Player Commitment to Massively Multiplayer Online Role-Playing Games (MMORPGs): An Integrated Model

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ABSTRACT: The massively multiplayer online role-playing game (MMORPG) phenomenon has generated significant interest on the part of consumers and software publishers. Despite considerable efforts to improve the technological quality (e.g., graphics, networking) of the games, little effort has been directed toward understanding the motivation that leads to successful and continued use of MMORPGs. The primary goal of this study is to identify the factors that influence player commitment to MMORPGs. We hypothesize that the key to obtaining loyalty is to motivate players to embrace ownership of the game by enhancing their ability to control their game character and to develop an online social identity. To achieve loyalty, two different strategies were proposed: (1) an ownership-enhancing strategy based on psychological ownership theory and (2) a socialization-enhancing strategy based on social identity theory. This study empirically examines the effectiveness of these two strategies in producing loyalty in MMORPG players. A structural equation model, developed to test the viability of the proposed strategies, found that both strategies contribute to establishing players’ e-loyalty to the MMORPGs, and this finding has business implications for software developers and publishers.

KEY WORDS AND PHRASES: E-loyalty, MMORPG, online role-playing games, psychological ownership, social identity, socialization.

Online gaming has increasingly attracted a broad range of enthusiasts of different ages and socioeconomic backgrounds and can currently be considered to be a part of daily life for many people [85]. For example, revenues from games embedded in social networking platforms, such as Facebook, were expected to reach $2 billion by 2012 [54].

Massively multiplayer online role-playing games (MMORPGs)—one of the fastest-growing forms of online game—are available worldwide through the Internet. An MMORPG is distinguished from other games because game players share experience, earn rewards, and collaborate with other players in the virtual world. Ye and Chen noted that MMORPGs are termed “persistent-state-world (PSW) or persistent-world (PW) because the virtual world is always available, and events happen continually in the game world, even while some of the players are not playing their character” [84, p. 46]. As a result, an MMORPG is similar in many ways to the simulated reality presented in the movie *The Matrix.*

In the typical MMORPG environment, millions of users use their avatars to interact, collaborate, and form relationships with other players to accomplish complex goals [87]. Although there are niche products in the science fiction, combat simulation, and social interaction categories, the majority of MMORPGs are in the fantasy or role-playing genre [4]. These highly social and structured environments can lead to the development of skills that can be
transferred to the material world [87]. MMORPGs are similar to other social interaction games, such as Linden Lab’s Second Life and Makena Technologies’ There, in which virtual environments provide opportunities to socialize, trade products, and even earn income [4]. Individuals may use MMORPGs to satisfy various needs and desires and to escape the pressures of real life.

MMORPGs require that the players cooperate to achieve advanced goals in the game. For example, in EverQuest, a group or party may form to pursue adventure, trade, or simply to socialize. Combat, medical, or fashion goods are sold on the open market and bought by mercenaries, doctors, and other members of the general public in the Star Wars Galaxies game environment [87]. Such game environments make MMORPGs relevant to research on social interaction and socialization.

Although some MMORPG companies are successful in attracting loyal game players and generating profits, many companies are not. The market is very competitive, and survival is difficult due to the dynamic and fickle nature of online communities.

Player loyalty, which is based on the ability to acquire and retain players, is essential for the success of an MMORPG. Game players are notoriously fickle and will abandon games if the game environment is awkward or new quests are slow to emerge. While most prior research focusing on MMORPGs has investigated the phenomenon from the perspective of addiction [87], the present study focuses on how to make these games more competitive in the marketplace. Therefore, the goal of this study is to identify effective strategies for promoting game player loyalty to MMORPGs by testing a proposed model using data from a survey of 173 players who were members of a large MMORPG community.

The following section of the paper presents background information and proposes a theoretical framework for MMORPGs. Based on this framework, later sections present the proposed research model, study hypotheses, instrument development, data collection methods, data analysis procedures, and the results of testing the model. Finally, we discuss the study findings, their implications and limitations, and future research directions.

Massively Multiplayer Online Role-Playing Games

An MMORPG is a shared Web-based environment in which many users simultaneously participate in different role-playing scenarios [36]. In games such as World of Warcraft, multiple players share a single game world and establish their characters by participating in quests. An MMORPG is essentially a self-contained, virtual world that is implemented on an Internet platform, and players choose an avatar or character to represent them in this virtual environment. The character, which is directed and maintained by the player, can move, communicate, and engage in many types of actions [15]. Appendix A provides a selection of MMORPGs and discusses the market share of popular games.

One important characteristic of MMORPGs is that game players control their “character” or avatar, and players determine their character’s actions
throughout the game [2]. The research literature suggests that the players view
the avatar as an idealized version of their own personality and that users are
less satisfied with their avatar when there are major discrepancies between
online and real personalities [23]. Another common feature of MMORPGs is
the presence of a “guild,” which is a community of players linked through the
game. The guild is also sometimes called a “clan.” Guild members regularly
play together in the game world, and many MMORPGs provide guild game
players with chat and instant messaging services to facilitate communication
among members [9]. This communication, which is an essential component of
MMORPGs, improves social interactions, game performance, and enjoyment
through the formation of social networks [82].

The persistent character of the MMORPG environment is also regarded as
a fundamental MMORPG feature because the world is ongoing, vibrant, and
evolving. This dynamism, in turn, stimulates interest and motivates players
to renew their game subscription. The increase in the number of MMORPG
players is paralleled by increased research on MMORPGs. However, previ-
ous investigations have primarily focused on game addiction [12, 56], social
networking [18, 76], and the engineering of the MMORPG environment, such
as system architecture [13, 47] and virtual reality technologies [55, 57]. Few
studies have examined player motivation and commitment to playing and
becoming regular customers of online games. However, acquiring and retain-
ing players are critical activities for MMORPG publishers because customer
acquisition and retention through loyalty are the two major components of
market share, and failure to attract and keep the customers can discour-
gage the growth of e-commerce [38]. Research on e-loyalty has found, for example,
that increasing customer retention by as little as 5 percent can increase profits
by 25 percent to 95 percent [68].

Yee found that age, gender, usage patterns, and in-game behaviors were
positively related to game players’ motives: “Not only do MMORPGs
appeal to a broad age range (mean = 26.57, range = 11–68), but their appeal
is very strong, leading to an average of 22 hours of usage per week across
all ages” [85, p. 309]. Ko [52] found no distinctive characteristics associated
with female players but found that older male players with lower self-esteem
and life satisfaction committed more to MMORPGs than other players. Lo et
al. [56] also found that players who experienced difficulty in social relation-
ships and players with higher levels of social anxiety spent more time on
online games. Sørensen [76] confirmed these findings and also found that
game players became committed to the game by playing together and chat-
ting with other players. Chapell et al., who focused on addiction to online
games, found addictive game play to be similar to alcohol and gambling
addictions and identified the central factors of such addictions as “salience,
mood modification, tolerance, conflict, withdrawal symptoms, cravings, and
relapse” [12, p. 205].

However, these findings do not fully explain success in the MMORPG
market. The primary goal of this study is to identify factors that motived

game players to commit to an MMORPG. To achieve this goal, this research
focused on key cognitive and social psychological variables influencing the
development of e-loyalty toward MMORPGs.
**Strategy Development**

Brand loyalty is defined as “the preferential, attitudinal and behavioral response of consumers toward one or more brands in a product category over a period of time” [29, p. 176]. Because of brand loyalty’s importance, researchers have extended their interest in loyalty research to the Internet market [39]. Gommans et al. [34] noted that e-loyalty is essentially an extended concept of brand loyalty and that the drivers of e-loyalty have immediate implications for developing and maintaining brand loyalty in e-space. Therefore, this study defines e-loyalty as the development and maintenance of game players’ preferential, attitudinal, and behavioral responses toward an MMORPG. Because many researchers have noted that loyal customers are more likely to provide positive word of mouth [37], one behavioral outcome of e-loyalty should be positive word of mouth, which might include higher-level strategic tasks, such as motivating group members, dealing with negative attitudes, dealing with group conflicts, and encouraging group loyalty and cohesion [85].

E-loyalty can also be explained in terms of the concept of lock-in, which is an extension of brand loyalty. In the economics literature, lock-in is defined as the behavioral tendency of consumers to refrain from switching products due to the costs incurred when switching from one product, service, or vendor to another [73]. For example, there might be setup costs for using a new product or penalties for abandoning a service, and in addition there are well-known psychological costs involved in switching brands and learning about a new product or service. Research in the marketing literature has documented that skill-based habits resulting from the continuous consumption and use of a product may produce cognitive lock-in [64]. MMORPG systems that facilitate the development of skills may also lead to cognitive lock-in.

To devise specific strategies to develop loyalty in MMORPG players, software makers must understand the psychological mechanisms at work. We stress that two strategies primarily generate e-loyalty: (1) an ownership-enhancing strategy, which is based on psychological ownership theory, and (2) a socialization-enhancing strategy, which is based on social identity theory.

**Ownership-Enhancing Strategies**

**Psychological Ownership as an Ownership-Enhancing Strategy**

Because players’ attitudes are considered to be an important factor contributing to an online game’s success, many companies have attempted to identify players’ feelings during game play. The present study assumes that there are psychological associations between the game player and his or her game character. We propose an ownership-enhancing strategy based on psychological ownership theory. Figure 1 illustrates the hypothesized relationships between control, psychological ownership, and loyalty, in which psychological ownership mediates the relationship between perceived control over one’s character and e-loyalty.
Psychological ownership is a cognitive-affective state that reflects individuals’ attitude toward various material and immaterial objects [65]. Although some scholars have claimed that ownership concepts are historically of Western origin [66], Heider [42] has observed that ownership attitudes are commonly found in all populations.

Psychological ownership is a state in which individuals feel as though the ownership target (a material object, a concept, or an entity) is theirs or belongs to them [66]. The ownership target can be viewed as an extension of the self [22], and the complex concept of psychological ownership is both cognitive and affective because it includes individuals’ thoughts, beliefs, and actions toward the target of psychological ownership. Just as legal ownership may be based on actions such as an individual purchase, intellectual distinctions determine what is psychologically owned or regarded as an extension of the self. From a systems theory perspective, the system boundary is defined by the intellectual choices with regard to the objects or entities that are included in the “definition of the self.” Objects that are incorporated into the individual’s self-concept are viewed as an extension of the individual and are psychologically owned; and these feelings of ownership are associated with a sense of efficacy and competence [81] that produces pleasure and gratification [31].

**Attaining Psychological Ownership: Control**

There are five primary antecedents of psychological ownership: (1) the desire for autonomy or control [31]; (2) the desire for pleasure [31]; (3) the desire for security [31]; (4) the expectation of enjoyment [31]; and (5) the expectation of satisfaction [31, 66]. The present study focuses on the desire for autonomy or control, because it is crucial for attaining psychological ownership [31, 66], particularly in the MMORPG environment. The desire to own something is associated with gaining power or avoiding feelings of powerlessness [46], because ownership implies control over what is owned. Ownership is related to control and is based on the need for *effectance*, which is the ability to
produce desired outcomes in the environment [81], and the *effectance motive*,
is the individual’s desire to affect his or her environment. Exploration of the
environment and the ability to alter the environment by one’s actions produces
intrinsic motivation, feelings of efficacy, and pleasure [66].

Feelings of psychological ownership are common across all age groups. Feelings of ownership develop in toddlers and young children due to their
innate desire to control objects and to be effectant [31, 66]; that is, people of
all ages seek to own and possess objects, because individuals seek to control
and influence their environment. When they achieve this control, individuals
then develop psychological ownership. It is also worth noting that “in addition
to producing intrinsic pleasure, control over the environment may produce
extrinsic satisfaction, because certain desirable objects are acquired” [66, p. 89].
This is especially relevant for MMORPG systems because the game typically
requires players to use one’s character to acquire objects in order to succeed
in the virtual world.

**Primary Control and Secondary Control**

As noted in the preceding discussion, the desire for control motivates individu-
als to obtain ownership, and individuals develop feelings of psychological
ownership toward target objects or entities as a result of controlling objects in
the environment. Control is thus a driving force in behavior, and individuals
strive to produce behavior-event contingencies to exert primary control over
the environment [81]. Conversely, individuals are averse to loss of control
and experience negative emotions when confronted with possible or actual
loss of control [41].

Because people strongly value the perception of control, they are reluctant
to lose this feeling and sometimes adopt alternative strategies to maintain the
perception of control. Rothbaum et al. [69] defined two types of control: (1) pri-
mary control, in which individuals gain control by altering the environment
to correspond to their wishes, and (2) secondary control, in which individuals
alter themselves or align with environmental forces.

One manifestation of secondary control is interpretive control, which is the
search for meaning and understanding [69]. Individuals seek to find meaning
in events in order to accept them. For Heckhausen and Schulz [41], secondary
control strategies are necessary because human actions may fail to achieve their
goals; individuals must therefore be selective in the goals that they pursue.
When individuals experience failure and the loss of primary control, they
adjust to the environment by creating secondary control through a search for
meaning. Understanding events is a cognitive behavioral adaptation to the
loss of primary environmental control.

In the MMORPG world the environment can be thought of as comprising
two components: (1) the character/environment in which players attempt to
control and skillfully manipulate the avatar, and (2) the game environment,
which is the virtual world, where the players’ avatar interacts with other
avatars and the virtual environmental setting.

Both primary and secondary control are essential for coping with the envi-
ronment. Primary control is related to the intrinsic need to exert control over
the environment [81]; secondary control is an adaptive behavior that provides enjoyment, gratification, and pleasure because of the “positive thoughts and positive mood that accompany the achievement of meaning” [69, p. 26] and because secondary control helps to maintain the perception of control. Thus, both primary and secondary control strategies maintain perceived control, which produces feelings of psychological ownership.

For MMORPG players, greater feelings of psychological ownership should increase positive feelings of experienced responsibility, caring, and stewardship [66], which in turn should produce greater loyalty to the online game. In MMORPGs, a player typically controls a single character that evolves over time in the environmental setting [71]. Yee argued that MMORPG players usually play characters that are able to alter the game environment and control the flow of a fight so that their character becomes the winner [86]. Control of the character/environment elicits feelings of efficacy and pleasure by producing environmental (game environment) change through one’s actions. Control of the character/environment may also produce extrinsic satisfaction [66]. Although control of the game environment and game success are the ultimate goals of the players, the MMORPG players can interact and control the game only through manipulating or controlling their character. Control of the character is a necessary, but not sufficient, condition for game success. Players must also possess skill, strategy, and knowledge. Because primary control is related to direct manipulation of the game character [66], MMORPG players attempt to manipulate their characters skillfully. As a result, the higher the character’s level, the greater the control the player has over the character [49].

Secondary or interpretive control can be an important mechanism through which individuals can recover the perception of control. When individuals experience a reduction in primary control, they may either withdraw (abandon the MMORPG and identify alternative goals) or they may invest in secondary control. To ensure a fair gaming environment, MMORPGs run in real time with a low level of live control [79], and players may therefore seek greater interpretive (secondary) control. Because secondary control is characterized by persistent behavior [69], by definition MMORPG players display secondary control behavior.

Psychological Ownership and E-Loyalty

Employees who consider themselves owners of an organization believe that they have the right to influence the direction of the organization and have a responsibility to others within the company [65, 66]. Vandewalle et al. [80] found that psychological ownership influenced the extra-role behavior of organization members, which suggests that individuals with a higher level of psychological ownership are more likely to engage in behavior that benefits the organization.

As mentioned in the preceding section, greater feelings of psychological ownership should increase positive feelings of experienced responsibility, caring, and stewardship, which should then produce greater loyalty in MMORPGs. Feelings of psychological ownership produce pleasure and gratification [31]; and satisfaction with online game environments has a positive
effect on e-loyalty [83]. Cyr et al. investigated the effects of user control, user connectedness, and responsiveness of a Web poll application on e-loyalty and found significant relationships between them [19]. Chang and Chen [11], who investigated the relationship between e-loyalty and customer interface quality, satisfaction, and switching costs, confirmed that customer interface quality, which included interaction [11], Web site’s ability of attraction [53], and operating service categories [44] contributed to e-loyalty. Furthermore, based on their empirical investigation, Gaskin and Lyytinen [33] argued that individual appropriation and psychological ownership were theoretically equivalent and that appropriation was associated with outcomes such as control, job satisfaction, and extra-role behavior. Taken together, these studies provide reason to believe that increased levels of psychological ownership should provide for increased feelings such as caring, responsibility, stewardship, and satisfaction and that these psychological feelings should be important drivers of e-loyalty.

**Hypotheses Development**

The time and effort an MMORPG player invests in improving the ability to manipulate a character produces feelings of control and ultimately strong psychological ownership toward the character, which positively influences the player’s behavior and perception as well as generating stronger levels of e-loyalty toward the game. In other words, the ability to control an MMORPG character directly produces efficacy and pleasure, and also induces psychological ownership, which in turn leads to feelings of stewardship and e-loyalty to the MMORPG. Figure 1 illustrates how the strong sense of psychological ownership that is developed by perceived control over characters creates e-loyalty toward MMORPGs.

Based on the above discussion, we propose the following hypotheses regarding an ownership-enhancing strategy:

**Hypothesis 1a:** The player’s perceived control over his or her own character (avatar) positively influences his or her psychological ownership of the character (avatar) in the MMORPG.

**Hypothesis 1b:** The player’s psychological ownership of his or her own character (avatar) positively influences e-loyalty toward the MMORPG.

**Socialization-Enhancing Strategies**

**Social Identity as a Socialization-Enhancing Strategy**

As noted earlier, a distinguishing feature of MMORPGs is that most game players join a guild when they play the game, which develops a stronger social bond between game players. According to an IBM report [45], various communication mediums, such as instant messaging, online chats, and VoIP,
among others, facilitate interactions between guild members. The report found that one of the guild leader’s important roles is to mediate conflicts and maintain social relationships in a guild, indicating that interaction through multiple communication tools is critical in maintaining a guild. Hence, perceived interaction between guild members was defined as the degree to which a guild member believed that interacting through game interface features provided by the game service provider enhanced satisfaction within the game environment [16].

Cole and Griffiths [18] found that MMORPGs are highly socially interactive environments that provide opportunities to create strong friendships and emotional relationships. As a result, to the extent that the game service providers furnish players with adequate communication and social interaction tools, it should be easier for game players to develop strong social relationships.

Shen et al. [74] found that in the virtual community context frequent member interaction promotes interpersonal attraction and influence, which in turn enhances member e-loyalty. Hsu and Lu [43] suggested that the concept of online communities could be used to improve players’ e-loyalty toward the game. Hence, we believe that social identity should mediate the relationship between perceived interaction satisfaction and e-loyalty. Figure 2 illustrates our theoretical model, which provides a basis for the socialization-enhancing strategy.

Three Aspects of Social Identity

Social identity is defined as the individual’s knowledge that he or she belongs to a particular social group, as well as the emotional and value significance of his or her group membership [1]. A core tenet of social identity theory is that individuals who define themselves based on a particular social identity will maintain or enhance the positive distinctiveness of the group associated with that identity [40]. Mael and Ashforth [58] noted that social identification is basically the perception of belonging to a group. The individual perceives himself or herself to be an actual or symbolic group member.

With regard to organizational behavior, Bergami and Bagozzi [7] argued that the cognitive component of the social identity of a valued group is based on the self-categorization of organization members and that the effect of membership in a valued group differs depending on the characteristics of the group. Bergami and Bagozzi distinguished three different aspects of the concept of social identity, noting that “social identity in terms of a valued group involves cognitive, affective, and evaluative components, and motivates behavior that is consistent with identity maintenance.” Table 1 presents definitions of these three aspects of social identity.

Socialization

Moon et al. [61] identified the socialization processes that produce social identity. Socialization is the process through which individuals become group
members, which involves processes that progressively restrict individuals’ behavioral potentialities within an acceptable range and prepare them for the types of roles they will play later in life [70]. Maltas [59] noted that the phenomenon of socialization could be understood through the concept of symbolic interaction theory because the theory explains the gestures, reference group, and significant others that construct meaning for an individual in a specific social situation. In the interaction theory approach, social interaction contributes to shared meanings among situated actors, and this interaction facilitates coordinated actions that define the uses and outcomes of communication technology in informal or formal groups [30]. In short, certain socialization processes enable an individual in a particular group or organization to develop three different aspects of social identity through appropriate social interactions with other members.

Figure 2. A Socialization-Enhancing Strategy Through Perceived Interaction Satisfaction and Social Identity

Table 1. Three Aspects of Social Identity

<table>
<thead>
<tr>
<th>Aspects of social identity</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Cognitive social identity (self-categorization)</td>
<td>“The perceived overlap between one’s own self-concept and the identity of the organization/group” [7, p. 555]</td>
</tr>
<tr>
<td>Affective social identity (affective commitment)</td>
<td>“Identification with, involvement in, and emotional attachment to the organization/group” [3, p. 253]</td>
</tr>
<tr>
<td>Evaluative social identity (organization-based self-esteem)</td>
<td>“Evaluations of self-worth deriving from one’s membership in the organization/group” [7, p. 555]</td>
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Source: Adapted from Moon et al. [61].
Findings from studies of e-communities support the claim that social identity can be developed or “socialized” in an online environment [21]. Churchill et al. [16] found that employing certain types of Web interface features facilitates and encourages successful symbolic interactions between online users.

Social Identity and E-Loyalty

Bagozzi and Dholakia [6] applied social identity theory to virtual spaces, and Dholakia et al. [21] further extended this research. In both studies, Internet users who had a stronger social identity tended to feel a greater desire to communicate with friends in virtual chat rooms. Other studies found that the group identification could occur in the absence of formal membership [67]. For example, electronic vendors, such as Amazon.com, Google, and eBay, which have each created a distinct consumer profile, attract committed, repeat customers with whom they build “deep, meaningful, long-term relationships” [8, p. 76], and these customers are both loyal and enthusiastic in promoting the use of these e-vendor’s Web sites [51]. Srinivasan et al. [78] found that e-loyalty is generated by community, contact interactivity, care, and character. The Web site image can also influence a company’s identity; research in marketing has found that Web site image affects both brand image [63] and consumer behavior [14].

In the marketing literature, Bhattacharya and Sen [8] applied the social identity approach to the customer domain and developed a conceptual framework for customer–company identification based on theories of social identity and organizational identification, in which customer–company identification occurs when a customer’s relationship with a company helps the customer satisfy one or more key self-definitional needs. Customer–company identification, which is active, selective, and volitional on the customer’s part, produces both loyalty and advocacy on behalf of the company. Hence, identifying with the company is an important social and psychological factor that transforms ordinary customers into “super customers.” As with other types of group identification, customer–company identification incorporates an emotional component, which Einwiller and colleagues described as follows: “Strong identification occurs when a company becomes personally relevant for consumers, and personal relevance creates the potential for emotional reactions” [26, p. 192]. Finally, identification causes individuals to become psychologically attached to the organization, which leads to other benefits, such as customer loyalty, company promotion, customer recruitment, and resistance to negative information [8].

King et al. [51] modified the notion of consumer–company identification to account for the unique features of e-commerce interactions and suggested that Web site identification is the e-commerce equivalent of consumer–company identification. This study provides e-vendors with a new perspective on managing the relationship with current and potential customers to create economic value and market performance. Other studies have found that customers who are more loyal will buy more from a firm, recommend the firm’s products and services to others, and be more likely to adopt a firm’s new services or products [62].
Identifying with a group motivates individuals to enhance the value of the group [27]. Players who identify strongly with their group will engage in actions that increase its status. In MMORPGs, guild members are aware of the existence of other guild members and experience a sense of belonging through their interactions with other players [48]. In addition, the guild allows them to share information and play games for longer periods, experiences that are not available when playing alone. Therefore, the social support provided by other guild members within the game environment should play an important role in developing loyalty toward MMORPG games because interactions among guild members and their social support encourage gamers to develop a sense of social identity [48]. Therefore, with regard to e-loyalty, we propose that players who identify strongly with their group will engage in loyal behavior, such as continuing to play the game and recommending the game to others. Social identity theory identifies three reasons for this relationship. First, loyalty validates and reinforces the feeling of group membership, which fulfills a self-definitional need. Second, social identity theory claims that group members seek to improve the status of their group, and the behaviors of continued playing and positive word-of-mouth recommendations serve this purpose. Finally, player–group identification fulfills an emotional need similar to customer–company identification [8]. Because players switching to another game environment would no longer receive this emotional benefit, their loyalty to the game with which they identify should increase.

**Hypotheses Development**

In an MMORPG, players are able to enhance symbolic interactions with other members [89] in the guild through diverse features such as “guild boards,” “guild chatting rooms,” and “guild messengers,” among others. Through these features, players become socialized and develop a social identity in the guild, which changes their game behavior. Many studies have found that a strong social identity is associated with increased job satisfaction [10], leadership [28, 35], and loyalty to the organization. Many researchers have studied the relationship between social identity and loyalty [35, 61]. Ashforth and Mael [5] suggested that strong social identity enables newcomers to reify the organization and feel loyalty and commitment to it. In addition, Moon et al. [61] found that strong social identity among bloggers leads them to develop e-loyalty to the blog service providers to which they subscribe. In this regard, players who have acquired a strong social identity through enhanced symbolic interaction will be more likely to be locked in to the MMORPG, as illustrated in Figure 2. This leads to the following hypotheses:

**Hypothesis 2a:** The player’s perceived interaction satisfaction with other guild members through the different features provided by the MMORPG positively influences the development of social identity in the guild.

**Hypothesis 2b:** The player’s social identity in the guild positively influences e-loyalty toward the MMORPG.
Research Methodology

Research Model

MMORPGs have two basic features: (1) players control their own character (avatar), and (2) most players join a guild to play with others. Based on these characteristics, two different strategies to establish e-loyalty toward an MMORPG were developed (see Figures 1 and 2). The study’s research model, which is based on these two strategies, proposes four hypotheses. The conceptual model and hypotheses were integrated into a structural equation model, which is presented in Figure 3. Following Bergami and Bagozzi [7], three different types of virtual social identity were identified: cognitive social identity, affective social identity, and evaluative social identity.

Instrument Development and Data Collection

We used data from a survey to test the proposed research model presented in Figure 3. Following Churchill [17], we developed construct measures through the successive stages of literature review, theoretical modeling, and refinement.
Because the targeted respondents were Korean, the English questionnaires were translated into Korean; a panel of experts in the MIS research area assessed the face validity of the questionnaire items, and the scale was modified and adapted to the MMORPG context. The measures were adapted from previous psychological, sociological, and behavioral science studies, which included Churchill et al. [16], Dholakia et al. [21], Dwyer and Ganster [24], Dyne and Pierce [25], Ellemers et al. [28], Kim et al. [50], McKinney et al. [60], Pierce et al. [65, 66], Srinivasan et al. [78], and Zeithaml et al. [88]. “Guild” was substituted for “group” for the items assessing social identity because the literature review indicated that the guild was equivalent to the group. For example, in EverQuest, a guild, which is also called a group or a party, describes a player association that is formed to engage in adventure or trade, or simply to socialize [87]. Appendix B describes the items used to develop the study constructs. Also, two marker variables were included in addition to the dependent variable, e-loyalty, to control for common methods variance of the survey research for this study.

We collected data through both paper and e-mail formats. First, we contacted MMORPG guilds, and the guild communities posted recruiting messages and the study questionnaire. The messages described the purpose of the study, criteria for participation (MMORPG players with at least two months of playing experience), and contact information for the investigator. The participants voluntarily took part in the survey by returning the e-mail to the researchers. The potential participants in this survey included students because they are among the most frequent game players with experience playing MMORPGs for at least two months. To identify eligible students, flyers were distributed on campus, and students who wished to participate contacted the researchers by e-mail or phone. Respondents could choose to respond using either paper or electronic questionnaires.

A total of 173 responses were collected, 75 (43.4 percent) paper surveys and 98 (56.6 percent) e-mail surveys. The 34 females and 139 males who responded had played at least one or more MMORPGs, such as World of Warcraft, EverQuest, EverQuest II, Lineage, Lineage II, Star Wars Galaxies, City of Heroes/Villains, RuneScape, and Final Fantasy XI; all had at least two months’ playing experience and provided information regarding the specific game they most preferred. Participants ranged in age from 16 to 42 years; the average age was 23.64 (SD = 5.06). The average time spent on game play was approximately 20.95 hours per week (max = 80, min = 1, SD = 18.98). Although male and female respondents did not exhibit a significant difference in playing time, age was significantly correlated with playing time, with younger respondents spending more time playing MMORPGs ($r = -0.186, p < 0.05$).

**Data Analysis and Results**

**Measurement Model Verification**

Data analysis employed the partial least squares (PLS) method. A cross-loading matrix and the correlation matrix with the square root of average variance
extracted (AVE) were used to verify convergent and discriminant validity. Due to low factor loadings, three items (pcon1, own1, and own3) were dropped during the process of measurement model verification (see Appendix B). Table 2 provides the composite reliability and AVE of the latent variables.

All of the composite reliability values are higher than 0.80 and all AVE values are higher than 0.60, which indicates that the measurement model has strong internal consistency. Cross-loadings for each questionnaire item are also explored and compared across all the latent variables; the final cross-loading matrix is provided in Appendix C. All PLS factor loadings on these constructs are quite high (greater than 0.70), and all cross-loadings are lower than their related factor loadings, which indicates that the measurement model exhibits both strong convergent and discriminant validity.

Table 3 gives the results from examination of the ratio of the square root of the AVE of each latent variable over the correlations of this variable with respect to all the other variables. The diagonal elements in parentheses are the correlations of each construct with its measure, which is the square root of the AVE. Off-diagonal elements indicate correlations between constructs. The correlations among the three forms of social identity are higher due to the common second-order factor. As indicated in Appendix C, each construct is more highly correlated with its own measures than with any other construct, which demonstrates that the constructs exhibit strong discriminant validity.

To evaluate possible nonresponse bias, we classified respondents into three groups based on when they returned the survey. Analyses of variance (ANOVAs), performed to evaluate the extent to which later respondents systematically differed from earlier respondents, revealed no significant nonresponse bias due to the diverse types of respondents.

A marker variable, “Attitude Toward the Tax Policy,” was used to examine possible common methods variance between the dependent variable and the independent variables. The low correlations between the marker variable and other variables (as shown in Table 3) indicate that the collected data were not significantly contaminated by common methods variance.
Table 3. Correlations Between the Latent Variables and the Square Root of the AVE.

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary control over the character</td>
<td>0.903</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary control over the character</td>
<td>0.536</td>
<td>0.894</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychological ownership toward the character</td>
<td>0.326</td>
<td>0.528</td>
<td>0.822</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Perceived interaction satisfaction</td>
<td>0.431</td>
<td>0.445</td>
<td>0.454</td>
<td>0.860</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive social identity in the guild</td>
<td>0.252</td>
<td>0.203</td>
<td>0.329</td>
<td>0.316</td>
<td>0.883</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affective social identity in the guild</td>
<td>0.230</td>
<td>0.243</td>
<td>0.365</td>
<td>0.334</td>
<td>0.794</td>
<td>0.863</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluative social identity in the guild</td>
<td>0.373</td>
<td>0.266</td>
<td>0.354</td>
<td>0.428</td>
<td>0.673</td>
<td>0.691</td>
<td>0.911</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude toward tax policy</td>
<td>0.136</td>
<td>0.062</td>
<td>0.061</td>
<td>0.219</td>
<td>0.059</td>
<td>0.085</td>
<td>0.127</td>
<td>0.843</td>
<td></td>
</tr>
<tr>
<td>E-loyalty toward the MMO RPG</td>
<td>0.397</td>
<td>0.372</td>
<td>0.339</td>
<td>0.488</td>
<td>0.248</td>
<td>0.276</td>
<td>0.414</td>
<td>0.092</td>
<td>0.842</td>
</tr>
</tbody>
</table>

Note: The number on the diagonal (in boldface) is the square root of the AVE.
Assessment of the Structural Model

Our investigation of the measurement model’s effectiveness for this study confirmed that the model exhibits reasonable internal consistency and construct validity. Next, we assessed the structural equation model developed for this study (see Figure 4).

Figure 4 reveals that all the hypotheses incorporated into the model were supported. The factor loadings of “Perceived Control over the Character” on the subconstructs of “Primary Control over the Character” and “Secondary Control over the Character” were 0.808 and 0.932, respectively. The factor loadings of “Social Identity in the Guild” on the three subconstructs were 0.880 for cognitive social identity, 0.949 for affective social identity, and 0.866 for evaluative social identity.

The results reveal that 26.3 percent of the variance of a game player’s psychological ownership toward his or her character was accounted for by perceived control over the character ($R^2 = 0.263$, with a path coefficient of 0.513). This finding implies that game players with greater perceived control over their character tend to develop stronger psychological ownership toward
the character, which supports the role of perceived control as an antecedent of psychological ownership.

About 16.4 percent of the variance of a game player’s social identity in the guild was explained by the perceived interaction satisfaction between guild members ($R^2 = 0.164$, with a path coefficient of 0.405). This finding implies that game players who interact with other guild members through communication features provided by an MMORPG tend to have stronger social identity with the guild, which supports the role of perceived interaction satisfaction between guild members as an antecedent of social identity associated with the guild.

The coefficients from “Psychological Ownership Toward the Character” and “Social Identity in the Guild” to e-loyalty toward the MMORPG were 0.24, and 0.26, respectively. The $R^2$ value was approximately 0.18 and explained 18 percent of the variance in e-loyalty. Psychological ownership also partially mediated the relationship between perceived control and e-loyalty, and social identity mediated the relationship between perceived interaction satisfaction among guild members and e-loyalty, which supports the study hypothesis that psychological ownership toward the character and social identity are important for the development of e-loyalty toward the MMORPG. However, the relatively modest extent of the variance explained in the endogenous study variables suggests that additional constructs should be included in the model. Variables such as playfulness, enjoyment, and virtual shopping enjoyment [32] in the online environment may also affect e-loyalty.

Finally, study results indicate that the two proposed strategies—psychological ownership through perceived control over the player’s character and social identity with a guild based on interaction among guild members—contribute to e-loyalty toward the MMORPG. These results reveal the need for software that allows users to maintain a high level of control over their character and that provides effective ways to interact and collaborate with other game players.

**Discussion and Implications**

Our primary goal in this study was to identify factors influencing game players to commit themselves to MMORPGs and to identify the important psychological factors leading to player lock-in. We found that strong e-loyalty is promoted by two proposed psychological strategies, which has important implications for MMORPG game developers and publishers. Key study findings and their implications are discussed below.

**An Ownership-Enhancing Strategy for Obtaining E-Loyalty**

Adopting an ownership-enhancing strategy should lead game players to perceive a higher level of control over their character, which in turn should lead to strong psychological ownership of the character. In general, players in MMORPGs manage their own character, and feelings of ownership emerge when players learn to control their character effectively and when they can
maintain a sense of interpretive control through a deeper understanding of the game environment. Strong psychological ownership then leads to increased e-loyalty as players become locked in to the MMORPG.

A primary goal of most MMORPGs is to acquire objects to exert control over the character and the virtual world. However, because some character classes or skill sets can easily defeat characters of other classes or skills in many MMORPGs, developers should consider a skill-point character development system over a class-based system to balance play and to provide an opportunity for any character class engaged in combat to win. In addition, developers should provide equal incentives for players to engage in one-on-one combat, a large-scale siege of a castle, or large-scale battles for territory. For players on both sides, large-scale battles are critical for establishing shared norms related to us-versus-them or good-versus-evil scenarios. Dynamic game environments motivate players to learn how to control and ultimately have feelings of ownership toward their character, their guild, and the game itself.

Players have control over the character they choose and how they present themselves to others. In World of Warcraft, players become attached to their avatars due to the time and emotional effort that they invest in their characters, and avatars reflect the player’s identity and embody the player in the virtual world. Developers could increase these dynamic social experiences by emphasizing three fundamental features of virtual worlds: player avatars, collaborative action through guilds, and personal communication. Specifically, developers could enhance these features through improvements in graphics, special effects, and technical game components similar to those found in single-player games, such as real-world physics, collision detection, and changing, dynamic environments. In addition, artistic improvements such as increased opportunities to adapt the avatar’s personal appearance and armor could provide each character with a unique visual appearance.

Our study findings are consistent with earlier findings of Achterbosch et al. [2] and indicate that developers should provide players with greater control over story-driven content by allowing players to adapt the “lore of the world” and to interact with nonplaying characters and other artifacts in the gaming environment. This might be especially important for players of lower skill. Although primary control of the avatar is a central focus of this research, the ability to control the avatar does not necessarily translate into ultimate game success.

With regard to different levels of player skill, those who are less successful at playing the game might nevertheless become loyal players if they perceive that they have some degree of control due to their investment of time and effort. This is the genesis of interpretive or secondary control, which is facilitated when the game provides interesting and unique content.

A Socialization-Enhancing Strategy for Obtaining E-Loyalty

We found that the development of strong social ties in the game environment increases e-loyalty. Thus, game publishers should also employ the socialization-enhancing strategy of promoting social interaction among game players.
In most MMORPGs, initial game quests can be accomplished easily without the assistance of other players. However, later and more advanced game quests are difficult and can be accomplished only by collaborating with other players. Because players need to cooperate to advance in the game, players must join a group, society, or guild. For instance, when players battle against other game players, a strong guild membership is essential for survival, and it is nearly impossible to win without a guild.

Social interaction, which is one of the most appealing features of MMORPGs, is “vital for enjoyment” [20]. An MMORPG player is able to present his or her authentic self when communicating and interacting with others, which makes close relationships possible. In World of Warcraft, for example, crafting professions such as blacksmithing require trade goods from miners and enchanter. Sanderson, a game designer, has noted that cooperative play occurs because the game creates opportunities for teamwork and rewards positive social behavior [72]. The avatar, gameplay, and chat aspects of MMORPGs create an online environment for communication that is open and intimate and fosters emotional bonding. Hence, players often forge relationships and create online communities [87]. Therefore, socialization—in the form of player economy and crafting systems—is a large part of MMORPGs, and MMORPG communities also influence individuals who prefer solo play. Therefore, distributors should consider providing players with items that can be crafted and that increase in value to compensate players for the game time spent learning the craft (which also adds to secondary, interpretive control). Furthermore, developers should consider more selective or elaborate chat rooms and guild features for socializing players. For example, in EverQuest, “parties” and “raids” provide temporary gatherings of players that form strong social ties toward the guild, and these ties can last beyond a single play session. In summary, MMORPG distributors should increase features that promote interaction and support socialization within the game environment.

Study findings revealed that MMORPG players’ perceived interaction satisfaction through the “guild” structure strongly influences the development of players’ social identity. This finding also supports arguments by Churchill et al. [16] that socialization can be facilitated through a Web interface that promotes symbolic interaction, as well as those by Achterbosch et al. [2], who argued that MMORPGs should provide more options for socializing.

A mechanism that facilitates guild membership is needed because many new players are reluctant to join guilds. Although many MMORPGs provide interaction tools for communication among guild members, this area could be improved. The development of a strong social identity is an important game aspect that produces customer loyalty; therefore, player communication through interaction tools, such as chat rooms, guild boards, or guild shelters, is essential for customer retention.

These study results should increase our understanding of the underlying psychological variables that are important for MMORPG success and provide MMORPG software developers struggling with game issues with an increased practical appreciation of individual psychological goals and dynamics. For example, software developers should provide more complex games that encourage and reward collaborative efforts, because the socialization-enhancing strategy indicates that this produces higher levels of e-loyalty. In
addition, the conceptualization of the game should provide players with the ability to directly control their character.

**Study Limitations and Future Research**

This study exhibits several limitations, and key questions remain unanswered. First, bias may be an issue because the data were self-reported. However, the marker variable procedures established that bias due to common methods variance was not a serious concern. Second, the study employed a cross-sectional design, and longitudinal studies of the effect of psychological ownership and socialization on player e-loyalty might better reveal how strategies change and interact over time and contribute to the development of e-loyalty over longer periods. Future studies that adopt different sampling strategies would also be useful to extend and validate these study findings. Third, we investigated only one antecedent of psychological ownership—player autonomy or control. As mentioned earlier, control over the game, and in particular the player’s avatar, is of special importance in MMORPG environments. However, other antecedents of psychological ownership, such as the desire for pleasure [31], desire for security [31], expectation of enjoyment [31], and expectation of satisfaction [31, 66], might also influence psychological ownership, and future studies should include these antecedents to provide a more comprehensive explanation of this phenomenon. Fourth, the current study investigated interpretive control as a mechanism to maintain perceived control. Interpretive control involves investment of the self in the object of control. Investment of the self was measured with respect to the time invested by the subject. Future studies would benefit by also including the cognitive dimension of investment of the self for a more comprehensive view. Finally, previous empirical studies that examined the success of Web-based systems have identified the importance of variables such as playfulness and enjoyment [32]. Future research should also investigate the importance of psychological ownership and social identity in the areas of online shopping and social networking.

**Conclusion**

Drawing upon psychological ownership theory and social identity theory, we developed and tested a model of MMORPGs that integrates two different loyalty strategies—an ownership-enhancing strategy and a socialization-enhancing strategy. Study findings revealed that game developers who seek to maintain and increase customer retention and commitment should design games that adopt both strategies by encouraging character ownership and facilitating the development of strong social ties with other game players.

**NOTES**

1. “The Matrix” was actually derived from several earlier projects including *Neuromancer*, a 1984 novel by William Gibson; *Snow Crash*, a 1992 novel by Neal
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Stephenson; and Tron, a 1982 Disney movie that was created, co-written, and directed by Steven Lisberger.

2. Economy refers to virtual items and currency which have to be gained through play and have definite value for players. Crafting systems refers to the skill in using goods made by the players. Crafting and production supports the economy of the game.

REFERENCES


86. Yee, N. Motivations of play in MMORPGs: Results from a factor analytic approach. The Daedalus Project, Department of Communications, Stanford University, Stanford, CA, 2006 (available at www.nickyee.com/daedalus/motivations.pdf).


**Appendix A: MMORPGs and Market Share**

MMORPGs are distinguishable from other games and have recently experienced significant growth, both in the United States and elsewhere [89]. For example, Smyth [75] found that MMORPG players spent more hours playing the game compared to players of other video games and that the former reported greater enjoyment in playing, displayed greater interest in continuing to play, and developed more online social relationships than other types of gamers. Smyth concluded that “MMORPGs represent a different gaming experience with different consequences than other types of video games” [75, p. 717].

Although data related to online activity are difficult to obtain, it has been estimated that MMORPGs have approximately 14 million active subscribers (http://en.wikipedia.org/wiki/Comparison_of_massively_multiplayer_online_role-playing_games/). Because of their popularity, MMORPGs are
expected to be more profitable than other types of online computer games. According to Cyber Creations (www.mmorpg.com), there were 239 different MMORPGs available as of January 2009. However, Smyth [75] has noted that while many different MMORPGs are available online, all share the same basic characteristics. Appendix Table A1 provides an overview of the leading MMORPG games in terms of subscription market share.

### Appendix B: Questionnaire Items

#### 1. Primary Control over the Character [24, 65]

- **Pcon1**: I can decorate or personalize my character as much as I want. (deleted)
- **Pcon2**: I know how to effectively control my character.
- **Pcon3**: In general, I am adept at managing my character.

#### 2. Secondary Control over the Character [24, 65]

- **Scon1**: I have invested a great deal of time in managing my character.
- **Scon2**: I spend a great deal of time as my character.
- **Scon3**: I frequently visit the game to manage my character.

#### 3. Psychological Ownership Toward the Character [25, 65]

- **Own1**: The character that I control in the game belongs to me. (deleted)
- **Own2**: I have strong feelings of ownership toward my character.
- **Own3**: I interact with my character. (deleted)
- **Own4**: I feel that my character is an extended part of myself.

---

**Table A1. The Market Share of Leading MMORPGs**

<table>
<thead>
<tr>
<th>Game title</th>
<th>Publisher</th>
<th>Web site</th>
<th>Market share*</th>
</tr>
</thead>
<tbody>
<tr>
<td>World of Warcraft</td>
<td>Blizzard Entertainment</td>
<td><a href="http://www.worldofwarcraft.com">www.worldofwarcraft.com</a></td>
<td>54.60%</td>
</tr>
<tr>
<td>Aion</td>
<td>NCsoft</td>
<td><a href="http://www.aiononline.com">www.aiononline.com</a></td>
<td>15.93%</td>
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<tr>
<td>RuneScape</td>
<td>Jagex</td>
<td><a href="http://www.runescape.com">www.runescape.com</a></td>
<td>6.37%</td>
</tr>
<tr>
<td>Lineage</td>
<td>NCsoft</td>
<td><a href="http://www.lineage.com">www.lineage.com</a></td>
<td>5.46%</td>
</tr>
<tr>
<td>Lineage II</td>
<td>NCsoft</td>
<td><a href="http://www.lineage2.com">www.lineage2.com</a></td>
<td>3.64%</td>
</tr>
<tr>
<td>Dofus</td>
<td>Ankama Games</td>
<td><a href="http://www.dofus.com/en/">www.dofus.com/en/</a></td>
<td>2.39%</td>
</tr>
<tr>
<td>Final Fantasy XI</td>
<td>Square Enix</td>
<td><a href="http://www.playonline.com/ff1us/index.shtml">www.playonline.com/ff1us/index.shtml</a></td>
<td>2.0%</td>
</tr>
</tbody>
</table>

* Information regarding the size of the MMORPG industry was updated on January 22, 2011, from mmorpg.com.
Own5: My character provides a kind of self-expression.
Own6: My character is extremely important to me.

4. Perceived Interaction Satisfaction Between Guild Members [16, 50]

Int1: I am able to easily share ideas with other players through the game interface features provided by this game service provider.
Int2: I can easily express my feelings or emotions to other players through the game interface features provided by this game service provider.
Int3: I can quickly communicate with other players through the game interface features provided by this game service provider.
Int4: Overall, I am satisfied with my interactions with other players through the game interface features provided by this game service provider.

5. Cognitive Social Identity (Self-Categorization in the Guild) [28]

Csi1: I feel there is overlap between my own identity and the identity of other guild members in the game.
Csi2: Imagine that one of the circles on the left in each row represents your own self-definition or identity and the other circle on the right represents the identity of your group in the game you play. Please indicate which image (A, B, C, D, E, F, G, or H) best illustrates the degree of overlap between your own identity and your guild’s identity.
6. Affective Social Identity (Affective Commitment) [21]

Asi1: I am emotionally attached to the other guild members in this game.
Asi2: I feel as though I belong to the guild in this game.
Asi3: I am happy to spend time with the other guild members in this game.
Asi4: I enjoy discussing the other guild members with people who are not guild members.
Asi5: My relationships with other guild members have a great deal of personal meaning to me.

7. Evaluative Social Identity (Group-Based Self-Esteem) [21]

Esi1: I am a valuable guild member.
Esi2: I am an important guild member.
Esi3: I feel that other guild members respect me.

8. Attitude Toward Tax Policy (Marker Variable)

Tax1: I am willing to pay higher taxes for social welfare.
Tax2: Generally, I support a high-tax policy rather than a low-tax policy.

9. E-Loyalty Toward the Game [60, 77, 88]

Loy1: I plan to recommend this game to my friends.
Loy2: I prefer this game to other games.
Loy3: I intend to continue playing this game.
Loy4: I plan to say positive things about this game to other people.
Appendix C: Cross-Loadings of Questionnaire Items

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pcon2</td>
<td>0.903</td>
<td>0.430</td>
<td>0.263</td>
<td>0.351</td>
<td>0.235</td>
<td>0.225</td>
<td>0.330</td>
<td>0.279</td>
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<td>Pcon3</td>
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<td>0.326</td>
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<td>0.221</td>
<td>0.191</td>
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<td>0.354</td>
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<tr>
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<tr>
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<tr>
<td>Own2</td>
<td>0.232</td>
<td>0.423</td>
<td>0.741</td>
<td>0.324</td>
<td>0.254</td>
<td>0.196</td>
<td>0.137</td>
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<tr>
<td>Own4</td>
<td>0.324</td>
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<tr>
<td>Own6</td>
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<td>0.271</td>
<td>0.275</td>
<td>0.270</td>
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<td>Int1</td>
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<tr>
<td>Int2</td>
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<td>0.888</td>
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<td>0.276</td>
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<td>0.366</td>
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<tr>
<td>Int4</td>
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<td>0.318</td>
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<td>0.860</td>
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<td>0.667</td>
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Note: Boldface elements are the PLS factor loadings.
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