

國立交通大學
管理科學系碩士班
碩士論文

衡量客服人員行為與心理壓力
以協助多管道客服中心介面設計

Measuring Agent's Behavioral and Psychological Loads for
Multi-Channel Contact Center Interface Design



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中華民國九十四年六月

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A Thesis

Submitted to Institute of Management Science

National Chiao Tung University

in Partial Fulfillment of the Requirements

for the Degree of Master of Business Administration

June 2005

Hsinchu, Taiwan, Republic of China

中華民國九十四年六月

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中文摘要

本篇論文的主旨是：第一、發現客服人員在操作多管道客服中心介面時，每一種溝通管道對其行為與心理壓力的工作負荷量；第二、發現用以改進客服中心系統操作頁面設計之要點。由於過去沒有針對電話接聽或是線上對談這類工作進行工作負荷量檢測之研究，因此本篇研究藉由 Wickens' 多重資源模型推導出假設。本研究使用 NASA 工作負荷量表檢測工作負荷量，及 QUIS 使用者互動滿意問卷檢測使用者對介面的滿意程度。本研究發現，一般而言，電話接聽工作相較線上對談有較高的工作負荷量；然而，線上對談有較高的生理負荷量，原因可能是線上對談需要較多的打字作業。在使用者滿意度問卷中，開放性問題詢問使用者對於「客服中心系統介面設計」之問項，獲得許多實用的資訊，有助於未來介面設計之改進。這些建議可以依照 Neilson 設計原則分為以下幾點：簡單、支援性、易視性、可回復性、回饋機制、與個人化。

Keywords: 多管道客服中心，工作負荷，客服中心系統介面設計

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ABSTRACT

The objects of the thesis are: first, find out the behavioral and psychological workload level from each of communication channel in multimedia contact center; and second, find out the factors and points of the contact center operation interface improvement. There is no prior research showed the workload level from telephone task, nor from online chat. The hypotheses are deduced from Wickens' multiple resources model. The study conducted the experiment to understand the workload from these two tasks. By using NASA TLI and QUIS questionnaires, the experiment generates the conclusions that telephone receiving task has higher workload in general. However, the online chat task has greater physical demand, due to its typing and key-in efforts. The open-end question, asking for user opinions about the design of contact center interface, acquired much information that can help future design. The suggestions can be classified by the principles of design: simplicity, support, visibility, reversible action, feedback accessibility and personalization.

Keywords: multimedia contact center, workload, call center interface design

ACKNOWLEDGEMENT

This master thesis was written under the supervision of Department of Management Science at National Chiao Tung University. First, I would like to thank Dr. Charles Trappey, who offered me great supports and suggestions to help me finish the thesis scheduled. Then, I want to express my gratitude to Dr. Amy Trappey for borrowing the NTHU IEEM 726 Lab and AvecTec CRM system to me to do the experiment. The next professor I have to appreciate is Sheue-ling Hwang in NTHU, who provided insightful opinions about the Human Factor section and methodology in the thesis. Finally, I am grateful for Dr. Li, Dr. Ho and Dr. Chang to be the oral defense committee and gave me helpful comments.

Furthermore, I appreciate those friends, Jim, Mingfeng and Chiahon, in NTHU helped me cope with the contact center system to finish the experiment. Those amazing ones in MS92g class have brought a lot of joy and knowledge and fulfilled my master life. I think I will always remember you. Ethne, Sally, Chunpeng, Weijing, Monica, and Chenchung, I would like to thank you specially, for encouraging each other while writing the thesis and preparing for the meeting.

Last, I want to show the highest acknowledgement to my parents and siblings. They gave me supports from all aspects and helped me accomplish both of thesis and master degree. Thank you!

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Chapter 1 Introduction

In the beginning chapter of the thesis, I'd like to tell why learning the interface of multimedia contact center is important in the research motivation part. Then, I will talk about the research objects in the second part. In the last part of the Chapter One, I'd like to give the overview of the thesis by using structure flow chart.

1.1 Research Motivation and Background

Along with the changing marketing techniques, more and more enterprises realized the importance of customer relationship management. It is the emergence of Internet and media technologies caused the "Network Revolution" in the early 90s that makes the customization marketing possible. The Network Revolution varied the communication channels between enterprises and customers. Nowadays, customers can not only contact the companies by using telephone, but also by using FAX, short messages, voice messages, and even on-line chat, e-mail, assisted browsing, and VoIP via Internet. On the other hand, the companies can reach their customers in the same way on the opposite direction. Serving customers from wide variety channels has been perceived as so important that the industry has relabeled call centers as contact centers (Kopf, 2001).

According to the research announced by OVUM in 2001(LANcom, 2002), the number of contact center will boom from 2001 to 2006, and so do the number of workers, or so-called "agent," in the contact centers. The revenues were only USD\$14.09 Billion in 2001; however, it will grow triply up to USD\$ 45.35 Billion in 2006. The North America still owns the largest market, and Asia has the fastest growth. The staffing requirement will reach 10 million in 2005 globally. The number of staff will be 7000 and industry size will amount to NT \$4 billion in Taiwan before 2006.

However, the contact center is notorious for high pressure and turnover rate. The America Institute of Stress went as far as to categorically identify a customer service worker as one of the ten most stressful jobs in America (Miller et al. 1988). In North America market, the turnover rates of customer service representative hyper-rise to 94% in 2001, compares to 61% in 2000. Experts explain that may because of the trend of Multimedia Contact Center, and not so many agents are able to operate multimedia interfaces (LANcom, 2003). ICCM Weekly concluded that one of the challenges and goals for contact center is to reduce the CSR (customer service representative) turnover rates, according to their research toward Contact Center (CC) user in 2002(LANcom, 2003). The evaluation for an agent is according to the number of calls he/she processed, the time being used to process, and the quality—the politeness and accuracy— of each call. It usually involves a lot of interactions between agents and “contact center interface” during the service process, thus, how good the interface is might influence the efficiency and effectiveness of the agents’ dealing abilities. In other words, if the interface is well-designed for the agent to handle the calls, the stress might be eliminated and the turnover rate could decrease.

In sum, the contact center is combined with multiple communication channels and each of the channels has its own character, which is its exclusive interface and attributions of communication. For instance, the agent should talk on the phone and view the information on the screen at the same time, when using the Telephone communication interface. However, they only focus on the screen without the audio interference when doing on-line chat service. Thus, the agents in the contact centers should learn how to operate these technologies and deal with customers among different interfaces from time to time. It obviously increases the agents’ workload, since they should adapt several interfaces and methods/workflows of communication. Different interface designs may affect human performance differently; it may also

lead to different level of behavioral and psychological loads, or in short, “stresses,” to agents. Davis (1989) stated, “...research on how usefulness and ease of use can be influenced by various externally controllable factors, such as the functional and interface characteristics of the system...is important.”

1.2 Research Objectives

Getting a new employee is more expensive than retaining one, so companies try every aspect, from comfortable working environment to incentive compensation, to keep their employees. Human Factors Engineering, Human Performance Engineering or Ergonomics, defined as “the science that discusses interactions between human and objects in the working environment,” has been mentioned since the Industry Revolution in the nineteen century. Workers now are facing more computer interfaces than ever. The agents in the contact center are one of those being affected mostly. In the era of call center, the agents dealt only with telephone and other paper works; however, the advanced in technologies create personnel computer, Internet, CTI (Computer Telephony Integration), IVR (Interactive Voice Response), and VoIP (Voice over IP), which make the works in the multi-channel contact center become complicated and increase the stress on the agent. No one wants to work with highly stress, so the turnover rates in the contact center are usually high. The objects of the thesis are:

1. Find out the behavioral and psychological workload level from each of communication channel in multimedia contact center.
2. Find out the factors and points of the contact center operation interface improvement.

For the system, Avec CRM contact center system, being used is a not-for-

specific-industry-use system, anyone qualified working in the contact center can be the objects of the experiment.

1.3 Thesis Structure

This thesis is meant to, first, measure the levels of stress (psychological and behavioral loads) that agents in the contact center suffer from each kind of communication channels: FAX, e-mail, telephone and on-line chat. Then, we will adjust the design of each interface. The following figure 1.1 is demonstrating the concept of this idea.

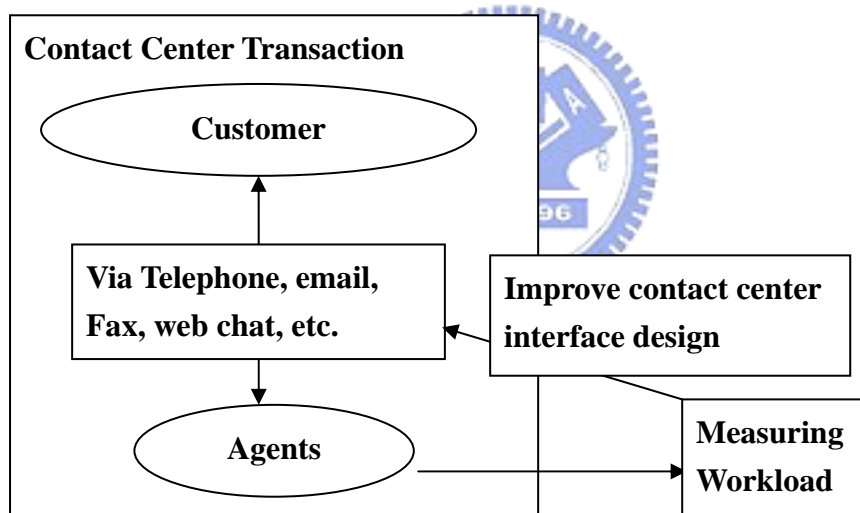


Figure 1. 1 Research Concept

To accomplish the idea and the objects state above, the research is structured by five chapters, which is illustrated in figure 1.2:

The first chapter is about the background of the research; the second chapter is literature reviews includes, concepts of contact center, the measurement of psychological and behavioral workload, and the rule of multimedia communication interface design. In the third chapter, the contact center being used is demonstrated.

Though, the system consists of four communication channels, we focus on the basic telephone channel and the emerging web-chat channel. This chapter also presents the experiment methodology. Following chapter conclude the result of our findings and discussion. And the final chapter is the conclusions and suggestions.

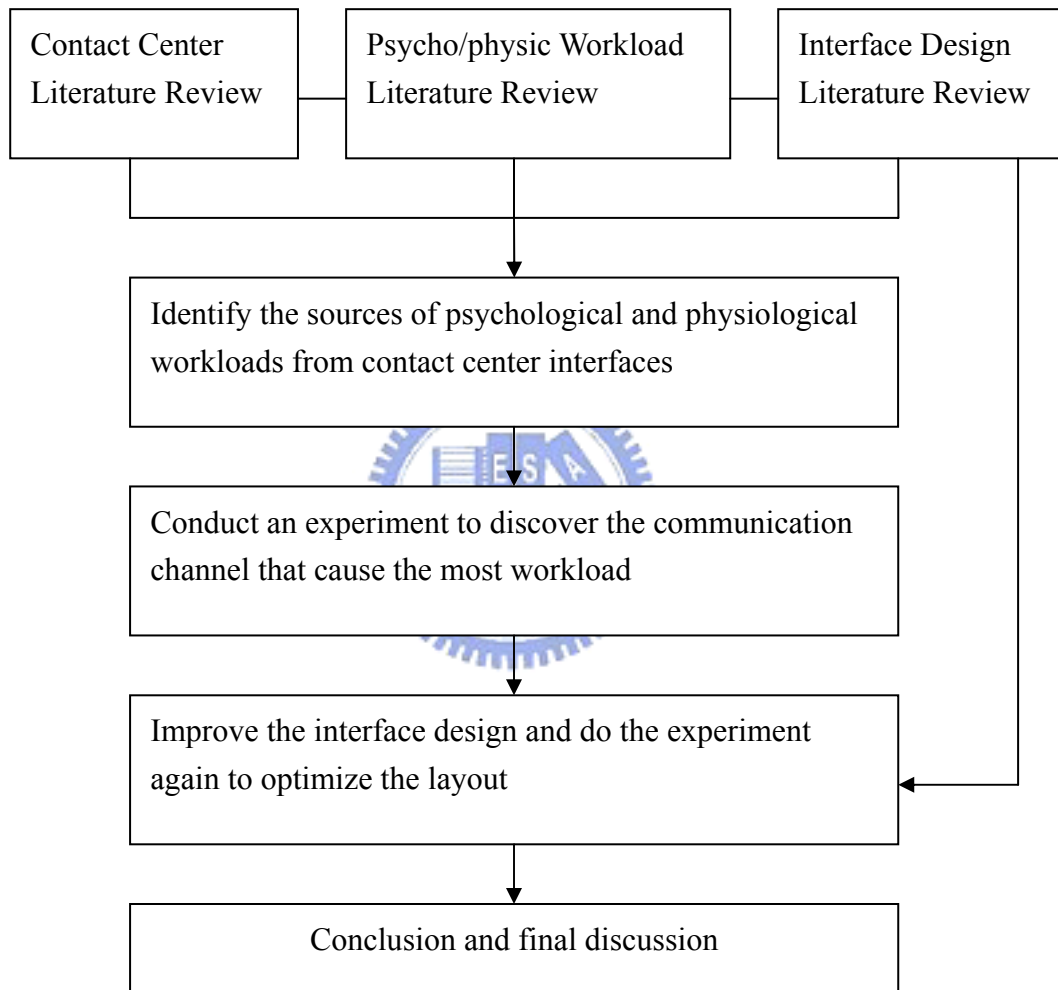


Figure 1. 2 An Overview of the Research

Chapter 2 Literature Review

This literature review is divided into three parts. The first part is the overview of Contact Center. It includes the definition of contact center mentions in the thesis, the developing progress, which describes the changing technologies and job contexts, and the system description. The second part discusses the sources of agent's stress and defines the difference between stress and "behavioral and psychological loads," which later is more suitable in this discussion. The final part presents the elements of interface design considering human factors.

2.1 Description of contact center

CRM has been a prevailing strategy among companies, and more and more it is. In 1989, CRM was the first time been mentioned; however, till year 2000, this noun has been mentioned over 14,000 times by medias. According to META Group, CRM software market was amount to USD \$20 trillion in 2001, but will reach to USD \$ 46 trillion in 2003. Thus, it can be concluded that the CRM era has come! There are many scope of CRM. The development and use of call centers to handle various aspects of customer relationship management continues to grow rapidly (Thaler-Carter, 1999). A majority of managers now see the call center as a customer-value management process—not the cost center of the past (Jon Anton et al., 1999).

2.1.1 Definition of Contact Center

Before talking about the contact center, we should to know the predecessor, call center, first. According to the Call Center Dictionary (Bodin, and Dawson, 1999), call center is a place where calls are placed, or received, in high volume for the purpose of

sales, marketing, customer service, telemarketing, technical support or other specialized business. One early definition described a call center as a place of doing business by phone that combined a centralized database with an automatic call distribution system.

Due to the advance in technology, there are more communication channels than merely phones. Especially the birth of Internet and web interface, the interaction via voice (telephone), words (FAX), email, Online chatting, Co-browsing, etc., can be all integrated for the single one customer service representative to handle. In accordance with IDC's research in 2001 (LANcom Information Group, 2002), the services done via telephone have decreased in percentages from 87% to only 57%; on the other hand, the services completed via Email, VoIP and other Internet system have leaped from 10% to 42%. These data can be the provenance that call center has transferred into multimedia interaction center. Since it is more than "phone calls," the proper name for this department or organization should be "Contact Center." The idea of "contact" is from the contact management, which defined as followed (Bodin, and Dawson, 1999):

"Contact management: a business has customers and prospects. Software to "manage" your interactions with customers and prospects is called contact management software. It has three elements: first, a screen or two of information about that contact (address, phone number, notes about your conversations). Second, the ability to print lists, and letters, labels, faxes and so on. And third, a tie-in with your phone system to let your computer dial your clients and fax them stuff. With many newer phone systems, you have one extra benefit—namely when your phone rings, your contact management software will receive the calling phone number and pop up a screen or two about your contact. This way you'll be a little prepared before you answer the phone."

Contact center has been defined as: a combination of multiple customer interaction channels to offer customer service/support, field service dispatch, quality management, intelligent routing, case-based reasoning, and knowledge repositories (Shahnam, 2000)

2.1.2 Developing Progress of Contact Center

Since the time they first appeared, call centers have been plagued by a problem that has been difficult for operational managers to reconcile: how to ensure that the balance is maintained between operational cost-efficiency and the provision of customer service that meets or exceeds customer expectations. Call centers were originally created because organizations needed to cut costs make interaction with customers more efficient. Early call centers were often sweat shop-like environments with a focus merely upon number of calls handled and talk-time (Brown, 2000). In the past, managing customer contact has conducted by the following phases of major channel:

- (1) Face-to-face contacts;
- (2) Correspondence delivered by the Post Office;
- (3) The telephone with toll calls;
- (4) The telephone with toll-free calls;
- (5) FAX;
- (6) E-mail correspondence; and
- (7) The Internet and corporate Web sites.

Currently, companies in most industries are moving their existing low-tech customer service call centers from back office support to the front-line of the enterprise (Jon Anton, 2000). In this migration, the call centers are being outfitted

with the latest in high-tech hardware and software in both voice and data applications, and in addition, the focus is moving from mostly telephone calls to all forms of customer access including e-mail, fax-mail, kiosk, and the Internet. The addition of new channels does not replace existing channels of access to information. Customers prefer multiple touch-points available at any time and for free. For many companies, global competition has reduced products to mere commodities that are difficult to differentiate through features, functions, or price. Executives are beginning to recognize the potential of the multimedia contact center as a significant revenue generator, perhaps one of the surest investments they can make in enhancing and creating customer value and bottom-line profits.

The contact center will grow in the importance of serving the demanding and information-hunger customers; thus, various technologies will be applied to enhance the accessibility of the call center. Following are some mentioned by Anton (2000):

(1) Voice of Internet protocol (VOIP)

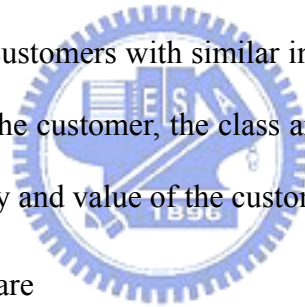
Web-enabled centers will allow a customer to visit a Web site, enter the key data typically asked for by the customer service agent at the beginning of a call, and to place the call via the Internet instead of over traditional phone lines. New technology also allows the customer to see the customer service representative that they are dealing with through the Internet.

(2) IVR and voice recognition

IVRs are the interactive recordings that allow the customer to make selections to route them to the specific customer service representative who will most likely be able to provide them with the special information that they seek. The new voice recognition equipped IVRs now have the capability to convert text-to-speech with a large vocabulary of speech recognition.

(3) Database engines and knowledgeware

Database marketing allows companies to focus on the individual customer and to provide enhanced customer service. This requires a great deal of quality information about the customer that may reside in several different systems like billing, shipping, and call center databases. The best way to manage all of this data is to store it in a data warehouse. A data warehouse is a database system built to store mass volumes of historical data for fast analysis and reporting. The data stored in a warehouse is a conglomeration of data entered into each of the different systems a company may have. Data mining makes companies logically group customers according to specific characteristics that will provide specialized or enhanced customer service. This is done by not only analyzing the purchases made by the customer but by also analyzing the purchases made by other customers with similar interests or purchases. With all of this information gathered on the customer, the class and level of service can easily be prioritized based on the history and value of the customer.



(4) E-mail management software

E-mail is one of customer favorite for contacting companies, and there are more companies offer e-mail management and automation software, which will automate the e-mail handling process, and also give the customer the 24-hour (or less) response time that they expect. E-mail has the tremendous advantage of handling customer issues asynchronously, thereby allowing more time to send the customer's e-mail to the one individual most able to handle it.

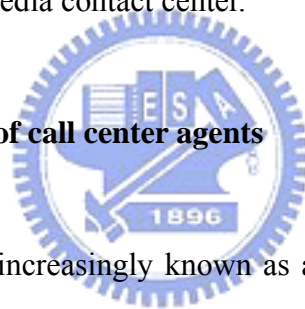
(5) Computer telephony integration (CTI)

Computer telephony integration (CTI) combines ANI (automatic number identification) and DNIS (dialed number identification service) to retrieve the calling customer's record from the corporate database, and then provide the agent with a

"screen pop" that identifies the caller and fills the screen with the essential information. This allows for the automated processing of complex customer transactions while integrating multiple call center technologies. The agent saves time by not having to ask the customer for basic information at the beginning of the call, nor does the agent have to ask the customer what their previous calls were all about. This allows agent to focus on the customer and to provide more superior customer service.

With all these complicated technologies involved in multi-channel contact center, there must be work enlargement and enrichment of agents' tasks, which cause more things to be done and higher workloads. The following paragraph will discuss the stress and workload in multimedia contact center.

2.2 Definition of stress/ role of call center agents



While the call center is increasingly known as a valuable resource for firms in managing customer relationships, it has also developed notoriety as a stressful work environment (Proper, 1998). The past researches focus more on customer service representatives' role stress: role ambiguity, role conflict, role overload and other emotional factors (Witt, Andrews, and Carlson, 2004); however, stress may also come from the ill-design of work environment. Mackay and Cox (1984) defined stress as a perceptual-cognitive phenomenon rooted in psychological processes; and stress will arise when individual's needs and values are not balanced by environmental supplies from the work environment.


2.2.1 Distinguish among stress, burnout, and psychological and physiological workload

McGrath(1976) and Schuler(1980) defined stress as a dynamic condition in which an individual is confronted with an opportunity, constraint, or demand on being/ having/ doing what one desires and for which resolution is perceived to have uncertainty but which will lead to important outcomes. Stress is often a consequence of high levels of mental workload, particularly if such workload is sustained for some time. Stress in turn will often produce changes in functioning of all of the information processing components, and so will produce effects on performance (Jung and Jung, 2001). Individuals in the organizations may have three categories of stress: physiological, psychological, and behavioral (Schuler, 1980). According to the summary done by Manshor et al (2003), researchers have identified five major categories of work stress:

1. *Factors intrinsic to the job.* These include working conditions, shift work, risk and danger, and new technology. Physical surroundings such as air quality, lighting, decoration and tidiness, noise, furniture and personal space can affect moods and overall mental state.
2. *Role in the organization.* Stress comes from role ambiguity and role conflict. Role ambiguity arises when individuals do not have a clear picture about their work objectives, their co-workers' expectation of them, and the scope and responsibilities of their jobs. Role conflict emerges when the worker has to choose between competing demands or expectations. Conflict situations can act as stress factors and lead to cardiovascular ill-health risks, such as elevated blood pressure and abnormal blood chemistry.
3. *Video display terminal stress (VDT).* VDT stress is an adverse physical and

psychological reaction to prolonged work at a video display terminal. Along with the massive increase in the use of computers and VDT's in all areas of work, researchers have found an increase in absenteeism and stress related illness related to the use of computers and VDTs.

4. *Relationships at work.* Dealing with bosses, peers and subordinates can dramatically affect the way one feels at the end of the day. Selye (1974) suggested that learning to live with other people is one of the most stressful aspects of life.
5. *Career development.* A host of issues can act as potential stress factors throughout one's working life. The lack of job security; fear of redundancy; obsolescence or retirement; and numerous performance appraisals can cause stress. In addition, the frustration of having reached one's career ceiling or not having been promoted can result in extreme stress.



Customer Service Agents' in the multimedia contact centers may encounter all these stresses: to provide perfect solution to customers in limited time (factors intrinsic to the job), to satisfy both of their customer and company's regulations that usually conflicts (role in the organization), ill-designed service interface that hard to help dealing with customers' problems (VDT stress), relationship at work, and career development (seldom promote in call center, there is not many managerial positions in call centers). There are many research papers discusses the rule ambiguity, role conflicts, and job satisfaction of call center agents; however, papers particularly focus on the call center interface is hardly to find. Work stresses from VDTs has been talked widely, but not in multimedia contact center. Hence, this paper is focus on the agent's work stresses from the interface, and the stresses may come from three dimensions: physiological, psychological, and behavioral.

Though, stress is the most common word to describe the mental and

physiological load and being widely used in the workload measurement. Singh, Goolsby and Rhoads (1994) have persuaded that “burnout” is more suitable to identify. Burnout tendencies are defined as a psychological disposition characterized by emotional exhaustion, lack of personal accomplishment, and a tendency to depersonalize others. Burnout represents a particular type of job stress result from a variety of work demands (stressors), especially those of an interpersonal nature. Cordes and Dougherty (1993) presented burnout as a key construct in understanding stress processes in many jobs and in organizations of all types. Job burnout is defined as a response syndrome of emotional exhaustion, depersonalization, and reduced personal accomplishment. The first component of burnout, emotional exhaustion, is characterized by a lack of energy and a feeling that one’s emotional resources are used up. This “compassion fatigue” may coexist with feelings of frustration and tension as workers realize they cannot continue to give of themselves or be as responsible for clients as they have been in the past. Another component, depersonalization or dehumanization, is marked by the treatment of clients as objects rather than people. The final component of burnout, diminished personal accomplishment, is characterized by a tendency to evaluate oneself negatively. Definitions of burnout can be concluded as:

- (a) to fail, wear out, become exhausted;
- (b) a loss of creativity;
- (c) a loss of commitment for work;
- (d) an estrangement from clients, coworkers, job, and agency;
- (e) a response to the chronic stress of making it to the top; and finally
- (f) a syndrome of inappropriate attitudes toward clients and toward self, often associated with uncomfortable physical and emotional symptoms (Perlman and Hartman, 1982).

Researchers agree that extreme role stress invariably result in an erosion of performance and job-related attitudes; however, moderate levels of role stress may increase performance as stress stimulates individuals to excel. The delineation between moderate and excessive role stress is problematic because the notion of moderate stress is subject to individual variability. The measurement of role stress is not sufficient to determine whether it has a positive or negative influence. In contrast, burnout occurs only when stressors overwhelm a person's coping resources. Consequently, burnout is potentially a more accurate predictor of critical job outcomes than the presence or extent of key role stressors.

The measurement of various stresses which influence the performance and responses of a human operator is called "workload." (Weiner, 1982) According to Hart and Wickens (1990), workload is a general term used to describe the cost of accomplishing task requirements for the human element of man-machine systems. This "cost" may be reflected in the depletion of attention, cognitive, or response resources, the inability to accomplish additional activities, emotional stress, fatigue, or performance decrement. Quantitative work overload (the perception of too much work to accomplish in the time available) is an important determinant of emotional exhaustion. Individuals' attempts to maintain performance standards despite insufficient time and staff may lead to an excessive expenditure of time and emotional energy, thus leading to an emotional exhaustion.

Workloads that come from the demands of a physical job which is the manual part of materials handling, such as the weight of a load, the frequency of handling a load, the duration of physical activity, and the moving distance with a load. Workloads from a working environment, which include improper temperature, lighting, noise, vibration, and exposure to chemicals (including dust and fumes), regards as environmental workloads. There is a general agreement that the strong and repeated

stimulation from an inadequate working environment can lead to a disturbance of the homeostasis of a human operator and hence increase the stress level. Workloads, which are induced by improper body motion and posture (i.e. standing, stooping, squatting, and twisting) are categorized as body motion and postural workloads. Body posture used to handle a load or conform with the physical arrangement of a workload may affect the metabolic cost of the job considerably, resulting in an increase in workload stress to the worker. Mental job demand workloads means that workloads caused by the mental and perceptual activity that is required in performing a job (e.g., calculating, thinking, deciding, communicating, remembering, looking, and searching). The basic notion of a mental is related to the difference between the amount of resources available within a person and the amount of resources demanded by the task situation (Sanders and McCormick, 1992).

Workload is an important and integrative concept that determines the ability of a human operator of complex system in order to accomplish mission requirements, while considering the equipment and the level of training provided and the organizational and environmental constraints placed on them (Jung and Jung, 2001). Since workload has a broad (including mental, physical, behavioral, and environmental variables) and quantitative view assess agent's stress from the work, the research will use "workload" to measure. In sum, whether we call the cost to accomplish task stress, burnout or workload, it consists of the following dimensions: physical (motion and postural), psychological (mental), insufficient time (temporal demand). Thus, if we want to exam the workload caused from certain task, we have to include these dimensions.

2.2.2 Contact center agent's workloads

Burnout is a type of stress –specifically, a chronic affective response pattern to stressful work conditions that features high levels of interpersonal contact. Often marketing programs require that boundary spanners, or the customer service agent mentioned in this paper, certainly deliver high levels of service quality through personal interaction, care, and concern for customer. Moreover, due to its innovation nature and large role set, boundary spanners are prone to elevated levels of role stress (Singh, Goolsby, and Rhoads,1994). Boundary spanning positions can include significant interpersonal interactions (Parkington and Schneider, 1979). The boundary spanner, who functions as an information processor or a filter between the organization and the client, represents the organization and acts as its agent in influencing the decision making of the client. Boundary spanners are caught in a difficult position when they perceive that client demand cannot or will not be met by the organization. Frequent face-to-face interactions that are intense or emotionally charged will likely be more demanding and can be expected to be associated with higher levels of emotional exhaustion (Maslach, 1982). Individuals who have little direct contact with clients, or who deal with more “neutral” client issues should experience less emotional exhaustion.

Table 2. 1 Predicted Emotional Exhaustion in Job Based upon Nature of Interpersonal Contact (Cordes and Dougherty;1993)

Frequency of Interpersonal Contact	High	(Moderate burnout) Receptionist, Librarian, Sales representative, Benefits representative	(High burnout) School teacher, <u>Customer service representative</u> , Nurse, Social worker
	Low	(Low burnout) Research physicist, Forest ranger, Oil refinery operator, Lab technician	(Moderate burnout) Paramedic, Fire fighter, Police detective, Public defender
		Low	High
Intensity of Interpersonal Contact			

There are some physical and psychological mechanisms behind the cause of workloads, such as time-sharing, resources limitation and allocation, attention and interference. In this paragraph, the research will discuss why the multimedia contact center interface may burden the agents with workload, and give the hypothesis of which interface may cause higher workloads.

For there is no prior research showed the workload level of telephone task and online chat task; in order to understand the issues mentioned above, the paper will introduce the Wickens' multiple resources model. The multiple resources model proposes that there are four important categorical and dichotomous dimensions that account for variance in time-sharing performance. Each dimension is to some extent independent of the others. For example, modalities are only defined for perception and codes are relevant to all stages of human processing (i.e. perception, working memory, and response). And each dimension has two discrete 'levels'. All other things being equal (i.e. equal resource demand or single task difficulty), two tasks that both demand one level of a given dimension (e.g. two tasks demanding visual perception) will interfere with each other more than two tasks that demand separate levels on the dimension (e.g. one visual, one auditory task). The four dimensions, shown

schematically in figure 2.1, are processing stages, perceptual modalities, visual channels, and processing codes. Consistent with the theoretical context of multiple resources, all of these dichotomies can be associated with distinct physiological mechanisms (Wickens, 2002).

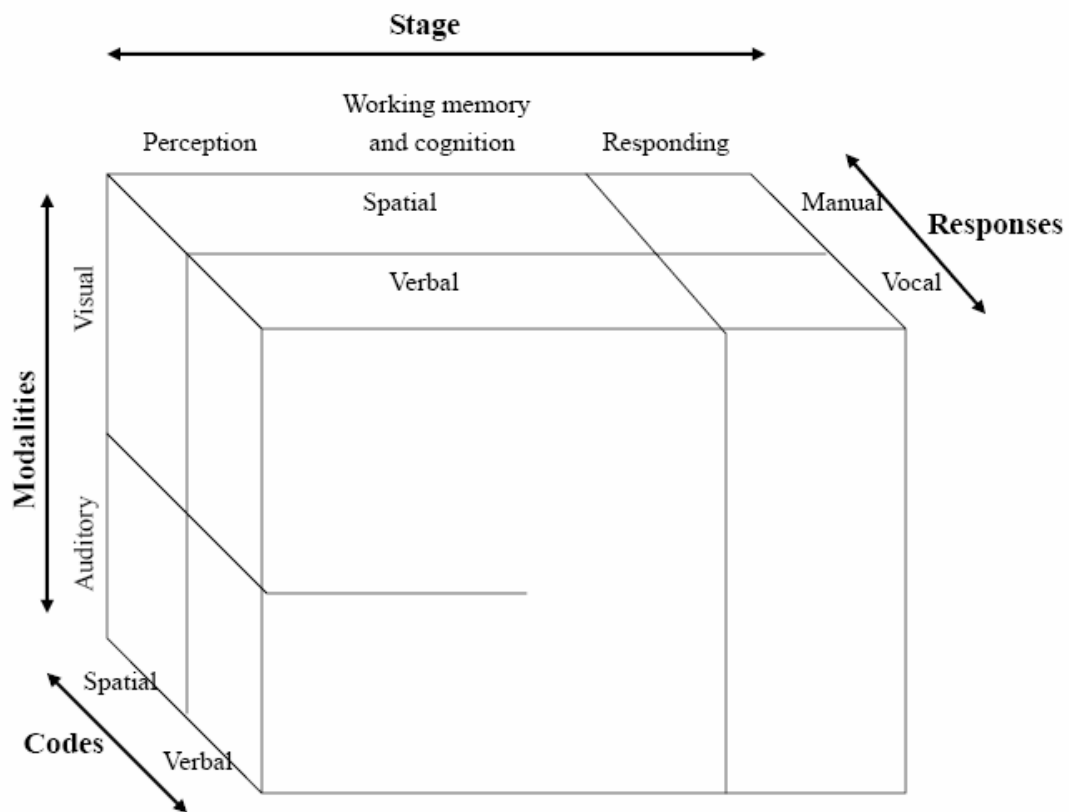


Figure 2. 1 Three-dimensional representation of the structure of multiple resources.

(from C.D. Wickens, "Processing Resources in Attention," in Varieties of Attention, ed. R. Parasuraman and R. Davies, NY: Academic Press, 1984)

These dimensions are briefly described as follows:

1. Stages refer to human perception, working memory, and responding.
 - o Perception and working memory require a different resource than responses require.
 - o Responding is related to responses and can be vocal or manual

2. Modalities refer to human auditory and visual perceptual channels
 - o Each requires a different resource – It is easier to divide our attention between a task requiring our eyes and another task requiring our ears than two tasks both requiring either our eyes or our ears.
3. Visual processing includes fovea vision (focal vision) and peripheral vision (sensing orientation), which also define separate resources.
4. Codes refer to human spatial and verbal processing
 - o Each requires a separate resource – Manual responses are normally spatial and vocal responses are verbal.
 - o Normally, it is the most efficient to perform a manual task and a verbal task together.

The multiple resource theory builds off this idea that there is more than one mental resource needed to meet the demands of multitasking. Mental resources demanded by each task, which include effort and difficulty, are useful in predicting the level of task performance possible in a multitasking environment. A task that is more difficult demands more mental resources in order to be optimally successful.

The resources used for perceptual activities and for cognitive activities, e.g. involving working memory, appear to be the same, and those resources are functionally separate from those underlying the selection and execution of responses (figure 2.2). Evidence for this dichotomy is provided when the difficulty of responding in a task is varied and this manipulation does not affect performance of a concurrent task whose demands are more perceptual and cognitive in nature or, conversely, when increases in perceptual cognitive difficulty do not much influence the performance of a concurrent task whose demands are primarily response-related.

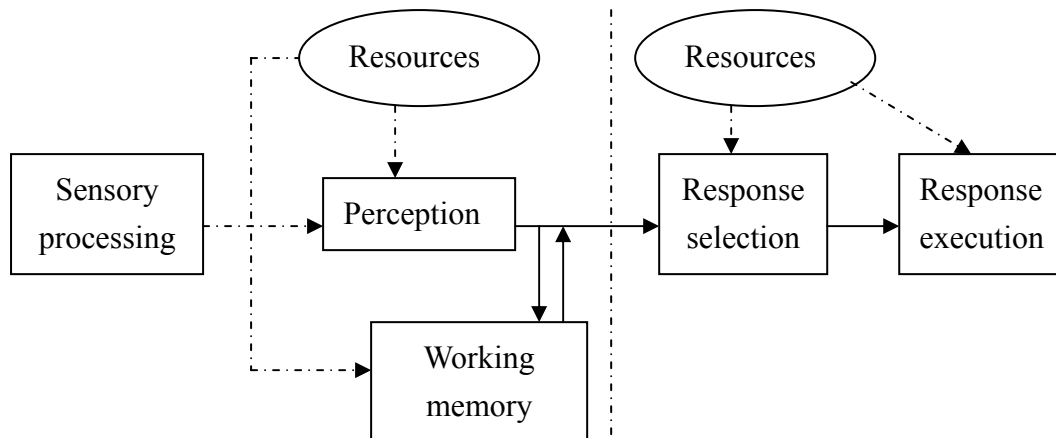


Figure 2. 2 Representation of two resources, supplying the different stages of information processing.

The distinction between resources underlying perception and resources underlying the selection of actions. (Wickens, 2002)

As shown in figure 2.2, the stage dichotomy of the multiple resources model also predicts that there will be substantial interference between resource-demanding perceptual tasks and cognitive tasks involving working memory to store or transform information (Liu and Wickens 1992). Even though these define different stages of information processing, they are supported by common resources. For example, visual search coupled with mental rotation, or speech comprehension coupled with verbal rehearsal, both provide examples of operations at different stages (perceptual and cognitive) that will compete for common stage-defined resources, and will thus be likely to interfere.

According to the multimedia contact center situation in the thesis, agents deal with the telephone call tasks must have higher workload levels than deal with online chat tasks. For agents perceive the questions verbally and in auditory form, and they need to look up in the database in the manual in visual form; then response to the customer in the vocal, verbal form; and finally, do the customers service recordings into the system in the manual form. The whole telephone task flow constituted different resources among each dimensions, thus, has higher workload. While the online chat task received the questions in the character, spatial form, then search in

the database, and respond in the manual, spatial form. The customer service recording is even on the same interface, doing online chat task. Without using different mental resources, the online chat task should cause lower workload level.

Successfully understanding variability of multitasking in the context of these mechanisms lead to an accurate ability for designers to know which of two or more design possibilities will allow the most efficient multitasking for the users. For example, speech input can offer its highest benefit for reducing task interference if the concurrent task demands are spatial related such as walking to a destination using a pedestrian navigation system (the user needs to keep on the right track in the environment). The Multiple Resource Model is especially important in understanding the relationships between different types of mental resource demands of a user. It identifies where potential conflicts and competition between two tasks can arise based on the resource demand from the user (Norlien, 2002).



2.2.3 Workload model

Since the 1960s, a large number of mental workload measures have been developed, and these measures can be classified into four categories: primary task performance, secondary task performance, physiological measures, and subjective assessment. Although there is no generally accepted definition of workload nor consensus on what the “best” measure is, the accepted viewpoint is that mental workload is multi-dimensional in nature, and it emerges from the interaction between the requirements of a task, the circumstances under which it is performed, and the skills, behaviors, and perceptions of the operator (Liu, and Wickens, 1994). Many researchers have come to the conclusion that workload is not a single entity. It has been hypothesized that the subjective experience of workload is the collective result

of several independent components such as task-related input loads, operator effort and motivation, and operator performance. Some workload researchers have addressed this multidimensional aspect of workload by developing measures that are themselves multidimensional. Following are the brief ideas of these four categories:

Primary-Task measure

It is a quantify method that defined mental workload as: divided Time Require in operating one task by Time Available for operating the task; if the ratio is larger than one, then, it is overload. Some other researcher defined the ratio as Time Pressure. This method exams the performance on the system interest, like computer data-entry speed, driving deviations from the center of the lane, or learning comprehension with a particular method of instruction. Because this is the target of evaluation, we refer to the task performed with this system as the primary task. The merit of this measurement is its quantified index that can compare the difference of working performance directly. However, the major weakness is lack of sensitivity that if two primary tasks are both lie in the “underload” region, this measurement cannot discriminate between them. The second weakness is that two primary tasks to be compared may differ in how they are measured or what those measures mean. Most primary task measurements are task specific, thus, the mental workload from different tasks cannot be compared. Third, it is sometimes impossible to obtain good measures of primary-task performance. Performance outcome is a very poor measure of all of the mental operations that were involved in reaching the final outcome.

Secondary-Task performance measure:

This method is assumed to be inversely proportional to the primary-task resource demands. Secondary task may reflect differences in task resource demand,

automaticity, or practice that are not reflected in primary-task performance. This measurement hypothesizes that under the limited capability and the single channel of information conveying, the more resources demand to deal primary task, the less can be used to do secondary task; thereby performance of secondary task worse. *Time production and time estimation* are two related techniques with somewhat different underlying assumption. If the operator is asked to produce time intervals of a constant duration, the intervals will tend to be overestimated when there are higher demands, as if the higher levels of workload interfere with whatever internal mechanism is responsible for mental time counting. The measure uses the performance to predict the mental workload levels. Rhythmic tapping task, random number, probe reaction time, memory searching and time estimation, which mentioned above, have been used as secondary task measure. The distinct benefits are: first, it has a high degree of face validity. Second, when the performance index is based on time, it has high sensitivity.

Finally, the same secondary task can be applied to two very different primary tasks and will give workload measures in the same units. However, this method is not always sensitive. When the secondary task shared the same resource (e.g., visual-spatial, auditory, speech, etc.) with primary task, it is hard to define the result of measurement is from the increasing of primary task or from the interference of secondary task. The other problem is that the secondary task may interfere with and disrupt performance of the primary task. It might cause danger, and the amount of disruption suffered by two primary tasks to be compared might not the same.

Physiological measures:

If the workload may cause effects on operators' physiological activities, then, measuring the physiological reactions under different workload levels can be workload index. This measure is based on the notion that human central nervous

system operates while processing information. These activities can be measured. The measure indices include: heart rate and heart rate variability, respiration, pupil diameter, and visual scanning. The benefits of this measure are: it provides a relatively continuous record of data over time, it does not intrude into primary-task performance, and it does not require subjects to do extra activities. Nonetheless, it required electrodes be attached or some degree of physical constraints be imposed, and therefore they are intrusive in a physical sense. These constraints will influence user acceptance. Furthermore, the physiological reaction may be caused by other variables not discussed in the experiment.

Subjective rating measures


This measurement is assessed by subjects themselves to rate the difficulty of the task, temporal pressure, frustration and other dimensions subjectively. There are two most popular methods in this category: Subjective Workload Assessment Technique (SWAT), and NASA Task Load Index (TLI). Subjective Workload Assessment (SWAT) technique: measures workload on three-point scales (Time load, Mental Effort load, Stress load). NASA Task Load Index (TLI) assesses workload on each of 5 to 7-point scales. Subjects are asked to make paired comparisons of each subscale as to which is more relevant to workload for a particular task. The number of times a subscale is chosen over another is used as the weighting for that subscale. A subscale that is never chosen over another is assigned a weight of zero. The result can be used to evaluate overall workload or the subscale scores can be used to diagnose the various workload components associated with a given task. TLI has a greater number of scales and greater resolution per scale, which allows it to convey more information, and appears to provide a more reliable measure. The benefits of subjective techniques are, for example, it does not disrupt primary-task performance and it is relatively easy to derive. The costs relate to uncertainty with which an operator's verbal statement

diagnostically reflects the investment of or demand for processing resources and is not influenced by other biases. (dislike or unfamiliarity of the task, or rater's reluctance to report that things are difficult.)

Research summarized the pros and cons of four workload categories mentioned before in the following table.



Table 2. 2 Comparing each task measure

Method	Primary-Task measure	Secondary-Task performance	Physiological measures	Subjective rating
Measurement	on the system interest	<ul style="list-style-type: none"> reflect differences that are not reflected in primary-task performance Time production and estimation are two related techniques 	<ul style="list-style-type: none"> Heart rate heart rate variability respiration Pupil diameter Visual scanning 	<ul style="list-style-type: none"> NASA Task Load Index (TLX) scale Subjective Workload Assessment (SWAT) technique
Benefit	<ul style="list-style-type: none"> Straight-forward Target of evaluation Quantify index 	<ul style="list-style-type: none"> high degree of face validity the same secondary task can be applied to two very different primary tasks 	<ul style="list-style-type: none"> provide a relatively continuous record of data over time do not obtrusive into primary-task performance 	<ul style="list-style-type: none"> do not disrupt primary-task performance relatively ease to derive
cost	<ul style="list-style-type: none"> sometimes hard to obtain good measures hard to compare between primary tasks 	<ul style="list-style-type: none"> not always sensitive may interfere with and disrupt performance of the primary task 	<ul style="list-style-type: none"> required electrodes be attached physical constraints obtrusive in a physical sense. 	<ul style="list-style-type: none"> uncertainty with verbal statement reflects the demand for processing resources not influenced by other biases

For some situations, the choice of a workload metric will be a tradeoff between the type of results desired against constraints on test resources. The nature of the system and the test issues will determine the nature of the test will determine the workload methods. Comparing the different selection guidelines, there appear to be six key features of good workload metrics common to all of them. The first feature is workload sensitivity, the ability of the measure to detect changes in workload for a given operator task. The second feature, intrusiveness, is the degree to which the workload measure interfaces with the operator task. Third, is the diagnosticity of the measure, the ability to discriminate the source of the workload (e.g., time pressure, stress, etc.). Fourth, is the convenience of measurement, the amount of time, money, and instrumentation required for measurement. Fifth, relevance or transferability, is concerned with the applicability refer to the operators' willingness to cooperate with, or be subjected to, the workload methodology. A good workload measure should be sensitive, nonintrusive, diagnostic, convenient to use, relevant different tasks, and possess good operator acceptance.

Questionnaires and rating scales have been used quite extensively in both psychological and ergonomic investigations to provide researchers with quantitative judgments of stimulus qualities. (Jung and Jung, 2001) Both of TLI and SWAT metrics have been employed widely in both laboratory and field test environments. The NASA TLI appears very similar to SWAT. Like SWAT, it is based on a multidimensional approach to the workload phenomenon and uses an adjustment to normalize rating for each subject. The assumptions and procedural details of the two methods, however, are substantially different. Instead of the three workload components assessed by SWAT, TLI divides the workload experience into six components: mental demand, physical demand, temporal demand, performance, effort, and frustration. Instead of three-point subscales for each component, TLI divided each

component subscale into twenty levels. Instead of the conjoint measurement procedures used in SWAT's scale development phase, TLI uses a somewhat simpler weighting procedure for combining information from six subscales. Besides, NASA TLI is the most widely known tool for assessing subjective workload on operators working with various human-machine systems. Thus, the research will use NASA TLI to measure the workload level induced from the interaction with multimedia contact center. Finally, the hypotheses are:

H1. Phone call task has higher total workload level than online chat task

H1a Phone call has higher mental demand than online chat

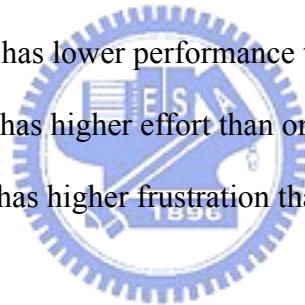
H1b Phone call has higher physical demand than online chat

H1c Phone call has higher temporal demand than online chat

H1d Phone call has lower performance than online chat

H1e Phone call has higher effort than online chat

H1f Phone call has higher frustration than online chat



2.3 Human factors and interface improvement

According to Hiltz and Johnson's studies (1990), high scores on "Interface" correspond to high satisfaction with the system interface. The primary components are finding the system to be: understandable, courteous, and not distracting easy to learn, friendly rather than impersonal, not frustration; and, overall, a "good" system rather than a "bad" system. ...Interface is concerned with a task orientation and a CMCS as primarily a computer system; however, since the task is communication, technological factors do not dominate its determination quite so strongly. Communications process variables (the content of what other humans do on the system) are much more important for determining perceptions of overall system performance of productivity

than they are in influencing interface satisfaction.

There are several conceptualizations of usability design heuristics and best practices that are widely used. The most pervasive is a set of user interface design principles that were elucidated by Nielsen (1994), based on a principal components analysis of the usability problems found in a number of studies of various user interfaces. These design principles are summarized as follows:

- Visibility of system status. The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.
- Match between system and real world. The system should speak the users' language, with words, phrases, and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.
- Error prevention. Even better than a good error message is a careful design which prevents a problem from occurring in the first place.
- User control and freedom. Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.
- Consistency and standards. Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.
- Recognition rather than recall. Make objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

- Flexibility and efficiency of use. Accelerators—unseen by the novice user—may often speed up the interaction for the expert user to such an extent that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.
- Aesthetic and minimalist design. Dialogues should not contain information that is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.
- Help users recognize, diagnose, and recover from errors. Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.
- Help and documentation. The ideal system can be used without documentation, but it may often be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

Also, there are many general principles for design of human-computer interfaces apply to the design of e-commerce environments (Helander et al., 1997). Examples include:

- **Simplicity:** Do not compromise usability to gain function.
- **Support:** User should be in control with proactive assistance.
- **Visibility:** Make objects visible and intuitive to control.
- **Reversible action:** Make actions reversible.
- **Feedback:** Provide visible (or auditory) feedback on all user actions.
- **Accessibility:** Make all objects accessible at all times.
- **Personalization:** Allow the user to customize the interface.

Elements of the visual should fit together in an aesthetic and harmonious relationship in a manner which is interesting but not distracting (Pettersson, 1999). The goal in information design should be clarity of communication. The following Table 2.3 presents some points summarized by Pettersson that how interface should be designed to get attention in several categories.

Table 2. 3 Different methods to get attention

Text	Color
<ul style="list-style-type: none"> ● Set text large enough. ● Set text bold enough. ● Set headings in different type versions to aid comprehension of the text content. ● Use space and the actual placement of a heading to enhance the hierarchic structure. ● Make the key words red or underline them. ● Use headings, italics, boldface, or a larger font to highlight the relevant information. ● Do not overuse accenting techniques in text. ● Use blinking and flashing text on a computer screen as an accenting technique. 	<ul style="list-style-type: none"> ● Use bright and bold colors to capture attention. ● Use color to clarify the structure of a text. Certain parts of the text may be printed with colors or printed on top of backgrounds in different colors. ● Consider embedded meanings of different colors when using colors to accent words in a text. ● Use color coding to improve attention. The number of color codes should be limited and they should always be explained. ● The number of colors simultaneously for the “default color set,” and not more than six colors for visual search, for color images and for color interpretation from memory.*

Pictures	Layout
<ul style="list-style-type: none"> ● Use pictures of the human figure, in particular the face. ● Use picture elements that are large enough to see. ● Make the most important part of the subject large and clear. ● Use picture elements that are bold enough. ● Use several kinds of visual types, such as diagrams, drawings, photos to increase interest in a material. ● Pictures must be in color so they resemble the real world. 	<ul style="list-style-type: none"> ● Put pictures between the appropriate paragraphs in the text to get maximum impact ● Use bullets, arrows, icons, underlining, margin notes, repetition, and/or white space to highlight the relevant information. ● Use arrows in order to draw attention to a picture ● Use lines in various colors in order to draw attention to a picture or to specific picture elements. ● Write a legend for each picture.
Balance	
<ul style="list-style-type: none"> ● Use unexpected, irregular, and unstable design to attract attention. ● Provide a good contrast between figure and ground ● Use combinations of dark and bright, large and small, round and square, to sharpen meaning 	

* Add by researcher. (Aarås, Horgen, Bjørest.Ro and Thoresen, 1998).

Chapter 3 Research Methodology

In order to verify the hypotheses, we conducted the experiments to test the CRS's workload level by using the contact center interface of telephone and online chatting functions. In this chapter, the contact center system be used in the experiment will be described. In the second part of this chapter, the two measuring tools, NASA TLI and QUIS, are going to be introduced. And the third part is the portrayal of the experiment.

3.1 Contact Center System Interface Description

The AvecCRM, an advanced customer service management system, is a multi-channel communication system that integrated with telephone, fax, e-mail, and online chat interaction function. The system also unites customer service management, customer relationship management and enterprise knowledge management. The whole contact center system could be divide into two parts, the maintain customer relationship platform and, obtaining customer and information platform. The whole concept structure of the system is shown in the Figure 3.1.

The maintain customer relationship platform is the interface customers contact with the call center agents, and the major issue to be discussed in the research. The obtaining customer and call center information platform shows how the customer information turns into company knowledge. Since this part is categorized as knowledge management and some of the technical issues have described in previous paragraph in 2.1.2, such as database engines and knowledgeware and CTI (computer telephony integration), this part will only be briefly mentioned in this part.

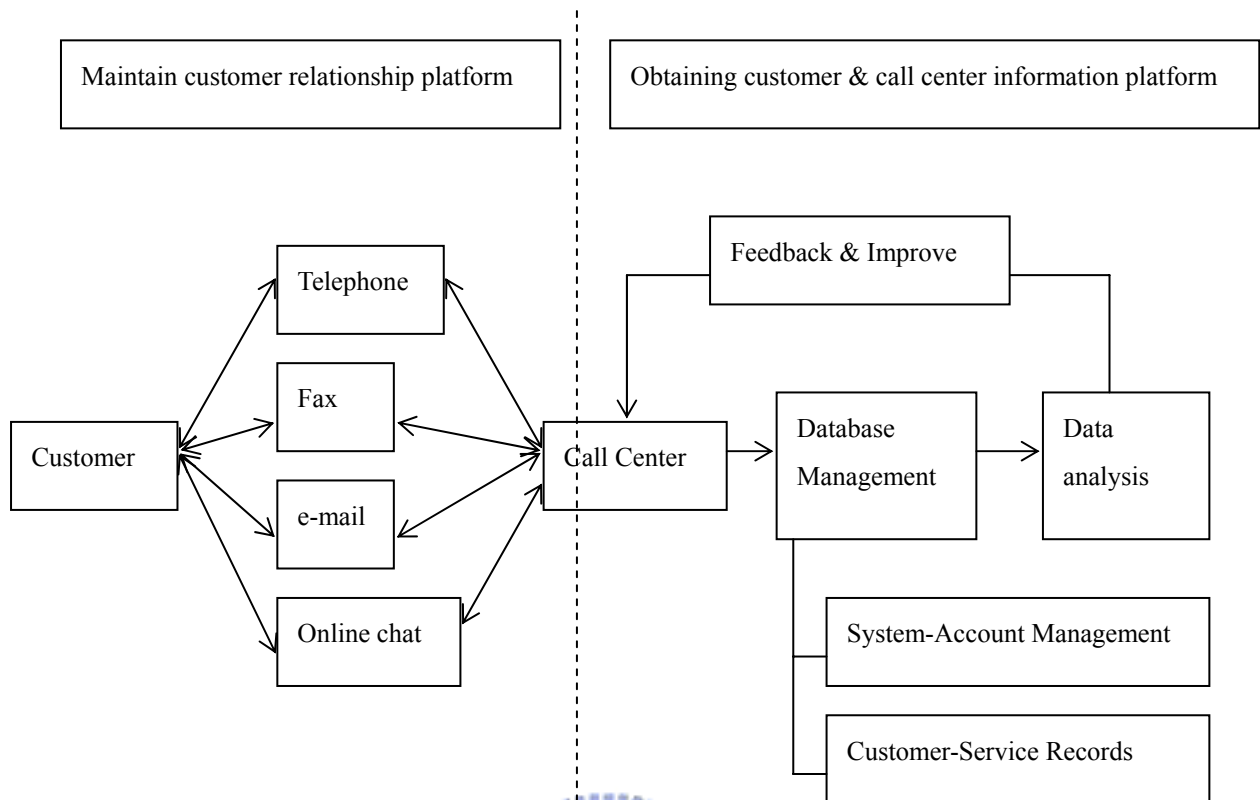


Figure 3. 1 Flowchart of multi-channel contact center

3.1.1 Obtaining customer/client and call center agent information platform

The two core parts of this section are: the system account management and the customer service records analysis. The system account management controls and supervise all the account on the system; thus, the managers can overlook each extensions and evaluate the service efficiency of each call center agencies. This subsystem has a grouping function that can categorize the users into different groups, which can make the further services more efficient.

The powerful database integration function that makes the customer service records analyses effective. Using graphic methods let each kind of customer service data clear. The managers can choose what kind of communication channel, which periods of data and what kind of graphic to present the data to analysis the operating situation. On one hand, they can supervise their employees; on the hand, they can

know the reasons of the clients' calls and can improve the service quality to gain customer loyalty. Also, the data analysis can have some feedback to the call center and the CRM system that leads to future improvement of service quality and service system for both clients and call center agents. The analysis subsystem has a forecasting function that can let managers to find out the potential customers and demand trend, which may help them to set goals and strategies.

This part dealt with analytical and managerial level of call center daily operation. Most of the customer service representatives do not use these functions often. Thus, this segment will not be probed in the research.

3.1.2 Maintain customer relationship platform

The Avectec web-based interface is not only easy to use, but also records the every transaction's key point; such as, when, who, what, at the same time. The four complimentary communication channels can let both customers and call center agents have their best own choice how to contact with each other. And with such system, the enterprises can respond to the clients quickly and more precise. It is because when a customer logs in the system in either way, the agent can retrieve the information to identify whether the client is new or repeated. The agent can also know the historical records of the client—what its background, what the purpose of the call, and how the response was. The telephone subsystem has answer machine function that the client can leave voice message if the agent missed the call. The Fax subsystem is similar to telephony subsystem that can take records of the calling time, the calling/receiving person, the purpose and the content of the call. For the e-mail subsystem, it is similar with Microsoft Outlook Express system—with added automatic reply function. The online chat subsystem provides client/agent to communicate on line by typing

message in dialog boxes that can be saved after chat, and agent can correct the data of the client at the same time if needed.

Due to the time-limited and experiment design, this research will focus only on telephone and online chat functions, which are more directly response to the customers and may cause higher workloads. The following paragraph will introduce these two interfaces.

- Telephone Interface

Refer to the Figure 3.2, there are some functions showed in it, like new-coming and historical call-in record options, new-coming and historical missing call-in record options and new-coming and historical call-out record options. Using mouse cursor, the agent can choose the record to operate with. On the left bottom side, there are two lines showing the instant information of the customer service processing status: the unconfirmed new-coming calls and unconfirmed missing calls. Thus, for example if the agent wants process the unconfirmed new-coming call, then, the agent has to click



Figure 3. 2 Telephone Record Interface

on “new-coming call-in record” option and to filled out the blanks as shown in Figure3.3. All the other options have the similar process procedures. These records are important because they will transfer into database for further analyses.



Figure 3. 3 Interface for new-coming call-in record edit

- Online Chat Interface

The online chat interface is similar with the prevailing MSN or YAHOO messengers, however, providing customer related profile. When the customer login the system, the profile of the customer will fill in the blank automatically, so the agent can view them before chat with customer. The agent do the typing in the blank on the right middle of the interface, and both of customer and agent’s inputs will show on the right top of the interface. After the problem solving via online chat, the agent have to take records of call-in reason and other items in the bottom left, orange-colored area. Unlike changing interface in completing telephone task, all the online chat task dealt with only one interface.

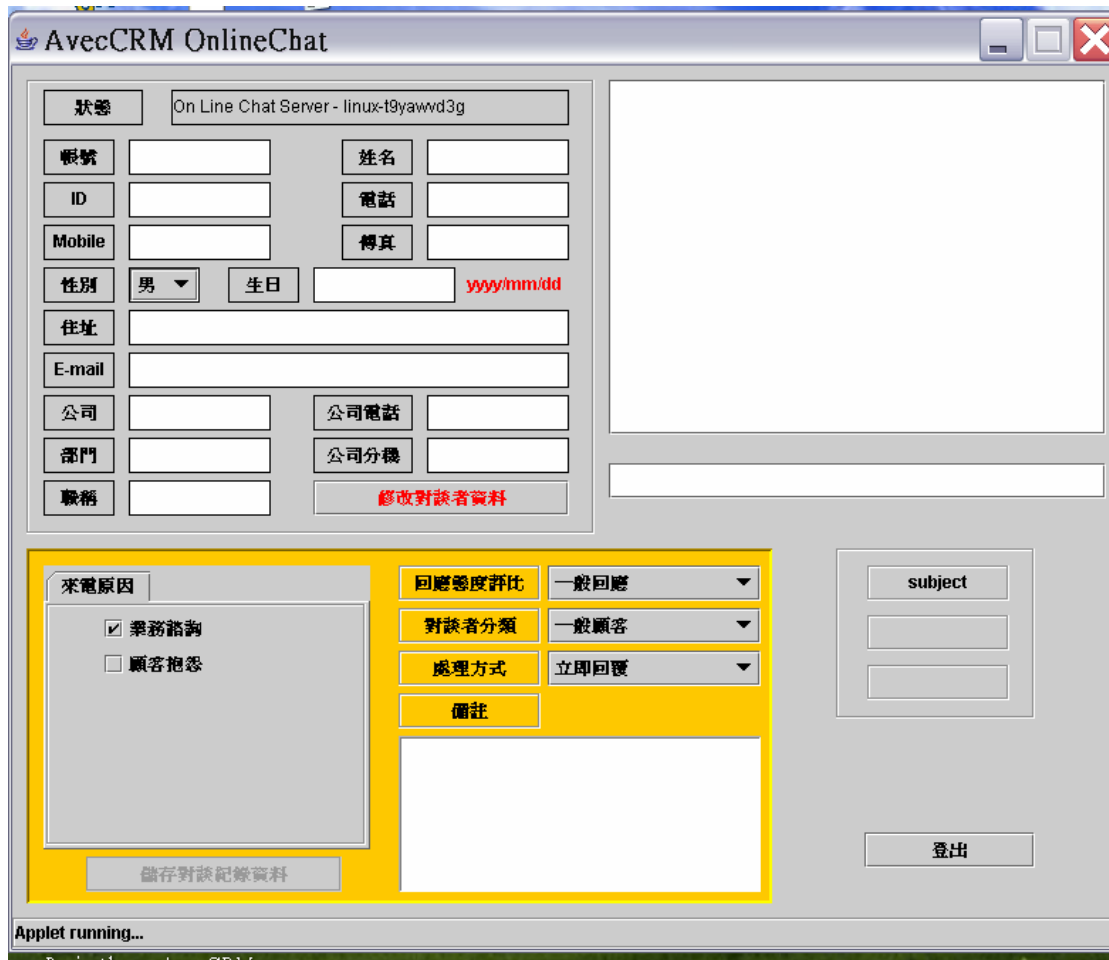


Figure 3. 4 Online Chat interface

3.2 Description of Measuring Tools

3.2.1 NASA TLI

This procedure for collecting workload ratings was developed by the Human Performance Group at NASA Ames Research Center during a three-year research effort that involved more than 40 laboratory, simulation, and in-flight experiments. The NASA Task Load Index is a multi-dimensional rating procedure that provides an overall workload score based on a weighted average of ratings on six subscales: Mental Demands, Physical Demands, Temporal Demands, Own Performance, Effort, and Frustration (NASA TLI V1.0 User Manual).

The NASA Task Load Index is a two-part evaluation procedure consisting of both weights and ratings. Three separate computer programs are provided: "WEIGHTS" is used to collect weights; "RATINGS" is used to collect ratings; and "COMBINE" is used to combine them into an overall weighted workload score. The first requirement is for each rater to evaluate the contribution of each factor (its weight) to the workload of a specific task. Three dimensions relate to the demands imposed on the subject (Mental, Physical, and Temporal Demands) and three to the interaction of a subject with the task (Effort, Frustration, and Performance). See the figure 3.5. These weights account for two potential sources of between-rater variability: differences in workload definition between raters within a task and differences in the sources of workload between tasks. In addition, the weights themselves provide diagnostic information about the nature of the workload imposed by the task.

The screenshot shows a software window titled "Questionnaire" with a subtitle "Task Questionnaire - Part 1". Below the subtitle is the instruction: "Click on each scale at the point that best indicates your experience of the task". There are seven scales, each with 11 vertical tick marks:

- Mental Demand:** Scale from Low to High.
- Physical Demand:** Scale from Low to High.
- Temporal Demand:** Scale from Low to High.
- Performance:** Scale from Good to Poor.
- Effort:** Scale from Low to High.
- Frustration:** Scale from Low to High.

At the bottom of the window are two buttons: "Cancel" and "Continue".

Figure 3. 5 NASA TLI Questionnaire“WEIGHTS”

Although it is clear that definitions of workload do indeed vary among experimenters and among subjects (contributing to confusion in the workload literature and between-rater variability), it was found that the specific sources of loading imposed by different tasks are an even more important determinant of workload experiences. Thus, the current version of the scale (the Task Load Index) combines subscale ratings that are weighted according to their subjective importance to raters in a specific task. There are 15 possible pair-wise comparisons (see example of Figure 3.6) of the six scales. Subjects select the member of each pair that contributed more to the workload of that task. The computer tallies the number of times that each factor was selected. The tallies can range from 0 (not relevant) to 5 (more important than any other factor).

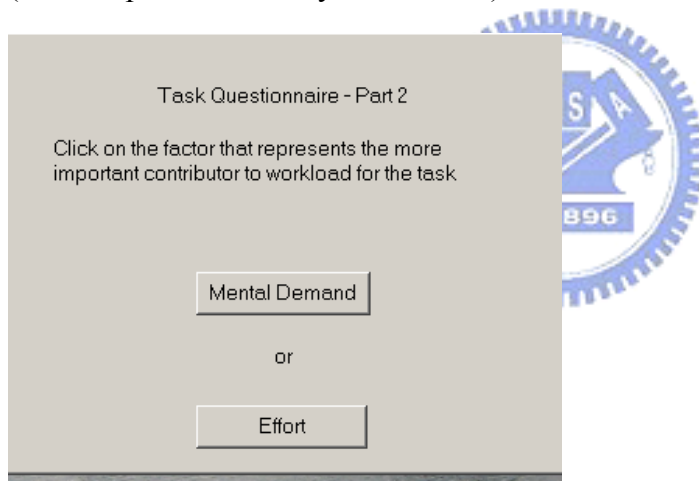


Figure 3. 6 NASA TLX "RATINGS"

The degree to which each of the six factors contribute to the workload of the specific task to be evaluated, from the raters' perspectives, is determined by their responses to pair-wise comparisons among the six factors. Magnitude ratings on each subscale are obtained after each performance of a task or task segment. Ratings of factors deemed most important in creating the workload of a task are given more weight in computing the overall workload score, thereby enhancing the sensitivity of the scale.

The Task Load Index has been tested in a variety of experimental tasks that range from simulated flight to supervisory control simulations and laboratory tasks (e.g., the Sternberg memory task, choice reaction time, critical instability tracking, compensatory tracking, mental arithmetic, mental rotation, target acquisition, grammatical reasoning, etc.). The research used NASA TLI to exam the workloads from telephone and online chat tasks separately.

3.2.2 User Satisfaction Questionnaire

The User Satisfaction Questionnaire, which was based on the Questionnaire for User Interaction Satisfaction (QUIS), a tool developed at the Human-Computer Interaction Lab (HCIL), University of Maryland at College Park. Each section of the QUIS measures users' satisfaction with a specific aspect of the interface, using a 9-point scale. There are eight sections in the QUIS, presenting as follows:

- System Type – Name of hardware and software, time of system using
- Past Experience – Hardware and software using experiences
- Overall User Reactions - Satisfaction along six high level interface factors
- Screen - Satisfaction with a number of factors related to visual displays
- Terminology and System Information - Satisfaction with system messages, user feedback, and task related wording that the system generates
- Learning - User's perception of their ability to learn complex system tasks
- System Capabilities - Satisfaction with the system's performance and reliability, both in error recovery and error prevention
- User opinion – blank ask user to write down their considerations

QUIS is configurable by including only the sections that are relevant to the particular study. This study utilized selected some questions from three parts of the QUIS,

which measure: Screen, Terminology and User opinions. Since the sample size only consisted of forty people, avoiding too large variations, the study reduced the scale to five points. The questionnaire is enclosed in the Appendix 4 at the end of the study.

3.3 Experiment

3.3.1 Subject

On one hand, due to the technical problem, the phone call and the online chat cannot be done automatically by the machine. And on the other hand, trying to be more real and interactive way, the “customer” should be “real human” to do the phone call and online chat. To control the situation, the customer should be the same person asking same questions. Thus, the sample size cannot be too large; otherwise the “customer” will feel exhaustion. To pass the minimum level of big sample and to be convenience, there are totally forty-one NCTU and NTHU graduate students involved in the experiment. The subjects act as the agents in the contact center in the experiment. Since some students get part-time job as customer service agents, it is suitable to use students as subjects.

3.3.2 Task

In the multimedia contact center, there are various tasks that the CRS have to operate, such as answering the inbound phone calls, sending FAX and e-mail, and responding online chats, which mentioned before. Since high burnout is from the combination of high frequency and high intensity of interpersonal contact, the research chose the phone-answering and online chat, which contact with customers more directly and instantly, to test the customer service agent’s workload level induce from the contact center interfaces.

3.3.3 Equipment

Desktop computer, 17-inch LCD monitor, TeleSynergy telephone and voice board, keyboard, mouse, AVEC CRM contact center software, hard copy of user manual (Appendix 1), hard copy of Customer Service Information Q&A database (Appendix 2)

3.3.4 Experiment procedure

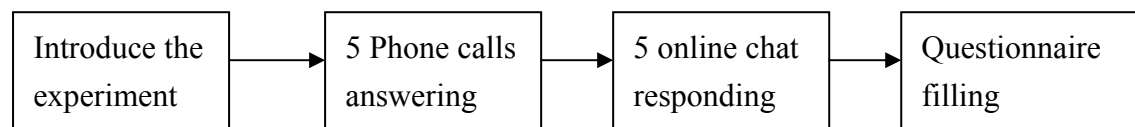


Figure 3. 7 Experiment procedure

- Asked 41 people who are qualified to work in the contact center (aging above 18, know how to operate computer and answer phone call, read Chinese) to be subjects.
- Introduced the experiment, which includes two parts: answering the phone call and responding the online chat, by using “User Manual” and real contact center interface operation in about 5 minutes.
- Researcher selects 5 questions from the list and does 5 phone calls sequentially. Subjects look up in the print-out, hard-copy information sheets and answer the questions. Subjects need to take records for each call and save them in the contact center system. The whole procedure costs about 10 minutes.
- After doing the phone call task, subjects change to online chat interface immediately. Researcher selects 5 questions from the list and does 5 online chats sequentially. Subjects look up in the print-out, hard-copy information sheets and answer the questions. Subjects need to take records for each online chat and save them in the contact center system. The whole procedure costs about 15 minutes

or longer, according to typing speed.

- After using the two interfaces, subjects need to fill out a questionnaire (Appendix 4), which includes two parts: workload level and interface perceived. NASA TLI was implemented to exam the workload levels from phone call interface and online chat interface separately. There are two parts in evaluating interface. One is five-point Likert scale, which items are selected from established questionnaire (University of Maryland, 1991). And the other part is open-end question, which ask subjects to write down their opinions toward the contact center system.
- When the experiment finished, subjects get NTD 50 as reward.

(1) Phone call experiment procedure

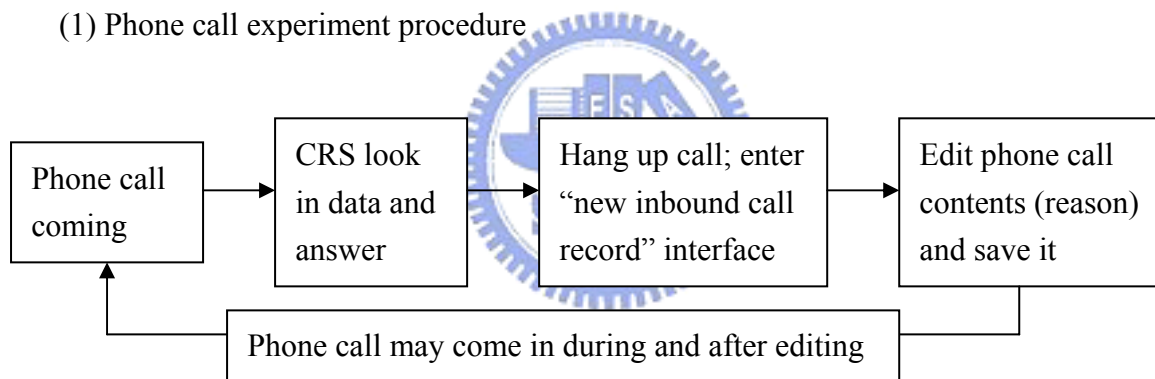


Figure 3. 8 Phone call experiment procedure

- First, agent picked up the phone and answered the question according to the answer written on the provided Information database.
- Completed the service and hung up the phone. Then, click the “certain” button on the screen to enter the new inbound call record.
- Edit phone call reasons, customer categories, response ways and other descriptions to complete one service procedure.
- To understand the procedure more detail step-by-step, please refer to Appendix 1.

(2) Online chat procedure

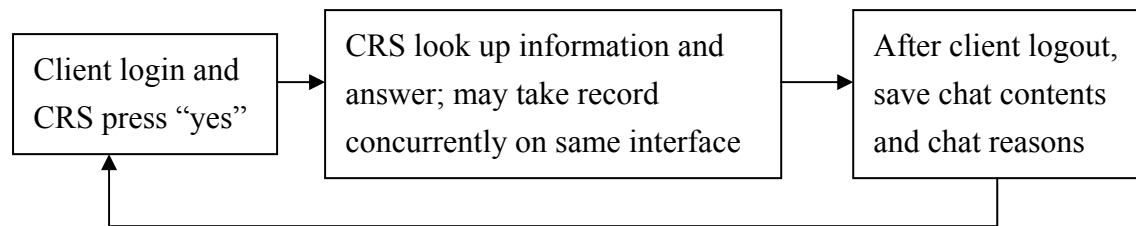
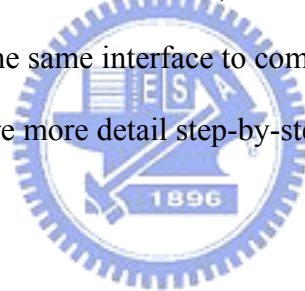


Figure 3. 9 Online chat experiment procedure

- Press "yes" to let customer login the system.
- Typing in the blank to communicate with customer and find out the answer on the hard-copy Information database to answer customer's questions.
- After customer logout, edit "call-in" reasons, customer categories, response ways and other descriptions on the same interface to complete one service procedure.
- To understand the procedure more detail step-by-step, please refer to Appendix 1.



Chapter 4 Data Analysis and Discussions

This chapter is meant to analyze the data and verify the hypotheses. First part is to test the questionnaire's reliability. Then, the study uses some descriptive statistics to demonstrate the sample characteristic and the results of workload and user satisfaction. The study uses t-test to verify the hypotheses. Final part is to show the qualitative information generated from user opinions.

4.1 Reliability

In this paragraph, the study discusses the reliability of questionnaires. The first part is the reliability of the NASA Task Load Index, and the second part is the reliability of the interface satisfaction questions selected from Questionnaire for User Interaction Satisfaction (QUIS), a tool developed at the Human-Computer Interaction Lab (HCIL), University of Maryland. Though these two are from the established questionnaires, we still have to test their reliabilities.

Using Cronbach's α to calculate the internal consistency, the reliability of seven items in NASA TLI, being used in Telephone Answering task, amounted to 0.8504, and the reliability of NASA TLI, used in Online Chat task, amounted to 0.8645. And as for the User Satisfaction Questionnaire, the reliability of the selected seven questions in five-point scale amounted to 0.8116.

4.2 Descriptive Statistics

The descriptive statistic includes subjects' characteristics, results of workload index and user satisfaction.

4.2.1 Subjects Characteristics

Nineteen of them were male and twenty-two were female. Their ages are arranged from 21 to 27, which are available to work in the contact center. All of them are graduate students. Only two of them had related experiences working in the call-center related tasks. Except one of them use computer and get on the Internet three to four times a week, all of them use computer and get on the Internet daily, which means they are quite familiar with computer devices, like keyboard and mouse, and familiar with web-based interface operation, like click and key-in.

4.2.2 Workload Index and User Satisfaction

Table 4.1 presents the Means and Standard deviations of the experiment, which calculated by using NASA TLX system. Figure 4.1 graphic the mean of the experiment. According to the data showed in Table 4.1 and Figure 4.1, the telephone task has higher workload level than online chat task, except on physical demand dimension. This is to verify the hypothesis one, and will be discussed in 4.3. We can see the highest workload among all is the Temporal Demand from telephone-call task, and the mean score is 63.781. The next two are Effort and Total Workload from telephone-call task. The lowest workload level is the physical demand from telephone-call task, which the mean score is 35.854. The following is the frustration from online chat task.

Furthermore, temporal demand is the highest in telephone and physical demand is the lowest. Mental demand is the highest workload for online chat task and frustration level has the lowest workload. The workload mean interval between telephone tasks is greater than online chat task.

Table 4. 1 Comparison of workloads between telephone task and online chat task

	Telephone		Online Chat	
	Mean	Std. Deviation	Mean	Std. Deviation
TW	54.675	18.270	43.593	18.551
MD	60.854	22.718	49.146	22.883
PD	35.854	26.146	46.098	23.783
TD	63.781	25.879	46.341	27.794
PERF	44.878	25.580	37.805	24.214
EFFORT	58.415	20.354	46.707	23.917
FRUST	49.756	24.030	37.073	25.322

TW: total workload; MD: mental workload; PD: physical demand;
 TD: temporal demand; PERF: performance; EFFORT: effort;
 FRUST: frustration

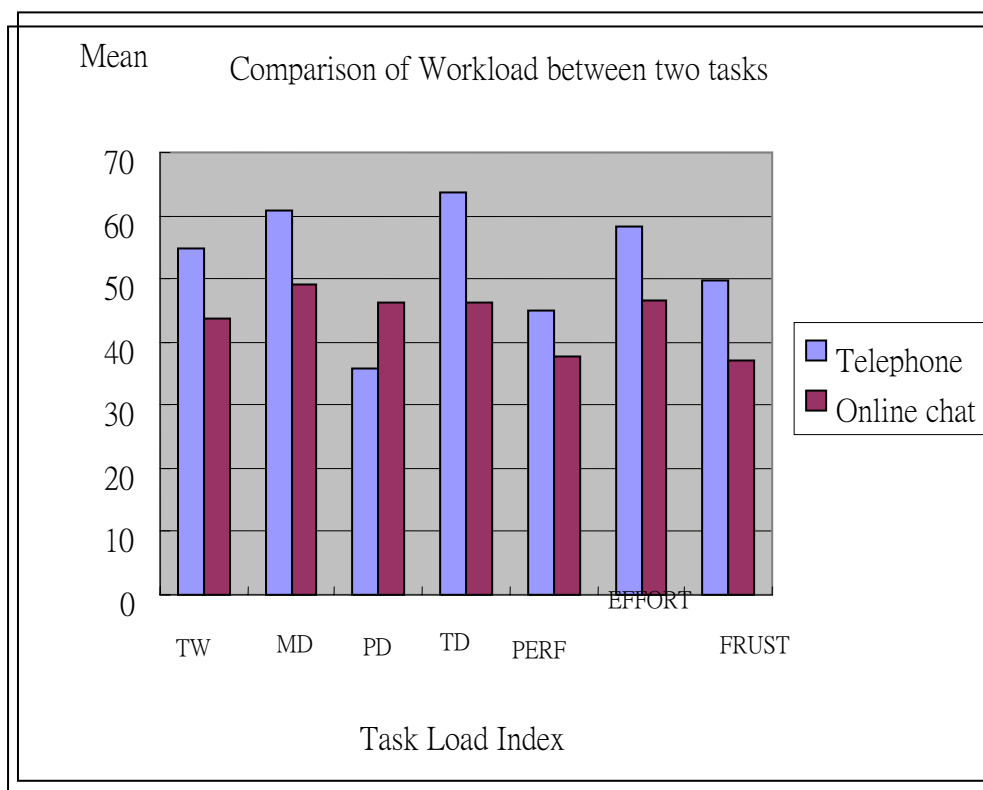


Figure 4. 1 Comparison between the Mean of two tasks

Table 4.2 shows the Mean and Standard deviation of overall user reactions toward both interfaces used. It shows that “Information shows in the interface with consistency” has highest satisfaction, which score is 3.975. And “Layout helpfulness”

and “Interface order” are the two with lowest satisfaction, which both scores are 3.439. Therefore, the results imply that the layout and the order of interface should do improvements.

Table 4. 2 Results of User Interaction Satisfaction

	Mean	Std. Deviation
Text readable	3.878	1.004
Layout helpful	3.439	0.896
Information appropriate	3.463	0.868
Info order logic	3.780	0.613
Interface order	3.439	0.923
Info consistency	3.975	0.570
Info clearness	3.756	0.830

4.3 Experiment discussion

Table 4.3 is about the correlation analysis between gender differences and workload level on both telephone call receiving task and online chat task. However, the conclusion is there is no difference between gender and workload level; in other words, the interface is useful for both gender.

Table 4. 3 Correlation analysis- Gender and Workload Index

	Telephone		Online Chat	
	Gender			
	Pearson correlation	Sig. (2-tailed)	Pearson correlation	Sig. (2-tailed)
TW	.103	.524	.083	.608
MD	.155	.332	.116	.469
PD	.050	.758	.106	.510
TD	.023	.888	.072	.654
PERF	.141	.380	.201	.208
EFFORT	.048	.764	.036	.823
FRUST	.093	.561	-.089	.579

** express p value<0.01; * express p value< 0.05

As we can see the data in Table 4.1 and Table 4.4, the total workload from telephone call task is higher than the total workload from online chat ($54.675 > 43.593$; $t > 1.68$; $p \text{ value} = 0.006$). Thus, support the hypothesis 1. that telephone call task has higher total workload level than online chat task.

In the first dimension, mental demand, the telephone call task still has higher workload level than online chat task ($60.854 > 49.146$; $t > 1.68$; $p \text{ value} = 0.006$), which support the hypothesis 1a. For the temporal demand dimension, the telephone task has cause workload significantly higher the workload caused by online chat ($63.781 > 46.341$; $t = 2.983 > 1.68$; $p = 0.005$), which strongly support the hypothesis 1c. As to the performance dimension, the most important thing needs to notice is that the higher the score the greater the failure feeling of coping with system interface. Hence, in this dimension, the telephone task has mean score of 44.878, which is higher than the online chat task's score, 37.805, refer to the subjects feel more failure in doing telephone task. However, the result between these two tasks is not significant. Hypothesis 1d only partially been supported. The result shows that telephone call task has to put more efforts than online task does ($58.415 > 46.707$; $t = 2.944$; $p \text{ value} = 0.005$), which also strongly supports hypothesis 1e. The last dimension of NASA TLI is frustration causes by the task. In this dimension, the telephone call task has workload mean of 49.756, which is higher than the online chat workload mean (37.073). According to the paired t-test, the t value is 2.472 and p-value is 0.018. So the hypothesis 1f is supported.

The only one hypothesis not been supported is Physical Demand. The mean of workload from telephone task is 35.854 and the mean from online chat is 46.098 ($t = -1.993$; $p \text{ value} = 0.053$). The result is reverse to the hypothesis 1b, which online chat task has higher physical demand than telephone task. This may because the online chat task has to do more typing and let subjects felt so tired.

Table 4. 4 Paired Samples t-Test

		Paired Differences				t	df	Sig. (2-tailed)
		Mean	Std. Deviation	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1	TW1 - TW2	11.0813	24.35134	3.3951	18.7675	2.914	40	.006***
Pair 2	MD1 - MD2	11.7073	25.65662	3.6091	19.8055	2.922	40	.006***
Pair 3	PD1 - PD2	-10.2439	32.91943	-20.6346	.1468	-1.993	40	.053*
Pair 4	TD1 - TD2	17.4390	37.43531	5.6230	29.2551	2.983	40	.005***
Pair 5	PERF1 - PERF2	7.0732	28.12862	-1.8053	15.9517	1.610	40	.115
Pair 6	EFFORT1 - EFFORT2	11.7073	25.46099	3.6708	19.7438	2.944	40	.005***
Pair 7	FRUST1 - FRUST2	12.6829	32.84619	2.3154	23.0505	2.472	40	.018**

Note: *p value<0.1, **p value<0.05, ***p value<0.01

4.4 Qualitative Information

Following are some Tables that summarized the user opinions. Table 4.5 is the general opinion for overall interfaces. Table 4.6 concludes the opinions for Interface related with processing telephone call records. And Table 4.7 contents the opinions of online chat interface. Last, Table 4.8 summarized the user opinion in frequency according to Neilson’s principles. The number in the right column means the opinion mentioned frequency, for example, there are 5 people praised that the both interfaces are clear, perfect and in good design. The opinions are categorized in positive and negative and are listed in the order of mentioned times. The more important is listed

in the front.

Table 4. 5 Opinions for both interfaces

For both interfaces	Mentioned times
positive	
clearly, perfect, good design	5
easy to learn and operate	2
negative	
establish database, add more options and have keyword search function	2
need to improve the layout(color)	1
too many bugs(sometimes user can't login)	1

Though there is one subject thought the color of the interface should be improved, there are five suggested that the interface is clear, perfect and with good design. These opinions is in accordance with the results presented in Table 4.2 that the information presented in the interface is consistent (3.975, the highest score) and the text on the screen is easy to read (3.756), thus, clear and easy to learn and operate; however, without established database and keyword search function, the interface helpfulness is ranked low. The main problem mentioned here is conflict the design principle mentioned in 2.3: lack help and documentation, and without aesthetic design.

Table 4. 6 Opinions for Telephone interface

Telephone	Mentioned times
positive	
can get instant feedback	1
negative	
facility	
use earphones, not handset	2
interface/system	
Flexibility and efficiency of use	

show call NO. and caller's data while the phone coming	6
Recognition rather than recall	
interface order is complicate	2
meaning of options are vague	1
User control and freedom	
can't process the record along with the call	2
should block the call until former recorded	1
difficult to change the previous record	1

The positive opinion, “can get instant feedback” is followed the design role of Feedback. Nevertheless, more opinions are asking to show the inbound call number and customer’s profile as soon as the phone rings. Without this function, the interface design violates the principles of support and feedback. The subjects felt more uncertainty about the situation, thus, the telephone call task has higher workload. Hence, to improve the interface design and to lower the agents’ workload from the telephone task, to add in “showing customer’s data instantly” is a must. Refer to Table 4.2, the order of interface has the lowest score among the seven questions and there are two opinions considered the interface order is complicated. It disobeyed the design rule that the function should be recognition rather than recall. And maybe owing to this reason, the telephone call task has higher mental demand workload level. The opinions, “can't process the record along with the call,” “should block the call until former recorded,” and, “difficult to change the previous record” is categorized as against “User control and freedom” and “Help user recognize, diagnose and recover from errors.” These negative opinions must be improved to enhance the ease of use of contact center system to lower the agent’s workload level.

Table 4. 7 Opinions for Online chat interface

Online chat	Mentioned times
facility	
keyboard is hard to use	1
interface/system	
Flexibility and efficiency of use.	
database for FAQ and greetings(drop-down list)	9
too much key-in may cause distract and inefficiency	2
more detail options in call-in reason	1
provide more detail, work-related client information	1
add "send file" function	1
distinguish agent and client's dialog with different color	1
the "client log-in" pop-up menu should appear on the top, not cover by the webpage	1
lag in reveal the typed message	1
Aesthetic and minimalist design	
should improve the design(color)	3
characteristics are too small	2
input column is too small	1
User control and freedom	
block income chat before save	3
should show both sides' action	2
should have expression symbols	2
should have instant saving	1
Recognition rather than recall	
get confused with "logout" function	1
get confused with P.S. and input column	1

Though the workload level is lower in using online chat interface, there are more opinions about how to improve the design. It may be because most of the subjects get used to communicate online and they felt more familiar with online chat interface.

The highest opinion mentioned is “need to have FAQ database and greeting database.” Since the customer service agents are trained to be polite, they have to say

something to greet the customer each time customer login. Therefore, having greeting database for agent to choose rather to type can have great improvement to lower down the physical demand on the online chat workload. And the same reason for the FAQ database. (The subjects stated that too much key-in may cause distract and inefficiency). If the agent can select the answer from the database rather than type, their work can be more efficient. The similar idea mentioned by the subjects is to “add ‘send file’ function” and “more detail options in call-in reason.”

The second highest suggestion is “should improved the design (color).” This follow the design principle that should considered the aesthetic issue. Other similar opinions, like “characteristics are too small” and “enlarge the input column,” can also be categorized in this area. Unlike face-to face or telephone communication, online chat communication lacks the expressions, so the agents may misunderstand the customer’s needs. Thus, to increase the efficiency of use by adding “expression symbols” is a good suggestion. On the other hand, since the both sides do not what opposite side is doing, and may end the talk freely even the other is typing; hence, to show the actions of both side is necessarily to increase the interface efficiency and decrease the uncertainty and workload level. In order to meet the “efficiency to use” criteria, adding the functions like “distinguish agent and client's dialog with different color,” “show CRS' name/No. on client side,” and “block next chat before saving the prior chat” are important recommendations.

In sum, the highest is the Flexibility and efficiency of use, the online chat task contributed 17 times (summarized in Table 4.8). And the 9 out of 17 is suggested that should establish greeting and information database for agent to select rather than type. And 6 out of 8 from the telephone task, is asked to show the customer’ s profile as long as the phone ring. Refer to Table 4.2, it shows that layout helpfulness and

Interface order have the lowest mean, which refer to the user have lower satisfaction on these two dimensions. And it parallel with the user opinion. Since the interface is not efficiency of use and not easy for user to control, the subjects thought layout of the interface is not helpful. The interface is not range in the appropriate order, so the subjects have to remember the action and recall it rather than recognize directly from the interface.

Table 4. 8 Summary of user opinions in mentioned frequency

	Both	Telephone	Online chat	Sum
Visibility of system status.				
Match between system and real world				
Error prevention				
User control and freedom		4	8	12
Consistency and standards				
Recognition rather than recall		3	2	5
Flexibility and efficiency of use	2	8	17	27
Aesthetic and minimalist design	1		6	7
Help users recognize, diagnose, and recover from errors				
Help and documentation				

These advices are precious for the future contact center interface design. Though some of them seems quite detail, most of them can be classified into certain sort of the principles of interface design. In other word, since the designs violate some principles, the interface become unfriendly and causes higher workloads.

Chapter 5 Conclusions and Suggestions

The end chapter consists of the conclusion, the limitation of the study and the suggestions for future research.

5.1 Conclusion

The objects of this study are to find out the workload level of the agents, who work in the multimedia contact center, and to help improve the interface design. Since there is no previous study related with workloads from telephone call processing task and online chat task, the research used Wickens' multiple resources model to deduce that the telephone task should have higher workloads. After doing literature review, the workload is constructed in six dimensions: mental workload, physical workload, temporal workload, performance, effort, and frustration. The study use NASA TLI to test each dimension. The user satisfaction toward the contact center is measured by using questions selected from QUIS, established by HCI lab, University of Maryland.

The experiment was conducted and there were forty-one subjects attended. Each subject has to receive five phone calls and took records for each calls in the Avectec multimedia contact center system. Then, they have to practice five times of online chat task and take records of each chat. After doing the interactions with the contact center interface, the subjects are asked to fill the questionnaire about the workloads and interface satisfaction.

Most of the hypotheses are supported by the experiment results. The total workload level, the mental demand of workload level, the temporal demand workload level, the put-in effort, the feel of failure on performance and the frustration level are higher in coping with telephone receiving processing task. However, the subjects have to do more typing in online chat task cause the physical demand of workload level

higher in this task.

The results of user interaction satisfaction showed the subjects are most satisfied with the “consistency and standard criteria” from the information shows on the system interface. None the less, they are less satisfied with the interface layout and the order of the interface. Their suggestions from the user opinion also show their concerns about the efficiency of use, user control, feedback, reversible actions and aesthetic design dimensions.

In practical using of the conclusion of the study is that companies should always do their best to reduce the workload causing from the work environment. The emergence of the Internet and telecommunication technologies enables the enterprise to collect information, search for new markets, and interact with customers and suppliers efficiently and instantly. There is a trend showing that more customer services have been done via Internet than phone call. It is good phenomena for the online customer service has lower workload, according to the research. With the emerging multimedia contact centers, to frame better interface for improving working condition and for decreasing working stress is essential. It is a continuing process to figure out the most suitable solution by following the interface design principles. The customers are requiring more customized products and service; hence, contact center is in the more important place. There are more people working in the contact center in the future. Try to lower the workload and the turnover rate, and make contact center operates more efficiently is significant topic.

5.2 Research limitation and Suggestion for future study

1. Since the study use convenience sampling method, all of them are students and are used to operate the computer and web interface, the results may have problem in

generalize ability. Suggest that the future study can use samples more diversely.

2. Due to time limitation, there are two functions, FAX and email, not being tested. Hope future research can add these two functions in the experiment and exam the workload causing from the real multimedia contact center tasks.
3. With limited technical skills, researcher did not construct the new interface with all the subjects' opinions. As we can see in 2.1.2, there are many technical issues related with contact center interface design, not only the "face" issue. The future research should cooperate with technicians to do the interface design, and find out the workload causing from the new interface.
4. Without similar experiment before and with limited time and human resources to do the experiment, the experiment only has one sequence, which telephone task first and followed by online chat task. In the future research, the experiment should be designed including all these: telephone task only, online chat task only, telephone task → online chat task, and online chat task → telephone task.
5. Interface design is a complex topic. Design for each interface can be a independent research topic, such as how large the text should be, what color is the most comfortable interface to reduce stress from the work, in what order the interface should be organized to be most suitable for operation, which kind of layout can be the most efficient way to present all the required information, and so on. This is the initial study of multimedia contact center workload measurement and interface design. The future study can focus on specific area, for example, compare different multimedia contact center interface layouts and find out the one with lowest workload level.

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APPENDIX 1 User Manual

使用者手冊

此手冊的目的：是要讓受試者在正式實驗開始前，了解測試系統的操作方式以及系統的使用環境，以使正式實驗能流暢進行。因此手冊的內容主要包含兩部分：第一部分為電話接聽操作介面之介紹、第二部分則為線上對談介面之介紹；此兩部分皆分別說明受試者所需熟悉的操作步驟。最後並描述此實驗所處的假設情境，以提供受試者在回答客戶詢問時的資訊背景。



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電話接聽操作說明

下圖 1，為您所見到的畫面首頁



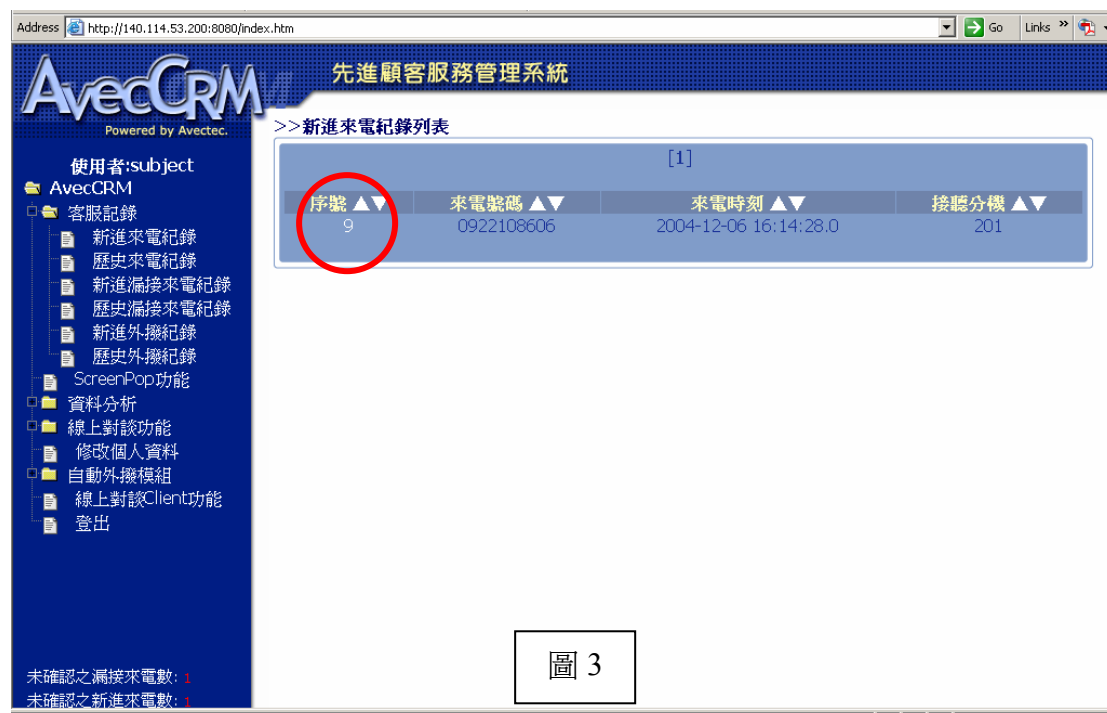
圖 1

當您點選左方資料夾前端的十字時，其選單會打開，如下圖 2 所示：當點選客服紀錄資料夾，就會顯示有新進/歷史來電紀錄、新進/歷史漏接來電紀錄、新進/歷史外撥紀錄等



圖 2

當您每次完成一件電話接聽客戶服務時，請點選上圖虛線方框中之“確定”，以進行客戶服務紀錄。當您點選“確定”後，會出現如下圖 3 之頁面，此介面會顯示序號、來電號碼、來電時刻、接聽分機，請點選序號下的數字(如下圖的數字為 9)



如下圖 4 所示，此客服紀錄編輯畫面包含來電分類、來電事宜、處理方式、回應態度評比、其他描述與語音留言部分。本次實驗僅需針對來電事宜、回應態度評比與其他描述(較詳細的紀錄來電確切事宜)進行紀錄即可。



最後按下上圖 4 中的“確定”鍵，即完成儲存客服紀錄資料。

在每完成一筆紀錄後，請返回新進來電紀錄頁面(圖 5)，等待下一通來電。

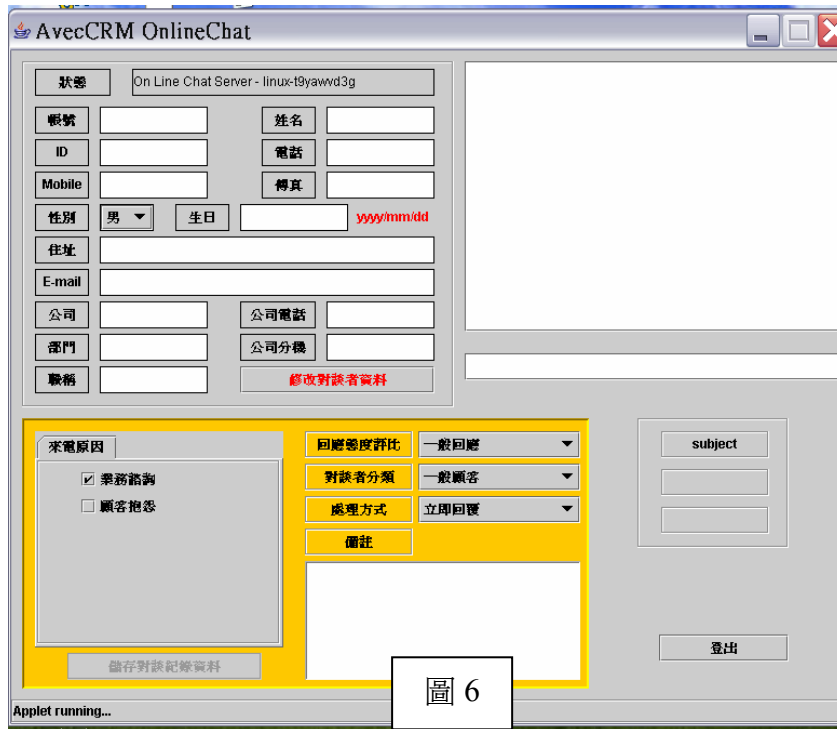


圖 5

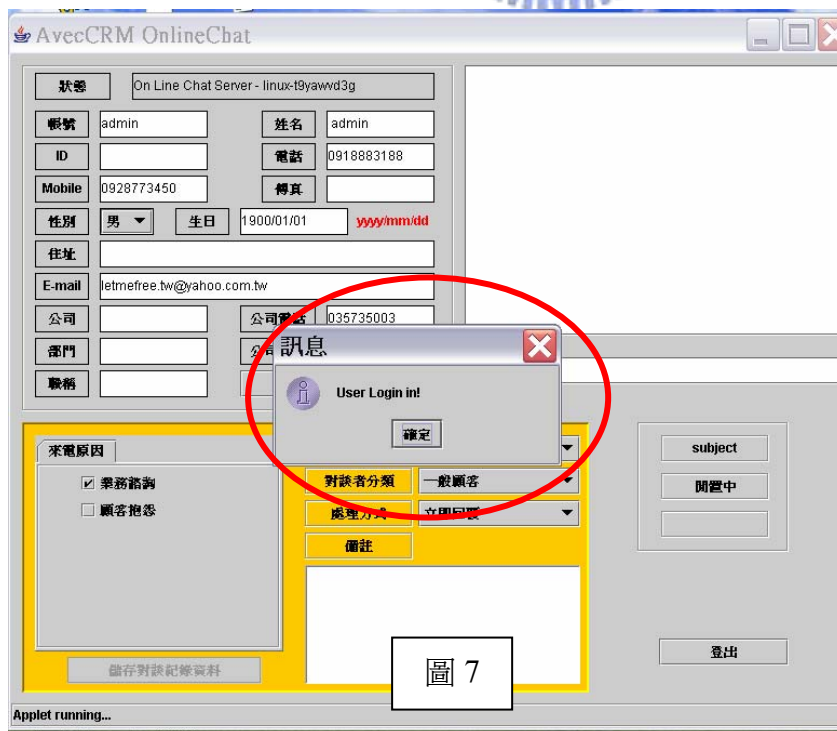
請按照以上說明進行試用，如有任何問題請於實驗開始前提出！

線上對談操作說明

下圖 6 為線上對談介面的首頁



當有客戶登入時，頁面便會出現另一對話框(如下圖 7 圓圈處所示)，而在帳號、姓名、電話、Mobile、生日、E-mail 等欄位中會自動填入來電者之資料。此時，請按下對話框中之“確定”，進入線上對談。



您可在下圖 8 中所圈出之欄位中，輸入您要與顧客對話之內容，像是顧客詢問的訊息。而所有客戶以及您的談話內容都會顯示在此欄位上方較大的空格中(如圖所示，有 C->S: hi 之處)。

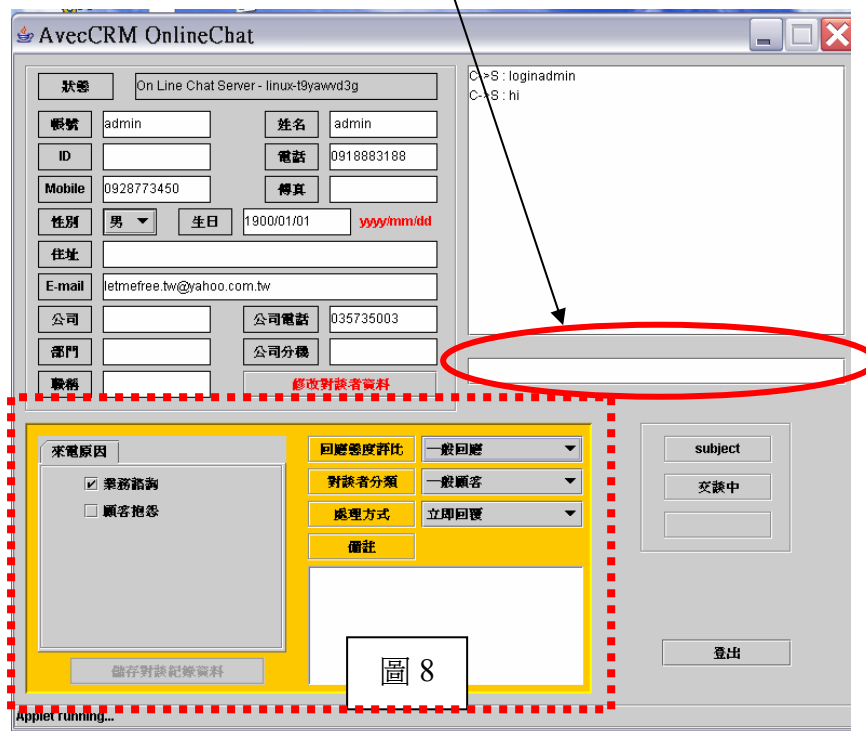


圖 8

在您與客戶對談的同時，或是您與客戶對談完之後，您必須填寫客服紀錄(上圖 8 虛線方框)，您必須按照您與客戶談話的內容記載來電原因、回應態度評比、與備註(較詳細的紀錄來電原因)。當看到客戶已登出對談系統(下圖 9 圓圈處)，並且您已完成對談紀錄，請按下“儲存對談紀錄資料”(下圖 9 虛線方框)

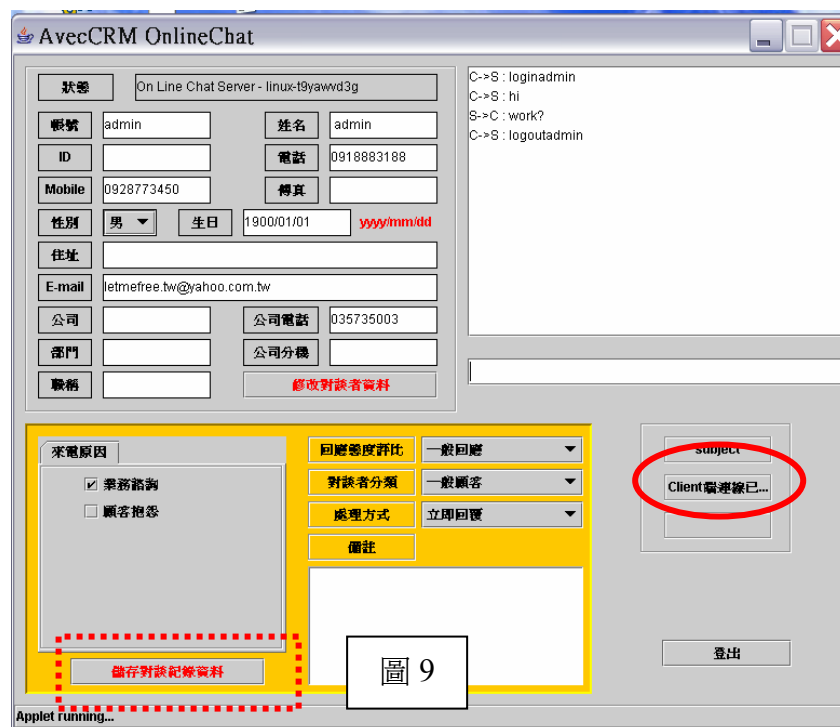


圖 9

當您按下“儲存對談紀錄資料”，介面會出現詢問“是否確定儲存”的對話框(如下圖 10)，請您按下“確定”並結束一次客服流程

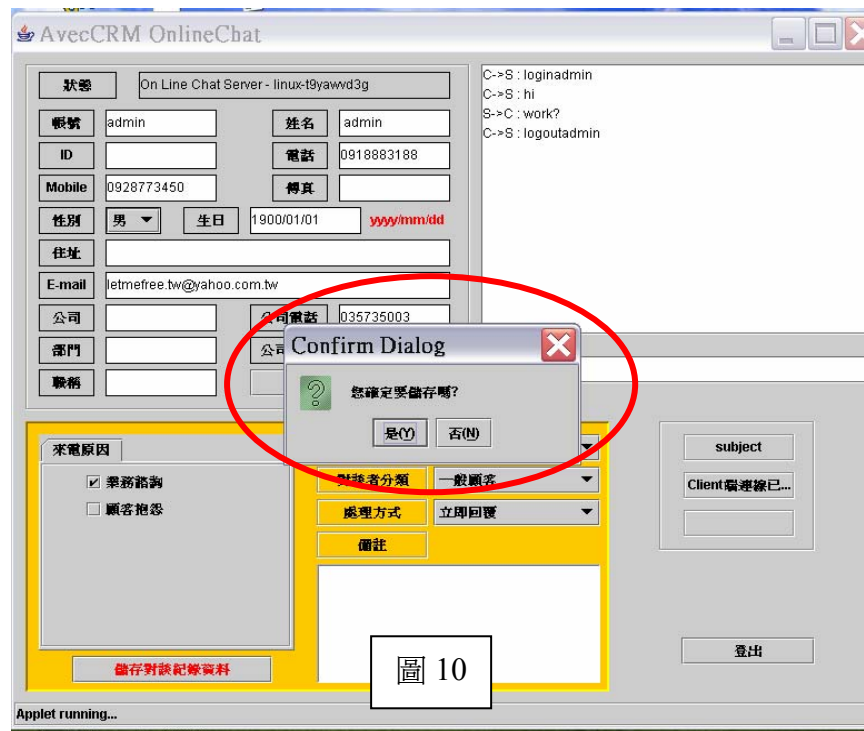
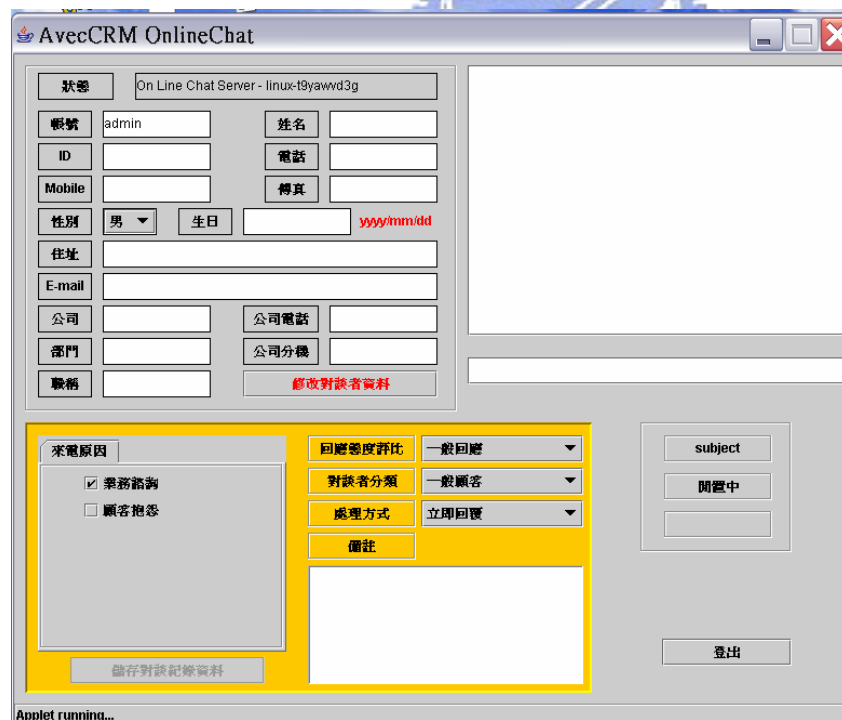


圖 10

最後會回到最初的畫面，並等待下一通線上對談。



請按照以上說明進行試用，如有任何問題請於實驗開始前提出！

實驗情境說明

請假設您是某電信公司客戶中心的服務人員，在此實驗中，您將接到數通由客戶撥打進來的詢問電話，以及經由線上對談系統對公司產品或技術方面的問答。請您根據您印象中客服中心人員應有的態度（如：親切有禮），進行電話接聽與線上對談系統的服務。您所需要的相關資料皆可在此網頁<http://www.tcc.net.tw/main/> 中的客戶服務與優惠活動找到。請您依據您所找到的訊息，將相關資訊提供給您的顧客。另外，由於客服中心作業繁忙，請您在進行客戶服務與編輯客服紀錄的操作速度能精準快速，而這部分也將列入您工作績效的考量。

實驗即將開始，請再次確認您對兩種介面操作工作流程的熟悉度，如有任何問題，請即刻提出！



APPENDIX 2 Customer Service Information for Experiment

實驗用客服資料

1 申辦/退租

申辦門號及促銷專案，需攜帶哪些證件？

辦理申裝業務，請至全省 [服務中心](#)、[特約經銷商](#) 辦理即可。

依電信總局之規範，申請電信服務時(含預付卡)，必須同時出示「**主要證件正本**」及「**第二證件正本**」。

1. 「**主要證件正本**」(例：身分證、駕照、殘障手冊、軍人身分證)
2. 「**第二證件正本**」(例：駕照、殘障手冊、軍人身分證、健保卡、護照)

※未滿 20 歲之申辦用戶，需請「**法定代理人**」同時攜帶「**身分證正本**」及「**第二證件正本**」陪同辦理



如何辦理退租事宜？

需請您攜帶身分證或駕照正本及私章(或本人簽名)，前往直營服務中心辦理即可。(未成年用戶需由法定代理人陪同前往辦理)。

如果要辦理退租，但遺失保證金的收據，該怎麼辦？

您依然可以辦理保證金退費，只要親自到直營服務中心辦理退租時，簽具一份切結書就可以了。

2 帳務問題

『本期應繳』與『本期新增』，我應該繳那一筆？

1. 『本期應繳』為本期加上之前未繳交的帳單總金額
2. 『本期新增』則為本期的帳單金額。

若您已繳清前期的款項，請選擇『本期新增』的金額繳納即可。

可以用別人的信用卡付款嗎？

為確保您個人的權益，目前僅限用戶使用本人名下信用卡繳交個人電信費用；如用戶使用非本人信用卡繳費，並經持卡人或原發卡行舉發，將由用戶本人自負一切法律全責。

目前「欠費停話」中的門號，可以使用「線上繳款」嗎？

可以。欠費停話中的門號，將在您線上繳款後(授權成功)1小時內恢復通話

我不小心重複線上繳款，可以退費嗎？

請您放心，如有重複線上繳款(溢繳款)情形發生，系統將自動於下一期帳單抵扣。

在國外漫遊時，接聽電話須負擔費用嗎？

是的。當您在漫遊國外接聽來電時，已正在使用國外系統業者所提供的轉接服務，所以您必須負擔由「發話者」轉接至漫遊網的國際電話費、漫遊網行動電話費及服務費用。

我已經辦了「自動轉帳代繳」，為什麼還會收到催繳通知？

申請「自動轉帳代繳」約需4到5天作業時間不等，在轉帳代繳未生效前，依然會有欠款的催繳通知，故在「轉帳代繳」尚未生效前，建議您以原方式先行繳納。

3 工程問題

我居住的地方，通訊品質不良怎麼辦？

倘若您遇到通訊品質不理想之情況，非常歡迎您利用網站的「[通訊品質反應區](#)」，提供我們相關資料，我們將立即派遣工程人員前往查測處理

客服人員請紀錄其不良之原因：

通話中斷訊--手機收訊良好 3 格以上，通話突然斷訊

訊號弱—手機訊號 0-2 格之間，因訊號不良導致電話難收撥，通話中容易斷線

通話斷斷續續—手機訊號 0-5 格之間，訊號不穩定

雜訊—通話中聽到其他干擾音

網路壅塞—非特殊節日，於同一地點手機重試多次外撥，皆直接跳回主畫面或顯示網路繁忙

迴音—非位在密閉室內或使用手機皮套，或用免持聽筒等原因而導致迴音的情形

聽不見聲音—通話中聽不到對方聲音

串音—通話中聽到第三者的聲音

手機不通了，該怎麼辦？

請先檢測以下可能導致無法通話的原因：

1. 電源打開後的顯示幕是否正常。
2. 請先檢查電池有沒有電。
3. 請檢查手機天線是否接觸良好。
4. 請檢查手機是否有設定密碼開機。
5. SIM 卡密碼是否輸入正確。
6. 請確認是否因沒繳費而被暫時停話。

若非上述原因，請您攜帶手機至本公司直營門市的維修中心，由維修工程師為您檢測服務。

手機為什麼有不明原因的響聲？

請先檢測以下可能導致的原因：

1. 電源不足之警示音，請檢視螢幕上有無指示低電池(LOW BATT)顯示。
2. 請檢查是否為簡訊服務的提醒聲音。
3. 手機連結上網成功時的提示音。
4. 是否有設定告警時間（例如：鬧鈴、行事曆）。
5. 請您重新開機試試看是否仍有異常聲音的現象。

若非上述原因，請您攜帶手機至本公司直營門市的維修中心，由維修工程師為您檢測服務。

為什麼「簡訊」一直無法傳送出去？

請依下列方式排除此問題：請先在手機的功能目錄中選擇【簡訊】相關功能設定，進入後請尋找目錄中有關於『手機訊息中心號碼』的設定，請您將訊息中心號碼設定為【+886935074443】即可傳送簡訊

4 其他

如何辦理 SIM 卡補發？

若為「月租型」門號，請本人攜帶「身分證」、「印章」至全國各地的直營、特約服務中心辦理(若本人無法親至現場辦理，可請代辦人攜帶「雙方身份證正本」及「印章」前往辦理即可)

若為「預付卡」門號，則需請本人前往直營及特約服務中心辦理；亦可由年滿二十歲代辦人備齊雙方證件協助辦理。



APPENDIX 3 Questions asking Customer Service Agent

1. 請問我要申請貴公司的促銷方案方案需要攜帶什麼證件？

什麼是主要證件 什麼是第二證件

2. 我要換新的門號，請問舊的門號要怎麼辦理退租？

3. 你們的帳單實在很複雜，有『本期應繳』與『本期新增』，我應該繳哪一筆？那我可以用別人的信用卡付款嗎？

4. 你們這些人真是很不可思議，我已經打了5次電話，辦了「自動轉帳代繳」，為什麼還會收到催繳通知？

5. 我現在使用的門號不是登記我本人的名字，我該如何辦理過戶？

6. 我不小心重複線上繳款，可以退費嗎？

7. 為什麼「簡訊」一直無法傳送出去？請問是系統出了什麼問題嗎？

8. 我辦了國際漫遊，在國外接聽電話須負擔費用嗎？那有什麼辦法可以不用付漫遊費呢？什麼市指定轉接？

9. 目前「欠費停話」中的門號，可以使用「線上繳款」嗎？

10. 我的 sim 卡掉了，要如何辦理 SIM 卡補發？

第二部分 線上對談

A. 請根據各問題之描述，填滿最符合您所感覺的程度的空格

1. 請問 <u>線上對談工作</u> 需要耗費您多少心理和知覺上的活動(像是思考、決策、計算、記憶、觀看和搜尋等)?													
少													多
2. 請問 <u>線上對談工作</u> 需要耗費您多少生理上的活動(像是推、拉、扭轉、控制、走動等)?													
少													多
3. 請問 <u>線上對談工作</u> 中，每一通來電的頻率(包含後續處理的程序)給予您的時間壓力是高還是低?													
低													高
4. 請問您認為您有多高的成功機率達到 <u>線上對談工作</u> 的工作目標? 請問您滿意您在此項工作的表現嗎? (請注意! 答項左邊為完美，右邊為失敗)													
好													壞
5. 請問您為了完成 <u>線上對談工作</u> 時做了多少努力(心理和生理方面)?													
少													多
6. 請問您在進行 <u>線上對談工作</u> 時是否有不安全感、沮喪、惱怒、煩躁、壓力和困擾，還是有安全感、滿足、放鬆? (左邊為較少不安全感與挫折)													
少													多

B. 請依據您的感受，圈出下列各組會造成工作壓力比較重要的因素，如：努力 v 表現

挫折感 v 努力	表現 v 挫折感	生理需求 v 挫折感
挫折感 v 心理需求	努力 v 生理需求	生理需求 v 表現
生理需求 v 時間需求	心理需求 v 努力	努力 v 表現
時間需求 v 心理需求	表現 v 時間需求	時間需求 v 努力
心理需求 v 生理需求	表現 v 心理需求	時間需求 v 挫折感

第三部分 綜合反應

請根據您對所操作的界面(非資料查尋介面)的感覺，在下列問題中勾選最符合您感受的選項

1. 在電腦螢幕上的文字	不易閱讀		容易閱讀		
	1	2	3	4	5
2. 使用介面設計有幫助嗎	完全沒有			很有幫助	
	1	2	3	4	5
3. 使用介面顯示的資訊	不適當			適當	
	1	2	3	4	5
4. 使用介面的資訊安排	不合邏輯			合邏輯	
	1	2	3	4	5
5. 介面的順序	令人困惑			清楚	
	1	2	3	4	5
6. 出現在介面中的訊息	不一致			一致	
	1	2	3	4	5
7. 出現在介面中的訊息	令人困惑			清楚	
	1	2	3	4	5

8. 使用者意見

請在以下空白處寫下您對此客服系統的意見

基本資料 是否曾擔任客服人員 是 否

使用電腦情形 每天使用 一週使用 3-4 次

一週使用 1-2 次 不使用電腦

使用網路情形 每天上網

每週上網 3-4 次

每週上網 1-2 次

不上網

謝謝您的合作，實驗到此完成

Experiment Questionnaire (English Version)

According to the experiment you have done just now, please answer following questions intuitively. The result only be used in this research.

Part I Telephone Call

A. According to each description, filled each scale **at the point that best indicates** your experience of the task.

1. How much mental and perceptual activity was required (e.g., thinking, deciding, calculating, remembering, looking, searching, etc.) to complete Phone Call task ?															
Low															High
2. How much physical activity was required (e.g., pushing, pulling, turning, controlling, activating, etc.) to complete Phone Call task ?															
Low															High
3. How much time pressure did you feel due to the rate or pace which the Phone Call task element occurred? Was the pace slow and leisurely or rapid and frantic?															
Low															High
4. How successful do you think you were in accomplishing the goals of the Phone Call task set by yourself? How satisfied were you with your performance in accomplishing these goals? (Notice! Left is perfect, Right is failure.)															
Good															Fail
5. How hard did you have to work (mentally and physically) to accomplish your level of performing the Phone Call task ?															
Low															High
6. How insecure, discouraged, irritated, stressed, and annoyed versus secure, gratified, content, relaxed, and complacent did you feel during Phone Call task ?															
Low															High

B. Circle each the following 15 grids on the scale title that represents the more important contributor to workload for the Telephone Call task. e.g., effort v performance

Frustration v. Effort	Performance v. Frustration	Mental Demand v. Physical Demand
Mental Demand v. Effort	Physical Demand v. Frustration	Performance v. Temporal Demand
Temporal Demand v. Effort	Frustration v. Mental Demand	Temporal Demand v. Mental Demand
Effort v. Performance	Physical Demand v Performance	Physical Demand v. Temporal Demand
Effort v. Physical Demand	Performance v. Mental Demand	Temporal Demand v. Frustration

Part II Online Chat

A. According to each description, filled each scale **at the point that best indicates** your experience of the task.

1. How much mental and perceptual activity was required (e.g., thinking, deciding, calculating, remembering, looking, searching, etc.) to complete Online Chat task ?															
Low															High
2. How much physical activity was required (e.g., pushing, pulling, turning, controlling, activating, etc.) to complete Online Chat task ?															
Low															High
3. How much time pressure did you feel due to the rate or pace which the Online Chat task element occurred? Was the pace slow and leisurely or rapid and frantic?															
Low															High
4. How successful do you think you were in accomplishing the goals of the Online Chat task set by yourself? How satisfied were you with your performance in accomplishing these goals? (Notice! Left is perfect, Right is failure.)															
Good															Fail
5. How hard did you have to work (mentally and physically) to accomplish your level of performing the Online Chat task ?															
Low															High
6. How insecure, discouraged, irritated, stressed, and annoyed versus secure, gratified, content, relaxed, and complacent did you feel during Online Chat task ?															
Low															High

B. Circle each the following 15 grids on the scale title that represents the more important contributor to workload for the Online Chat task. e.g.,

effort v performance

Frustration v. Effort	Performance v. Frustration	Mental Demand v. Physical Demand
Mental Demand v. Effort	Physical Demand v. Frustration	Performance v. Temporal Demand
Temporal Demand v. Effort	Frustration v. Mental Demand	Temporal Demand v. Mental Demand
Effort v. Performance	Physical Demand v Performance	Physical Demand v. Temporal Demand
Effort v. Physical Demand	Performance v. Mental Demand	Temporal Demand v. Frustration

Part III Compositive Question

According to the Contact Center interface you have used (the one on the LCD monitor), please circle the number that most suitable for your feeling.

1. Characters on the monitor	Uneasy to read		Easy to read		
	1	2	3	4	5
2. Design of Interface helpfulness	none		very helpful		
	1	2	3	4	5
3. Information loads shows on the interface	inappropriate		appropriate		
	1	2	3	4	5
4. Information arrangement on the interface	illogical		logical		
	1	2	3	4	5
5. Order of interface	confusing		clear		
	1	2	3	4	5
6. Information shows on the interface	discordance		accordance		
	1	2	3	4	5
7. Information shows on the interface	confusing		clear		
	1	2	3	4	5

8. User opinions

Please write down your suggestions toward the Contact Center System in the blank.

Personal profile

Have you ever been call center agent? Yes No

Computer Using Frequency everyday 3-4times a week
 1-2times a week never

Internet Using Frequency everyday
 3-4times a week
 1-2times a week
 never

Thank you for your attendance.