in theory
- Rich event-based interaction logging
- Nested subgames
- Large-scale in-game events

These features are a response to the current state of research in the field and the perspectives of MMOG developers. Our goal here is not to manipulate the player base but to provide ourselves with some first principles for the game and to provide researchers with the necessary tools to carry out experiments and examine data. In this limited way, we hope to provide researchers with the ability to interface with the player base, to deal with potential design issues such as how game behaviors map to real world activity, and to determine how adherence or deviance from a socio-cognitive model implemented in a game maps to adherence to or deviance from said model in a non-game environment.

FUTURE WORK

While the implementation of *Cosmopolis* is almost complete, it is important to begin a practical assessment of the validity of the features we've identified in this paper. While we are confident of the saliency of the points here identified, only through additional study will we ascertain how they can be improved to help researchers and how they truly hinder or help the player experience.

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