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The Impact of Simulation Training on Call Center Agent Performance: A Field-Based Investigation

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The most prevalent form of training call center agents is via classroom instruction coupled with role-plays. Role-play training has a theoretical base in behavior modeling that entails observation, practice, and feedback. Emerging simulation-based technologies offer enhancements to behavior modeling that are absent in role-play training. This study evaluates the effectiveness of simulation-based training (henceforth, simulation training) as a behavior modeling technique vis-à-vis role-play training in a real-world call center environment *across* tasks of different levels of complexity. We collaborate with call centers at two *Fortune 50* firms and examine on-job performance metrics to evaluate the effectiveness of simulation training. The performance measures of interest are call accuracy and call duration because these are two important factors that influence customer satisfaction and productivity in call center operations. After controlling for factors such as trainee's learning and technology orientation, age, education, and call center experience, results show that simulation training outperforms role-playing-based training in terms of both accuracy and speed of processing customer calls. Further, the relative superiority of simulation training improves at higher levels of task complexity.

Key words: call centers; simulation training; behavior modeling; field experiments; performance measurement
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1. Introduction

Call centers employ over five million workers and represent a $180 billion industry in the United States (Markels 2003). While call centers have become a major gateway that link customers to a firm, research indicates that 84% of consumers have had a dismal call center experience (Markels 2003). Customer service problems at call centers are not surprising considering that the average turnover rate among call center agents is 30% (Tuten and Neidermeyer 2004). This rate of turnover implies that call centers must train approximately a million and a half new agents every year in North America alone (Baker 2005). Given that the average cost of recruiting and training call center agents is about $10,000, this represents a cost of $15 billion annually (Baker 2005). With the stakes so high, it is not surprising that companies are constantly on the lookout for efficient, effective, and scalable ways of training and retaining agents.

The most prevalent form of training new call center agents is via classroom instruction coupled with role-plays (Baker 2005). Role-play training, which has a theoretical base in behavior modeling (i.e., observation, practice, and feedback), is widely accepted as a training technique for improving new agent performance. The primary drawback of role-play training is that it is not individualized, not easily scalable, and is susceptible to variation in the quality of instruction. Instructor experience and proficiency, as well as situational characteristics such as the instructor's mood, classroom setting, and trainee dynamics can impact the quality of role-play training.

Not surprisingly, call center managers have explored other training alternatives such as computer-based training (e.g., CD-Rom; online training tools). Computer-based training (CBT) methods have met with limited success because of their static nature and lack of proper feedback systems (Fleischer 2003).

Indeed, call center managers often question the ability of CBT methods to engage and motivate call center agents to learn the business process of interest, navigate through information systems, have an active interaction with a customer, and perform all these tasks expeditiously and accurately (Baker 2005, Fleischer 2003).

More recently, advancements in technology have led to the development of a new genre of simulation training methods for call centers. Simulation training, similar to role-play training, relies on the principles of behavior modeling for influencing performance. Simulation training, however, incorporates enhancements to behavior modeling and differs from role-play training in terms of the nature of the practice sessions and delivery method, thereby leaving open the question as to whether performance differences are likely to emerge between the two training methods. Accordingly, the primary goal of our study is to examine the relative effectiveness of simulation training vis-à-vis role-play training on new call center agent performance.

Bolt et al. (2001) find that behavior modeling is superior to lecture-based training for complex tasks (e.g., linear programming using Excel 5.0). Call center agents field a variety of calls that vary in terms of their complexity and differ considerably from tasks involved in computer skills training for word processing, spreadsheets, and solvers. In addition, because both simulation and role-play training are based on behavior modeling, it is not clear whether one of these methods will perform better than the other as task complexity increases in a call center environment. Understanding these boundary conditions is important so call center managers can make informed choices regarding the most appropriate training method based on the complexity of calls handled by agents. Thus, the second objective of the study is to investigate whether task complexity moderates the effectiveness of simulation and role-play training.

To investigate these important empirical issues, we obtained the cooperation of two *Fortune 50* firms. While one of the firms preferred that the study be conducted in a tightly controlled lab environment, the other firm substituted a portion of their training for new agents previously conducted via role-play with simulation training, thereby allowing us to conduct a field experiment. At this latter firm, upon completion of training, the actual on-job performance of the simulation method trainees was compared to that of the role-play trainees. To the best of our knowledge, ours is the first study to compare the relative performance of simulation and role-play training in a field experiment using the on-job performance metrics of the participating company.

The remainder of this paper is organized as follows. Section 2 discusses role-play and simulation training methods. Section 3 contains the theoretical underpinnings of the study. Section 4 presents the first hypothesis, which examines the relative efficacy of role-play and simulation training. The details of Study 1 comprising of industry context, research method, and analysis are provided in the §5. Section 6 discusses the second hypothesis regarding the moderating influence of task complexity, while §7 presents Study 2. Section 8 discusses the managerial implications of the results. Section 9 identifies some potential shortcomings of the paper and proposes issues for future research. Section 10 summarizes the key conclusions and contributions of the paper.

2. Role-Play and Simulation Training Methods

Training in call centers most often begins with classroom training, where the focus is on learning product knowledge, customer service etiquette, and training agents to interact proficiently with information technology (IT) systems associated with the service. Role-play training is typically incorporated toward the end of classroom instruction to provide "real-life" experience to trainees. One or more customer calls are scripted and enacted, where one party plays the role of a customer (typically the instructor or a trainee) while another party (a trainee) plays the role of the call center agent. The contact is face-to-face allowing the parties in the role-play as well as other onlookers (i.e., trainees) opportunities for observation. The participants also have an opportunity to practice the role-plays and obtain feedback from the instructor when mistakes are made.

Simulation training in call centers follows a three-step process, namely, "paced observation," "modularized practice with feedback," and "integrated practice with feedback." In the first step comprising of "paced observation," the simulation provides an integrated audio-visual presentation of mock conversations between customers and call center agents (i.e., this is akin to observing "role-plays"). The trainee is merely an observer in this stage. The trainee not only gets to listen to mock conversations but also obtains a clear view of the computer keystrokes required to navigate through the appropriate screens of the information system. Additionally, the trainee obtains an opportunity to *pace* through each step of the call and observe the computer play the role of both the customer and call center agent, thus providing for a rich observational learning experience.

The second step in simulation training involves a "modularized practice with feedback," wherein the trainee handles a part of the call and the computer handles the rest. That is, rather than making the agent perform all tasks simultaneously (i.e., listen, think, talk, and type), the agent is eased into the different tasks sequentially. For example, trainees may focus on screen navigation and data entry, while the computer carries out the conversation with the customer. This helps to reduce the cognitive load on the trainee because fewer sensory mechanisms have to be integrated, while preserving the realism of the context. The computer prompts a corrective action in case the trainee makes a mistake. The third step involves an "integrated practice with feedback," wherein trainees field the entire call, with the computer prompting the right course of action in case of trainee error. Thus, in simulation training, there is an in-built feedback mechanism, which helps to accelerate learning.

3. Theoretical Underpinnings

Behavior modeling, which has its foundations in social cognitive theory, and adaptive character of thought (ACT*) theory of cognitive structure form the theoretical bases for the hypotheses developed in this paper. Each is discussed briefly in this section.

3.1. Behavior Modeling

Behavior modeling has been shown to be effective in teaching a wide range of skill sets ranging from mathematics to soft skills such as selling capabilities and assertiveness (e.g., Taylor et al. 2005). Several studies examine the efficacy of behavior modeling for computer skills training, which forms an integral aspect of call center training (e.g., Bolt et al. 2001; Compeau and Higgins 1995; Gattiker 1992; Johnson and Marakas 2000; Simon and Werner 1996; Simon et al. 1996; Yi and Davis 2001, 2003).

Goldstein and Sorcher (1974) proposed the concept of applied learning in the context of supervisory skills training. Their training concept is commonly referred to as "behavior modeling." Behavior modeling is based on Bandura's social learning theory (1977) and social cognitive theory (1986), which suggest that people can learn vicariously or by observing the experiences of others. Behavior modeling is an example of vicarious experience, wherein one observes the behaviors of another and mimics these behaviors via practice (Wood and Bandura 1989). Social cognitive theory views observational learning as an information processing activity consisting of the construction of knowledge structures based on the transformation of information both about the behavior and from the external environment into a set of rules to guide future actions with respect to that specific behavior (Bandura 1986).

Behavior modeling training suggests that learning in practice involves five steps—description to the trainees of a set of behaviors to be learned, modeling for trainees the effective use of those behaviors, providing opportunities for trainees to practice using the behaviors so as to facilitate cognitive organization and retention (i.e., rehearsal), providing feedback and social reinforcement to trainees after practice, and helping trainees transfer the desired behaviors to the job (Goldstein and Sorcher 1974, Decker and Nathan 1985, Taylor et al. 2005, Yi and Davis 2001). These steps ensure that the four key component processes of social cognitive theory—attentional, retentional, reproduction, and motivational—are closely adhered to in behavior modeling (e.g., Taylor et al. 2005).

Gaining the attention of trainees and modeling for them the use of the key behaviors are the first two steps of behavior modeling. These two steps help to develop basic competencies through vicarious learning (e.g., Wood and Bandura 1989). Whereas attentional processes foster the transfer of knowledge to short-term memory, the focus of retentional processes is to facilitate the behavior to long-term memory (Taylor et al. 2005). Symbolic coding is often used in behavior modeling training to facilitate retention (e.g., Davis and Yi 2004). Because the skills learned in the first two steps need to be perfected, the third and fourth steps in behavior modeling involve rehearsal and feedback. Cognitive rehearsal, actual practice, and feedback enhance trainee involvement, participation, experimentation, and performance (e.g., Davis and Yi 2004, Simon et al. 1996). Lastly, the skills learned in simulated situations should be put into practice through an effective transfer program, such as one that mimics the job environment (Robertson 1990).

While empirical results are largely supportive of behavior modeling approaches to training (e.g., Taylor et al. 2005, Bolt et al. 2001, Robertson 1990), several scholars (e.g., Davis and Yi 2004; May and Kahnweiler 2000; Yi and Davis 2001, 2003) make an important contribution by demonstrating that enhancements to classic behavior modeling training can yield superior results. Davis and Yi (2004), for example, show that incorporating symbolic mental rehearsal to a behavior modeling approach can substantially improve computer skills training. Likewise, in an active listening context, May and Kahnweiler (2000) find that adding a mastery practice design to conventional behavior modeling practice improves retention and skill demonstration. The addition of mastery modeling as a "complement" to behavior modeling is consistent with theory. Bandura (1986), for example, proposes mastery modeling as a means for developing competencies. In sum, these studies demonstrate that different variations of behavior modeling can have differential impacts and effectiveness (for a complete review, see Taylor et al. 2005).

Some recent studies make an important contribution by examining the underlying processes through which behavior modeling impacts performance. Consistent with social cognitive theory, Davis and Yi (2004) find that the effects of behavior modeling are mediated by knowledge structures or mental models. Knowledge structures refer to the manner in which individuals organize knowledge (Rouse and Morris 1986). In addition to the organization of knowledge, mental models impact both the acquisition and interpretation of new knowledge (Kraiger et al. 1993). Knowledge structures become more refined through learning and practice. In the early learning stages, knowledge is often organized in individual chunks. Through interventions such as symbolic coding and cognitive rehearsal, these individual chunks become more interconnected and sophisticated (Davis and Yi 2004). As such, this research suggests that training environment factors can influence the development of knowledge structures.

3.2. ACT* Theory of Cognitive Structure

The ACT* theory, which has its origins in the human associative memory (HAM) theory of memory, explains how individuals encode and deploy knowledge (Anderson and Bower 1973). According to ACT* theory, knowledge is created by the encoding of objects in the environment (referred to as *chunks*) or simple encodings of transformations in the environment (called *production rules*). Based on the task an individual is presented with, the appropriate chunks and production rules are selected by activation processes.

Anderson's ACT* theory of cognitive structure states that there are three contributing stages to skills acquisition. In the cognitive stage, declarative knowledge, which is the knowledge of facts and procedures (Anderson 1983), is developed through the learning of a process. In the associative stage, procedural knowledge is developed through the compilation of learned facts and the integration of these facts. Procedural knowledge is concerned with "how" to do things (Anderson 1983). In the last stage or autonomous stage, the skills become automated over time with practice and a person becomes fluent in applying a skill set. It is this final stage of processing that is critical for performance and is referred to as a "crucial point in instructional theory" (Goldstein 1993, p. 110).

May and Kahnweiler (2000) note that attaining automaticity of skills is difficult, in part, because most training programs allow trainees to usually only practice a few rounds, thereby allowing them to merely become familiar with the necessary behaviors for executing a task. In other words, the actual learning of what is required to complete the task is not complete. This is especially problematic for tasks centered around soft skills that are complex in nature, such as active listening, negotiating, etc. because of the high cognitive load. These findings suggest that for complex call center tasks, where trainees have to perform multiple tasks simultaneously (e.g., listening and responding to a customer query while also navigating information systems) and deal with a high amount of information, trainees are likely to experience cognitive overload.

ACT* theory provides some suggestions for enhancing skills acquisition and facilitating the transition to the autonomous stage. The theory suggests that the strength of encoding of declarative and procedural knowledge in memory determines the accessibility to these two types of knowledge. The more "elaborately" this knowledge is processed, the stronger the memory for it. As such, the amount and type of practice determines the extent to which information is elaborately processed (May and Kahnweiler 2000). Anderson (1995) suggests that elaborate processing is more likely when (a) there is repetition, (b) connections are established to prior knowledge (e.g., through checklists, feedback), and (c) there is an overlap between the training context and application context, suggesting that training programs that provide the "right" type of practice will enable accessibility of declarative and procedural knowledge.

The work of Anderson (1983, 1995) and May and Kahnweiler (2000) yields two key insights that are particularly relevant to our study. First, to process a task, one must retrieve and execute knowledge from memory and it is often difficult to achieve this automatic process. Indeed, tasks that require the integration of multiple sensory mechanisms are typically difficult (without considerable practice) because of the strain it puts on cognitive resources. Thus, if such tasks could be simplified by distributing them (i.e., breaking them into more manageable modules) or by pacing the learning experience, then the "transfer" of learned skills is likely to be much faster and more effective (Tannenbaum and Yukl 1992). The spacing and decomposition of new tasks in the acquisition of a new skill result in better retention of that skill (Anderson 1995).

A second insight is that information is elaborately processed when there is repetition, connections to prior knowledge, and the incorporation of contextual features. To put it simply, repeated practice causes behavior to become automatic (Howell and Cooke 1989, Weiss 1990, Arthur et al. 1998). Transfer will also be maximized to the extent there are identical stimulus and response elements in learning and job situations (Wexley and McCellin 1987). Furthermore, when new knowledge is elaborated within a specific context, retrieval of that knowledge becomes easier within that same context (Eich 1985). Recall of knowledge is enhanced within a certain context if the encoding of that knowledge was integrated with the context in their memory (Anderson 1995). Thus, the closer the training experience is to the real job situation, the greater the transfer of knowledge and skills.

4. Hypothesis: Role-Play and Simulation Training

Behavior modeling training essentially involves observation, rehearsal, and feedback (Robertson 1990). Both simulation and role-play training contain the essential elements of behavior modeling techniques. Specifically, in role-play training, participants observe the instructor and/or fellow trainees, perform a behavior, and then reenact it themselves. Feedback is provided, particularly when mistakes are committed. In simulation training, the first step involves the trainee observing mock calls between customers and call center agents. The second and third steps of simulation training consist of the trainee performing the behavior observed. Further, feedback is provided if the trainee commits an error during practice.

There are, nevertheless, substantial differences in the two methods in how practice sessions are conducted as well as in delivery. We argue that these differences create conditions that enable simulation method trainees to outperform their role-play counterparts in terms of having lower call duration and higher call accuracy. Specifically, there are three training environment factors on which simulation training differs from role-play training—realistic context, guaranteed feedback with less threatening environment for repetitions, and a paced learning environment. In turn, these environmental factors influence the formation of knowledge structures, which are a critical mediator of the effectiveness of behavior modeling training (Davis and Yi 2004). Each of the three environmental factors is discussed below.

Realistic context: We argue that simulation training for call center agents mimics the job context more strongly than role-play training, thereby leading to superior transfer of skills and behaviors as well as more elaborate processing that enables access of declarative and procedural knowledge (Anderson 1995, Yi and Davis 2003). In call center jobs, agents work alone in their respective cubicles and have no opportunity to see the customer. In role-play training, however, the training is done in public with the instructor being face-to-face with a group of trainees. The mere presence of the instructor and fellow trainees creates a context that is dissimilar from the job setting. Thus, for example, during role-plays, trainees can alter their response based on the body language (e.g., a facial grimace) of an instructor or fellow trainees. This body language, however, is not observable in the call center job setting.

In contrast, simulation training replicates the job context because the trainee receives calls, albeit simulated calls, as he or she would in a call center job. The trainee also works alone, which is representative of the job context. The realistic context enables the "transfer of training," which is a key component of behavior modeling (e.g., Decker and Nathan 1985). As such, realistic context facilitates learning through the principle of identical elements (e.g., Taylor et al. 2005). Importantly, when the training context parallels that of the work environment, it is likely to lead to development of knowledge structures that are pertinent to the task at hand. In contrast, the knowledge structures of trainees undergoing role-play training will have to be "updated" to accommodate the dissimilarity in the task context. Similarly, ACT* theory notes that when there is an overlap between the training context and application context, it leads to stronger encoding of declarative and procedural knowledge (Anderson 1995), thereby enabling trainees to move quicker from the declarative to the associative and then finally to the autonomous phase (Eich 1985, Wexley and McCellin 1987). Overall, these arguments suggest that training context favors simulation training over role-play training.

Guaranteed feedback with less threatening environment: Feedback is an essential component of behavior modeling (e.g., Yi and Davis 2001). Robertson (1990) suggests that feedback facilitates cognitive organization and retention. Likewise, ACT* theory suggests that feedback establishes connections to previously learned skills and knowledge. In role-play contexts, trainees have the opportunity to go beyond the scripted calls and receive feedback. While this is an advantage, the trainees are also the cynosure of attention and they have to seek feedback in public. Empirical research demonstrates that, by and large, seeking feedback is difficult because of impression management concerns (e.g., Ashford and Northcraft 1992, Levy et al. 1995). These impression management concerns of the trainees develop because individuals are apprehensive that others (e.g., instructor, fellow trainees) may view their feedback-seeking behavior as a sign of incompetence or low ability. These findings suggest that role-play trainees may be sensitive to ask for repetition of call scenarios or seek clarifications that may be viewed by others as "basic" knowledge (especially if they have already gone through classroom training). In other words, in role-play contexts, feedback is not guaranteed and, further, the feedback provided by the instructor may or may not address a trainee's individual concerns.

In contrast, with simulation training, there is an inbuilt feedback mechanism. Whenever a trainee makes an error, the computer prompts the right course of action, thereby eliminating the burden of seeking feedback. Thus, the feedback is guaranteed and it addresses the individual's specific needs (i.e., provides corrective feedback on errors made by the individual). Feedback, which is central to behavior modeling training, serves as a correctional function, thereby helping to reduce discrepancies between ideal behaviors and the individual's actions (Davis and Yi 2004, Decker and Nathan 1985). Feedback also helps trainees develop procedural knowledge, have a complete cognitive understanding of the task, and strengthen cognitive organization and retention (Kraiger et al. 1993, Robertson 1990, Simon et al. 1996). These, in turn, lead to the development of mental models that are more appropriate for the task at hand. The less-threatening environment also mitigates concerns of social distress, thereby encouraging repetition or rehearsal, which can lead to "overlearning" (Taylor et al. 2005).

Paced learning: Lastly, several scholars note that enhancements to behavior modeling such as including a mastery practice design or retention component further improves the effectiveness of behavior modeling (e.g., May and Kahnweiler 2000, Yi and Davis 2001). Simulation training offers a similar enhancement in the form of a paced learning experience. Simulation training allows trainees to go through the different training steps at their own pace (by pausing and even backtracking when necessary). Allowing trainees to pace through the simulation provides them an opportunity to assimilate information at their own comfort level. This is particularly important for new trainees because individuals differ in the rate at which they learn new material (Hirsch 1977, Simon and Werner 1996). Paced learning allows trainees the opportunity and time to actively encode and mentally rehearse information (i.e., engage in effortful modes of learning and overlearning), which has been linked to organized knowledge structures (e.g., Davis and Yi 2004). Paced learning allows trainees to continually refine and develop their knowledge structure as they practice, backtrack and practice again until their compilation of the procedures is sound. This allows them to progress more rapidly to the autonomous phase that defines expert performance (Craik and Lockhart 1972, Anderson 1995). On the basis of these arguments, we propose:

Hypothesis 1 (H_1). *Simulation trainees will have* (a) *lower call duration, and* (b) *higher call accuracy than role-play trainees.*

5. Empirical Study 1

5.1. Background

A key goal of this study is to examine the effectiveness of simulation training in a real-world call center environment. We contacted a company that makes simulation training software for call center environments. The firm's software had been acclaimed in the press and was considered state-of-the-art. The firm readily agreed to participate in the study. The senior management at this firm saw an opportunity to understand and gauge the potential benefits of their technology in an objective manner. They agreed to build simulations for any call center context.

We contacted four *Fortune 500* companies, of which two were deemed not well suited for the study from the standpoint of sample size, timing of the training, and logistics associated with on-site visits. A third firm (henceforth, the Study 1 firm) allowed us to conduct a field-based experiment following the procedures of Cook and Campbell (1979). The fourth firm (henceforth, the Study 2 firm), also agreed to participate, and formed the basis for Study 2 (which we describe in §7). At both firms, we had extensive discussions over multiple visits with the call center management staff to identify suitable call scenarios for the study. Next, a development team from the simulation training software company interacted with call center managers and trainers to simulate the calls (i.e., understand the nature of the call, capture screens, conversation, keystrokes, and data entry associated with each call). The simulations were finalized once call center managers deemed them to be close to the experience of handling a live customer call. Next, we describe the context, sample, procedures, and analysis for Study 1.

5.2. Study 1 Procedures

5.2.1. Context and Sample. The firm that participated in Study 1 is a *Fortune 50* company in the package distribution business with national and international operations. It has several call centers throughout the United States. This firm agreed for an on-site field experiment during their training sessions for new hires at one of their call centers. This firm's call center handles customer service calls regarding pick-up and delivery of packages, tracking of packages, billing, and so on. The normal training for new agents spans six days of classroom instructions of which approximately four and three-quarter days are spent on familiarizing trainees with the firm, its culture, its products and services, its business processes, customer service etiquette, and making them acquainted with the details of their mainframe information systems relevant to handling calls. Next, the remaining time is spent in classroom training on 10 call scenarios. Toward the end of this classroom training, per the firm's guidelines, call center trainees participate in role-playing exercises on five of these 10 call scenarios for approximately an hour and a half (time reasons permitted role-play training on only

Table 1 Study 1—Training Procedure

Classroom instruction training common to both role-play and simulation groups

Background training

- Instructors provide introduction to the firm, its culture, and HR procedures. They familiarize trainees with the firm's products, business processes, customer service etiquettes, and details of the mainframe information systems that are relevant to handling calls.
- Each participant responds to a printed pretraining survey questionnaire (see the appendix).

Call scenario training

- An experienced instructor provides details on the 10 common call scenarios that trainees will encounter on their jobs.
- Instructors use flow charts and power-point presentations for each call scenario to provide the purpose and specifics of each call. Instructor demonstrates the screens to be navigated and the fields where information is to be sought or entered.
- Trainees have computers in front of them, so they can witness the screens and fields.
- Instructors provide trainees with an enhanced script (i.e., a sheet that describes the sequence of actions related to conversation and keystrokes required to respond to a customer query). Trainees have access to the enhanced scripts at all times during classroom instruction. They use the enhanced script to navigate the screens and fields in the system for each call scenario.
- This marks the end of common training. Per the training procedures at firm A, the trainees next move to the practice phase that constitutes the last component of training, during which they participate in rehearsals on five prespecified call scenarios. An hour and a half (approximately 15% of call scenario training time) is allocated for this phase. Both simulation and role-play trainees rehearse the same five call scenarios.

Practice phase

Role-play trainees	Simulation trainees
• Trainees continue to have access to computers and the enhanced script for each of the five call scenarios. • Trainees observe instructors role-play each of the five call scenarios, including observing the navigation of screens and fields which were projected on a screen. • Next, each call scenario is role-played thrice in a sequential manner. An instructor plays the role of a customer and a trainee plays the role of an agent. • While a role-play is in progress, trainees get to follow the role-playing agent's key strokes because they are projected onto a screen. They also use the enhanced script to identify errors as they follow a role-play. • Instructor points out the right course of action when mistakes are made. Trainees are encouraged to clarify any doubts pertaining to a call scenario. • Thus, each trainee observes, talks, and/or navigates the screens and fields for each call scenario four times.	• Trainees do not have access to the enhanced script. • The following steps are repeated for each of the five call scenarios: —*Paced observation*: Trainees seated at computer terminals with headsets observe a model call (computer simulation). Trainees pace (step) through the call once (i.e., pause when desired). —*Modularized practice with feedback*: Next, trainees go through the call in modularized mode once (i.e., the computer controls one aspect of the call—e.g., conversation—while the trainee handles the keystrokes). The computer prompts the correct action in case of a mistake. —*Integrated practice with feedback*: Lastly, each trainee practices the entire call (once) wherein the computer prompts the correct action in case of a mistake. • Thus, each trainee observes, talks, and/or navigates the screens and fields for each call scenario four times.

half of these scenarios). To accommodate the study, the firm agreed to substitute the role-play training on the five call scenarios with simulation training. Thus, after classroom instruction training on 10 call scenarios, both role-play and simulation groups practiced the same five call scenarios. Subsequently, on-job performance data was collected for these five call scenarios. Table 1 outlines the training procedure for Study 1.

Managers at the Study 1 firm randomly split the incoming class of 77 trainees into two groups, where one group of 38 underwent normal training that included classroom instruction and role-plays. The second group of 39 received identical classroom instruction as the first group, but substituted the role-plays with simulation training. After accounting for missing data, the final sample sizes are 36 and 35 for role-play and simulation training, respectively. Each trainee was administered a pretraining questionnaire to gather information on demographics, trainee learning orientation, technology orientation, and proficiency in computer software applications. Learning orientation was measured because prior research indicates that an individual's motivation to learn and experiment significantly impacts performance (Kohli et al. 1998, VandeWalle 1997). *Technology orientation* refers to an individual's belief on whether technology is beneficial and rewarding. Given that the simulation group receives training using technology, it was important to control for the technology orientation of trainees (Parasuraman 2000). Lastly, we measured an individual's proficiency in computer software applications because of the extensive use of computers in call center jobs. These measures are provided in the appendix. The coefficient alphas for the multi-item scales exceeded the 0.70 level recommended by Nunnally (1978).

The role-play and simulation groups did not differ significantly on demographics, learning orientation, technology orientation, or on proficiency in computer software applications. The role-play and simulation groups have 5.8 and 6.2 months of call center experience, respectively ($t = 0.18$, ns). Role-play trainees were on average 25.3 years old, while their simulation training counterparts were 28.1 years of age ($t = 1.2$, ns).

Upon completion of training, as per company policy, the firm evaluated the actual job performance of trainees by randomly monitoring customer calls on the five call scenarios on which they received either role-play or simulation training. Call monitors listened in on random customer calls relating to these scenarios during the first two weeks of a trainee's new job. The company used two metrics to evaluate a new agent's job performance—call duration (in seconds) and accuracy. These metrics were in place at this company for many years. Accuracy was scored as "1" if no incorrect information was provided by a call center agent to the customer. Accuracy was scored as "0" even if a single mistake was made.

On average, the performance metrics for the role-play group were collected 4.5 days into their job, while for the simulation group it was collected 4 days into the job. No significant difference (i.e., $p > 0.10$) exists in the variable "day" for collecting performance data, thereby suggesting that performance data for both groups was gathered over identical intervals of time. Because monitoring was done randomly by the participating company, the more frequently encountered call scenarios resulted in a larger number of data points. The measurements associated with each call scenario are presented in Table 2. Call scenario 2 has zero and two measurements, thereby suggesting that it should be excluded from any analysis. As can be seen from the table, other than call scenario 3, none of the other scenarios have sufficient sample size to justify an individual analysis. Accordingly, we performed analyses on call scenario 3. In addition, to increase the confidence in the results and include data from the other scenarios, we also performed the analyses on an aggregated data set that combined all the scenarios.

Table 2 **Study 1—Call Scenario Descriptions and Number of Measurements**

Call scenario	Descriptions of call scenarios	No. of measurements: Role-play	Simulation
1	Late delivery: A package is delivered late, but the delay may be because the shipper did not provide the accurate address	24	15
2	Tracing call: The package is not delivered on time and customer calls to trace it.	0	2
3	Redelivery request: Customer sees that an attempt was made to deliver a package. Customer calls to schedule a convenient time for delivery of the package.	108	99
4	Refund request: A package is delivered past the guaranteed time. Receiver/Shipper calls for refund.	9	7
5	Expedited delivery: While a package is in transit the customer calls to see if it can be delivered earlier than the scheduled date/time.	21	12

5.2.2. Analysis and Performance Results.

Call duration: An ANCOVA model was estimated using the generalized linear model (GLM) procedure (Hays 1988). The covariates in the model included trainees' learning orientation, technology orientation, call center experience, education, average number of days into the job, and proficiency in computer software applications. For call scenario 3, all participants had at least two calls monitored, while very few had three or more measurements. The average call duration for the first two measurements was taken as the measure of the dependent variable for this call scenario.

The ANCOVA results for call scenario 3 are presented in Table 3. Training method has a significant effect on call duration ($F = 4.47, p < 0.05$). Overall, the variables explain 19% of the variation in the dependent variable. Table 4 presents the means for call duration for the two groups. On average, the simulation training group took 45 seconds less than the role-play training group to complete the call (role-play = 215 seconds; simulation = 170 seconds). As noted earlier, we also performed the same analysis on the aggregated data set as a validity check. The pattern of results is similar to that obtained for call scenario 3. Training method has a significant effect on call duration ($F = 4.43, p < 0.05$) and the simulation group took 42 seconds less than the role-play group (role-play = 238 seconds; simulation = 196 seconds) to complete a call. Thus, consistent with Hypothesis 1(a), we find that trainees exposed to simulation training have significantly shorter call durations than those in role-play training.

Table 3 **Study 1 (ANCOVA Results)—Call Duration in Seconds for Call Scenario 3**

Source of variation	SS	*df*	MS	F
Covariates				
Education	14,402.1	1	14,402.1	2.01
Call center experience	38,442.9	1	38,442.9	5.36*
Learning orientation	414.1	1	414.1	0.06
Applications proficiency	6,341.9	1	6,341.9	0.88
Technology orientation	3,853.8	1	3,853.8	0.54
Average day	9,632.1	1	9,632.1	1.34
Treatment				
Training	32,089.9	1	32,089.9	4.47*
Error	451,964.7	63	7,174.0	
Total	554,335.5	70		

Note. Training remains significant even if covariates are excluded.
*$p < 0.05$.

Table 4 Study 1—Call Duration and Accuracy for Call Scenario 3

	Role-play	Simulation
Time: Avg. call duration (sec.)	215	170
Accuracy+	0.84	0.83
N (no. of trainees)	36	35

+Proportion of calls in which no mistakes were made.

Accuracy: As noted earlier, the firm's call monitors assign a score of "1" if all responses by the trainee on the customer call are correct. Even if one response on the call is incorrect, accuracy is given a score of "0." For each training group, accuracy is the proportion of calls scored a "1" (i.e., no mistakes are made). Next, for call scenario 3, an ANCOVA model was estimated using the GLM procedure. The covariates are identical to those used to test the hypothesis on call duration. Table 4 reports the accuracy scores, while Table 5 reports the results from the ANCOVA analyses. There are no significant differences between the two groups with respect to accuracy, which is not entirely surprising because the measure of accuracy does not capture the true variation on this construct. The same pattern of results is obtained for the aggregated data. Overall, we receive no support for Hypothesis 1(b) in Study 1.

6. Hypothesis: Task Complexity

Researchers have recognized that the effectiveness of different managerial interventions vary as a function of the characteristics of a task, in particular, its complexity. Task complexity is increasingly being recognized for its important role in defining the boundary conditions of different training methods. Indeed, May and Kahnweiler (2000) suggest that traditional conceptualizations of training practices may be inadequate or misleading when applied to complex tasks or skills. Bolt et al. (2001), using a modified social cognitive theory framework, demonstrate that for computer skills acquisition, the effectiveness of behavior modeling training is moderated by the complexity of the task.

Table 5 Study 1 (ANCOVA Results)—Accuracy+ for Call Scenario 3

Source of variation	SS	*df*	MS	F
Covariates				
Education	0.02	1	0.02	0.36
Call center experience	0.21	1	0.21	3.16
Learning orientation	0.00	1	0.00	0.04
Applications proficiency	0.01	1	0.01	0.14
Technology orientation	0.11	1	0.11	1.58
Average day	0.00	1	0.00	0.01
Treatment				
Training	0.02	1	0.02	0.32
Error	4.18	63	0.07	
Total	4.51	70		

+Proportion of calls in which no mistakes were made.

Task complexity has been defined from various perspectives. Complex tasks are characterized as those in which the paths to a goal are unclear and on the basis of the number of subtasks that need to be performed (e.g., March and Simon 1958, Terborg and Miller 1978). Taking an information processing perspective, Schroder et al. (1967) suggest that complex tasks have higher information load, higher information diversity, and faster rate of information change, indicating that complex tasks place high cognitive demands on individuals. Campbell (1988) construes tasks in terms of the number of paths, the number of potential outcomes, the number of interrelated and potentially conflicting elements, and possibility of uncertain linkages.

The above definitions suggest that a task increases in complexity when the number of information cues that must be processed increase and the number of distinct acts to be performed increase. Further, as complexity increases, the cognitive overload increases correspondingly (Wood 1986). New trainees are particularly susceptible to cognitive overload because it is difficult for them to think about what they are doing and simultaneously execute behaviors in a comfortable and fluid manner (e.g., May and Kahnweiler 2000). Under such conditions, drawing from Anderson's (1983, 1995) ACT* theory, we argue that simulation training offers an enhancement to behavior modeling in the form of a distributed learning experience that allows trainees to cope with the cognitive overload effectively.

According to Anderson's (1983, 1995) ACT* theory, accessibility of declarative knowledge and performance of procedural knowledge depends on the strength of encoding of this knowledge in memory. The memory for these two types of knowledge is stronger the more elaborate the processing of information. While role-plays have advantages such as allowing an instructor to clarify beyond a call script, it nevertheless requires new trainees to master the information, understand the linkages among different pieces of information, and respond to the trainer's queries (i.e., the mock customer) by integrating different sensory elements simultaneously. This places high cognitive demands on trainees because it is difficult to think and execute a complex task without substantial practice (e.g., May and Kahnweiler 2000).

In contrast, simulation training offers an advantage over role-play in managing the cognitive overload that arises from complex tasks by distributing the task load. In the mandatory modularized practice mode in simulation training (i.e., the second step in the training), the trainee handles a part of the call and the computer handles the rest. For example, trainees handle the navigation through different screens and fields while the computer does the talking on behalf of both the customer and the trainee. This separation of sensory tasks during the learning phases allows trainees to practice one component at a time and helps them arrive faster at the final proceduralized form that is typical of expert knowledge (Tannenbaum and Yukl 1992). In other words, the distribution of tasks helps in reducing the cognitive load, thereby enabling stronger encoding of declarative and procedural knowledge (cf. Anderson 1983, 1995).

Additionally, as noted earlier, simulation training allows trainees to pace through a task at their own comfort level. This opportunity to pace through the training task is even more important for complex tasks because new trainees are otherwise likely to be overwhelmed by the amount of information that they have to manage. Lastly, for complex tasks it is critical that practice sessions be conducted in an environment that mimics the job context. Otherwise, trainees have to make this additional adaptation while dealing with the significant pressure of handling a complex task. For reasons articulated earlier, simulation training is superior to role-play in mimicking the job context. Therefore, based on the above arguments, we anticipate the following:

Hypothesis 2 (H_2). *Simulation training will have a greater positive effect than role-play training on call accuracy when task complexity is high than when task complexity is low.*

7. Empirical Study 2

While Study 1 provided a rich real-world context, it did not permit us to achieve all the objectives of the research. Specifically, we were unable to investigate the interaction between training method (simulation versus role-play) and task complexity on performance (i.e., H_2). In addition, the categorical measure of accuracy in Study 1 restricted the ability to measure the true variance on this construct. The objective of the second study was to overcome these weaknesses.

7.1. Context and Sample

The firm that participated in this study is a division of a *Fortune 50* conglomerate. This division has revenues exceeding $1 billion in the energy industry. The call center at this firm caters to parts and services needed by the capital-intensive energy sector with continuous operations. The call center handles calls related to processing quotes, providing status on quotes, processing and tracking orders, and other general account management support to customers. Based on discussion with call center managers, the quote status and quote processing calls were selected because they represent different levels of complexity. The quote status call is simpler to handle than the quote processing call because agents have to interact with fewer fields on the firm's legacy system. In the quote status call, a call center agent interacts with 10 fields. In contrast, a quote processing call requires agents to interact with 30 fields.

Unlike the firm that participated in Study 1, the number of new call center hires is very small at the Study 2 firm. Call center training for new hires at the Study 2 firm involves interacting with the firm's legacy information system and becoming familiar with the products. Given our focus on training agents to handle quote status and quote processing calls, managers at this firm deemed it appropriate to eliminate the need to simulate complexity of product knowledge, and suggested that we focus on the underlying business process and do the study at a university with them overseeing the entire process. Therefore, a representative part of this firm's training is replicated in a laboratory environment at a large research university.

A total of 126 students participated in the experiment. The participants mainly comprised of undergraduate seniors in the business program. All participants were provided with a $20 gift certificate toward any purchase at the university bookstore as an incentive to participate in the experiment. The participants were randomly assigned to the role-play and simulation groups and by task complexity. 31 students each were assigned to the two role-play groups and 32 students each were assigned to the two simulation groups. Each participant was administered a pretraining survey identical to that used in Study 1. In all, eight training sessions were organized to accommodate lab-size restrictions and availability of students. Half the training sessions were for the quote status call (i.e., the simple task), while the other half were for the quote processing call (i.e., the more complex task).

Given the participant demographics, not surprisingly, there are no differences in age and education for the participants. Those in the simulation group have significantly higher call center experience (role-play = 0.18 months; simulation = 0.93 months; $p < 0.05$). However, the difference is less than a month in terms of experience and was thus deemed managerially insignificant by both the researchers and call center managers. The managers indicated that the uniqueness of the legacy information system at their firm would prevent the marginally more experienced group from having any differential impact on performance given the newness of the learning context. Further, there are no significant differences between the two groups in terms of learning orientation, technology orientation, and proficiency in computer software applications.

Table 6 Study 2—Training Procedure

Classroom instruction training common to both role-play and simulation groups

- Instructor provides an introduction to the participating company and shows short video on the firm.
- Each participant signs a consent form (for approval of human subject research at the university).
- Each participant responds to a printed pretraining survey questionnaire (see the appendix).
- The instructor provides an overview of the information system, the underlying business process, and explains the given call scenario using a flow-chart diagram. For a given training session, this call scenario is either a quote status call or a quote processing call. A call scenario was randomly preassigned to each training session during experimental design.
- The participants observe a model call (a computer simulation provides the conversation between a customer and a call center agent along with a clear view of the screens and fields to be navigated).
- Instructor walks trainees through an entire call using PowerPoint slides and an enhanced script (i.e., a sheet that describes the sequence of actions, including conversational responses and keystrokes). Each participant is provided a copy of the enhanced script.
- The participants observe the model call again and follow the conversation and navigation of screens and fields associated with the call using the enhanced script.
- This marks the end of common classroom instruction-based training and participants move to the practice phase. In this phase, both groups respond to computer-simulated customer queries during rehearsals and are subsequently evaluated on identical simulated calls. All participants respond to an identical posttraining questionnaire at the end of rehearsals (see the appendix).

Practice phase

Role-play group	Simulation group
• Each participant continues to keep the enhanced script during role-play training and has access to a computer. • In addition, each participant is provided a navigation sheet (i.e., a sheet that lists nonintuitive alphanumeric labels to navigate through various fields and screens of a legacy system at the participating firm). • The participants observe a role-play wherein the instructor is the mock customer and a participant is a mock agent. In addition to the conversation, participants have a clear view of the screens and fields being navigated by the mock agent during role-play. • Subsequently, each participant practices twice on the simulated system. Participants use the enhanced script and are allowed to seek help from the instructor. • The enhanced script is taken away from each participant prior to performance evaluation. • Lastly, each participant is evaluated for accuracy on two simulated calls.	• The enhanced script is taken away from each participant prior to the start of simulation training. • Instead, each participant is provided with a basic script, which only has details on conversation and none on keystrokes. • Each participant is provided a navigation sheet (i.e., a sheet that lists nonintuitive alphanumeric labels to navigate through various fields and screens of a legacy system at the participating firm). • *Paced observation*: Each participant paces (steps) through the simulated call once (i.e., can pause when desired). • *Modularized practice with feedback*: Each participant practices data entry (once) in a modularized mode wherein the computer does the talking while the participant navigates through relevant screens and fields. The computer prompts the correct action in case of a mistake. • *Integrated practice with feedback*: Each participant practices the entire call (once) wherein the computer prompts the correct action in case of a mistake. • Lastly, each participant is evaluated for accuracy on two simulated calls.

Recall that the quote status call and quote processing calls were identified as relatively simple and complex tasks, respectively, based on discussions with managers as well as objective criteria (i.e., number of fields to interact with). However, as an additional manipulation check, we also measured each participant's perception of task complexity (using a post-experiment questionnaire). The measures for task complexity are provided in the appendix. The average response on task complexity for the quote processing call is 4.64, while for the quote status call it is 3.14. These differences are significant ($p < 0.05$). As in Study 1, the coefficient alphas for the multi-item scales exceed the 0.70 level as recommended by Nunnally (1978).

7.2. Research Method and Analysis

Because it was vital to develop training sessions that mirrored those at the participating firm, we conducted a series of pilot studies to hone the content and quality of the training. The training procedure is outlined in Table 6. A graduate research associate (GRA) played the role of the trainer. To control for variation in instruction, the same GRA provided instruction in all the sessions (pilot and main study). Two managers from the call center at the participating firm observed the quality of instruction provided by the GRA and approved both the content and delivery of training instructions. Once again, the training time for both groups was equivalent.

7.3. Accuracy

The firm that participated in Study 2 provides parts and services to power plants worldwide. Given that thousands of part numbers are processed at their call center, accuracy is very important lest the wrong part be delivered to a customer. At this firm, the performance of call center agents is measured as the proportion of fields filled correctly by the agent. Clearly, this represents a measure of accuracy. We adopted this measure of accuracy as the dependent variable. This continuous measure of accuracy allows us to alleviate the limitations experienced in Study 1,

Table 7 Study 2 (ANCOVA Results)—Accuracy+

Source of variation	SS	*df*	MS	F
Covariates				
Call center experience	0.07	1	0.07	3.53
Learning orientation	0.00	1	0.00	0.04
Applications proficiency	0.00	1	0.00	0.15
Technology orientation	0.06	1	0.06	2.88
Treatment				
Training	0.11	1	0.11	5.56*
Task	0.44	1	0.44	23.02***
Training × task	0.10	1	0.10	5.05*
Error	2.28	118	0.02	
Total	2.99	125		

Note. Significance of treatment factors remains unchanged even when covariates are excluded.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

+The proportion of fields entered correctly by a trainee in a given call scenario.

Table 8 Study 2—Proportion of Accurate Responses by Task and Training Method

	Role-play	Simulation
Accuracy (avg.)	0.70	0.76
No. of participants	62	64
Simple task (quote status)+		
Accuracy (avg.)	0.76	0.79
No. of participants	31	32
Complex task (quote processing)++		
Accuracy (avg.)	0.63	0.72
No. of participants	31	32

+Quote status call requires a trainee to enter data in 10 fields.

++Quote processing call requires a trainee to enter data in 30 fields.

where accuracy is measured using a categorical "1/0" scale. The simulation provider, in conjunction with the research team, developed the routines to measure call accuracy. Unfortunately, because very significant resources were required from the simulation provider as well as the researchers to track call duration in the university laboratory setting, it was not possible to measure this construct in the second study.

At the end of the training, each participant was asked to go over their assigned call (i.e., either quote status or quote processing) twice, thereby providing us with two measurements of accuracy proportions. A mean of these two measurements was taken and, as in Study 1, we estimated an ANCOVA model. The treatments are type of training (i.e., role-play or simulation) and task complexity (simple or complex), while the covariates include call center experience, learning orientation, technology orientation, and proficiency in computer software applications.

Table 7 presents the results from the ANCOVA analysis. Overall, the variables explain 24% of the variation in the dependent variable. Training method has a significant effect on accuracy ($F = 5.56$, $p < 0.05$). As anticipated, the interaction between training method and task is significant ($F = 5.05$, $p < 0.05$). Table 8 presents the proportion of accurate responses by training method and task. Interestingly, the accuracy scores are more or less the same for the two training methods for the simple task (role-play = 0.76 and simulation = 0.79). However, consistent with H_2, the gap in accuracy scores between the two training methods widens as task complexity increases. Specifically, simulation trainees have an accuracy score of 0.72, while role-play trainees have an accuracy score of 0.63. These findings lend support for H_2 and suggest that the simulation training method is more beneficial when the cognitive overload is higher (i.e., a complex task). For relatively simple tasks, the benefit of simulation training is more marginal, at least with respect to accuracy. Next, we highlight the managerial implications of these findings in a call center environment.

8. Managerial Implications

Call center managers consider call accuracy and call duration to be two important metrics to gauge call center agent performance. Accuracy is often considered as one key driver of call center service quality. After all, it is of little solace to customers that a wrong part was sent to them, or that their package was delivered to the wrong location. While increased accuracy is always desirable, shorter call durations are desirable if accuracy and other metrics are not compromised. Call centers are often viewed as cost centers and are constantly under pressure to reduce costs. If call duration can be reduced, without sacrificing service quality, it would mean that a firm would require fewer agents, thereby enhancing its cost competitiveness. Our study suggests one way in which managers can improve call accuracy and shorten call duration for new call center hires.

Overall, simulation training results in a significant reduction in call duration relative to role-play training. The average call duration for simulation trainees is 20% lower than that of role-play trainees during their first two weeks on the job. Given the volume of calls in a call center environment, where even shaving a few seconds off the call is considered managerially significant, the magnitude of the difference is somewhat surprising. Managers from the Study 1 firm were pleasantly surprised by the result because their role-play training process had been honed over several years and they have experienced instructors perform the training. Discussion with managers as well as theory-based reasoning leads us to believe that training environment factors inherent to simulation training (i.e., realistic context, guaranteed feedback with less threatening environment, and paced learning) lead to the formation of knowledge structures that result in superior performance. Additionally, the advantages of simulation training (e.g., potential for stronger encoding of declarative and process knowledge in memory) lead to these trainees being more comfortable with the task at hand. However, whether the call duration advantage persists over time remains to be seen and represents a fruitful area for future research.

Shorter call durations, as noted earlier, are desirable if accuracy is not compromised. Our results indicate that the benefits of call duration did not come at the expense of any loss in call accuracy. Call accuracy of simulation and role-play trainees is equivalent in Study 1 where both call duration and call accuracy are measured, while it is significantly higher for simulation trainees in Study 2. These results are encouraging to call center managers because they do not have to make an "either or" compromise. They can drive cost efficiencies while maintaining and/or enhancing effectiveness, at least when it comes to accuracy.

The newness of simulation training in call center environments is likely to raise questions as to whether these simulations can be used primarily for training of simple tasks or whether they can also be used for complex tasks. Our findings suggest that the advantage of simulation training over role-play training widens with an increase in task complexity. Simulation training provides a significant improvement in call accuracy when the task is more complex. This finding is particularly important to the firm participating in Study 2 because it receives large numbers of calls that are typical in nature to the complex task performed in the study. Furthermore, as cost pressures drive firms to shift increasingly more complex work to call centers, this finding is likely to be of interest to a broader set of firms. As such, the ability to train agents to handle complex tasks with accuracy can allow firms to transition such tasks to call centers and realize greater cost savings.

Furthermore, role-play training often relies on a pool of instructors that are often the best and most experienced call center agents. This means that these agents are "away" from serving customers. In addition, call centers often adopt a buddy system that pairs experienced agents with new hires. In a high turnover-rate environment, training and mentoring new hires accentuates the need to draw upon these proficient agents, leading to a significant loss of productive capacity. The net effect of loss in productive capacity coupled with mistakes made by new hires leads to increased waiting times and poor service quality. In essence, these conditions place severe restrictions on the ability of firms to rapidly "scale up" role-play training. Simulation training, which is highly scalable once the simulations have been developed, offers the ability to mitigate these ill effects. Not only does simulation training result in greater call accuracy for new hires, it is also much more scalable than role-play training.

Call centers have a reputation for stressful conditions. Agents often have to field calls from irate or upset customers and still maintain their composure during a call, without exception. Given these conditions, it is important that new agents perform well from day one to build their confidence. If agents are not off to a good start, it can increase their stress and anxiety and result in high turnover. It is well documented in the literature that relieving job stress can lead to a significant decrease in turnover (De Croon et al. 2004, Tuten and Neidermeyer 2004). Our study results indicate that simulation training can provide the new hires with superior competency, thus leading to a higher level of confidence. This can alleviate the stress and lead to a significant reduction in turnover, thus reducing training costs and improving customer service.

Lastly, simulation training provides an opportunity to mimic the real-world call center context in a consistent manner. One does not have to worry about variation in the proficiency of the instructors as in role-play, although it is important to recognize that simulations can only be used on call scenarios that do not change too frequently. Unlike traditional training that relies on a one-to-many mode of instruction, simulation training provides a one-to-one learning experience. It is more scalable because it is not constrained by trainer availability restrictions as is role-play training. Simulation training is ideal for self-directed and individualized learning because it offers new hires a better opportunity to seek feedback for their own mistakes rather than being limited to learning from others' mistakes, as is often the case in role-play training. Overall, simulation training provides an opportunity to offer consistent training to new hires that perform better from the start.

9. Limitations and Future Research

It is important to recognize three limitations of the present studies because they provide some guidance for future research. First, the discussion of the superiority of simulation training for complex tasks must be tempered by an assessment of the generalizability of the results. The quote processing task (i.e., the complex task) in this study required participants to process or deal with more pieces of information than the quote status (i.e., the simple task). While this task is typical of complex tasks in call centers, it does not represent tasks in which complexity arises due to lack of structure and/or uncertainty in an agent's task (e.g., in help desks for technical support). Future research should explore tasks beyond the current domain (i.e., where tasks or processes can be standardized to a degree) and define the boundary conditions for the effectiveness of simulation training.

Second, in Study 1, we used two metrics of performance—call duration and accuracy. The firm participating in this study measured accuracy as a nominal variable, where a score of "1" was assigned if no mistakes were committed or "0" was assigned even if a single mistake was made. While this firm preferred this measure, nevertheless, it does not capture the true variation in accuracy. In Study 2, we capture the true variation in accuracy by measuring it as the proportion of correct responses scored by a participant. In this study, it would have been ideal to measure call duration too. Unfortunately, logistics, programming, and resource constraints made it impossible to capture this metric. Having complete equivalence in the dependent variable metrics across the two studies would increase the confidence in the results. Finally, we primarily focus on the performance of new hires. Because many call centers are faced with recurring training for existing agents (due to changing needs of their clients), it is important for future research to also evaluate the effectiveness of simulation training on more experienced agents.

Interestingly, as noted earlier, we incorporate simulation training once classroom instruction is complete. While the results are promising, our research nevertheless represents a *conservative test* because we do not evaluate the benefits that might accrue if simulation training were integrated with classroom training from the onset. Potentially, the impact of simulation training may be greater the earlier it is integrated with classroom training. This remains a fruitful area for future research, one that could lead to a deeper understanding of the true potential of simulation training by incorporating it into the entire training process.

10. Conclusion

The contribution of this research can be primarily viewed in terms of contribution to both business practice as well as the academic literature. For practitioners, this research provides a tangible basis for call centers to evaluate investments in emerging simulation-training technologies. Most critically, we provide clarity to call center managers regarding the relative effectiveness of simulation training vis-à-vis role-play training on new call center agent performance. Paced observation, modularized practice with feedback, and integrated practice with feedback are key features of simulation training for call centers. In addition, the manner in which these aspects of simulation training are operationalized in this study also provides a basis for developing effective simulation training for other call center contexts.

In terms of contribution to the academic literature, this paper joins a growing body of research on the impact of "enhancements" to behavior modeling on training effectiveness. Interestingly, this paper is, to the best of our knowledge, the first field study to consider the influence of task complexity on the effectiveness of simulation training in a real-world call center environment using the actual performance metrics at the sample firms. Unlike role-play, simulation training incorporates behavior modeling enhancements such as providing an in-built feedback mechanism for individual learning, mimicking actual tasks, and relieving cognitive load in processing complex tasks that requires the integration of multiple sensory mechanisms. Although the behavior modeling literature studies the influence of various enhancements to behavior modeling on training effectiveness, we investigate the collective manifestation of many of these enhancements in a more complex and real-world business environment. Thus, we are able to add to the growing body of knowledge on behavior modeling by demonstrating that behavior modeling enhancements lead to superior performance in a call center training environment.

Appendix[1]

Technology Orientation—Adapted from the Technology Readiness Scale (Parasuraman 2000).

Used in Studies 1 *and* 2: *Pretraining Survey Questionnaire*

1. Products and services that use the newest technologies are much more convenient to use.
2. You prefer to use the most advanced technology available.
3. You find new technologies to be mentally stimulating.
4. Learning about technology can be as rewarding as the technology itself.
5. Computers are easier to deal with than the people performing the same service.

Firm 1 *alpha for technology orientation* = 0.74; *Firm* 2 *alpha for technology orientation* = 0.74.

Learning Orientation—Adapted from VandeWalle (1997) and Kohli et al. (1998).

Used in Studies 1 *and* 2: *Pretraining Survey Questionnaire*

1. I am willing to select a challenging work assignment that I can learn a lot from.
2. I often look for opportunities to develop new skills and knowledge.
3. I enjoy challenging and difficult tasks at work where I will learn new skills.

[1] Technology orientation and learning orientation are measured using a 7-point Likert scale with 1 coded as "Strongly Disagree" and 7 coded as "Strongly Agree." Task complexity is also measured using a 7-point Likert scale with the scale anchors as shown above. The scale anchors for proficiency in computer applications are 1 "Not At All" and 7 "Used Extensively."

4. I prefer work situations that require a high level of ability and talent.

Firm 1 alpha for learning orientation = 0.80; *Firm 2 alpha for learning orientation* = 0.84.

Task Complexity—Adapted from Schroder et al. (1967), Wood (1986), and Campbell (1988).
Used in Study 2: Posttraining Survey Questionnaire

1. Was no challenge at all - - - - - - - Was a challenge.
2. Required almost no effort - - - - - - - Required high effort.
3. Required very little skill - - - - - - - Required a high degree of skill.
4. Needed very little information processing - - - - - - - Needed a high degree of information processing.
5. Was simple - - - - - - - Was complex.

Firm 2 alpha for task complexity = 0.90.

Proficiency in Computer Applications—New Scale
Used in Studies 1 and 2: Pretraining Survey Questionnaire

1. Word-processing software (e.g., Word, Word Perfect).
2. Spreadsheet software (e.g., Excel, Lotus).
3. Databases (e.g., Access, Oracle, Fox Pro).
4. Internet (surfing the web).
5. Business information systems (e.g., order entry, order tracking, billing systems).

"Applications proficiency" measure was used as a formative scale in both studies.

Education—Seeks highest level of education
Used in Study 1: Pretraining Survey Questionnaire

—— High School
—— Some College
—— College Graduate
—— Some Graduate Work
—— Graduate Degree

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