Gifting and Status in Virtual Worlds

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Abstract: While profitable business models elude many virtual worlds, sales of virtual products are a potentially lucrative source of revenue. One new addition to this strategy is virtual gifting, whereby users purchase virtual products to give to other users. The monetary value of such virtual good transactions is economically significant but no prior study has examined this phenomenon in a strictly virtual context. We apply theory from the economics literature to examine gifting behavior in a virtual world in which users' social status is reflected in observable social connections (friendships) and interactions (personal messages). We find strong evidence that gifting is associated with future enhancements of the gift giver's social status, consistent with a social status–seeking motivation, thus confirming a theorized behavior that is difficult to study in the real world. Our study has implications for system proprietors and managers because we show that gift giving increases system use continuance. We identify various antecedents of gift giving, which may assist a manager in identifying users who are most inclined to give gifts and enable the manager to signal the social exchange benefits to users as a way of improving their social connections.

Key words and phrases: gift economy, MMOG, status in virtual worlds, virtual gifts, virtual worlds.

Virtual worlds and massively multiplayer online games (MMOGs) are significant business growth areas [90], but monetizing such ventures is challenging for the managers and developers of these online social platforms [31]. Many operators of virtual-world platforms generate revenues by inducing users to spend real-world currency to purchase virtual goods for in-world use. The monetary value of such virtual good transactions is economically significant; for example, market analysis from the McKinsey Global Institute [88] predicts global sales of virtual products to reach $13 billion in 2015. Platform operators seeking to increase sales of virtual goods need to understand the factors that motivate this expenditure.

Anecdotally, we observe virtual-world proprietors encouraging users to use real-world currency to purchase virtual items as gifts for other users, but we have little formalized knowledge of this virtual gift giving. Prior studies of virtual worlds have focused on real-world implications of use, including user addiction [27], motivation and intention to play [21, 72, 108, 118], and uptake of social and virtual community systems. Other work has examined the purchasing and use of virtual products [51, 56]. However, there are no prior studies of virtual gifting behavior in the information systems (IS) literature. Research in this regard is generally constrained by the difficulty of obtaining data concerning individual behavior in complex dynamic virtual worlds [106].

There are severe constraints on the study of real-world gifting behavior. The economics literature offers theoretical explanations for gifting, often intersecting with

sociological and anthropological literature. When viewed as consumable endowments, nonmonetary gifts are generally less efficient than cash [39, 97], but as signals of affection or esteem [52] or other relationship signals, nonmonetary gifts may be preferred in particular social circumstances [98, 116]. The economics literature largely theorizes about motivations for real-world gifting because empirical tests are confounded by data limitations. These limitations arise because markets are not fully observable, nonmonetary values are not measurable, givers and receivers of gifts have different information sets, and many consequences of complex dynamic social relationships are unobservable [63].

To date, the theories and propositions argued in the extensive socioeconomic literature have not been applied to gifting in virtual worlds. Concepts of social status in studies of real-world behavior are complex and involve asymmetric attention, differential respect and esteem, and differential influence within groups [4]. This complexity is greatly reduced in virtual worlds, where user status can be gauged by simpler metrics. Access to proprietary data from a large European virtual world allows us to address both the real-world difficulties in studying the relations between gifting and social status, and the substantial gap in the IS literature by linking the theorized socioeconomic behaviors to virtual-world behavior. The virtual-world context provides a valuable opportunity to examine some basic propositions from the socioeconomics literature because the simpler virtual environment circumvents some of the more severe impediments to studying gifting in the real world. In the virtual world, there is an easily known, finite set of gifts with fully determined prices, and a limited number of consequences. This circumstance yields seemingly complete markets and relatively low degrees of information asymmetry.

We draw on propositions regarding status and gifting prevalent in the broader economics literature to develop hypotheses concerning gifting and social status. In doing so, our main objectives are as follows:

1. to examine the impact of gift giving on the giver's future status, and
2. to evaluate the impact of gift giving on the giver's future system use.

We focus on outcomes that accord with the motives for real-world gift giving that have been theorized in the sociology and economics literature. Our focus on future status avoids the potentially trivial confirmation of the expected contemporaneous (endogenous) associations between gifting, status, and system use. We conduct an exploratory analysis of the antecedents of gift giving that informs our modeling of gift-giving outcomes.

Our evidence suggests that socialization indicators and gifting behavior interact in virtual-world environments. These results are not obtainable from real-world studies, where gifting occurs in much more complex circumstances and where many behaviors are unobservable, but they confirm the importance of social status in relation to gifting behavior in a manner consistent with real-world conjectures and economic theorization in this regard. We also find that gifting has implications for continued system use, which, combined with knowledge of motives for purchasing in-world virtual goods, improves our understanding of virtual-world user behavior in ways that

can be exploited by virtual-world operators. The implications of reported system use are specific to virtual-world platforms. We thus contribute to both the broad literature concerned with gifting behaviors and the IS literature concerned with either system use or virtual worlds.

The rest of this paper is structured as follows. In the next section, we first discuss the relevant attributes of virtual products in virtual worlds and then review the main features of the broader economics literature concerned with gifting motives in a social context. In the third section we draw on these discussions to develop hypotheses relating gifting to future social status and system use. In the fourth section, we first describe the particular attributes of our virtual world, users' specific use of avatars, and the data available to us. We then analyze the antecedents of gifting to inform the development of models used to test our hypotheses concerning the consequences of gift giving. In the fifth section, we report the results of our regression models and extensive robustness tests. The last section concludes the paper with a discussion of our results and the implications.

Background

Virtual Worlds and Virtual Products

Virtual worlds are online systems where real-world users congregate and interact electronically. Users typically assume virtual characters, represented in-world as avatars that embody the users' virtual identities. Collectively, users create an online society where individual behavior is propelled by user interaction and social exchange [105]. There are several types of virtual worlds, which differ in conceptual focus, models of player interaction, degree of in-world mobility, and exchange paradigms [31, 32]. This variety serves different user preferences for models and styles of social interaction. Some virtual worlds are geared solely toward player social interaction that is limited to conversing with other users, with no other goal or incentive. Other virtual worlds supplement player interaction with goal-directed activities, such as games, tasks, or quests. In some cases, these activities dominate the virtual-world paradigm and player social interaction is secondary. Virtual worlds also vary with respect to types of financial commitment. Some virtual worlds are free to use, and are funded through player donations or third-party advertising programs. Others require periodic subscription payments to gain access, and some are free to join but users pay to access higher status, additional features and functionality, or in-world benefits under the "freemium" model [23, 85]. In this study, we examine a social virtual world where social interactions and connections are the principal user activities. This environment is similar to social virtual worlds examined in several IS studies [61, 62, 85], and exhibits the social advancement phenomena that we seek to examine.

Virtual worlds allow users to purchase virtual products for use within the virtual environment [49], using either real-world or in-world currencies. Virtual products differ from material products in that they exist only within the confines of the virtual world [77]. Like material goods, virtual products may possess various functional,

social, and hedonic attributes, depending on their type [67]; however, they typically cannot be moved to or used within other virtual-economy environments. Some users spend substantial amounts of real-world money to improve their virtual experience, including the purchase of virtual items to maintain or change their virtual appearance [109]. Several online applications integrate micro transaction and virtual product distribution systems. For example, Second Life allows members to trade in virtual products for virtual currency [107]. Facebook and Myspace have implemented their own micro transaction payment platforms, Hi5 introduced its own virtual currency, and systems such as Habbo Hotel and Tencent offer several direct micro payment methods for purchasing virtual products and services [9, 79]. The complexities [81] and idiosyncratic properties [50] of each virtual world have led most prior studies to focus on a single virtual world.

To understand how virtual products may function in a gifting context, we first searched the prior literature for relevant articles. While there have been no prior studies of gifting behavior in the virtual context, prior work has identified relevant concepts. Early research into virtual objects sought to allow users to interact with virtual objects in virtual reality spaces [103], partly to improve perceptions of use, enjoyment, and realism [58]. After the advent of larger multiuser environments, research identified how virtual objects enhance a disembodied user's sense of personal and social identity [86]. Since then, research in other fields has explored the value of abstract representations of physical objects for the purposes of marketing [20, 80], sales [60], and product and service design [92].

More recent research has sought to understand the use and consumption implications of virtual objects. This research comprises two broad arms of enquiry: the personal and social effects of virtual products and system implications of virtual product use. Research into the personal and social effects of virtual products has found that personal identity, social identity, and social status are important to users [70], and that these concepts are closely related in social virtual worlds [99]. Furthermore, virtual products enhance user perceptions of personal presence [53], despite their intangibility and virtuality [80], thereby contributing to user flow experience and personal individuality. In turn, this flow enhancement has positive effects on the user's perceptions of social presence and stability [5]. Other work has explored the importance of making social connections, especially in online social networks [56], in order to elevate social status. Typically, these social connections involve acquiring "friends" by sending and receiving friendship invitation messages [76]. Displaying the extent of these social connections (by disclosing the number of friends held) to other users acts as a positive quality signal [111]. Purchasing virtual objects has hence been found to be motivated by user expectations of social reward, advancement, and recognition [50, 51].

With regard to system implications of virtual product use, users find enjoyment in the immersion and interaction effects of virtual-world participation, which may be enhanced by the acquisition and use of virtual objects. Consistent with prior work regarding general system use [18, 68], the positive affect arising from enjoyment is related to the user's intention to continue using virtual worlds. Purchasing virtual products improves the user's personal and social engagement in the system, thereby

increasing their satisfaction with use and encouraging continued system use [35, 38]. Accordingly, prior work has also observed a relation between continued use, use intentions, and purchasing of virtual products in social virtual worlds [5, 13, 85]. This use continuance is typified by regular logins to the system and time spent engaging in virtual-world activities and interactions [14, 90].

Gifting, Status, and Socialization

The complex institution of gifting has long attracted the attention of sociologists and anthropologists (at least since Malinowski [84] and Mauss [87]). Explanations for gifting have challenged economic theory [24]. Following Belk [15], more recent literature [75, 100] relates the anthropological, social, and economic aspects of gifting, whereby the gifting process contributes to four functions deemed important in social integration: communication, social exchange, economic exchange, and socialization.

Status describes the perceived prestige and relative esteem of the actor [43, 47] and is a social property that can be created through self-presentation. Acquired status provides a valuable emotional good [40] that attaches to or enables socialization. The value of status as an emotional good is rooted in a psychological need for admiration, the attainment of normative ideals, and generation of more gratifying social contact [54]. The explorations of status by Mead [89] and Veblen [115] portray status as displays of wealth, professional prestige, and formal position. Status is often represented in economic analyses in monetized terms that are not well suited to social analysis. Measures of status relying on wealth or economic resource indicators, such as earnings and income [29, 42, 113], number of assets owned [48], personal savings [55], number of possessions [48], or access to resources [91], have yielded mixed results (cf. [41]) and do not adequately capture relational contexts [43] or apply in noneconomic social contexts.

Sociologists maintain this largely economic perspective when expressing status as an actor's relative standing in a group [16, 112]. This rendering of strategic status seeking in a cycle of social and economic resource acquisition is supported by contemporary economic studies; for example, individuals with higher status tend to obtain better terms in market negotiations than individuals with lower status [10], experience better health and education outcomes [33], and are more socially mobile [42]. For this expression of status (resting on prestige rather than on a formal position) to be evident, it must be conveyed by expressions of recognition and approval from others [57]. Displaying and comparing this rank has payoffs [30] for economic and socialization objectives. While there are benefits for incomes and wealth endowments [19], higher status increases an individual's likelihood of displaying positive emotions in social settings [65], thus increasing sociability and cooperation [59] and strengthening affective ties in social collectivities [74]. The benefits of social status in achieving an individual's socialization objectives should motivate rational individuals to undertake tasks and actions expected to increase their social status.

The relationship between gift giving and status and socialization has been widely studied since the acclaimed work of Malinowski [84] and Mauss [87]. The substantial literature on gifting behavior remains fragmented across economic and social motives. From an orthodox economic perspective, the behavior of givers and receivers is characterized by rationality and self-interest [26]. Givers and receivers are expected to unilaterally pursue optimization of their own interests that encapsulate the different costs and benefits within gifting transactions [1]. Much of the dilemma in economics has focused on the inefficiency of gifting nonmonetary items, compared to cash. However, Camerer [24] and Carmichael and MacLeod [26] both explain that, to build relationships, gifts must be inefficient. Carmichael and MacLeod [26] apply an evolutionary framework to show how the exchange of inefficient gifts (the cost to the giver exceeds the value to the receiver) at the beginning of any new match can break down mistrust and permit cooperation. Camerer [24] views gifts as signaling devices used by players in the first stage of a two-stage investment game to establish a relationship. These and other analytical studies establish that the relevant motive in gift giving depends on the relationship between the giver and receiver [34].

While a large part of the gifting literature is concerned with reciprocity and pure gift giving, there is little or no consensus regarding the existence of pure gifts and altruism [25, 110]. However, it has long been argued in political economy terms that gifting is a socially symbolic ritual, whereby gift givers signal their positive attitudes toward the recipients and their willingness to invest in future relationships (e.g., [24, 84, 87]). The interpersonal symbolism of gifting is an important theme in the gifting literature (e.g., [24, 28]), and it is widely held that the key to understanding gifting, particularly in economically primitive societies, is its relevance to social relationships [75]. Lee [75] argues that, at least in primitive settings, people value social status in and for itself, and emphasizes the relational role of gifts in this regard. Consistent with this approach, Godbout and Caillé [46] argue that bonding value dominates gifting. Skågeby [110, p. 172] relates this argument to gifts being manifestations of social ties and asserts that most literature on gifting recognizes the importance of social relationships as the central vector of bonding value. Similarly, gifting is relevant in economic exchanges because the gift exchange itself contains a social interaction element that is valued in itself by the economic agents [64].

Despite the ambivalence concerning the relationship between gifting and status in the economics literature, several articles identify links between gifting, status, and socialization [26, 37, 64, 71, 97]. Furthermore, social approval is achieved through status [3]. Akerlof recognizes that "social decisions" affect and are affected by an individual's social network and shape an individual's social identity:

> All of these activities will affect who I am in an important way, and thus how I associate with my friends and relatives, as well as who those friends may be. As a consequence, the impact of my choices on my interactions with other members of my social network may be the primary determinant of my decision, with the ordinary determinants of choice (the direct additions and subtractions from utility due to the choice) of only secondary importance. [3, p. 1006]

Hypotheses

Based on the discussion in the previous section, we hypothesize relations between gift-giving behavior and social status in a virtual world. We posit that gifting and status relations are endogenous, with gifting transactions influencing subsequent social status, and achieved social status influencing subsequent gift-giving behavior.

The actions of virtual-world users are a manifestation of human preferences. If individuals value social status [3, 57], and act purposively in its pursuit [10, 89], their success in this regard will be reflected in the extent to which their actions are related to future social status. Thus, measures of future social status reflect the consequences of gifting as prior purposive behavior (motives). Individuals' persistent attempts to improve their social status [2] are one of the most important motives for human social behavior [12]. According to Anderson et al. [4], concepts of social status in studies of real-world behavior involve: (1) asymmetric attention, whereby members with higher status attract more attention than those with lower status; (2) differential respect and esteem, whereby members of higher status have more respect and are held in higher esteem; or (3) differential amounts of influence within the group, whereby members of higher status are allowed to have more control over group decisions and processes. While it is difficult to gauge these complex effects in the real world, this complexity is greatly reduced in virtual worlds, where user status can be represented by simple metrics.

As we discuss here, the main in-world social status indicators for users in many virtual worlds are their social connections (number of friends) and the extent of their social exchanges (numbers of messages sent or received). Therefore, we develop gifting hypotheses for both social connections and social exchanges to address our study's first objective. We then extrapolate from the inferred user motives to hypothesize about gifting and system use continuance, which is crucial to the interests of the virtual-world operator and addresses the second objective of our study.

In formulating our hypotheses, we use frequency (number of gifts) to measure gifting because our emphasis is on gifting transactions or activity, not the differential values of gifts or nonscalar indicators of gifting activity. However, we examine both the value of gifts given and a dichotomous indicator of any level of gift-giving activity in our sensitivity tests and obtain results consistent with those reported for the number of gifts given.

Social Connections

We draw directly on our discussion of gifting and socialization in the second section to formulate our hypotheses concerning gifting and social connections. Real-world gifting is a symbolic signal of the giver's willingness to invest in a future relationship with the receiver (e.g., [24, 84, 87]). Gifts signal an esteem for the recipient on the part of the giver that is not productively conveyed using money alone [22], and this esteem invites a longer relationship between the giver and receiver. This analysis is appropriate to the simplistic relationships between users in virtual worlds. In the absence of

survival threats, gifting cannot be motivated by primitive concepts of consumption or subsistence, thus emphasizing the relational role of gifts [75, 95].[1] If gifting signals the giver's willingness to invest in a future relationship with the receiver [24, 84, 87], and assuming that users are motivated to increase their number of social connections [56, 76], we expect gifting to be followed by a formalized social connection, designated as a "friend." We argue that, in a world based on social interactions, signals of a user's willingness to give gifts or invest in relationships attract other users to establish connections with the giver. Therefore, observably giving a gift is expected to subsequently increase the giver's number of "friend" connections, as expressed in our main "friends" hypothesis, H1:

> *Hypothesis 1: The number of friends established by a user in a period is positively related to the number of gifts given by the user in the prior period.*

Establishing new social connections in many virtual worlds requires one user to send a "friend" invitation to another, and for the invitee to accept [76]. Therefore, the establishment of a new "friend" connection following a gifting transaction means that either the giver accepted an invitation from another user to become a friend (an incoming connection) or the giver issued a friendship invitation to another user that was accepted (an outgoing connection). We expect incoming connections to systematically dominate outgoing connections as a consequence of gift giving for several reasons. First, giving a gift may generate a sense of gratitude from the recipient [8, 45, 104], increasing the likelihood that the recipient will respond with an invitation to be friends. Second, a recipient may favorably communicate about the giver's generosity to other users [39], inducing them to seek friend status with the giver. Third, giving gifts and issuing friend invitations will appear to be substitute forms of friend-seeking effort for a user [73]. If giving a gift induces the receiver to send a "friend" invitation or, as we argue above, attracts other users to send "friend" invitations because it signals the giver's willingness to invest in relationships, then the giver has less subsequent incentive to send friend invitations. Accordingly, we expect that, on average, gift giving will have a larger effect on incoming connections than on outgoing connections, such that incoming connections dominate outgoing connections. This argument leads to our "user attractiveness" hypothesis, H1a:

> *Hypothesis 1a: The difference between a user's incoming and outgoing connections in a period is positively related to the number of gifts given by the user in the prior period.*

Social Exchanges

Communication has explicit and implicit social, informational, and instrumental purposes [119]. Communication is both an objective and primary action in many virtual worlds [69] and multiplayer online games [44]. As discussed earlier, a principal method of undertaking social exchange in the virtual context is through messaging [76]. While numerous IS studies have examined the role of private messaging in

forming and preserving relationships [36, 94], the affective benefit of messages may be particularly valued in a virtual world where the emotional dimensions of social interaction are highly constrained [70, 105].

In virtual worlds, communication frequency is hence often observable as the number of messages received and sent for each user. We argue that the number of messages received is a stronger indicator of a user's popularity, degree of social inclusion, or higher personal demand than messages sent. While both sending and receiving messages may be valued as an outcome, messages sent may be strategic in advancing both the number of friends and communication as status indicators. This implies that the social status dimension of messaging is more strongly indicated by messages received. Consequently, we focus on the relation between gift giving and messages received in our "user popularity" hypothesis, H2:

> *Hypothesis 2: The number of messages received by a user in a period is positively related to the number of gifts given by the user in the prior period.*

Use Continuance

Our expectation regarding the effect of gifting on subsequent system use is informed by the IS literature on use continuance, which largely examines intentions. Continued use intention arises from a user's positive attitudinal beliefs about a system or technology they already use [82], leading to an ongoing relationship [11] beyond the initial decision to sample or trial the system and is distinct from initial system adoption decisions [18, 83].

The relevant economics literature argues that appropriate gifting can positively affect socialization and social status. Gifts convey esteem and social information beyond that carried in conventional verbal communication alone [22, 66, 97], which can serve to elevate the perceived status of the gift giver [93]. This improvement in status can also enhance socialization by improving relationship links [114]. If virtual-world gifting advances in-world socialization or status objectives, the outcomes should enhance the giver's satisfaction with the system, thus encouraging increased system use. This inferred link between a user's satisfaction with the system and the motives for gift giving leads to our "use continuance" hypothesis, which relates system use to a user's previous gift giving:

> *Hypothesis 3: A user's system use continuance in a period is positively related to the number of gifts given by the user in the prior period.*

Data and Method

Context

We test our hypotheses using proprietary data from a virtual world located in Europe. The virtual world has approximately 900,000 registered users (of which around 230,000 logged in during our sample period) who are represented in the virtual world

by graphical avatars. Users adorn their avatars with selectable clothing styles and virtual products they purchase for themselves or receive as gifts from other users. Users socialize in the virtual world through the activities of their avatars. The primary user activities emphasize the formation of in-world social connections as "friends" and communicating with other users.

Users establish friend connections by sending friend requests to other users (which are accepted or rejected). The number of friend connections established by a user is visible to other users in the virtual world. Users may also communicate "privately" through an internal messaging system, similar to other virtual-world environments. Using their avatars, users enter and communicate in public spaces throughout the virtual world, represented by graphical rooms that are distinguished thematically. Users may also activate private rooms for selected groups of users; and they can choose the decoration, furniture, and adornment of these virtual rooms. Users purchase virtual products using virtual currency that is obtainable only from the operator using real-world currency.

Users do not develop in-world skills or abilities and cannot produce goods themselves nor earn in-world currency. This obviation of scarcity or specialization that can arise from differential user effort precludes corruption of the in-world economy by the real-world third-party gaming services industry, which is a frequently cited problem for virtual economies that rely on within-world activities to generate virtual wealth (see [78]). We also avoid the complications of in-world labor market effects where users may effectively work for each other to develop wealth. This also alleviates the related complexities of potential transactional gifting and simplifies the modeling of relations between gifting and user behavior.

Because users do not develop in-world skills or abilities or acquire wealth, users' "advancement" or success is only in terms of the extent and nature of their avatars' adornments, growth in their number of friends, and the experiential value of in-world social engagement. Consequently, user activities focus on acquiring items, social interactions, and increasing their "friend" connections.

Virtual Products and Gifts

Users can purchase a variety of virtual products with which to modify their avatars' appearance. These adornments are visible to other users as an avatar moves around the virtual world. For example, the user's avatar may be seen to hold a drink, a cake, a bouquet of flowers or a toy. The prices of these virtual products vary depending on the appearance of the product and its potential attractiveness to a user. Pricing relativities for individual product groups notionally reflect pricing relativities in the real world; for example, cool drinks and fruit juices have the lowest prices and mascots, flower bouquets, and toys have the highest prices. In this sense, particular items might be attributed with status value commensurate with cost.

At the time users choose to purchase an item, they elect either to use it to adorn their own avatar or to gift it to another user (who chooses whether to accept it); once the allocation is made, it cannot be varied, and the recipient cannot re-gift the item. Thus, the only means of direct exchange between users is by mutual gifting.

Modeling Approach

Our ability to model player behavior is data dependent. Therefore, before we define the empirical models we use to test our hypotheses, we describe the available user transaction data. We then conduct an exploratory analysis of factors that plausibly induce gift giving. This analysis has two purposes. First, it improves our understanding of gifting behavior in the virtual world; this is desirable because there are no prior studies of virtual worlds on which to base assumptions regarding statistical relations. Second, the analysis informs the selection of control and instrumental variables in our main empirical modeling, and the choice of regression methods applied.

User Transaction Data

Our sample is drawn from a file of all user logins between December 6, 2009, and April 26, 2011. From this file, we prepared monthly panel data, which records the end-of-month cumulative totals (from account creation date) of user activity. Our variables discussed in detail here are summarized in Table 1.

The total time since a user created his or her account is measured as the number of days (*DAYS*). A notional demographic is the reported sex of the user, which we identify with the categorical variable *MALE*. We use six measures of user activity: the number of gifts given (*GIFTSENT*); the number of gifts received (*GIFTREC*); the number of personal messages received (*MESSAGESIN*) and sent (*MESSAGESOUT*); the number of logins made by the user (*LOGINS*); and the total purchases made using virtual-world currency, excluding gifts (*PURCHASES*). We use four measures pertaining to a user's "friends": *FRIENDSTOTAL*, *FRIENDSIN*, *FRIENDSOUT*, and *FRIENDSURPLUS*. *FRIENDSTOTAL* is the number of friends recorded for a user. This is comprised of *FRIENDSIN*, which is the number of friends established by responding to invitations from other users (incoming friend connections), and *FRIENDSOUT*, which is the number of number of friends established by sending invitations to other users (outgoing friend connections). We calculate *FRIENDSURPLUS* as the difference between *FRIENDSIN* and *FRIENDSOUT*. Larger positive values of *FRIENDSURPLUS* indicate that a user has established more connections as a result of other users seeking such a connection, compared to connections initiated by the user, and suggests higher status compared to smaller values.

For each of the above cumulative activity and friend-level variables, we compute monthly activity by subtracting the beginning-of-month level of each variable from the month-end level. These monthly activity variables are prefixed *MLY* to distinguish them from the accumulated levels variables. For cumulative level variables, a subscript t indicates that the variable is measured at the *end* of month t. For monthly activity variables, a subscript t indicates that the observation is measured during month t.

The maximum usable sample in each of the empirical tests varies with the required number of lags in the data. The sample used in our ordinary least squares (OLS) regressions of the outcomes of gifting comprises 111,534 user-months, representing 32,580 individual users.[2] Descriptive statistics are reported in Table 2. Our OLS models of the antecedents of gift giving are based on this sample. Our linear dynamic panel

Table 1. Variable Descriptions

Lifetime variables
GIFTSENT: The number of gifts sent by a user since account creation.
GIFTREC: The number of gifts received by a user since account creation.
FRIENDSTOTAL: The number of friendships established by a user since account creation.
FRIENDSIN: The number of friendships established by a user since account creation, arising from the user *being asked* for friendship.
FRIENDSOUT: The number of friendships established by a user since account creation, arising from the user *asking another user* for friendship.
FRIENDSURPLUS: *FRIENDSIN – FRIENDSOUT.*
MESSAGESIN: The number of private messages received by a user since account creation.
MESSAGESOUT: The number of private messages sent by a user since account creation.
PURCHASES: Expenditure by a user on virtual products for adornment of their personal avatar, measured since account creation.
LOGINS: The number of times that a user has logged into the virtual world since account creation.
SYSTEMUSE: The number of times that a user has logged into the virtual world since account creation, constrained by a maximum daily increment of three.
DAYS: The number of days since a user's account was created.
MALE: An indicator variable = 1 if the user reports their sex as male, otherwise = 0.
Monthly activity variables
MLYGIFTSENT: The number of gifts sent by a user during a calendar month.
MLYGIFTREC: The number of gifts received by a user during a calendar month.
MLYFRIENDSTOTAL: The number of friendships established by a user during a calendar month.
MLYFRIENDSIN: The number of friendships established by a user during a calendar month, arising from the user *being asked* for friendship.
MLYFRIENDSOUT: The number of friendships established by a user during a calendar month, arising from the user *asking another user* for friendship.
MLYFRIENDSURPLUS: *MLYFRIENDSIN – MLYFRIENDSOUT.*
MLYMESSAGESIN: The number of private messages received by a user during a calendar month.
MLYMESSAGESOUT: The number of private messages sent by a user during a calendar month.
MLYPURCHASES: Monthly expenditure by the user on virtual products for adornment of their personal avatar.
MLYLOGINS: The number of times that a user has logged into the virtual world during a calendar month.
MLYSYSTEMUSE: The number of times that a user has logged into the virtual world during a calendar month, constrained by a maximum daily increment of three.

models require longer lags that reduce the number of available cases; sample sizes for the dynamic panel models vary from 41,811 user-months to 78,547 avatar-months. The untabulated descriptive statistics for these alternative samples are similar to those for the OLS sample.

Table 2. Descriptive Statistics

	Raw value						Natural log transformed					
Variable	Mean	Minimum	25%	Median	75%	Maximum	Mean	Minimum	25%	Median	75%	Maximum
Monthly activity variables												
MLYGIFTSENT	0.07	0.00	0.00	0.00	0.00	29.00	0.03	0.00	0.00	0.00	0.00	3.40
MLYGIFTREC	0.09	0.00	0.00	0.00	0.00	25.00	0.04	0.00	0.00	0.00	0.00	3.26
MLYFRIENDSTOTAL	30.33	0.00	0.00	5.00	27.00	2,481.00	1.99	0.00	0.00	1.79	3.33	7.82
MLYFRIENDSURPLUS	1.77	–1,404.00	0.00	0.00	2.00	806.00	0.19	–4.41	–0.13	0.00	0.69	6.61
MLYMESSAGESIN	43.43	0.00	0.00	3.00	26.00	8,673.00	1.84	0.00	0.00	1.39	3.30	9.07
MLYMESSAGESOUT	33.29	0.00	0.00	1.00	15.00	7,866.00	1.52	0.00	0.00	0.69	2.77	8.97
MLYLOGINS	16.96	1.00	2.00	4.00	15.00	1,220.00	1.98	0.69	1.10	1.61	2.77	7.11
MLYPURCHASES	0.29	0.00	0.00	0.00	0.00	241.00	0.08	0.00	0.00	0.00	0.00	5.49
MLYSYSTEMUSE	11.08	0.00	1.00	4.00	13.00	93.00	1.74	0.00	0.69	1.61	2.64	4.54

Cumulative total variables												
GIFTREC	0.77	0.00	0.00	0.00	0.00	25.00	0.27	0.00	0.00	0.00	0.00	3.26
FRIENDSTOTAL	433.18	0.00	69.00	217.00	538.00	11,038.00	4.93	0.00	3.97	5.22	6.21	9.29
FRIENDSURPLUS	62.50	–5,862.00	–30.00	5.00	68.00	7,539.00	0.35	–6.90	–0.38	0.13	0.80	8.43
MESSAGESIN	574.50	0.00	47.00	190.00	576.00	46,954.00	4.72	0.00	3.50	5.07	6.25	10.74
DAYS	102.78	0.00	18.00	66.00	160.00	449.00	3.79	0.00	2.94	4.20	5.08	6.11
LOGINS	112.74	2.00	16.00	44.00	117.00	9,112.00	3.50	0.69	2.40	3.50	4.55	9.02
PURCHASES	2.59	0.00	0.00	0.00	1.00	287.00	1.01	0.69	0.69	0.69	1.10	5.67
SYSTEMUSE	127.94	0.00	20.00	61.00	159.00	1,437.00	4.27	0.00	3.40	4.33	5.25	7.32
MALE	0.28	0.00	0.00	0.00	1.00	1.00						

Notes: The descriptive statistics above are based on the sample of 111,534 observations reported in our OLS regressions of the outcomes of gifting. The distributional properties of these variables for our other samples are substantively similar to those tabulated. For convenience, all variables are measured contemporaneously. *MLYGIFTSENT* = the number of gifts sent during a calendar month; *MLYGIFTREC* = the number of gifts received during a calendar month; *MLYFRIENDSTOTAL* = the number of new friend connections established by an avatar during a month; *MLYFRIENDSURPLUS* = the number of the incoming friend connections established by an avatar during a month minus the number of outgoing friend connections established by that avatar during the month (the log-transformed measure is the difference in the logs of the incoming friend connections and outgoing friend connections); *MLYLOGINS* = the number of times that an avatar logged into the system during a month; *MLYPURCHASES* = expenditure on virtual products (excluding gifts) by the user responsible for an avatar during a month; *MLYSYSTEMUSE* = the sum of monthly logins constrained to a maximum daily increment of 3; *MALE* = 1 if the avatar is identified as male, 0 otherwise. *GIFTSREC*, *FRIENDSTOTAL*, *FRIENDSURPLUS*, *MESSAGESIN*, *DAYS*, *LOGINS*, *PURCHASES*, and *SYSTEMUSE* are the accumulated totals of the aforementioned monthly activity variables.

Most of the variables are significantly skewed, with some large outliers. For this reason, and to better satisfy the assumptions of the regression methods employed, we use the natural log transformation of all levels and activity variables in our empirical analysis.[3] We report descriptive statistics for both the raw measures and the log transforms in Table 2.

It is clear from Table 2 that gifting is a relatively infrequent event, with a mean value of 0.07 gifts sent per user-month (*MLYGIFTSENT*). Untabulated analysis reveals that, for the 44,379 user-months representing users who make any in-world purchases, the mean value of *MLYGIFTSENT* is 0.185. In an average month, an avatar establishes 30.33 new friends, receives 43.43 incoming messages, and logs on 16.96 times.

Exploratory Analysis of Antecedents of Gift Giving

We first conduct an exploratory analysis of the antecedents of gift giving as a preliminary test of our assumptions regarding the motivational aspects of gifting and to identify factors that may be plausibly associated with our hypothesized outcome variables. This preliminary testing identifies relevant controls, thereby informing the modeling we subsequently use to test our formal hypotheses.

We explore the antecedents of gift giving by regressing the number of gifts given in the current month against a series of potential explanatory factors measured in the month *prior* to gift giving. We estimate eight model variants. Models (1) and (2) relate monthly gifts given to total activity levels. Models (3) and (4) relate monthly gifts given to monthly activity levels. Model (2) (Model (4)) extends Model (1) (Model (3)) by including *FRIENDSURPLUS* as an additional variable. Models (5) through (8) duplicate Models (1) through (4) with the addition of the lagged dependent variable. For brevity, we do not formally specify Models (5) to (8).

Models of monthly gift giving using cumulative levels of explanatory variables:

$$\begin{aligned} MLYGIFTSENT_{t+1} = {} & \alpha + \beta_1 GIFTREC_t + \beta_2 FRIENDSTOTAL_t \\ & + \beta_3 MESSAGESIN_t + \beta_4 DAYS_t + \beta_5 LOGINS_t + \beta_6 PURCHASES_t \\ & + \beta_7 MALE + \Sigma\beta_k MONTH + \varepsilon \end{aligned} \tag{1}$$

$$\begin{aligned} MLYGIFTSENT_{t+1} = {} & \alpha + \beta_1 GIFTREC_t + \beta_2 FRIENDSTOTAL_t \\ & + \beta_3 FRIENDSURPLUS_t + \beta_4 MESSAGESIN_t + \beta_5 DAYS_t + \beta_6 LOGINS_t \\ & + \beta_7 PURCHASES_t + \beta_8 MALE + \Sigma\beta_k MONTH + \varepsilon. \end{aligned} \tag{2}$$

Models of monthly gift giving using lagged monthly activity in explanatory variables:

$$\begin{aligned} MLYGIFTSENT_{t+1} = {} & \alpha + \beta_1 MLYGIFTREC_t + \beta_2 MLYFRIENDSTOTAL_t \\ & + \beta_3 MLYMESSAGESIN_t + \beta_4 MLYLOGINS_t + \beta_5 MLYPURCHASES_t + \\ & \beta_6 MALE + \Sigma\beta_k MONTH + \varepsilon, \end{aligned} \tag{3}$$

$$\begin{aligned} MLYGIFTSENT_{t+1} = {} & \alpha + \beta_1 MLYGIFTREC_t + \beta_2 MLYFRIENDSTOTAL_t \\ & + \beta_3 MLYFRIENDSURPLUS_t + \beta_4 MLYMESSAGESIN_t + \beta_5 MLYLOGINS_t \\ & + \beta_6 MLYPURCHASES_t + \beta_7 MALE + \Sigma\beta_k MONTH + \varepsilon, \end{aligned} \tag{4}$$

where $MLYGIFTSENT_{t+1}$ is the log of the number of gifts given by a user during month $t + 1$; $GIFTREC_t$ is the log of the number of gifts received between account creation and the end of the month prior to gift giving; $FRIENDSTOTAL_t$ is the log of the total number of friend connections accumulated by a user at the end of the month prior to gift giving; $FRIENDSURPLUS_t$ is the log of the total number of incoming friend connections accumulated at the end of the month prior to gifting minus the natural log of outgoing friend connections accumulated at the end of the month prior to gift giving; $MESSAGESIN_t$ is the log of total number of incoming messages received by a user between account creation date and the end of the month prior to gift giving; $DAYS_t$ is the log of the number of days between the user's account creation and the end of the month prior to gift giving; $LOGINS_t$ is the log of the total number of logins made by the user between account creation and the end of the month prior to gift giving; $PURCHASES_t$ is the log of the value (measured using in-world currency) of purchases of virtual goods for user's personal use between account creation and the end of the month prior to gift giving; *MALE* equals 1 if the user is identified as male, 0 otherwise; $MLYGIFTSREC_t$ is the log of the number of gifts received by the user during the month prior to sending gifts; $MLYFRIENDSTOTAL_t$ is the log of the total number of friend connections established by a user during the month prior to gifting; $MLYFRIENDSOUT_t$ is the log of the total number of incoming friend connections established by a user during the month prior to gifting minus the log of outgoing friend connections established during the month prior to gift giving; $MLYMESSAGESIN_t$ is the log of the number of personal messages received by a user during the month prior to gift giving; $MLYLOGINS_t$ is the log of the number of logins initiated by a user during the month prior to gift giving; $MLYPURCHASES_t$ is the log of the value of a user's purchases of virtual goods for adornment of their own avatar during the month prior to gift giving; and $\Sigma MONTH$ is the indicator of the month in which gifting occurred to control for fixed time effects.

The regression results for Models (1) to (8) are reported in Table 3. The R^2 statistics suggest that models based on monthly activity (Models (3), (4), (7), and (8)) are better specified than those that rely on total cumulative measures (Models (1), (2), (5), and (6)), and that the inclusion of a lagged dependent variable significantly improves the fit of all models but does not substantially affect the other coefficients. We partly attribute the modest R^2 statistics of these regressions to the lagging of all explanatory variables. If we include concurrent measures of login activity and purchase of goods for personal use, the R^2 statistics increase to approximately 20 percent. We use the lagged models because the regressors in these models are more likely to be exogenous to our measures of user status subsequent to gifting.

Of initial interest in these models is the relation between the established number of friends and subsequent gift giving. Established friends are important to our analysis because they are our primary indicator of social status. While H1 and H1a argue that gift giving affects future friend connections, it is also plausible that the existing number of friends affects subsequent gift giving. Our exploratory models include the total number of friend connections established (*FRIENDSTOTAL*, *MLYFRIENDSTOTAL*), and measures of the extent to which a user's number of friends arise as a consequence of incoming or outgoing friend requests (*FRIENDSURPLUS*, *MLYFRIENDSURPLUS*).

Table 3. Antecedents of Gifting

	Static models				Dynamic models			
Variables	(1) $GIFTSSENT_{t+1}$	(2) $GIFTSSENT_{t+1}$	(3) $GIFTSSENT_{t+1}$	(4) $GIFTSSENT_{t+1}$	(5) $GIFTSSENT_{t+1}$	(6) $GIFTSSENT_{t+1}$	(7) $GIFTSSENT_{t+1}$	(8) $GIFTSSENT_{t+1}$
Accumulated levels variables	RHS levels	RHS levels—using friend surplus	RHS monthly activity	RHS monthly activity—using friend surplus	RHS levels	RHS levels—using friend surplus	RHS monthly activity	RHS monthly activity—using friend surplus
$GIFTREC_t$	0.0403***	0.0400***			0.0224***	0.0221***		
	(0.000)	(0.000)			(0.000)	(0.000)		
$FRIENDSTOTAL_t$	–0.0019*	–0.0007			–0.0015	–0.0003		
	(0.092)	(0.572)			(0.116)	(0.761)		
$FRIENDSURPLUS_t$		0.0020**				0.0020**		
		(0.040)				(0.011)		
$MESIN_t$	0.0020**	0.0010			0.0020**	0.0010		
	(0.036)	(0.365)			(0.012)	(0.278)		
$DAYS_t$	–0.0049***	–0.0051***			–0.0038***	–0.0040***		
	(0.000)	(0.000)			(0.000)	(0.000)		
$LOGINS_t$	0.0060***	0.0060***			0.0057***	0.0058***		
	(0.000)	(0.000)			(0.000)	(0.000)		
$PURCHASES_t$	0.0088***	0.0085***			0.0096***	0.0093***		
	(0.000)	(0.000)			(0.000)	(0.000)		
MALE	0.0117***	0.0110***	0.0100***	0.0081***	0.0087***	0.0080***	0.0076***	0.0057***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Monthly activity variables								
$MLYGIFTREC_t$			0.0874***	0.0865***			0.0377***	0.0369***
			(0.000)	(0.000)			(0.000)	(0.000)
$MLYFRIENDS\text{-}TOTAL_t$			–0.0051***	–0.0036***			–0.0047***	–0.0032***
			(0.000)	(0.000)			(0.000)	(0.000)
$MLYFRIENDS\text{-}SURPLUS_t$				0.0064***				0.0062***
				(0.000)				(0.000)
$MLYMESIN_t$			0.0058***	0.0051***			0.0054***	0.0046***
			(0.000)	(0.000)			(0.000)	(0.000)
$MLYLOGINS_t$			0.0144***	0.0127***			0.0136***	0.0119***
			(0.000)	(0.000)			(0.000)	(0.000)
$MLYPURCHASES_t$			0.0487***	0.0483***			0.0172***	0.0169***
			(0.000)	(0.000)			(0.000)	(0.000)
$GIFTSENT_t$					0.1769***	0.1769***	0.1460***	0.1459***
					(0.000)	(0.000)	(0.000)	(0.000)
Constant	–0.0139***	–0.0143***	–0.0209***	–0.0105***	0.0022	0.0011	–0.0187***	–0.0088***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.517)	(0.750)	(0.000)	(0.006)
Observations	111,100	111,100	111,094	111,093	111,098	111,098	111,094	111,093
R^2	0.028	0.028	0.049	0.050	0.065	0.065	0.067	0.068

Notes: This table reports the results of OLS regressions of monthly gift-giving activity against potential antecedent variables. Two-tailed cluster-robust *p*-values are in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

All coefficients relating to total friends (*FRIENDSTOTAL*, *MLYFRIENDSTOTAL*) are negative. The significant negative coefficients for *MLYFRIENDSTOTAL* (Models (3), (4), (7), and (8)) suggest that users with a larger number of established friends are less likely to give gifts. *FRIENDSURPLUS* and *MLYFRIENDSURPLUS* are uniformly positive and significant in all relevant models (Models (2), (4), (6), and (8)). While not tabulated, these results hold if we omit *FRIENDSTOTAL* and *MLYFRIENDSTOTAL* from the regressions and if we estimate regressions for subsamples of firms with positive and negative values of *FRIENDSURPLUS*. These relations suggest that, while the total number of established friend connections (*MLYFRIENDSTOTAL*) reduces the propensity for future gift giving overall, where the established number of friends arises predominantly from incoming friend connections, future gift giving is increased. Consistent with this relationship, where a user's established number of friends has arisen largely as a consequence of outgoing friend connections, the overall negative relation between friends established and future gift giving is even stronger (not tabulated). Data limitations do not allow us to explore this relationship further, but it is plausible that the results for *FRIENDSURPLUS* and *MLYFRIENDSURPLUS* indicate that users feel obliged to those who sought a friend connection with them and are thus more inclined to subsequently give that friend a gift. Similarly, the results regarding the complement of these measures, where a user's established number of friends arise largely as a consequence of outgoing friend connections, may reflect a substitution effect between giving gifts and sending friend requests. In other words, users who seek additional friends by sending more friend requests than they receive may choose to give fewer gifts; this effect might be a consequence of a considered strategy or budget constraints.

Users' system use, proxied by the number of monthly logins (*MLYLOGINS* in Models (3), (4), (7), and (8)) and the total number of logins since account creation (*LOGINS* in Models (1), (2), (5), and (6)) is positively associated with subsequent gift giving. These results likely reflect the simple association between prior system use and all forms of user activity, including future system use and gift giving.

While we examine the relation between gift giving and future messages-in when we test H3, we also consider the numbers of messages received, either since account creation (*MESSAGESIN*) or in the current month (*MLYMESSAGESIN*), as indicators of users' prior and current engagement with and status in the world. This observation, and our contention in the development of H2 that messaging can be a strategic action, are supported by the significance of messages-in in relation to subsequent gift giving. While the significance of *MESSAGESIN* is sensitive to model specification, *MLYMESSAGESIN* is positively associated with subsequent gift giving in all relevant models (Models (3), (4), (7), and (8)).

The receipt of gifts (*GIFTREC*, *MLYGIFTREC*) is positively associated with subsequent gift giving in all models. While this finding may reflect reciprocation, we would expect such effects to concentrate in the same month in which the gift is received (rather than in the subsequent month). We suggest that users who have previously received gifts are naturally likely to be more aware of this aspect of virtual-world functionality,

and that the receipt of a gift may encourage the user to positively assess the impact of gifting on the social status of the sender.

Users' cumulative and monthly expenditures on in-world goods (other than gifts) are positively associated with subsequent gift giving. These relationships likely reflect the fact that prior expenditure is correlated with a user's capacity to pay real-world currency for virtual-world goods, and this naturally extends to the user's financial capacity for gift giving.

Our measure of user tenure, the number of days since account creation (*DAYS*), is significantly negatively associated with gift giving, indicating that users tend to send gifts earlier in their virtual career. These coefficients remain negative if the regressions are reestimated without including total logins (*LOGINS*) as an explanatory variable.

MALE is significantly positive in all models, indicating that users who identify themselves as male are systematically more likely to give gifts.

We also estimated Models (1) through (8) as probit regressions, recoding the dependent variable as a binary indicator of whether any gifts were given by the user in the current month. This analysis did not produce any noteworthy differences relative to our OLS results, although the model fit statistics (pseudo R^2) were higher, ranging between 9–10 percent for models based on the beginning-of-month levels and 13–14 percent for monthly activity models.

Above we identify a number of relationships relevant to our subsequent modeling of the outcomes of gift giving. Our analysis shows that monthly activity variables possess greater explanatory power than the cumulative total measures. We also demonstrate that users with a larger number of established friends are less likely to send gifts. However, where the established number of friends arises predominantly from incoming (outgoing) friend connections, future gift giving is increased (decreased). Although we cannot test whether the apparent substitution effect of sending more friend requests versus gift giving reflects a strategy or budget constraints, we note that users' in-world expenditure (excluding amounts spent on gifts) is positively associated with subsequent gift giving, implying a general budget constraint effect on all expenditures.

We also identify a simple association between prior system use and all forms of user activity, including future system use and gift giving. However, the implied satiation level of friends, combined with the finding that users tend to send gifts earlier in their virtual careers, suggests that the average user reaches the limit of his or her utility from the "friends" status measure.

Our results also indicate that the receipt of gifts increases future gift giving. This finding may reflect reciprocation, but the persistent lag also suggests that users who receive gifts become more aware of the gifting-status relation, which encourages them to use gifting to advance their social status.

Finally, the results in Table 3 suggest that empirical tests of our hypotheses should take account of the potentially endogenous relationships between gifting and status. For example, *MLYFRIENDSTOTAL* may both induce gift giving and result from gift receiving. It is also plausible that *MLYFRIENDSTOTAL* is associated with our other outcome variables, such as *MESSAGESIN*. Consequently, our subsequent empirical

analysis of the outcomes of gift giving includes dynamic linear panel models in which several variables are treated as endogenous.

Empirical Models of the Outcomes of Gift Giving

IN THIS SECTION WE CONSTRUCT LINEAR MODELS TO TEST OUR HYPOTHESES regarding the effects of gifting on the giver's subsequent in-world status and system use. We also describe the estimation methods used because these affect the choice and measurement of some variables. We use two regression methods: (1) OLS regressions with standard errors adjusted for within-user clustering (see [96]), and (2) Arrelano–Bond linear dynamic panel regressions. These are described below.

In our OLS regressions, because we pool multiple period observations for a single user, we relax the usual assumption of independence of residuals and explicitly calculate the correlations between the residuals generated by each particular user. If residuals are positively (negatively) correlated within user clusters, normal OLS standard errors are biased downward (upward). Cluster-adjusted standard errors correct this bias, but coefficient estimates remain identical to those of normal OLS.

While the simplicity of the OLS approach is appealing, two potential limitations are the likelihood of serial correlation and endogeneity. Serial correlation arises because a well-specified model of each outcome variable (e.g., new incoming friend connections) is likely to include lagged values of the dependent variable. If the number of time periods in a sample is small, including a lagged dependent variable in OLS models or user fixed effect models may induce serial correlation in the residuals associated with each user and bias the estimated regression coefficients [102, 117]. Potential endogeneity is suggested by our exploratory analysis, which shows that gift giving is associated with the lagged values of our outcome variables, and some of our outcome variables are included as explanatory variables in other models of the effects of gift giving.

To address these serial correlation and endogeneity concerns, we estimate linear dynamic panel regressions [6], in which we include statistically selected lags of the dependent variable and treat any explanatory variables that are also outcome variables in other models as endogenous.[4] This generalized method of moments (GMM) approach first transforms the raw data to remove user fixed effects and then estimates a regression based on this transformed data. Because the lags of the dependent variable and other explanatory variables may be endogenous, instruments for these variables are used in the regressions on transformed data.[5] Specifically, the lagged *levels* of the potentially endogenous variables act as instruments for the transformed data. The shortest lag that can validly be employed is that observed two periods prior to the period in which the dependent variable is measured. To avoid problems arising from the proliferation of instruments [102], we constrain the number of lagged instruments employed in each model. Generally, we include between two and five period lags of any variables that are potentially endogenous, with the specific lags employed in any model determined by the results of diagnostic tests for autocorrelation and exogeneity.[6] Subject to satisfying these diagnostic tests, the GMM approach yields results robust

to serial correlation and dynamic endogeneity. We now describe the general form of the models used to test each hypothesis.

H1 posits that giving gifts increases the number of friends established by the gift giver in the subsequent period. The general form of the OLS models used to test the impact of gift giving on the giver's new friend connections is shown in Model (9):

$$\begin{aligned} MLYFRIENDSTOTAL_{t+1} = \alpha + \beta_1 MLYGIFTSENT_t + \beta_2 FRIENDSTOTAL_{t-1} \\ + \beta_3 DAYS_t + \beta_5 MLYLOGINS_t + \beta_6 LOGINS_{t-1} + \beta_7 MLYPURCHASES_t \\ + \beta_8 MALE + \Sigma\beta_k MONTH + \varepsilon, \end{aligned} \tag{9}$$

where $MLYFRIENDSTOTAL_{t+1}$ is the log of the number of new friend connections established during the month subsequent to gift giving; $MLYGIFTSENT_t$ is the log of the number of gifts given during month t; $FRIENDSTOTAL_{t-1}$ is the log of the total number of friend connections accumulated at the end of the month prior to gift giving; $DAYS_t$ is the log of the number of days since the user's account creation, measured at end of month of gift giving; $MLYLOGINS_t$ is the log of the number of logins occurring during the month in which gift giving occurs; $LOGINS_{t-1}$ is the log of the total number of logins made by the user from account creation to the end of the month prior to gift giving; $MLYPURCHASES_t$ is the log of the number of purchases of virtual goods for use on the user's personal avatar during the month of gift giving; *MALE* equals 1 if user is identified as male and 0 if female; $\Sigma MONTH$ is the categorical indicator of the month in which gift giving occurred to control for fixed time effects.

Recall that we transform all continuous variables using the natural logarithm function to reduce the influence of large positive outliers and because our preliminary tests indicated that this generated superior model fit. Model (9) tests whether gifts sent during month t affect the number of friend connections established in the following calendar month (month $t + 1$). We measure *GIFTSENT* as the log of the number of gifts given during a month. A positive coefficient for this variable is consistent with gift giving increasing a user's future social status, as measured by total friend connections. We include several control variables likely to affect the future total friend connections and which, as shown earlier, are correlated with our test variable. We control for the lagged cumulative level of friendships established at the end of the month prior to gifting ($FRIENDSTOTAL_{t-1}$), because this is likely to be related to a user's desire to attract new friends in the future, and is negatively correlated with the number of gifts sent. *DAYS* and cumulative logins (*LOGINS*) measure a user's tenure and historic activity in the virtual world and may plausibly be correlated with both effort expended in attracting friends and the user's attractiveness to others. $MLYLOGINS_t$ controls for the joint impact of recent system usage on the likelihood of contemporaneous gift giving and subsequent attraction of friends. Our exploratory analysis reveals that *DAYS*, *LOGINS*, and *MLYLOGINS* are each correlated significantly with subsequent gift giving; therefore, we include them as controls in all of our OLS models of the outcome of gift giving. A user's expenditure on virtual products employed to adorn their own avatar (*MLYPURCHASES*) is included as a control because the virtual products acquired may increase that user's social attractiveness, and because we have previously shown that this expenditure is strongly positively correlated with

gift giving. We earlier demonstrated that gifts received (*GIFTREC*) is positively correlated with subsequent gift giving. However, in developing our empirical models of the outcomes of gift giving, this variable (whether measured in month t or $t-1$) does not significantly contribute to model fit (R^2), and its inclusion does not substantively affect the coefficients of other variables in the model. Therefore, we do not include *GIFTREC* as a control variable in the reported models.

Because the GMM approach extracts user fixed effects, variables representing lagged cumulative totals (*LOGINS*, *FRIENDSTOTAL*) and those that are constant within-subject (*MALE*) are dropped from these regressions; their impact is accounted for in the data transformations and instruments applied under GMM. For example, the orthogonal deviation in the cumulative variable, *LOGINS*, and the untransformed variable, *MLYLOGINS*, are structurally correlated. Nevertheless, if we include these as endogenous variables in our GMM models, the significance levels of the coefficients for our test variables are not affected.

In our GMM models, we allow untransformed *DAYS* to enter the difference equation because we believe this to be more economically meaningful and because this variable does not present an endogeneity threat. A difference or orthogonal deviation transformation to *DAYS* has no empirical value because the number of days in the system changes mechanically by approximately 30 days for each consecutive user-month. All explanatory variables that are highly correlated with another outcome variable (*MLYLOGINS*, *MLYPURCHASES*) and the test variable (*MLYGIFTSENT*), including variables used as outcome variables in other models, are specified as predetermined endogenous variables and are instrumented with their lagged levels as described above. We formally specify these variables as predetermined endogenous variables to maintain consistency with our OLS model. Three lags of the dependent variable are included in this model.

We use Models (10) and (11), which are of similar form to Model (9), to test the impact of gifting on the balance between new incoming and outgoing friend connections (H1b):

$$\begin{aligned} MLYFRIENDSURPLUS_{t+1} = {} & \alpha + \beta_1 GIFTSENT_t + \beta_2 FRIENDSURPLUS_{t-1} \\ & + \beta_3 DAYS_t + \beta_4 MLYLOGINS_t + \beta_5 LOGINS_{t-1} + \beta_6 MLYPURCHASES_t \\ & + \beta_7 MALE + \Sigma\beta_k MONTH + \varepsilon \end{aligned} \tag{10}$$

$$\begin{aligned} MLYFRIENDSURPLUS_{t+1} = {} & \alpha + \beta_1 GIFTSENT_t + \beta_2 FRIENDSURPLUS_{t-1} \\ & + \beta_3 DAYS_t + \beta_4 MLYLOGINS_t + \beta_5 LOGINS_{t-1} + \beta_6 MLYPURCHASES_t \\ & + \beta_7 MALE + \beta_8 MLYFRIENDSTOTAL_t + \Sigma\beta_k MONTH + \varepsilon, \end{aligned} \tag{11}$$

where $MLYFRIENDSURPLUS_{t+1}$ is the log of the number of new incoming friend connections minus the log of the number of new outgoing friend connections, during the month subsequent to gift giving, and $FRIENDSURPLUS_{t-1}$ is the log of the number of accumulated incoming friend connections minus the log of the number of accumulated outgoing friend connections, prior to the month of gift giving. The other variables are as previously defined.

The control variables employed in Model (10) are similar to those in Model (9), with the exception that the lagged cumulative level of *FRIENDSURPLUS* replaces that of

FRIENDSTOTAL. Model (11) differs from (10) purely in that it includes the number of new friends established in the month of gifting ($MLYFRIENDSTOTAL_t$) as an additional control. *MLYFRIENDSTOTAL* is specified as a predetermined endogenous variable in our linear dynamic panel estimate of Model (11).

Model (12) is used to test H2, which concerns the relation between gift giving and subsequent personal messages received:

$$\begin{aligned} MLYMESSAGESIN_{t+1} = \alpha + \beta_1 GIFTSENT + \beta_2 MLYMESSAGESOUT_t \\ + \beta_3 MESSAGESIN_{t-1} + \beta_4 DAYS_t + \beta_5 MLYLOGINS_t + \beta_6 LOGINS_{t-1} \\ + \beta_7 MLYPURCHASES_t + \beta_8 MALE + \Sigma\beta_k MONTH + \varepsilon, \end{aligned} \tag{12}$$

where $MLYMESSAGESIN_{t+1}$ is the log of incoming messages received in the month subsequent to gift giving; $MLYMESSAGESOUT_t$ is the log of outgoing messages sent in the month of gift giving; and $MESSAGESIN_{t-1}$ is the log of number of incoming messages received between account creation date and the end of the month prior to gift giving. The other variables are as previously defined.

In addition to the controls used in our earlier models, we include messages sent in the month of gift giving ($MLYMESSAGESOUT_t$) because of its correlation between a user's propensity to send messages and the rate at which messages are received. *MLYMESSAGESOUT* is specified as a predetermined endogenous variable in our linear dynamic panel specification.

Models (13) and (14) are used to test H3, which predicts that gift giving is positively associated with a user's future system engagement, as proxied by purchases of virtual products for adornment of the user's personal avatar, and future system use:

$$\begin{aligned} MLYPURCHASES_{t+1} = \alpha + \beta_1 GIFTSENT_t + \beta_2 PURCHASES_{t-1} + \beta_3 DAYS_t \\ + \beta_4 MLYLOGINS_t + \beta_5 LOGINS_{t-1} + \beta_6 MALE + \Sigma\beta_k MONTH + \varepsilon, \end{aligned} \tag{13}$$

where $MLYPURCHASES_{t+1}$ is the log of the number of purchases of virtual goods for adornment of the user's personal avatar during the month subsequent to gift giving; $PURCHASES_{t-1}$ is the cumulative value of purchases of virtual goods for the adornment of the user's personal avatar at the end of the month prior to gift giving. The other variables are as previously defined.

$$\begin{aligned} MLYSYSTEMUSE_{t+1} = \alpha + \beta_1 GIFTSENT_t + \beta_2 SYSTEMUSE_{t-1} + \beta_3 DAYS_t \\ + \beta_4 MLYPURCHASES_t + \beta_5 MALE + \Sigma\beta_k MONTH + \varepsilon, \end{aligned} \tag{14}$$

where $MLYSYSTEMUSE_{t+1}$ is the log of the constrained number of user logins during the month following gift giving; $SYSTEMUSE_{t-1}$ is the log of the cumulative constrained number of user logins at the end of the month prior to gift giving. The other variables are as previously defined.

Results

In this section, we report the main results for our hypothesis tests and describe a variety of robustness tests. We discuss the implications of these results in the concluding section of the paper.

Future Friend Connections and Gift Giving (H1)

We report the results of regressions of total new friend connections $MLYFRIENDSTOTAL_{t+1}$ against gifts sent in column 1 of Table 4. Our OLS model (Table 4, Panel A) is well fitted, with all control variables significant and an R^2 statistic of 19.2 percent. Consistent with H1, Table 4, Panel A, column 1 reports a significant positive coefficient for $MLYGIFTSENT_{t-1,t}$ ($\beta = 0.1428$, $p < 0.001$), indicating that the number of gifts given is positively associated with the subsequent number of new friend connections established.

Our linear dynamic panel regression (Table 4, Panel B, column 1) employs three lags of the dependent variable, and treats all explanatory variables other than the time dummies as predetermined endogenous variables. We use two standard diagnostic tests for each of our GMM regressions. First, the presence of significant serial correlation in residuals beyond the AR(1) level would suggest a need for deeper lags as instruments; however, the Arrelano–Bond serial correlation test does not identify significant autocorrelation beyond the first lag (AR(2) $p = 0.229$). Second, the collective exogeneity of instruments is assessed using the Hansen overidentification test; we find no evidence that the instruments are endogenous ($p = 0.494$). Consequently, our model specification appears valid. The coefficient for our test variable, $MLYGIFTSENT_t$, is significantly positive, supporting H1 and confirming the results reported under OLS.

These results provide strong support for H1, which predicts that gift giving by a user is followed by an increase in the number of new friend connections established by the user. This outcome is consistent with gift giving being motivated by the desire to enhance social status.

User Attractiveness and Gift Giving (H1a)

The results of our regressions of $MLYFRIENDSURPLUS_{t+1}$ against gifts given are reported in columns 2 and 3 of Table 4. These models are also well fitted, with all control variables significant and R^2 statistics in excess of 24 percent. We obtain a significant positive OLS coefficient for $MLYGIFTSENT_t$ regardless of whether *MLYFRIENDSTOTAL* is excluded (Table 4, Panel A, column 2: $\beta = 0.0793$, $p = 0.031$) or included in the regression (Table 4, Panel A, column 3: $\beta = 0.0721$, $p < 0.001$). We obtain similar results when using a dynamic linear model with endogenous regressors (Table 4, Panel B, column 2: $\beta = 0.0740$, $p < 0.001$; Panel B, column 3: $\beta = 0.0577$, $p = 0.011$). Numerous tests of the sensitivity of this model to the number of lagged instruments yield similar results.

These results support our "user attractiveness" hypothesis, H1a, which predicts that, relative to the number of friend connections initiated by a user, gift giving increases that user's attractiveness to the extent that other users subsequently initiate a larger number of friend connections with the giver. This consequence is consistent with gift giving being a strategy motivated by the desire to enhance social status.

Table 4. OLS Model and Linear Dynamic Panel Regression

Variables	(1) $MLYFRIENDS\text{-}TOTAL_{t+1}$	(2) $MLYFRIEND\text{-}SURPLUS_{t+1}$	(3) $MLYFRIEND\text{-}SURPLUS_{t+1}$	(4) $MLYMESSAGES\text{-}IN_{t+1}$	(5) $MLYPURCHAS\text{-}ES_{t+1}$	(6) $MLYSYSTEM\text{-}USE_{t+1}$
Panel A: Outcomes of gifting						
$MLYGIFTSENT_t$	0.1428***	0.0793***	0.0721***	0.2184***	0.1514***	0.4785***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
L.CUM(Y)[a]	0.0001***	0.2901***	0.2947***	0.0001***	0.0030***	0.0008***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$DAYS_t$	0.0064	0.0117***	0.0115***	0.0320***	0.0034**	–0.1214***
	(0.395)	(0.001)	(0.001)	(0.000)	(0.019)	(0.000)
$MLYLOGINS_t$	0.4801***	0.0628***	0.0399***	0.1105***	0.0375***	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
$LOGINS_{t-1}$	0.0637***	0.0216***	0.0173***	0.1421***	0.0015	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.158)	
$MLYPURCHASES_t$	0.1146***	0.0375***	0.0317***	0.0859***		0.4838***
	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)
GENDER (1 = male)	0.1162***	0.1412***	0.1337***	0.2269***	–0.0080***	0.0086
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.429)
$MLYFRIENDSTOTAL_t$			0.0466***			
			(0.000)			
$MLYMESSAGESOUT_t$				0.3682***		
				(0.000)		
Constant	0.1856***	–0.2345***	–0.2491***	–0.3196***	–0.0594***	2.6317***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	111,534	111,534	111,534	111,534	111,534	111,534
R^2	0.192	0.243	0.250	0.319	0.058	0.128

(continues)

Table 4. Continued

Variables	(1) $MLYFRIENDS\text{-}TOTAL_{t+1}$	(2) $MLYFRIEND\text{-}SURPLUS_{t+1}$	(3) $MLYFRIEND\text{-}SURPLUS_{t+1}$	(4) $MLYMESSAGES\text{-}IN_{t+1}$	(5) $MLYPURCHAS\text{-}ES_{t+1}$	(6) $MLYSYSTEM\text{-}USE_{t+1}$
Panel B: Linear dynamic panel regressions						
Predetermined endogenous variables						
L.Y	0.8043***	0.2592*	0.3238***	–0.0483***	–0.0346	0.1210
	(0.000)	(0.055)	(0.000)	(0.001)	(0.768)	(0.139)
L2.Y	0.0886***	0.1751***	0.1515***	0.0016		–0.0380
	(0.000)	(0.000)	(0.000)	(0.394)		(0.404)
L3.Y	0.0201***		0.0854***			–0.3406***
	(0.005)		(0.000)			(0.003)
$MLYLOGINS_t$	–0.8945***	–0.0312**	–0.0932***	0.0862***	0.0096	
	(0.000)	(0.029)	(0.000)	(0.000)	(0.199)	
$MLYPURCHASES_t$	0.1580***	0.0393***	0.0359**	0.0015		0.4570
	(0.000)	(0.001)	(0.011)	(0.838)		(0.169)
$MLYGIFTSENT_t$	0.2602***	0.0740***	0.0577**	0.0189*	0.1658**	1.2160**
	(0.000)	(0.000)	(0.011)	(0.092)	(0.039)	(0.023)
$MLYFRIENDS\text{-}TOTAL_t$			0.0497***			
			(0.000)			
$MLYMESOUT_t$				1.0016***		
				(0.000)		

Exogenous variables						
$DAYS_t$	0.1634	0.3143***	0.2448	0.0068	0.0214**	0.6430
	(0.719)	(0.000)	(0.132)	(0.793)	(0.038)	(0.406)
Time fixed effects (exogenous)	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,816	56,972	41,811	56,982	78,547	56,277
Number of users	11,115	15,162	11,115	15,163	21,568	15,131
Number of instruments	107	126	167	139	89	88
AR(1) *p*-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) *p*-value	0.229	0.153	0.415	0.121	0.292	0.411
Hansen test *p*-value	0.494	0.456	0.305	0.190	0.408	0.251

Notes: Panel A reports the results of the OLS regressions of our outcome variables against monthly gifts sent by an avatar and control variables. [a] *L.*(*Y*), *L2.*(*Y*), *L3.* (*Y*) = the first through third lags of the dependent variable. Panel B reports the results of Arrelano–Bond linear dynamic panel regressions, using the orthogonal deviations transformation. The sample sizes vary due to differences in the number of lags of the dependent variable employed, and in the lag structure of the instrument sets employed for the predetermined endogenous variables. The models tabulated represent the most parsimonious models and instrument sets that satisfied both the Arrelano–Bond test for autocorrelation (AR(2) *p*-value in the table) and the Hansen test for exogeneity of the instrument set (Hansen test *p*-value in the table). The null hypothesis in each specification test is that distributional assumptions of this GMM approach are valid, and thus insignificant *p*-values suggest that our models are valid. In Panel A, cluster-robust *p*-values are in parentheses; in Panel B, two-tailed cluster-robust *p*-values are in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

User Popularity and Gift Giving (H2)

The regression of messages received after gift giving (Model (3)) is reported in column 4 of Table 4. The OLS model (Table 4, Panel A) is well fitted with an R^2 statistic of 31.9 percent. Our GMM regressions employ two lags of the dependent variable and treat all variables other than the time fixed effects and *DAYS* as predetermined endogenous variables. We obtain significant positive coefficients for $MLYGIFTSENT_t$ in both our OLS ($\beta = 0.2184$, $p < 0.001$) and GMM ($\beta = 0.0189$, $p = 0.092$) regressions, supporting H2. These results are robust to variations in the instrument set; the exclusion of the *MLYMESSAGESOUT* control; and contemporaneously measuring *MLYMESSAGESOUT* with *MLYMESSAGESIN*. In fact, in each of these untabulated variants, the GMM coefficient on *MLYGIFTSENT* is more significant than in our tabulated results.

The results support our "user popularity" hypothesis, H2, which predicts that gift giving enhances a user's social engagement by increasing the willingness of other users to communicate with the gift giver. Again, this finding is consistent with gift giving being motivated by the desire to enhance social status.

Use Continuance and Gift Giving (H3)

We employ two indicators of system use continuance: *MLYPURCHASES*, which is the future purchase of virtual products to adorn the user's personal avatar during a month; and *SYSTEMUSE*, which is total monthly logins (constrained by system reporting to a maximum of three logins per day).

The OLS result for *MLYPURCHASES* is reported in column 5 of Table 4. The model fit is weaker than for other outcome variables ($R^2 = 0.058$), reflecting the relative noisiness of the dependent variable. Our GMM model satisfies diagnostic tests for autocorrelation and instrument exogeneity, includes a single lag of the dependent variable, and treats all explanatory variables other than the time dummies and *DAYS* as predetermined endogenous variables. The GMM results are robust to variation in the instrument set employed, and to the inclusion of several additional endogenous regressors, including *GIFTREC*, $MLYFRIENDSTOTAL_t$, and $MLYFRIENDSURPLUS_t$. We obtain significant positive coefficients for $GIFTSENT_t$ in both our OLS ($\beta = 0.1514$, $p < 0.001$) and GMM ($\beta = 0.1668$, $p = 0.039$) models.

The results for *SYSTEMUSE* are reported in column 6 of Table 4. Model fit appears reasonable, with an R^2 of 12.8 percent and all control variables, other than *MALE*, significant. The GMM model includes three lags of the dependent variable, and satisfies both the Arrelano–Bond test for autocorrelation ($p = 0.411$) and the Hansen test for the exogeneity of the instrument set ($p = 0.251$). We obtain significant positive relations for use continuance and gift giving in both our OLS ($\beta = 0.4785$, $p < 0.001$) and GMM ($\beta = 1.2160$, $p = 0.023$) models.

The results for *MLYPURCHASES* and *SYSTEMUSE* support our "use continuance" hypothesis, H3, which predicts that a user's system use continuance is positively related to the number of gifts given by the user in the prior period, predicated on the

argument that the process or consequences of gifting induce sufficient user satisfaction to encourage their further engagement and financial commitment.

Robustness Tests

To assess the robustness of our results, we conducted a series of additional tests, which we summarize here. The results of these various tests indicate that our reported results are particularly robust.

Because some of our outcome variables are necessarily nonnegative, and therefore bounded at zero, we reestimated our OLS models using Tobit regressions with adjustment for left censoring. The results are substantially similar to those tabulated.

We investigated the sensitivity of our OLS results to the measurement of gift giving. In all cases, the results are consistent with our main results. We first replaced logarithmic measures of our outcome, gift giving, and control variables with the raw measures. We also reestimated models using a binary gift-giving variable equal to 1 if at least one gift was sent by a user during a month, and zero otherwise; we included this variable in all OLS regressions, with a Heckman-type endogeneity correction. Finally, we replaced the logarithm of the number of gifts given with the logarithm of the value of gifts given. While this latter test confirmed our main OLS results, the significance of the coefficients for the logarithm of the value of gifts sent was generally weaker than those reported in our main results.

We reestimated our GMM regressions on subsamples defined by user attributes that might plausibly affect user behavior. We estimated our models using subsamples split by user sex. These male-specific and female-specific models are generally better fitted than the reported pooled sample models, but the significance levels of our test variables are largely unaffected. The exception is the association between gift giving and *FRIENDSURPLUS*, which remains strongly positive for male users but not significant for female users.

We also reestimated our regressions excluding users with zero total expenditure. We do this because there may be systematic differences between these that might affect the specification of our models. This subsample of users who, at any time during the sample period, spent real-world currency in the virtual world consists of 44,379 user-months for 8,969 discrete users. The coefficients for our test variables obtained using this restricted sample are substantially similar to our main results. The main difference was that the coefficient of *MLYGIFTSENT* in the *MLYPURCHASES* regression (H3) increased in significance ($p < 0.001$).

To examine the impact of outliers on our test variable, we also reestimated all regressions in successive trials while excluding cases where the user sent more than 10, 15, and 20 gifts in a single month. All of our test results hold at similar confidence levels.

Because of the potential sensitivity of GMM regressions to the definition of the instrument set employed, we conducted extensive further modeling in which we varied both the number of lags of the dependent variable included in the models and the range of lagged levels of endogenous variables included in our instrument set.

We also reestimated our GMM regressions while varying the model specification so that all control variables that are outcome variables in another model are measured contemporaneously with the dependent variable (i.e., at $t + 1$). We then augmented the model of *MLYPURCHASES* by adding controls for *MLYFRIENDSTOTAL* and *MLYFRIENDSURPLUS*. For every model variant that satisfied the Arrelano–Bond autocorrelation test and the Hansen test for exogeneity, our test variable *MLYGIFTSENT* remained positive and significant at similar confidence levels to those reported for our main results.

Finally, we reestimated our models of the antecedents of gifting (our exploratory analysis) using the dynamic linear panel approach employed for our outcome regressions, with a single lag of the dependent variable. The level of outgoing friend connections became nonsignificant in these models, but otherwise the nature and implications of the reported results are unchanged. Thus, we are confident that our findings are robust to both dynamic endogeneity and serial correlation.

Conclusions

THE DEARTH OF RESEARCH INTO VIRTUAL-WORLD PURCHASING or gifting of virtual products, and the lack of research on gift giving in online contexts [17] means that we have little knowledge about the in-world social and economic behavior of virtual-world users. Because of the substantial empirical constraints on studying the causes and consequences of real-world gifting behavior [63], theorized relations between gifting and socialization are largely untested in the economics literature.

We partially address these knowledge deficiencies in our study of user behavior in a virtual gift economy, where users engage in social interaction. The simplified economic and social environment and stylized representations of participants in the virtual world allow us to address some of the intractable problems attaching to the analysis of real-world gifting behavior. Importantly, in addition to having objectively stylized measures of social connections and exchanges, we are also able to observe which user initiates a social connection; this is not generally possible in real-world studies, which limits the extent to which the sequencing of people's actions and changes in their social network connections can be causally attributed.

We obtain robust evidence regarding gifting and socialization behavior that is consistent with real-world conceptualizations of gifting as a socially symbolic ritual with economic significance. We thus contribute to the IS literature concerned with virtual-world behavior, and the broader literature concerned with the economic and social dimensions of gifting behavior. We find that gifting is positively associated with users' future formation of social connections and social engagement. We also find that this behavior is positively linked with future system use and purchasing. Our evidence that gift givers systematically exhibit increased future financial commitment has potentially important implications for both virtual-world operators and real-world socioeconomics of gifting.

Support of our main hypothesis (H1), that giving gifts increases a user's social connections, accords with two arguments prevalent in the literature concerned with

the economics of gifting or status-seeking: (1) that gifting may be symbolic of the giver's willingness to invest in a relationship [24, 84, 87] and (2) that the extent of a person's social network contributes to his or her status [3]. This is reinforced by the support for our secondary hypothesis (H1a) that the increase in social connections arises as a consequence of the increased attractiveness (as a friend) of the giver to other users. This is distinguished from the post-gifting increased general popularity of the gift giver proposed in H2 and evidenced in the increased social exchanges (messages) sent to the giver. Our results also suggest that there may be some substitution between gift giving and messaging as efforts to increase social connections or status. This suggests that a user's virtual world status may be a more important objective than the utility from social exchanges per se. However, this issue cannot be adequately addressed with archival system data, and might be better addressed by future research using experiments.

Our study has implications for managers. First, our results show that gifting of virtual products increases system use continuance and virtual product purchases. Use continuance is crucial to the future financial prospects of the system because an unused system is unlikely to be successful. Promoting virtual gift purchases hence increases revenue from sales of virtual products and ongoing use of the system. Developing a virtual gift strategy alongside a conventional virtual product retail program hence has clear benefits. Second, our study identifies a variety of antecedents of gift giving, which may assist a proprietor in identifying those users who are most inclined to give gifts. Understanding these antecedents could assist the proprietor in developing and implementing customized promotions that specifically target users according to those criteria. For example, proprietors could offer discounts on gifts to those users with more days logged in the system or those with a greater number of accumulated friends, each of which is associated with a lower inherent likelihood of gift giving. Alternately, other promotions could be tailored to those inherently more likely to give gifts. The social exchange benefits identified in our study also suggest that such promotions may also have longer-term benefits in developing new networks within the virtual world that might in turn be amenable to gift purchasing. Third, the proprietor can communicate the observed long-term outcomes of gifting to members of the virtual community, thereby encouraging gift sending. Explicit understanding of these gifting outcomes is likely to improve gifting propensity for those users who want to improve their social connections, thereby contributing to revenues.

We contend that, in addition to supporting theorizations of real-world gifting and socialization relations, our results collectively have important ramifications for understanding virtual-world behavior. However, generalizing our results to other virtual-world settings requires some caution, because we do not know the consequences of some limitations to our study. Although our virtual-world users cannot directly trade in virtual products, they can exchange gifts. Gift reciprocation is consistent with users' socialization objectives, but modeling this would substantially lengthen this study. We suggest that the low rate of gift reciprocation is unlikely to materially influence our results; we note that users reciprocated less than 8 percent of gifts, of which 50 percent were sent within 3 minutes, 75 percent within 30 minutes, and 90 percent

within 3 days of the initial gift. More importantly, the relations between socialization and gifting may be more ambiguous in virtual worlds where users can specialize in the in-world production of goods and profit from trading, and where production skills themselves may contribute to status. More generally, settings that provide any other means of acquiring social status are likely to cause the contribution of gifting to be less pronounced. This warrants further research, but it does not obviate the importance of socialization objectives in motivating users. Future research is also needed to assess the extent to which our findings may apply to the use of virtual objects in other online arenas, such as social network systems [56].

While our study supports economic theorizations of real-world relations between gifting and socialization [16, 112], we are constrained by the difficulties of fully observing relational contexts that have also impeded real-world analyses of gifting [43]. In our case, we do not know the extent to which users are known to each other in the real world and form virtual-world networks. Most studies of virtual worlds are likely to encounter this same problem, which cannot be addressed using system data. Future research might address how to observe people's real- and virtual-world relationships to understand the implications of real-world relationships for virtual-world behaviors and, perhaps more importantly, to understand whether people's engagement in virtual worlds has any implications for their real-world relationships and socialization.

Notes

1. We do not emphasize the virtual-world similarity with primitive gift socio-economy, because the in-world preclusion of re-gifting items is a substantial difference to status and relationship building in ceremonial gifting systems, such as *kula,* or value-transferring systems, such as *potlatch.* Nonetheless, in both the material and nonmaterial realms, the key to understanding primitive gift socio-economies is social relationships [75, p. 482].

2. We do not require user-month observations to be contiguous. If a user logs in during February, and next logs in during April, the February data are treated as the one-month lag of the April data. Our results are not sensitive to this treatment.

3. For monthly activity variables, we apply the log transformation to $(x + 1)$, where x is the value of the monthly activity variable. This method allows us to calculate logarithms in cases where the monthly activity variable equals zero. We measure *FRIENDSURPLUS* as the difference between $\ln(1 + FRIENDSIN)$ and $\ln(1 + FRIENDSOUT)$.

4. The limited number of variables included in our data set effectively precludes the simultaneous estimation of our models as a full system of six equations.

5. We use the orthogonal deviations transformation of Arellano and Bover [7]; for each variable, each observation is transformed by subtracting the mean of all subsequent observations of that variable. The traditional first difference transformation magnifies the effect of gaps in unbalanced panels [101, p. 104].

6. Endogeneity occurs where regressors are correlated with the errors in a regression, and may arise from a number of sources, including omitted variables, unobserved heterogeneity, and simultaneity. In GMM, explanatory variables that are measured contemporaneously with the dependent variable are traditionally described as "endogenous variables," while those measured in the period prior to that in which the dependent is measured are described as "predetermined endogenous variables." The econometric impact of this distinction concerns the shortest lag that can be validly used as an instrument in the difference equation. For endogenous variables, the shortest valid lag is two periods. For predetermined variables, the shortest valid lag is one period. If the dependent variable is observed at time $t + 1$, the most recent lag that can be used as an instrument is observed in time $t - 1$. Our main analysis treats outcome variables that are

included as explanatory variables in another model as predetermined (i.e., we measure them in time t rather than $t + 1$), but our results hold if we measure these variables at time $t + 1$, and use lags of two periods and greater in levels as instruments.

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