Introduction

Games have always held a fascination for humans. The earliest games were dice games, based on chance and luck. Some of the earliest recorded board games, such as *Senet* or the *Game of Ur*,[1] developed in the 3000–3500 B.C. range, are still familiar to us, incorporating chance and strategic thinking on ornate boards.

A central factor in many games, sometimes the primary purpose, is to foster connection between the players. Games can provide an element of competition and cooperation that bridge the "air gap" between humans. Sporting events like the Olympic Games can bring countries together, while other games can knit players into communities.

Given this, it is no surprise that video games have followed this trend as well. Even before the rise of online gaming there were arcades, shared spaces for players, and specialized events such as local area network (LAN) parties during which gamers gather to share a LAN and participate in extended gaming sessions of popular games. Indeed, it would be a surprise if players *did not* communicate about their deeds and heroics and exhibit an eagerness to share them. We should remember that humans have one unique skill out of the rest of the animal kingdom – the ability to communicate with an expressive and rich language. Is it any surprise that humans crave to use this capability?

And thus we know we can study human behavior and social interaction in games, but does it really matter? The simple answer is "yes." As the chapters in this book show, human behavior in games is rich, complex, and varied, especially so in what we call "virtual worlds" that are created within massively multiplayer online games (MMOGs).

Is it worthwhile to study such behavior? Why should we study behavior in a virtual world that has no link to reality and in fact explicitly attempts to flee

[1] http://content.time.com/time/specials/2007/article/0,28804,1815747_1815707_1815665,00.html

from a realistic and accurate portrayal of the world? There is a good answer to that: it is still humans who are making decisions and acting – humans with innate biases, unconscious tendencies, and implicit attitudes. These do not go away in a virtual world, but rather are mediated and applied to this realm. Just as these tendencies pervade our everyday life and experiences, games (even the most prosaic) provide another avenue to inspect these tendencies.

In fact, games provide a unique venue. They are rich enough to capture complex environments, but simple enough that a large number of people can play the game. They are monitored extensively so we know a good deal about the behaviors within the game.

What stops us from studying games? One of the major challenges (and opportunities) with studying human behavior in virtual worlds is the interdisciplinary nature of such research. Many fundamental computer science problems arise in analyzing large quantities of data ("big data"), but along with that are foundational questions on human behavior. It is clear that humans change behavior when playing a game, but what type of behavior changes? Do people put on different personalities online? (Recent evidence suggests that this is not always the case.) Studying behavior within virtual worlds is an inherently interdisciplinary endeavor, requiring the expertise of computer scientists, statisticians, economists, communication scholars, sociologists, and psychologists.

Our primary goal with organizing this book is to address the need for a single volume that encompasses the interdisciplinary nature of the field. Current offerings are focused on specific problems (for instance, analytics for better monetizing games) and generally keeping within one discipline. This multiauthor volume presents a unified perspective on the field, drawing from contributions from a variety of disciplines. Currently there is no single conference or journal where this research is published, so we hope this book can serve as a valuable resource and guide to the community – especially to new researchers who can have, in one volume, key insights from across the major areas of the field.

We have organized this book within three theme areas. Part I, "Individual Behaviors and Dyadic Relationships," primarily focuses on the behavior of individuals and pairs within a game. Part II, "Groups: Norms, Leadership, and Virtual Organizations," focuses on the patterns of behavior that exist within groups of players. Part III, "Understanding Culture with Games," looks at the interaction of games and cultures. Finally, to study games and the large data sets they engender, we need new techniques that can effectively, and scalably, analyze and extract patterns. In Part IV, "Techniques for Analyzing Game Data," we have contributions that address this important element.

Following are brief synopses for each chapter that will also provide an overview to this book.

Individual Behaviors and Dyadic Relationships

1. VERUS: A Multidisciplinary International Behavioral Study of Virtual World Users

At the central core of the study of virtual worlds is a hypothesis that player behavior in virtual worlds can say something about behavior in the real world. Establishing this relationship is of critical importance in framing and interpreting results from virtual world studies. In the "VERUS" chapter, the authors describe efforts from a multifaceted large research project on exactly this topic. Subjects were asked to play in online games, choosing from public ones (such as *World of Warcraft*) or two worlds created for this project. Subjects also provided demographic details. Using rule-learning techniques from the machine learning community, the authors identified relationships between in-game behavior and a variety of real-world characteristics. This chapter summarizes results around risk-related behavior, avatar characteristics, virtual world movement, and avatar language use.

2. Understanding Aggressive and Nonaggressive Individual Behaviors in Massively Multiplayer Online Games

Ahmed, Pilny, and Poole tackle important issues of aggression and their relationship to video games. While there is a sizable body of research (which at times is controversial) on the change in aggression among video game players, this study focuses on the correlation between aggressive behavior in video games and existing personality traits linked to aggression. Using player behavior data from *EverQuest II* and existing inventories to measure physical aggression, the authors develop several predictive models of aggression based on subject behavior within the game.

3. From Good Associates to True Friends: An Exploration of Friendship Practices in Massively Multiplayer Online Games

Quite noticeable in the last decade has been the advent of ubiquitous socialization – the ability of people to constantly display and monitor the actions of friends, family, and strangers. This no doubt provides the underpinnings for

socialization. Games benefit from this, as technical underpinnings have been developed to allow for massively multiplayer environments. A key question then is: How do subjects socialize with others within the gaming environment? In this chapter by Fanny Anne Ramirez, this question is tackled through a qualitative study of players in *EVE Online*. She finds that much like real-world relationships, online relationships exist on a continuum and are continually changed through interaction in the game.

4. Couples Who Slay Together, Stay Together: Benefits, Challenges, and Relational Quality among Romantic Couples Who Game

This chapter tackles the important question of how gaming together affects real-world romantic relationships: What happens when real-world romantic relationships mix with virtual world team relationships? In multiplayer online battle arenas (MOBAs), two teams of players compete in a head-to-head fashion to control a territory within a short time period. Previous relationship studies have primarily analyzed MMOGs that differ in several ways from MOBAs: they span a longer duration, include greater character customization, and have more diversity in winning objectives, compared to the fast-paced, intense battle arena games. Evans, Craig, and Taylor study the benefits and challenges in romantic relationships among MOBA players. Despite the common perception that MOBAs are a nexus for hostility and toxicity between players, they find that MOBAs can also serve as an important tool in sustaining romantic relationships.

Groups: Norms, Leadership, and Virtual Organizations

5. Virtual Team Communication Norms: Modeling the Mediating Influences of Relational Trust, Presence, and Identity on Conversational Interactivity, Openness, and Satisfaction

The problem of creating productive virtual teams has risen in importance as workplaces become more distributed, increasing the probability that team members are not colocated and must rely on videoconferencing and chat tools. Online games are an excellent testbed for studying human team performance, since many MMOGs pose challenges that require sophisticated group coordination and problem solving. Effective communication is a prerequisite for good teamwork; however, communicating in virtual environments is a specialized

skill that is acquired over time, which increases the challenge of working in virtual teams.

Sherblom, Withers, Leonard, and Smith study communication norms in virtual teams who were tasked with surveying residents in the *Second Life* virtual world. Their chapter reports the results of a path analytic study measuring the effects of relational indices, such as trust, on the virtual team conversational interactivity. They find that being competent with virtual communication is a necessary but not sufficient condition to guarantee that good team communication norms, such as interactiveness and openness, are followed.

6. Toxic Allies and Caring Friends: Social Systems and Behavioral Norms in *League of Legends* and *Guild Wars 2*

Video games can offer diverse gaming experiences. Moreover, far from being neutral, these technological platforms are sociotechnical apparatuses shaping social interactions through the institution of relationships of power. Thus, video games are contexts in which social systems develop through behavioral norms. Accordingly and following a soft technological determinism approach, the authors assert that online video games not only influence players' experience within the apparatus, but also inform the production of collective identities, as each game elaborates a specific form of video game community through which players recognize each other. Using a semiotic research approach, this chapter then presents results of a comparative analysis of the production of social norms within two games: *Guild Wars 2* and *League of Legends*. The authors affirm that while one may identify many parameters that encourage or discourage certain behaviors and influence the development of cultural practices, video games cannot entirely constrain gaming experiences. Relationships of power remain embedded within specific features, mechanisms, and uses of signs, as well as within worldviews, modes of intersubjectivity, actions, and values that are prescribed within the community. As semiotic objects, video games are effects of a cultural, ideological, and institutional context, but they also produce cultural, ideological, and institutional norms. Therefore, they are not neutral.

7. Management (Im)Material: Negotiating Leadership in Virtual Worlds

Academic research has begun to chart the leadership activities cultivated by players in commercial MMOGs such as *World of Warcraft* (WoW) and *EVE*

Online. Players form into groups, ranging from temporary small teams to large-scale, long-term associations numbering in the hundreds, in order to carry out goal-driven and cooperative activities. Directing these activities requires an array of communicational and interpersonal competencies, from establishing and communicating short-term and long-term priorities, recruiting new players, resolving conflicts between players, allocating resources, negotiating interactions with other player associations, and choreographing the actions of other players whose avatars have specific roles, skill sets, and weaknesses. This chapter offers an empirically driven account of the (dis)connects between players' dispositions and the embodied experiences of their play, and their propensity for and enactment of leadership in MMOGs. The study reports of game-based leadership styles and behaviors that found what the authors coined *self-interested* leadership to be least effective in terms of in-game progression; *autocratic* leadership was next, and *networked* leadership was demonstrably most successful. The authors also demonstrate that different kinds of gameplay invited and supported different forms of leadership, one being formal-managerial and the other contingent, networked, and task-driven.

8. Virtual Organization and Online Games

Virtual organizations have become popular in conjunction with the rapid growth of electronic commerce and are regarded as one of the promising new organizational forms of the future. MMOGs offer new promising opportunities to research virtual organizations. The characteristics of MMOGs allow researchers here to obtain objective data from a large and multinational population. Lasting over months or even years, MMOGs facilitate longitudinal studies and ensure a high involvement of participants reflective of their work and activities in real-life virtual organizations. Moreover, collecting data from online surveys and game servers keeps the costs of MMOG studies relatively low. In addition, the players on MMOGs operate and function within the game the same way as if they were in a virtual organization. The author illustrates how research in MMOGs can utilize these opportunities to overcome some limitations of traditional research and study the very features of virtual organization environments. He addresses a variety of essential characteristics, design principles, and enablers of virtual organizations, while recognizing that flexibility is the main goal when forming virtual organizations. Wigand discerns that virtual organizations manifest themselves across many boundaries: time and space, as well as legal definitions. Trust counts as a decisive coordination mechanism for virtual organizations. Several limitations, however, can be recognized,

including the technical infrastructure, as well as human behavioral patterns imposed on institutions.

9. Virtual Economic Experiments

Behavioral economics, which studies economics with human psychology in mind, has grown in significance. However, many human studies have subject participants that are limited in diversity and in sterile settings. Virtual worlds provide an alluring alternative to in-lab experiments. In this chapter the authors survey a wide variety of experiments and discuss the benefits and drawbacks of virtual experimentation specifically for economic experiments. In terms of benefits, drawing from a diverse population is an important factor: this allows us to understand the impact of culture and other factors on decision making. Control of the virtual environment, and naturalistic settings, are also important.

Understanding Culture with Games

10. A Simulated Utopia: The Social System of a Virtual Ancient Egypt

This chapter is based on *A Tale in the Desert*, a noncombat MMOG emphasizing cooperation as the players construct a virtual version of ancient Egypt. It is designed to run in long cycles, i.e., "tellings," starting from scratch each time. This author has studied culture and social structure in *Tale* in both the fourth and sixth tellings, 2008–2010 and 2011–2015. Here he reports on the transition from the sixth to Seventh Telling. In contrast to many combat games, players in *Tale* are encouraged to join multiple guilds, resulting in the guilds specializing and creating a vast interlinked social structure marked by the division of labor. As could be observed in real ancient societies such as Egypt, social structure is supported by religious rituals, although unlike other fantasy games, *Tale* does not emphasize simulated magic. Rituals utilize ancient Egyptian culture and tend to be realistic, such as the marriage ceremony, which actually results in the establishment of community property between marriage partners. Because building structures ranging from small farms to huge pyramids requires a great diversity of skills and materials, individual players must help each other, although they also compete – peacefully. There even is a political system in which players may gain status and that decides some of the secondary rules of the game. A variety of methodologies are employed in this research, connected to standard concepts in a range of social theories. However, here a special emphasis is given to the classical research and theory on utopian

movements. Arnold Toynbee used ancient Egypt as a prime example for his theory of challenge and response. The study concludes that online communities may be the most practical form of utopian experiments possible in today's world, because it is impractical to secede from the global economy, but feasible to create the experience of social harmony in an internet-delimited environment. The author provides new insights about human cooperation in a virtual environment.

11. Gaming in Multicultural Classrooms: The Potential of Collaborative Digital Games to Foster Intercultural Interaction

This chapter addresses the growing cultural diversity in European educational settings. This includes acculturation processes in schools having become increasingly complex as well as "problems" associated with cultural essentialisms in everyday classroom practices. Digital games have been embraced as an effective tool in efforts to learn and to utilize learning processes. The authors demonstrate in several studies how benefits in the use of digital games in educational settings were derived. In general, these studies focus on how digital games are being used for knowledge acquisition. In the present research, however, the authors created a new approach for the study of digital games in educational settings. Utilizing collaborative efforts, the potential of digital entertaining collaborative games to foster intercultural interaction in culturally diverse classrooms is explored. The authors anchor their research theoretically on mechanisms available through intergroup contact theory that, in turn, demonstrate the importance and explain intercultural interactions. In all, these efforts are seen to be embedded in long-term processes of integration, thus enhancing intercultural competence, mitigating conflicts stirred by cultural differences, and fostering processes of language and social integration among pupils in culturally diverse settings in the field of education. A key policy priority should therefore be to plan for the implementation of innovative teaching/learning approaches to tackle the problems deriving from cultural diversity in educational environments.

Techniques for Analyzing Game Data

12. The Power of Social Features in Online Gaming

This section explores novel techniques for analyzing social data extracted from online games and virtual worlds. It is clear that social interaction plays a

nontrivial role in motivating players to participate in games, particularly MMOGs. An important question is to understand how social interaction can be measured in order to improve the gameplay experience. The use of social features and a "Quality of Experience" measure based on social features allows capturing how negative behavior, such as toxic comments, can impact game experience. In this chapter the authors focus on this and related problems. They describe different aspects of player experiences in online social games and survey methods for identifying social features.

13. Profiling in Games: Understanding Behavior from Telemetry

Sifa, Drachen, and Bauckhage provide an overview of commonly used profiling techniques for understanding player behavior in their chapter. The term "telemetry" refers to the software systems used to log player actions during gameplay; player profiling is the process of computationally constructing models of player behavior from data. It has numerous practical applications, including improving user experience, detecting fraud, and increasing monetization. This chapter presents a selection of case studies showing how machine learning, clustering, and low-rank matrix factorization can be applied to various profiling problems. The general aim of profiling is to cluster the players into different groups, based on their past behavior. In some cases, it is possible to predict future player behaviors; however, often the goal is providing interpretable models of player activities to game designers seeking to understand the effects of design choices on user experience.

14. Using Massively Multiplayer Online Game Data to Analyze the Dynamics of Social Interactions

While Sifa et al. focus on the commercial aspects of profiling users, Hajibagheri and his coauthors treat MMOGs as a laboratory both for conducting social science experiments and evaluating the performance of predictive models of social dynamics. Player transaction data is represented as a dynamic multiplex network in which the nodes represent players and the edges denote different types of social interactions, such as chatting, trading, or fighting. The network structure is dynamic and expressed as a time series of snapshots taken at periodic intervals. This chapter chronicles their research on *Travian*, a real-time strategy game, and introduces several new algorithms for predicting future network structure from past interactions. To succeed at *Travian*, players must form alliances and conquer territory to achieve the final civilization-building

game objective. These dual processes of cooperation and conflict between players combine to shape the multiplex network and create cross-layer patterns that can be exploited to improve prediction accuracy. The authors describe their method for extracting, aggregating, and reweighting topological network features in order to predict future player actions.

Conclusion

History, as they say, repeats itself. In ancient times, games were used to understand, predict, and manipulate the world. It is perhaps appropriate, then, while considering the ocean of work on games and human behaviors (to which we humbly hope this volume makes a contribution), to think of games serving the same purpose as they did before – to help us understand the world we live in.