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# MANAGING CUSTOMER TURNOVER IN ONLINE SERVICES: A SYSTEMS THINKING APPROACH

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## Abstract

*Even as they enjoy impressive growth, one of the major challenges facing providers of online services is a high rate of customer turnover. It has adverse impacts on business performance and has therefore attracted management attention. The literature continues to identify individual determinants of pre- and post-adoptive customer behavior in online services. However, their collective impact is less clear. In this research, we take a “systems thinking” view of turnover. The added value of the systems approach is that interaction among individual determinants and their feedback effects can be modeled. Besides representing the mechanics of turnover more accurately, this approach also allows one to examine the dynamics of turnover. Specifically, we develop a simulation model using the methodology of systems dynamics. Conceptual foundations for its structural components are offered. The model’s ability to replicate turnover behavior observed in practice further strengthens its validity. It can contribute to our understanding of the turnover phenomenon and, since the model can be simulated, provide decision support in managing turnover.*

## 1. INTRODUCTION

The demand for access to online services continues to grow rapidly (Crockett and Young 1999; Hoffman et al. 1996). Factors fueling this demand include improvements in local broadband services, user friendly and standardized browser technology, and content development tools. The largest service provider, America Online, had 17 million customers in early 1999, an increase of 40% from the previous year. However, despite the growth in subscriber base, customer turnover continues to be a problem (King 1999). While prominent providers such as AOL have better retention statistics than others, there is little evidence of customer loyalty in this market. Turnover is of concern to online service providers for several reasons. It is expensive to sign up new customers. There are costs associated with identifying potential customers and, once signed up, new customers typically need more service than existing customers (Knight 2000). Also, if customers depart due to dissatisfaction with the service provider, there will be negative word of mouth effects that make it more difficult to attract new customers. In short, high turnover rates can have an adverse impact on business performance and have thus attracted of management attention.

The academic and practitioner literature continues to identify more determinants of pre- and post-adoptive behavior of online customers. Each of these findings is significant in that it helps us understand specific aspects of the turnover phenomenon. For instance, the literature reports the impact of price changes on demand (Firdman 1997) and that of quality of service on propensity to switch or discontinue service (Green 1998). New determinants will undoubtedly continue to be identified and improve our understanding of turnover. Nevertheless, it is easy to see that even as additional determinants are uncovered, our understanding will remain incomplete as long as we are unable to assess their integrated and collective impact on turnover. In this ongoing research, we show how a systems thinking approach can help address this gap in our understanding.

Specifically, we develop a life cycle process model of online customer turnover based on the well-known systems dynamics (SD) methodology. The value added by the SD approach is that interaction and feedback effects among individual determinants can be modeled and their integrated impact on turnover can thus be studied. These findings on collective impact would complement findings on individual determinants in the literature. By capturing feedback effects, the SD approach also allows us to study the dynamics of turnover. Since SD models can be simulated, our model can also serve as a synthetic environment for scenario analysis to plan a course of action to manage turnover in specific circumstances. The SD approach has been successfully used to develop process models for a wide variety of applications (Richmond 1993). The remainder of the paper is organized as

follows. In the next section, we present details of the process model including the conceptual foundation for its structural components. The reasons for choosing systems dynamics as a methodology are discussed. We also discuss the model's ability to replicate process behavior actually observed in practice, increasing confidence in the validity of the model. We conclude with a discussion of remaining research and what we propose to present at the conference.

## 2. METHODOLOGY AND CONCEPTUAL FOUNDATIONS OF MODEL

In this section, we will develop a life cycle model of customer turnover in online services using the well-known systems dynamics (SD) methodology (Forrester 1968; Goodman 1974; Richmond 1993). This is a general-purpose systems modeling method based on a rigorous foundation of differential equations, which enables us to study the integrated impact of the different drivers of customer turnover in online services. SD models can be simulated to study dynamic behavior and perform scenario analysis and have been developed for a wide variety of applications areas (Hall and Menzies 1983; Morecroft 1991; Nail 1992). Its basic premise is that system structure determines system behavior. This is well suited for our objectives since the determinants of customer turnover available in the literature provide the conceptual foundation for different structural components of the turnover process. Due to space limitations, we only summarize the main structural components of the systems dynamics methodology. Systems are represented using four constructs: *stocks*, *flows*, *connectors*, and *converters*. Stocks represent accumulations in the system while flows cause changes in stock levels. Flows obey the laws of conservation. Connectors convey information from one point in the system to another. Information flows are *not* conserved. Converters perform instantaneous calculations and have no memory. SD models are collections of difference equations, although we will represent them graphically for ease of exposition.

### 2.1 The Life Cycle Systems Model and Structural Validity

In this section, we describe the structural components of a life cycle model of customer turnover. As with any model, we need to establish its validity. SD models are generally validated in three stages (Richmond 1993). Establishing face validity requires that the conceptual foundation for each structural component be identified. The next stage requires the model to demonstrate an ability to replicate reference behaviors. These are behaviors of the process actually observed in practice. The third stage involves validation of the model through detailed case studies. At this point in our research, we will establish the first two stages of validity.

Figure 1 shows our life cycle model of customer turnover, which begins with the pre-adoption phase and ends with discontinuation of service. The graphical symbols for the four SD constructs are as follows. Stocks are shown as rectangles; flows appear as thick arrows with a "tap" in the middle; connectors are thin directed arrows; circles represent converters. To facilitate correspondence between the textual description and Figure 1, variables representing stocks, flows, converters, and connectors will have superscripts S, F, Cv, and Cn, respectively. The system of difference equations underlying Figure 1 will not be listed here for brevity.

We will now explain the process structure shown in Figure 1 in a top down manner and identify its conceptual foundations. In doing so, we address the first phase in establishing the SD model's validity. There are three major segments—SEG1, SEG2, and SEG3—identified in Figure 1. SEG1 consists of the structural elements  $\text{InitMarket}^S$ ,  $\text{Growth}^F$  and  $\text{GrwthRate}^{Cv}$ . In each period, the pool of potential customers increases by  $\text{Growth}^F$ . SEG1 is justified by substantial evidence in the literature that documents the growing awareness of online services and the sustained increase in the number of potential customers (ISP 2000; Riezenman 1998).

The second major structural segment—SEG2—captures that part of the turnover process where a portion of potential customers try the service and then make a decision on whether or not to sign up. In Figure 1, this consists of the following sequence of flows and stocks:  $\text{IncomingPotentials}^F$ ,  $\text{PotCust}^S$ ,  $\text{TryOuts}^F$ ,  $\text{CustInTrial}^S$ , and  $\text{Signup}^F$  along with their accompanying converters. Conceptual justification for SEG2 can be found in the academic and practitioner literature. For instance, it is common for service providers to offer a free trial period and free software to potential customers to enhance the likelihood of eventual adoption (Using Sign-Up 2000). The collection of customers trying out the service is represented by the stock  $\text{CustInTrial}^S$ . Notice that  $\text{CustInTrial}^S$  is shown as a rectangle, as a stock should, but has "slats" inside it. This is just a variation on stocks where accumulated elements have a finite transit time: customers try the service for the trial period and then either sign up for a fee or

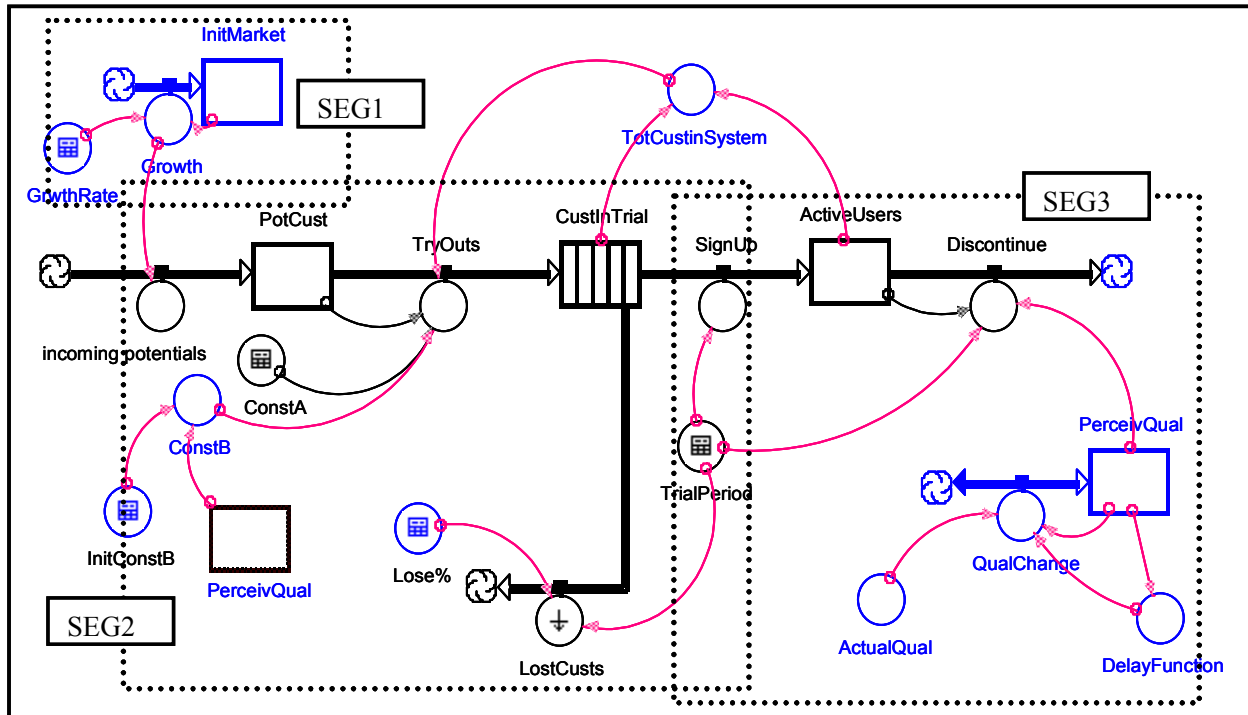


Figure 1. Systems Dynamics Model of Customer Turnover

discontinue. Two flows emanate from  $CustInTrial^S$ . The first,  $SignUp^F$ , flows into the stock of paying customers,  $ActiveUsers^S$ . The second flow,  $LostCusts^F$ , represents those who chose not to adopt. It flows into a “cloud,” meaning these customers exit the system altogether. The connector from  $TrialPeriod^{Cv}$  to  $LostCusts^F$  and  $SignUp^F$  reflects the impact of the length of the trial period upon adoption of service.

Note that  $TryOuts^F$  is driven by four inbound connectors -  $ConstA^{Cv}$ ,  $ConstB^{Cv}$ ,  $TotCustinSystem^{Cv}$ , and  $PotCust^S$ . The functional relationship (which is not shown in Figure 1) is  $Tryouts = (ConstA + ConstB * TotCustinSystem) * PotCust$  and represents the well-established diffusion equation in the marketing literature (Bass 1969; Lilien et al. 1992; Rogers 1995) that includes innovators and word of mouth effects.

SEG3 in Figure 1 represents the service discontinuance part of the turnover process. Of those who sign up and become paying users, some will discontinue in each period. This outflow is represented by  $Discontinue^F$  and is driven by three inbound connectors:  $TrialPeriod^{Cv}$ ,  $PerceivQual^S$ , and  $ActiveUsers^S$ . The conceptual justification for SEG3 can also be found in the literature. Some of the determinants of post-adoption behavior in online services have been reported in the literature (Parthasarathy and Bhattacharjee 1998). The results indicate that weak perceptions of usefulness and ease of use during early periods increases the likelihood of discontinuation. Clearly then, the length of the trial period will have an impact on the fraction of active users who discontinue. Hence the connector from  $TrialPeriod^{Cv}$  to  $Discontinue^F$ . The impact of service quality perceptions on dissatisfaction levels is also well documented in the industry literature (Metcalf 1997; Using Sign-Up 2000; Wallace and Wagner 1997). It is well known that there is a delay before customers perceive changes in service quality (Lilien et al. 1992). However, this delay is not “symmetric”: bad news travels faster than good. In other words, it takes longer for customers to perceive improvements as compared to degradation in quality. The stock  $PerceivQual^S$ , flow  $QualChange^F$  and converter  $DelayFunction^{Cv}$  together capture this lagged perception of service quality.

To complete our description of the life cycle model, notice that the diffusion constant  $ConstB^{Cv}$  in SEG2 is also a function of  $PerceivQual^S$ . This is appropriate since user experience with service quality—both good and bad—will be communicated through word of mouth, affecting the diffusion process. This life cycle model is being refined to capture more of the behavioral findings from the literature.

### 2.2 Model's Ability to Reproduce Observed Adoption Behaviors

The life-cycle model of Figure 1 has been implemented using the iThink simulation software (HPS 2000). We will now show some simulation runs, which demonstrate the model's ability to reproduce adoption behavior observed in practice. This is the second level of validity checking mentioned earlier in the paper and it improves our confidence in the model's structure. In each run, we observe the dynamic behavior of ActiveUsers<sup>S</sup>, CustInTrial<sup>S</sup>, and Discontinue<sup>F</sup>. A fourth variable TotCustinSystem<sup>Cv</sup>, is also plotted although it is just the sum of ActiveUsers<sup>S</sup> and CustInTrial<sup>S</sup>. The parameter values used for each run are also clearly shown along with the *end-of-simulation* values of ActiveUsers<sup>S</sup>, CustInTrial<sup>S</sup>, and TotCustinSystem<sup>Cv</sup>.

Figure 2 is a benchmark run in that it shows the behavior generated by the model when market size is fixed and there is no "leakage" in the system, i.e., Loss%<sup>Cv</sup> = 0 and GrwthRate<sup>Cv</sup> = 0. The behavior observed in practice under these circumstances is the familiar S-shaped diffusion curve (Lilien et al. 1992) and the model's behavior in Figure 2 replicates this. Since Loss%<sup>Cv</sup> = 0, all customers who try the service become ActiveUsers<sup>S</sup> after the trial period. As ActiveUsers<sup>S</sup> grows, the word of mouth effect increases, increasing the number of TryOuts<sup>F</sup> (see formula for TryOuts<sup>F</sup>). Eventually, since GrwthRate<sup>Cv</sup> = 0, there are fewer and fewer potential customers and ActiveUsers<sup>S</sup> flattens out. This is the causal basis for the observed S-shaped diffusion curve.

Figure 3 compares the impact of the length of the trial period on adoption behavior. Notice that the only parameter difference between the two parts of the figures is in the value of TrialPeriod<sup>Cv</sup>. The observed behavior in practice is that a longer trial period usually entices more customers to actually sign up and become ActiveUsers<sup>S</sup> but with diminishing returns. A comparison of the end-of-simulation values for ActiveUsers<sup>S</sup> in Figure 3 shows that the model is able to reproduce this observation.

Figure 4 compares the impact of service quality perceptions on adoption behavior. The only difference between the two simulation runs is in the value of perceptions about service quality. Observations in practice indicate that higher perceptions of service quality lead to lower turnover (Bolton 1998). A comparison of the end-of-simulation values for ActiveUsers<sup>S</sup> in Figure 4 confirms that the model is able to reproduce this observed behavior as well. With reference to Figure 1, the connector from PercievQual<sup>S</sup> to Discontinue<sup>F</sup> conveys information about higher perceived quality to the discontinuing customers, slowing down that outflow and leading to higher retention of active users.

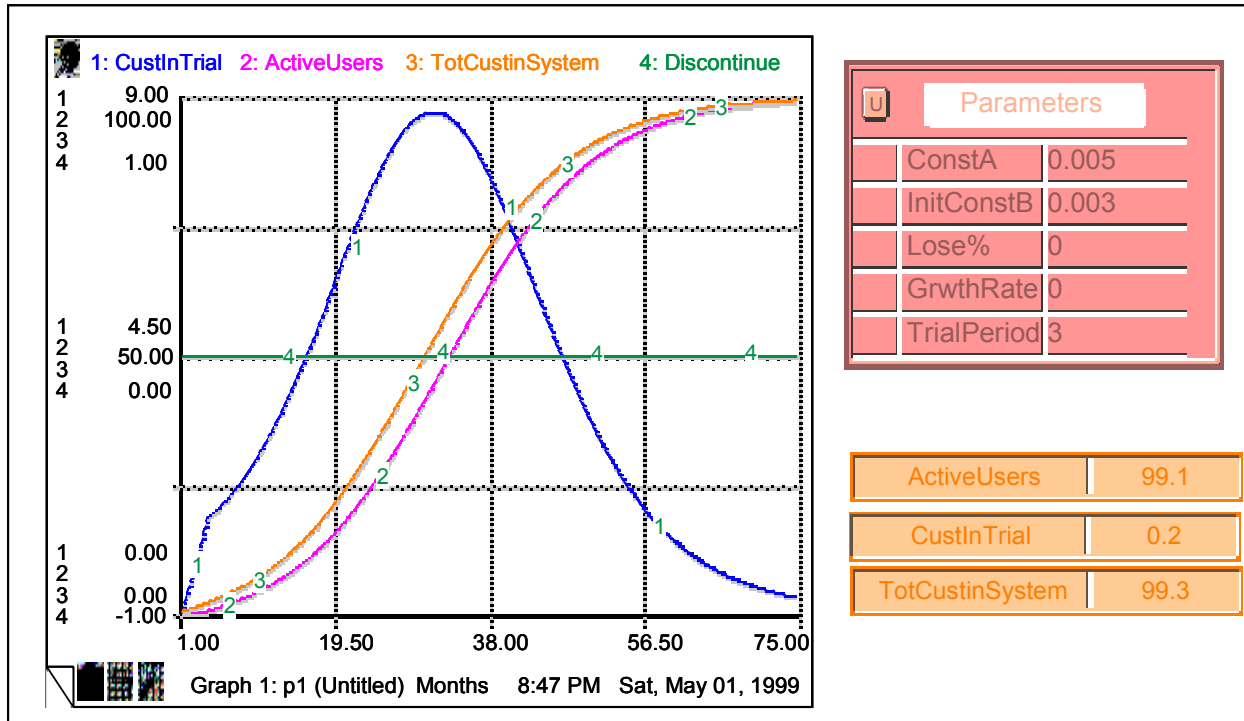


Figure 2. Adoption Behavior Under No Loss Conditions

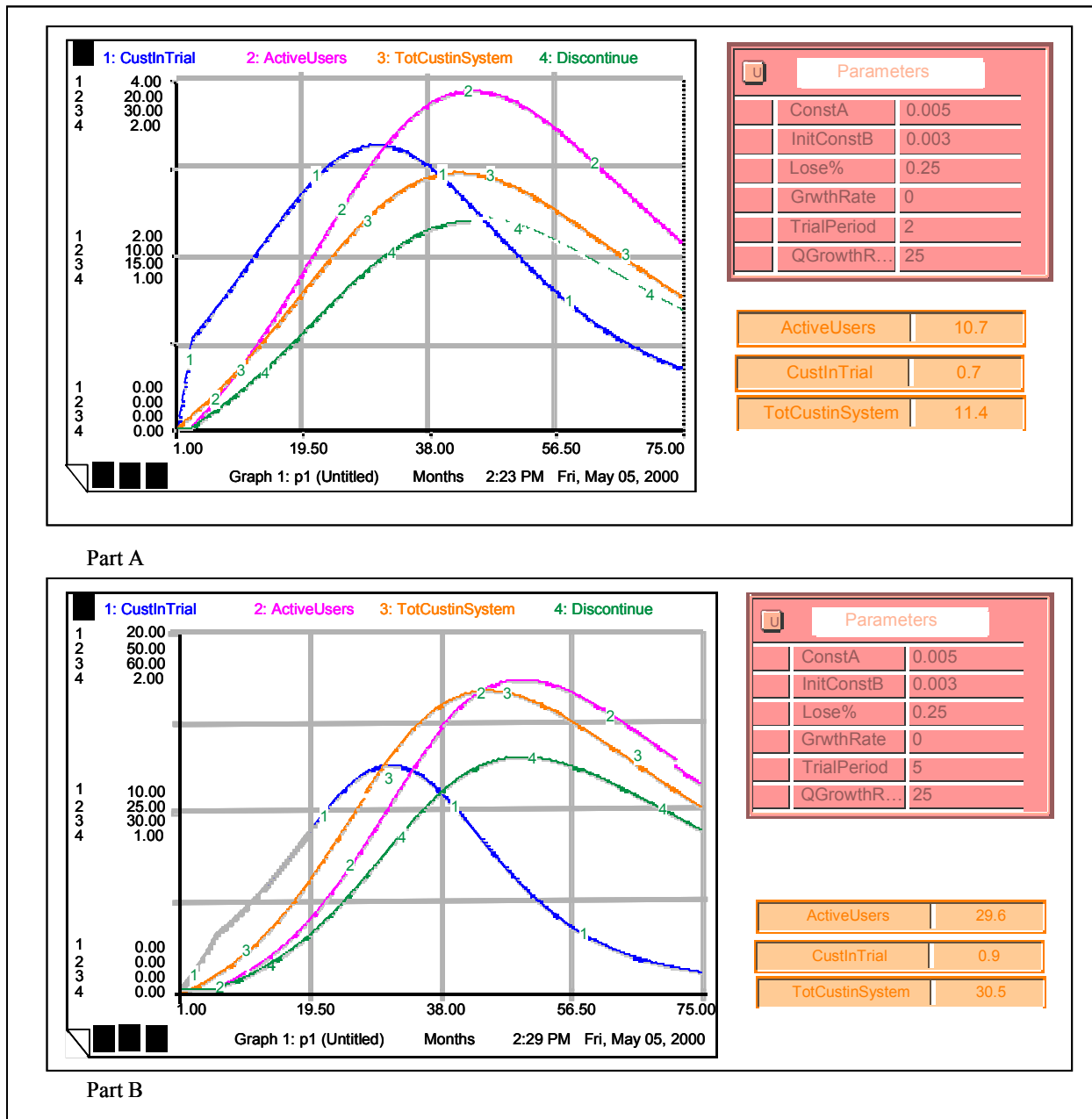


Figure 3. Impact of Trial Period Length on Adoption Behavior

### 3. CURRENT STATUS OF PROJECT

The work thus far suggests that the methodology of systems dynamics can be used to understand the integrated impact of various determinants on the dynamics of customer turnover. The complexity of interaction among determinants and feedback effects caused by them makes it difficult to assess overall impact in the absence of an integrated model of the turnover process. This is where we expect the systems approach to further contribute to our understanding of this phenomenon. Since the model can be simulated, it could also serve in a decision support role. Currently the simulation model shown in Figure 1 is being structurally refined and tested to establish its ability to replicate more observed behaviors. Space constraints prevent us from documenting more of these tests. Based on these tests, the functional forms of some of the relationships in the model are being refined. Certain

technical aspects of the simulation, such as step size and the numerical integration method are also being tested under different scenarios to ensure that the simulation is robust.

One major enhancement to the SD model is being developed in order to capture the impact of competition from other service providers. This will enable us to study how business performance measures, such as market share, evolve dynamically in the presence of competition in the online services market.

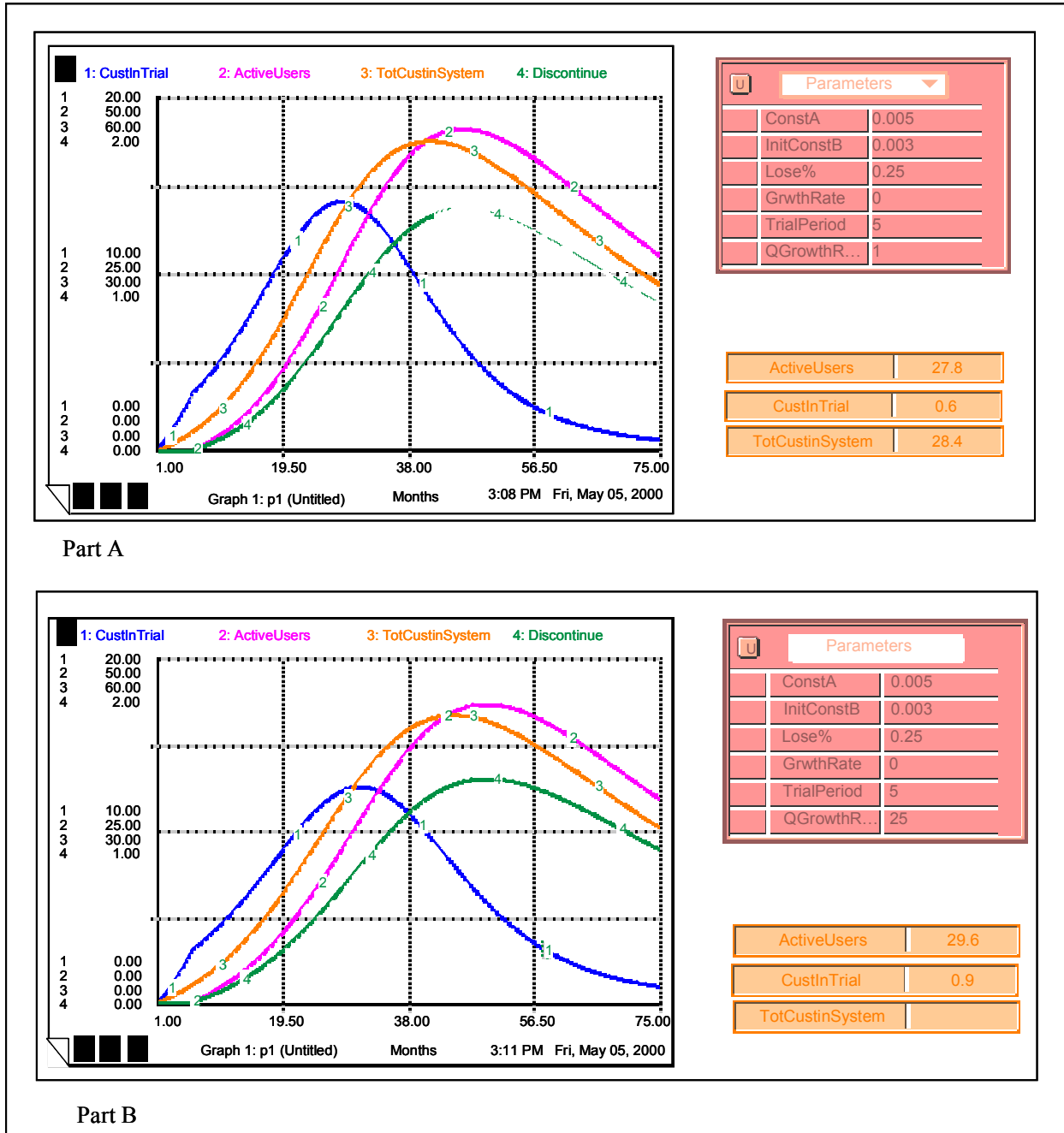


Figure 4. Impact of Quality Perception on Adoption Behavior

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