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An Agent-Based Model of Turnover in a Nonprofit Organization

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Abstract

Great Commission Ministries (GCM) is a nonprofit (501(c)(3) status) [1] organization that focuses on evangelical missions. As a measure to keep overhead as low as possible, GCM asks employees to raise their own salaries by soliciting donations (known as Ministry Team Development- MTD), a procedure common in many nonprofit organizations. This article explores the relationship between the coaching (the conscious monitoring of progress in raising financial support as well as the offering of social support) of GCM employees and ability to maintain employee salary levels insofar as this relationships bears on organizational turnover. The model in this article is based on data collected from GCM and makes preliminary suggestions as to how GCM can change coaching techniques to minimize turnover. In particular, we examine the effect that the number of coaches and coaching quality have on employee turnover. Linear regressions conducted on the results of an agent-based simulation show that both variables exert an influence on turnover but that number of coaches is more important than the quality of the coaches.

It is often said that in organizations, change is constant. Whether the variable is personnel, infrastructure, product, or profit, companies are constantly in a state of assessment as to the dynamic of whatever variable is in question. The current paper examines the dynamic of people, more specifically, the loss of people. The change management perspective (Manzoni and Angehrn 1998), argues for the importance of understanding organizational terrain, momentum (both advent and loss of), communication, and receptivity. The current study proposes a case study analysis of such components as they relate to the departure of employees from a faith-based organization in the United States.

Great Commission Ministries, Inc., (GCM) is a faith-based, nonprofit organization (501(c)(3)) started in 1989, with national headquarters in Winter Park, Florida. The organization employs just over 300 people at over 30 US locations (primarily college campuses) and in over 10 countries (Great Commission Ministries 2007). The organization processes about $13 million annually for all salaries, benefits, and overhead to run the organization. For the past four years (prior to the close of 2008), GCM has not seen the organizational growth it desires. Although they bring in new employees at two set points during the year (January and June New Staff Trainings), they are losing as many people as they are taking in (Great Commission Ministries 2007).

This article illustrates how social simulation can be used to derive practical advice for solving real-world problems. Only rarely have social simulations been tied to specific, real-world organizations. For example, Moss (1999) modeled the behavior of middle-level managers at a water company, and Westera (2007) modeled a peer tutoring system based on the Open University of the Netherlands. More often, however, social simulations model theoretical

processes not specifically connected to real systems, such as Mosler's (2006) simulation of the Elaboration Likelihood Model.

In this article, we create an agent-based model (ABM) that simulates the turnover process in Great Commission Ministries. Agent-based models are computer simulations employing autonomous "agents" capable of making decisions, communicating with one another, and engaging in goal-directed behavior (Gilbert and Troitzsch 2005). Good social simulations simplify underlying processes without oversimplifying to the point where interesting phenomena are lost (Lave and March 1993). Agent-based models are especially useful in the study of complex phenomena, and they allow an experimenter to explore behavior that is difficult to analyze otherwise. Axelrod (1997) argued that a social simulation "is able to take complicated inputs, process them by taking hypothesized mechanisms into account, and then generate their consequences as predictions" (p. 3).

The structure of this article is as follows: First, we describe GCM's fundraising process and the problems they face with regard to employee turnover. Then, after discussing the dynamics of employee turnover, we present an agent-based model and its procedure, both of which are based on the situation at GCM and the algorithm it employs. Next, we describe a simulation using the model. Finally, we present the results of the simulation and discuss its implications.

Fundraising and turnover at Great Commission Ministries

Great Commission Ministries' fundraising process lends insight to the financial dynamics of the organization. Field staff employees (missionaries in the field) are responsible for raising financial support from donors to provide for their own salaries, medical insurance, and retirement packages. This process is known as Ministry Team Development (MTD). Potential

employees are interviewed and screened for missionary employment. If hired by GCM, the missionary must attend one-week training in the fundamentals of MTD, where she/he learns about the process of MTD and associated challenges.

Employee implementation of MTD is quite difficult. The following example (a *general* example for contextual purposes; MTD amounts differ, based on cost of living associated with the location at which the employee is currently stationed) helps to provide a context of the MTD effort:

> *An entry-level missionary for GCM makes approximately $3,000 per month. Assume, as an example, this employee is married with one child. The organization's health care package requires the employee to raise approximately $1,000 per month above and beyond salary. If the missionary wants to take advantage of the organization's retirement package, an additional $200 per month (approximately) must be raised. Office-related expenses (e.g., mailings to donors, cell phone, business phone line, Internet connection) are approximately $250 per month. An attrition buffer (shortfall of monthly giving) is built in at ten percent (in this example, it would be approximately $445 per month), and there is a 12% administrative fee to run the organization ($534 per month). Altogether, the missionary who expects a salary of $3,000 per month is responsible for raising just over $5,000 every month in order to receive a full paycheck and benefits*

In this article, we will use the term *Ministry Team Development* and its acronym (MTD) in two distinct ways. First, MTD will refer to the process of raising funds as described above. Second, however, MTD will also be an attribute of each of the agents in our model indicating what percentage of the missionary's target has been raised.

In the face of increasing costs of living and rising health care and organizational costs, GCM faces an additional difficulty: stagnant growth in which attrition is just balanced by new hiring. These difficulties have put pressure on existing employees to increase their financial support raising activities. As a consequence, the MTD process has become taxing for many within the organization and it has been identified as a major cause of employee attrition (see Kozey 2007).

A crucial element of MTD is *coaching*. GCM provides each new employee (missionary) with a coach responsible for monitoring the employee's progress. The coach's primary duty is to assess the overall well-being (emotional and financial) of employees to whom they've been assigned. The coach is expected to provide guidance in the MTD process. As mentioned above, missionaries, when initially hired, take part in a week-long training session that helps them to understand the key principles of MTD. The coach helps the missionary recall and implement the strategies learned from the training session. However, the efficacy and quality of coaches varies from highly effective (able to provide employees with timely and useful advice) to ineffective (unable to provide effective assistance to employees). Furthermore, some coaches devote a significant amount of time to their charges, providing a source of social support and stability, whereas other coaches have only limited contact with their charges.

Given that attrition rates within missions-related work peak approximately 24 months from the time of initial employment, and growth within GCM is stagnant (attrition figures match new employee figures), GCM is interested in examining specific characteristics within the coaching infrastructure in the near to medium future (48 months). This real-world case study provides a unique opportunity to employ a developing social research methodology: agent-based

modeling. This article will assess the outputs of the constructed model and provide commentary for the outputs generated.

The dynamics of turnover

Our model focuses on the relationship between coaching and attrition rates at GCM. As will be explained below, the model determines whether employees stay or leave the network through measures of job satisfaction and outside opportunity. Job satisfaction has been linked to turnover in a number of studies (e.g., Cotton and Tuttle 1986; Griffeth Hom and Gaertner 2000; Hackman and Oldman 1976). In this model the determinant of an employee's level of job satisfaction is the level of the employee's MTD activities.

Studies have linked job satisfaction to both pay and performance (e.g., Brown and Peterson 1993; Cotton and Tuttle 1986; Griffeth et al. 2000; Spector 1985; 1997). Thus those employees with high MTD are both being paid at the expected level and meeting job performance standards. These employees should be more satisfied with their jobs than those with lower levels of MTD. The dual nature of MTD as a measure of performance and pay is a sound benchmark on which to base employee job satisfaction. For the purposes of our model, we use MTD as a proxy for job satisfaction.

Employee coaching plays an integral role in GCM in the MTD process. Coaching is intended both to encourage employees (social and communicative support) and to remind them of effective techniques for raising funds (financial training refresher). Frequent and effective coaching should help employees maintain higher MTD levels. It should positively affect employees in two ways: by providing expertise about the task at hand and by providing social support. Social support has been proposed to have a positive relationship with an employee's likelihood to stay at a current job (i.e., Feeley and Barnett 1996). Frequency and quality of

coaching, moderated by MTD level and job satisfaction, should have an inverse relationship with employee turnover. In this model we attempt to find how to best use coaching to lower turnover at GCM.

Model description

Overview

This study employs an agent-based model created using the NetLogo (Wilenski 1999) modeling environment (the source code is available upon request from the first author). In this particular case, we abstract the MTD process into two major input variables: number of coaches in the organization and coach quality. We then model the process of employees receiving guidance and support from their coaches. We measure attrition outcomes as they occur under various coaching situations. The operationalizations of terms are listed below as they are germane to understanding the model and its outcome.

Agents

The agents in our model are of two types: *missionaries* and *coaches*. Coaches are fixed features of the model, missionaries come and go. We examine the impact of coaching quality and the number of coaches on the turnover of missionaries within the organization.

The coaches and missionaries are arrayed in a network, and the links of the network are defined by which coaches coach which missionaries. Every missionary has exactly one coach, but any coach may oversee more than one missionary.

At the beginning of the simulation, the missionaries and coaches are given certain attributes, and the missionaries are randomly linked to the coaches. At each time step (which we think of as being one month), the attributes are updated, missionaries decide either to leave or to stay with the organization, and departing missionaries are replaced by new missionaries who are

assigned a coach and who have new attributes. Global outcome variables are updated, and the process repeats for each subsequent time step until the simulation ends in the 48th month [2].

Attributes

The various attributes of the missionaries and coaches along with the attributes' legal ranges and initial values are shown in Tables 1 and 2. In this section, we describe those attributes and give justifications for our choices.

Table 1. Agent Attributes

Attribute	Range	Numeric Type	Status
Missionaries			
Age	$[0, \infty)$	integer	dynamic
MTD	[0,125]	real	dynamic
Satisfaction	[0,125]	real	dynamic
Decay	$[0,\infty)$	real	static
M. Involvement	[0,8]	integer	dynamic
Opportunity	[5,95]	real	dynamic
Coached?	yes/no	{0,1}	dynamic
CoachedBy?	[1,*N*]	integer	static
Coaches			
Quality	[1,5]	real	static
NumberCoached	[1,*M*]	integer	dynamic

Note. *M* is the number of missionaries and *N* is the number of coaches. The notations [*x*,*y*] and [*x*,*y*) represent closed, and half-open intervals, i.e. the set of integers or real numbers greater than or equal to *x* and less than or equal to (bracket) or strictly less than (parenthesis) *y*. Dynamic attributes are those that can change throughout the simulation; static attributes may vary from agent to agent, but once set they remain the same for that agent throughout the simulation.

Table 2. Initial Attribute Values

Attribute	Initial Value
Quality	**N**(q,2; 1,5)
Age	**N**(a_0,6) for existing nodes; 0 for new nodes
MTD	m_0
Decay	**N**(d,1; 0, ∞)
Opportunity	**U**(5,95)

Note. The notation **U**(5,95) means that the attribute's initial value is a uniformly distributed integer between 5 and 95. **N**(μ,σ;min,max) is a censored normal distribution. A real number from the normal distribution with mean μ and standard deviation σ is generated. If this number is less than min or greater than max, then it is recoded as min or max respectively. If min and max are not present in the notation, then the ordinary normal distribution with mean μ and standard deviation σ is meant. Finally, a_0, d, m_0, and q, are tunable parameters set by the user. For the simulations discussed in this article, we set $a = 6$, $d = 2.5$, $m_0 = 100$, and we looked at various levels of q in order to get an idea of the impact of coaching quality.

Age. With regard to *age,* each iteration in the simulation represents one month and *age* is the number of months the missionary has been with the organization. At the beginning of the simulation, missionaries are assigned random ages. As new missionaries are created, they are assigned an age of 0.

MTD and Satisfaction. In the model, *MTD*, is the percentage of the fund-raising target that each missionary has in fact raised. We start with the simplifying assumption that a missionary begins in the organization by raising all of the needed funds, and hence we set a missionary's initial MTD at 100 (a modeling choice so as to focus on the rate of attrition). As the simulation progresses, this value changes. We allow the MTD to rise above 100 (if the missionary is exceeding targets), but cap it at 125 on the assumption that anything larger would be unrealistic (employees do raise above 100% of their financial goal periodically, but it is an uncommon occurrence within this organization). *Satisfaction* is a driving attribute in the model. The interplay of satisfaction and outside opportunity largely determine whether a missionary decides to leave the organization. A primary determinant of satisfaction, of course, is one's pay rate, which at GCM is governed by a missionary's success at MTD. Consequently, we use MTD

as a proxy for satisfaction by simply equating the two. We acknowledge that factors other than MTD, such as such as relationships with leaders in the organization, working conditions, and employee involvement, undoubtedly contribute to overall satisfaction. At this point, we make the simplifying assumption that these other factors are small compared to MTD so that we can equate it to satisfaction. In the model, we nonetheless treat them as separate attributes in anticipation of future research where we incorporate factors other than MTD into the computation of satisfaction.

Decay. *Decay* in this model refers to a decline in the efficacy of particular fund-raising strategies over time, and the natural attrition of supporters from the missionaries' supporter rolls. When missionaries enter the organization they attend a Ministry Team Development training workshop which presents current best practices and strategies. After this workshop, however, natural human forgetting causes people to lose some of the information presented at the training. Coaching, too, serves to refresh a missionary's memory, and presents opportunity for the sharing of new opportunities and strategies developed by the organization. To simulate this decline in efficacy we simply subtract a small amount from the missionary's MTD in those iterations in which it is not coached. The actual amount subtracted is the value of the agent's decay attribute, and we allowed these decays to be normally distributed with a mean of 2.5 and standard deviation of 1.

Missionary Involvement. Missionary involvement allows us to model an attrition phenomenon experienced by GCM. Past research organizationally within GCM has shown that new missionaries experience a "honeymoon" phase where they are initially very committed to the organization. As their employment continues, they gradually become more susceptible to outside influences (e.g., other opportunities elsewhere), and this susceptibility peaks at 24

months when they are most likely to leave. As employees last past the 24-month mark, they again become increasingly committed to the organization (a veritable *tipping point*). In our simulation, we modeled this susceptibility to outside influences with a U-shaped step function of age. More specifically, the *missionary involvement* attribute takes on integer values from 0 to 8. Starting with a high value of missionary involvement, it decreases in six-month intervals until it reaches a low of 0 for the 18- to 30-month period (when a missionary is most susceptible to outside influences). Thereafter, it gradually increases, again in six-month intervals. Because missionary involvement is added to satisfaction in our model, high missionary involvement values decrease the likelihood that a missionary leaves the organization, whereas low values increase the likelihood.

Opportunity. Employees, from time to time, find opportunities for employment elsewhere. Although it is something that the organization does not particularly enjoy, they have embraced that other organizations may appear attractive to current employees at GCM. The *opportunity* attribute is a number from 5 to 95 which is assigned randomly to each node and which randomly fluctuates from month to month. We put upper and lower bounds on the attribute so as to avoid missionaries who leave instantly or who never leave. A simple comparison of opportunity to satisfaction (modified by decay or coaching) determines whether the missionary stays or leaves the organization.

Coached? and CoachedBy? These attributes allow us to do some bookkeeping. Coached? is a simple yes/no variable that allows us to keep track of whether or not a given missionary was coached in the current time period, and CoachedBy? keeps track of each missionary's specific coach.

Coaching attributes. In our simulation coaches have only two attributes, quality and the number of missionaries that they coach. We measure quality on a 1 to 5 scale, distributed as a censored normal variate with a mean set by the user (see Table 2). Moreover, each missionary randomly picks a coach, so the NumberCoached attribute varies from iteration to iteration as missionaries leave or join the organization.

Simulation dynamics

Initialization. At the outset, the user needs to choose the number of coaches and the number of missionaries and needs to set several tunable parameters, namely the mean coaching quality, the mean decay, initial missionary MTD, and the mean age at $t = 0$. For this article, we set the mean decay to 2.5, the initial MTD to 100, and the mean age to 6. We also started each run of the simulation with 100 missionaries. We manipulated the number of coaches and the mean coaching quality so as to get an idea of the impact of these factors on employee attrition. After the above choices are made, initial values are set for each agent attribute according to the dicta in Table 2.

The algorithm. Each iteration in the simulation represents one month. The critical period we are looking at is 0 to 48 months, as GCM, through prior organizational research, has indicated that that covers the potential entry and exit of employment for people within the organizational employment cycle. Thus, we start the simulation at time $t = 0$ and end it at $t = 48$.

At each time period, the algorithm in Table 3 is followed. For each missionary, at any given time period, we first update the missionary's age. We then use this age to set the missionary involvement attribute so that new or long-term employees have higher missionary involvement than those near the 24-month mark. Next we check whether or not the missionary is

coached. We assume for the purposes of this simulation that the probability of being coached depends entirely on the number of missionaries that the coaches have. For example, if a given missionary's coach has a total of 6 missionaries, then at the current time step we provide coaching to the missionary under consideration with a 1/6 probability.

Table 3. Simulation Algorithm.
Consider a missionary i with decay $D(i)$ and with coach $C(i)$ who has quality $Q(i)$. Then, at time $t + 1$ follow the algorithm below.

Update i's age:

$AGE_{t+1} = AGE_t + 1$

Update i's missionary involvement:

If	$0 \leq AGE_{t+1} < 6$	then	$RESIST_{t+1} = 6$
If	$6 \leq AGE_{t+1} < 12$	then	$RESIST_{t+1} = 4$
If	$12 \leq AGE_{t+1} < 18$	then	$RESIST_{t+1} = 2$
If	$18 \leq AGE_{t+1} < 24$	then	$RESIST_{t+1} = 0$
If	$24 \leq AGE_{t+1} < 30$	then	$RESIST_{t+1} = 0$
If	$30 \leq AGE_{t+1} < 36$	then	$RESIST_{t+1} = 2$
If	$36 \leq AGE_{t+1} < 42$	then	$RESIST_{t+1} = 4$
If	$42 \leq AGE_{t+1} < 48$	then	$RESIST_{t+1} = 6$
If	$48 \leq AGE_{t+1}$	then	$RESIST_{t+1} = 8$

Determine if i is coached at $t + 1$:

Provide coaching with probability = 1/NUMBERCOACHED

Update i's MTD:

If i is coached at $t + 1$ then

$MTD_{t+1} = MTD_t + [Q(i)]/2$

else

$MTD_{t+1} = MTD_t — D(i)$

Update i's satisfaction:

$SATIS_{t+1} = MTD_{t+1}$

Update i's opportunity:

$OPP_{t+1} = OPP_t + X$, where X is distributed as $\mathbf{N}(0,5)$

Determine if i leaves the organization:

If $OPP_{t+1} > SAT_{t+1} + RESIST_{t+1}$ then

Missionary i leaves the organization

Create a new missionary with appropriate initial attributes

Randomly assign a coach

else

Missionary i stays

Update global variables:

Mean AGE

Mean SATIS

Total Attrition

If the missionary receives coaching this time period, then its MTD (and equivalently its satisfaction) is increased slightly (with the size of the increase depending on the coach's quality) and decreased slightly (by the decay value) if the missionary is not coached.

To determine if the missionary leaves the organization, satisfaction and missionary involvement are compared to opportunity. We allow a missionary's opportunity to vary from time period to time period, and after noting how it has in fact varied, we then compare the new opportunity value to the sum of the satisfaction and missionary involvement attributes. If this comparison indicates that the missionary leaves, we then create a new missionary with appropriate initial attributes and we randomly assign a coach to the new missionary.

After each missionary has been updated in a given period, we then update our global variables, namely the mean age of the missionaries, their mean satisfaction, and the total number of employees who have left the organization.

We followed the above process for an organization with 100 missionaries, but with varying average coaching quality and a varying number of coaches. Specifically, we started each run with one of five coaching qualities (from 1 to 5) and with anywhere from 1 to 30 coaches. Then, for each of these 150 combinations, we conducted 10 runs, for a total of 1500 runs for the entire simulation.

Results

Face validity

To get an idea as to whether our model's assumptions were realistic, we first tried to reproduce the GCM attrition figures from a recent year. In 2007, the coach-to-missionary ratio was 32% coaches (remember, varying displays of coaching) to 68% missionaries. Moreover,

10% of the missionaries left the organization that year. To see whether our model could reproduce this level of attrition, we duplicated the coach-to-missionary ratio by setting the number of coaches to $N = 47$. Because we have $M = 100$ missionaries, therefore, 32% of the agents in this simulation were coaches and 68% were missionaries. We then set q, the average coaching quality, to 2.5, which is the midpoint of the quality range. Then we ran the simulation for 12 iterations (one year), and observed that 10 of the 100 missionaries left the organization, which matches the 10% attrition rate from 2007. At this point, we were confident enough in the assumptions of our model that we felt justified in varying the number of coaches and the average coaching quality so that we could see how these two variables influenced attrition. In sum, we accounted for the rate of attrition; we accommodated for the ratio of coaches to employees; finally, we accounted for the varying levels of coaching that exist within the organization.

Descriptives

Our three main dependent variables were *total attrition*, the total number of missionaries who had left the organization by the end of the run; *mean attrition age*, the average age of exiting employees at the end of the run; and *mean satisfaction*, the average satisfaction level of the employees at the end of the run. Means and standard deviations of these variables are shown in Table 4.

Table 4. Descriptive Statistics for Dependent Variables

Variable	Mean	Standard Deviation
Total Attrition	543.11	284.98
Mean Attrition Age	4.95	1.71
Mean Satisfaction	36.14	16.47

Note. Means and standard deviations are based on a sample size of 1,500 runs.

Main results

Figures 1 through 3 plot the dependent variables as a function of the number of coaches. As can clearly be seen, as the number of coaches increases the total attrition decreases and satisfaction increases.

We regressed each of the dependent variables on number of coaches and average coaching quality [3]. In each case we found a significant fit, and the independent variables always explained in excess of 80% of the variance in the dependent variable. For total attrition, we obtained an R^2 of .91, $F(2,1497) = 7378.38$, $p < .001$. The R^2 of .83 for mean attrition age was somewhat lower, but still significant, $F(2,1497) = 3694.43$, $p < .001$. Finally, we obtained an R^2 of .95 for mean satisfaction, $F(2,1497) = 14015.51$, $p < .001$. Table 5 shows the regression coefficients for each of the models.

Table 5. Linear Regression Coefficients

	Number of Coaches			Avg Coach Quality		
Dependent Variable	*b*	β	*t*	*b*	β	*t*
Total Attrition	-31.17	-0.95	-120.72	-21.38	-0.11	-13.53
Mean Attrition Age	0.18	0.90	85.32	0.13	0.11	10.47
Mean Satisfaction	1.83	0.96	165.12	1.88	0.16	27.71

Note. There are 1,497 degrees of freedom for each of the *t* tests. All tests are significant at the .001 level or better. The unstandardized regression coefficients are in the columns labeled *b* and the standardized regression coefficients are in the columns labeled β.

Discussion

This study is a preliminary attempt to model and understand real-world behavior. This study is rather novel in that it is highly case-focused. We examine data specific to one organization and several narrow relationships within that particular organization (based on analysis from Kozey, 2007). GCM has a coaching system in place designed to promote healthy

growth for the organization and its employees. That system is not working as initially (and ideally) intended. While many organizations struggle with stagnant growth and high turnover rates, we are specifically hoping to learn about the relationship between coaching and turnover at GCM and to gain insight on how to improve that organization's growth and retention rates.

In this initial exploration we decided to focus on the relationships among coaching, MTD, and turnover within the organization. Although other variables may moderate these relationships, we feel that this agent-based model meets our admittedly modest goal of replicating and increasing our understanding of observed real-world behavior. Ministry Team Development is one of the main predictors of whether an employee leaves or not, and both the quality and amount of coaching are what control the change in MTD. This explanation is obvious given the large effect sizes in the regression models.

More interesting than the amount of variance explained by the two coaching variables in the models is the large difference in importance between these two measures. Our results show that while increasing the quality of coaching does decrease attrition, increasing the number of coaches (quantity increase) is actually more important. Increasing the number of coaches in the network increases the number of times each individual employee is coached. This contact in turn helps the employees boost their MTD for the next iteration. As Table 5 shows, for each coach added, just over 31 fewer missionaries leave the organization over the 48-month period, missionaries who do leave stay an average of .18 months longer, and the missionaries' MTD (and thus satisfaction) are increased by just under 2 percentage points. The unit for coaching quality is rather arbitrary, so it makes more sense to look at standardized regression coefficients. For each standard deviation increase in coaching quality, total attrition decreases by .11 standard deviations, and attrition age and satisfaction increase by .11 and .16 standard deviations,

respectively. Clearly, both variables are important determinants of turnover; our position, however, is that number of coaches is the more important of the two. Comparing the standardized regression coefficients in each model in Table 5, we see that number of coaches has six times the impact of coach quality on satisfaction, and nearly nine times the impact on attrition age and total attrition. It seems that more frequent coaching contact, even from poor coaches, does a better job of maintaining an employee's MTD at a high level, than does infrequent, high quality coaching.

The data on which we based our assumptions and the findings reported are specific to GCM and its particular financial model. However, findings from this study could promote discussion in other fundraising, nonprofit organizations. Within the realm of faith-based, nonprofit work, many organizations employ a model similar to (although not exactly the same as) that of MTD (e.g., notable faith-based nonprofits employing a similar model are Campus Crusade for Christ, Navigators, Intervarsity Christian Fellowship, to name a few). Both pay and job performance can be linked to turnover within many organizations. Further, coaching of employees takes on many different forms and is evident in all types of organizations, ranging from traditional mentor-subordinate relationships to in-work class and training opportunities. These findings suggest that coaching plays a valuable role in whether people stay with or decide to leave an organization. It may be of interest to others outside of GCM that increasing the amount and quality of coaching can improve employee performance rates, and dramatically so. This relationship between coaching and turnover may partially be a function of the social support provided by coaching, but can also be linked to continual employee training to increase knowledge and competence within the workforce (specifically as it relates to employees' job responsibility to raise financial support).

To draw more solid conclusions from simulations like the one employed in the present article, further study is needed, and we acknowledge that this simulation has several limitations. Many of these limitations are related to the relatively high-level approximations of behavior used in the simulation. The "decay" factor, for example, simulates the ongoing, increasing challenge of participating in the MTD process. This factor was intended to account for forgetting of best practices, obsolescence of existing strategies, and attrition among the donor population. This simplistic factor does not account for individuals' personal learning and experience. If experience were included as an agent variable, different outcomes might be observed.

A second factor that warrants further attention in future research is the concept of missionary involvement. The personal or ideological commitment of a given individual is unlikely to closely follow the U-curve presented in the model. Some may find their commitment lags or increases linearly over time. Others may experience different curves or cycles. Our U-curve is a best approximation, based on familiarity with this particular organization. Varying commitment among agents will be an interesting direction for future research.

Future models will need to take into account more complex measures of job satisfaction and opportunity to leave. Further, the role of coaches as actors within the network should be explored. In the current model, coaches are differentiated along a single axis of "quality," implemented to represent the various factors (knowledge, teaching skills, personality, etc.) that contribute to positive coaching outcomes. A more realistic simulation must more completely address the nature of coaching, and this will require further analysis of the actual organization. Finally, it would be of interest to disaggregate and address separately coaching's effects on social support and job performance.

Although this model can undoubtedly be improved, we are encouraged by ABM's ability to help us better understand the dynamic of coaching. We have isolated and identified variables important to GCM's organizational goals. We have results that allow us to suggest tentative directions for GCM in the future. Lastly, we have demonstrated, to a limited extent, that ABMs can be built from the ground up based on real-world data, and can replicate those data with some success. Such research is attractive from the standpoint of utilizing real organizational data, allowing scientific analysis of the information provided to us by GCM. In essence, the merging of the academy with real organizational data is an excellent venue for moving research forward in agent-based modeling.

In terms of future research, the authors are seeking to examine the deeper relationship between coaching quality and the number of coaches within the organization. Further, it is clear that the current study has shed light on the existing infrastructure problem within the realm of coaching; however, a deeper understanding of the nature of coaching would help to move the research forward as well.

Notes

1. In the United States, a 501(c)(3) is a categorization for a non-profit organization. These organizations are exempt from federal taxation as well as most forms of state taxation.

2. To ensure that our results are not tied too closely to the stopping time of 48 months, and to test for possible start-up bias, we repeated the entire simulation with a stopping time of 100 months (iterations), with a stopping time of 148 months, and also using a wider coaching quality range (1-10 rather than 1-5) and found no qualitatively different effects. In the text, however, we report the results of the 48-month runs only.

3. We conducted linear regressions. For total attrition, however, there is a floor at zero, meaning that the appropriate function is probably logarithmic rather than linear. Evidence of this effect can be seen in the scatterplot of Figure 3. We transformed total attrition by taking the natural logarithm and recomputed the regression. We obtained a better fit, $R^2 = .93$, $F(2,1499) = 10557.80$, $p < .001$, and the regression coefficients for both number of coaches, $b = -0.06$, $\beta = -0.13$, $t(1497) = -143.90$, and coaching quality, $b = -0.5$, $\beta = -0.13$, $t(1497) = -20.22$, $p < .001$, were significant. Nonetheless, in the text we report the linear regression on the untransformed variable because the regression coefficients are easier to interpret.

Figure 1. Total Attrition as a Function of the Number of Coaches

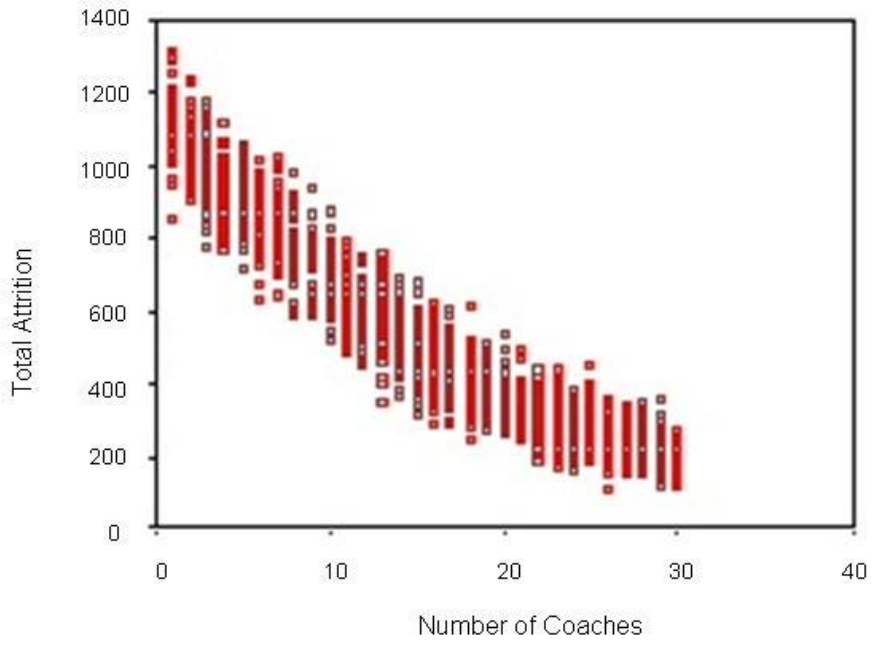


Figure 2. Mean Age at Attrition as a Function of the Number of Coaches

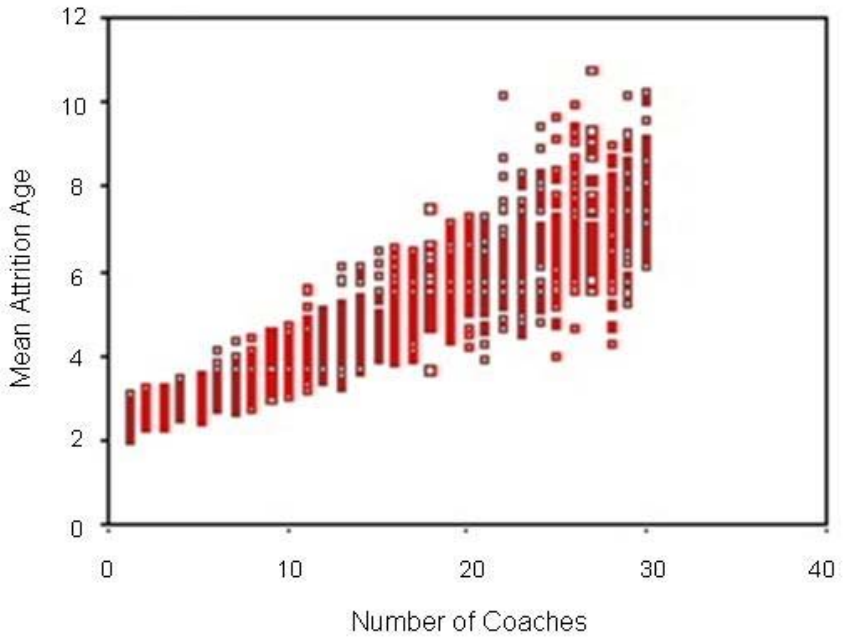
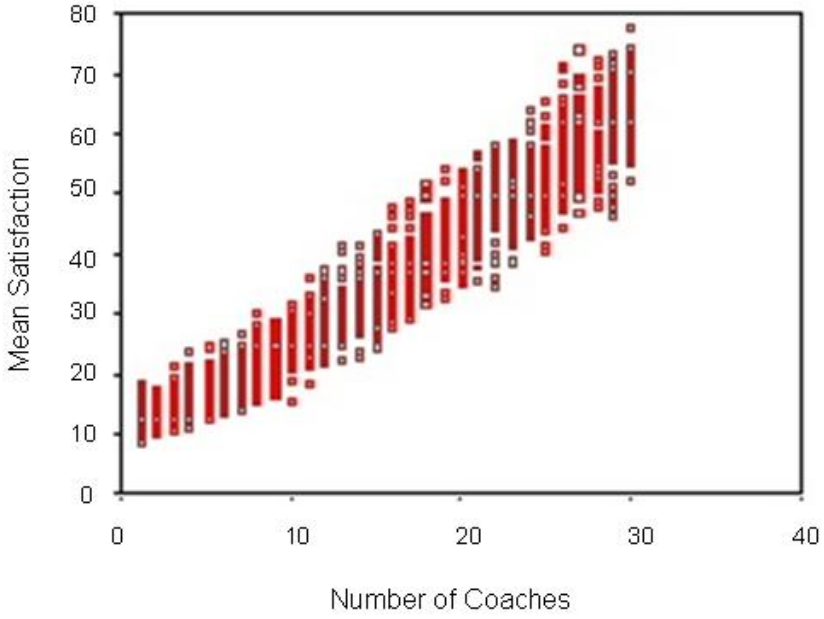


Figure 3. Mean Satisfaction as a Function of the Number of Coaches



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