Research Focused on Communication Design in Technical Support

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Abstract

With the increasing use of network technology in society, there has been a sharp growth in technical support requests from novice users. This paper describes our approach to implement efficient and high-quality user support by understanding the behavioral characteristics of novice users.

1. Current state of technical support

With the expansion of IP (Internet protocol) services on broadband networks and the growing sophistication and complexity of IT (information technology) equipment, users are becoming increasingly likely to run into a growing variety of system problems. When they encounter problems with IT equipment, the way in which they deal with them appears to vary according to their level of technical proficiency. Highly skilled users tend to solve problems themselves by taking suitable steps to isolate the cause of the problem and gathering the information they need to solve it. On the other hand, novices are usually unable to isolate problems satisfactorily and are thus often unable to find a solution by themselves. For such reasons, technical support centers are having to deal with enquiries in significantly greater numbers and are facing the important issue of how to continue providing efficient support while maintaining/improving the quality of support provided to their customers.

1.1 Problem-solving process

The processes involved between the occurrence and resolution of an equipment problem are shown in **Fig. 1**. When an equipment problem occurs, the first steps involve checking the status of the equipment and gathering the necessary information from sources such as manuals and FAQs (frequently asked questions (and answers)). The cause of the problem is then narrowed down to a particular location, and suitable remedial action is taken. If the remedial action is unsuccessful, then other possibilities are investigated by returning to the narrowing-down step. If the remedial action is successful, then the equipment is checked to confirm that it is operating normally, and if it is, the problem is solved. In this sequence, the efficiency with which work is carried out at the support center has a significant bearing on which stage users can reach by their own efforts and on the efficiency with which each stage is handled.

1.2 Behavior of inexperienced users when a problem occurs

When users complain of being unable to connect to the Internet, in most cases the cause is something that can be solved by taking simple steps such as correcting a mistyped ID or password or resetting the modem. When users contact a technical support facility, ones with a high level of technical skill can often partially narrow down the problem beforehand, so the technical support staff only need to deal with the remaining issues. However, inexperienced users generally tend to contact the support center directly without taking any preliminary steps, so the operators must perform every step of the process shown in Fig. 1 regardless of how difficult or easy the problem is. This results in the technical support center spending a long time addressing problems that could be resolved

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by simple measures such as checking an ID/password or resetting the modem.

Inexperienced users contact technical support without taking any prior action partly for physical reasons (e.g., being unable to make sense of the manual or having no manual at all or lacking the tools needed to solve the problem) and partly for psychological reasons (e.g., assuming they are incapable of solving the problem or being afraid or unwilling to tackle the problem). Furthermore, when inexperienced users talk to a support center operator, there are liable to be communication barriers originating from the user's lack of technical knowledge or familiarity with terminology (e.g., inability to describe the status of the equipment accurately or inability to understand the operator's instructions), and this can place a large psychological load on the user.

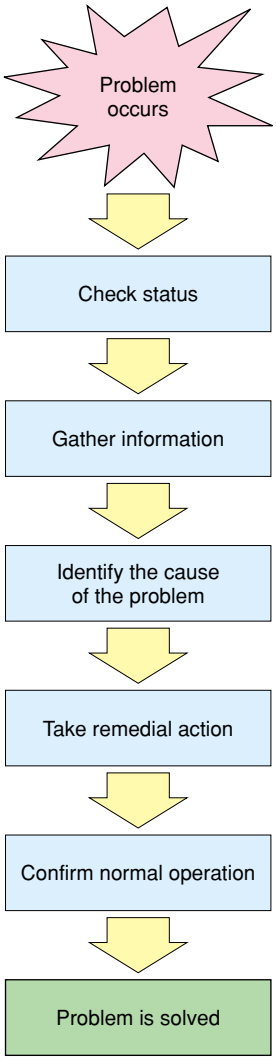

Fig. 1. Processes involved in solving an equipment problem.

2. Communications design in technical support

To improve the efficiency of technical support and provide high-quality support that reduces the psychological load on users, we have studied a communications design that considers both physical and psychological factors. Specifically, we have studied online help systems that make things easy for inexperienced users, and we have researched and developed an educational support system that encourages inexperienced users and a visual support scheme that increases the efficiency of telesupport.

3. Online help to support inexperienced users

3.1 Experiment on behavior of inexperienced users

To investigate why inexperienced users are unable to resolve problems by themselves, we experimentally reproduced situations in which an Internet connection could not be established, and we observed the way in which novices used online (telephone) help to resolve these problems [1]. A graph of the overall success rates for different types of problems is shown in **Fig. 2**. These tests were performed under four sets of conditions comprising combinations of two factors: (1) problems such as user ID input errors (setting errors) or disconnected wires or the like (wiring errors) and (2) whether or not there was a delay (e.g., restarting the system) between the user taking the actions indicated by the online help and the problem being solved.

The point plotted in the top-left corner of Fig. 2 shows that a success rate of 100% was achieved in setting error problems where there was no time delay. These problems were ones that could be solved

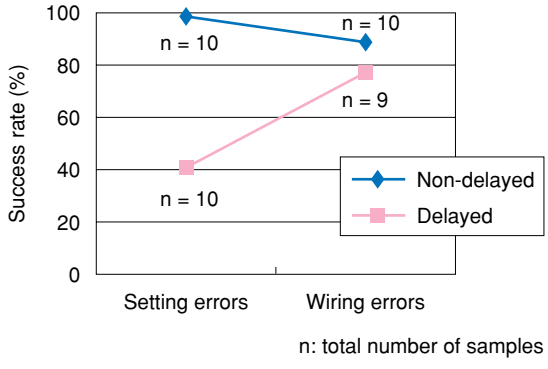

Fig. 2. Success rates achieved with different types of problems.

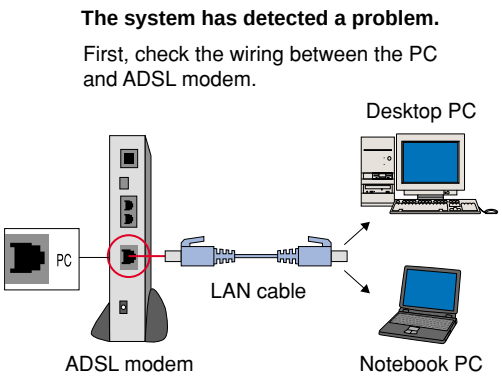

Fig. 3. Example of an explanatory diagram.

straight away simply by pressing a button indicated by the online help. Thus, even novices could easily solve problems of this level by themselves. However, it was not so easy for novices to perform operations such as fixing wiring problems or inputting user information based on their understanding of the contents of the online help. We observed some characteristic problems.

An example of an explanatory diagram used in the online help is shown in **Fig. 3**. Although it tells a user to check the wiring between the ADSL (asynchronous digital subscriber line) modem and the PC (personal computer), we found that some users mistook their splitter (equipment for splitting the voice and data signals) for the ADSL modem and ended up checking the wrong cable. Although the modem and splitter were both white and rectangular in shape, they were different sizes and also had different locations and functions in the system configuration. We also observed errors in which users input an email password instead of an Internet connection authentication password. Another problem was that the help system gave users instructions via a figure in which the connection authentication password part in the user manual was circled in red. However, since the representative password used in this example was almost certainly different from a user's actual password, users were liable to enter the example password instead of their own password. Novices lacking this sort of system understanding characteristically made mistakes involving confusion of superficial descriptions of images and keywords.

3.2 Online help matched to skill levels

Although these tests used simple problems that would have been easy to solve by following the help instructions, mistakes were still observed. Real problems are more complex because they involve various factors such as the user's terminal environment and software environment. Consequently, we think that errors will occur more frequently in practice than in these tests.

To comprehensively resolve these issues, it is necessary for users themselves to have some understanding of the system so that they do not become confused by superficial descriptions. However, novices cannot be expected to buy textbooks or put in hours of study. We are therefore researching and developing an online help system in which additional information in the help system promotes user understanding of the problem-solving process so that inexperienced users gradually deepen their understanding of the system through repeated use of the help system.

4. Educational support to promote a positive attitude to problem-solving

Current technical support systems generally employ methods in which users are entirely guided by the operators and mechanically perform the instructions given by the operators [2]. In other words, the users usually do not gain any understanding of the operations they are performing (e.g., why such operations are necessary). Although this sort of operator-led interaction saves time, it has the drawback of not raising the user's skill, no matter how many times it is repeated.

We have therefore proposed and are studying the concept of "educational support" whereby every effort is made to explain to users why each operation is needed and how it relates to the problem-solving process as a whole, instead of presenting the user with a simple operational procedure for solving the problem. The aim of educational support is to allow users to learn by experience from the problems they are currently encountering. Since users attach great importance to solving their problems, this form of support is characterized by a stronger motivation to learn than curriculum-based learning such as tutorials or "classroom-in-a-box" type products.

On the other hand, when users are unable to solve problems by themselves, the cause is not just a matter of them having insufficient knowledge and skills to tackle the problem, but also includes psychological fears and aversions such as an unwillingness to touch anything in case it breaks. And there are probably some users that assume the problems are too difficult for them to even think about fixing and who never go near a computer manual. In educational support, we aim to deepen the user's understanding of topics such

as the workings of the Internet based on the problems that the user is actually experiencing right now, thereby eliminating the above-mentioned negative feelings while helping users feel more involved with the online world. In this way we hope to resolve users' uncertainties about recognizing the significance of the actions they are currently performing and increase their eagerness to tackle problems by themselves.

Ways of putting educational support into practice include methods in which the significance of each remedial measure is explained while the support center operator is solving the problem (simultaneous commentary) and methods in which a summarized explanation is given after the problem has been solved (subsequent commentary). Both methods have benefits and drawbacks, but we have found experimentally that subsequent commentary tended to be preferable to simultaneous commentary, especially when the user had a low level of computer skill. The main reason for this seems to be that novices have enough trouble performing the problem-solving actions and do not have time to listen to technical explanations at the same time. Furthermore, when subsequent commentary is provided, the same information can be represented using various means and methods, such as a verbal description or an illustrated text document. We are designing such forms of educational support and experimentally evaluating their effectiveness. We are also performing studies on putting this knowledge to practical use.

5. Visual support for improving the efficiency of telesupport

It has been found that when inexperienced users talk to a technical support center over the telephone, they find it difficult to accurately tell the operator, using words alone, how the problem occurred and what sort of environment the equipment is operating in. Novice users also find it difficult to accurately understand and act on technical instructions provided by an operator over the telephone. Consequently, when there is a substantial gap between the level of technical knowledge and vocabulary between parties involved (e.g., between an inexperienced user and a technical support operator), the effectiveness of telesupport can be impaired because mutual understanding often cannot be reached smoothly through communication using a single information channel such as a telephone. To break through this barrier, we are conducting fundamental studies into visual support techniques that introduce video into telesupport for inexperienced users. Although visual support could be provided via a cellular phone with a videophone function, in this experiment we prepared online video to provide higher resolution [3]. The graph in **Fig. 4** shows the results of psychological tests conducted to determine how the time taken by inexperienced users to perform tasks differs between cases where telesupport is provided by telephone only (Audio-G (audio group)) and where the support is provided by the telephone and online video (Video-G (video group)). The vertical axis shows the average task execution time, and the horizontal axis shows the type of task being performed. As this figure shows, the use of video resulted in a (statistically significant) reduction in the time taken to perform problem-solving tasks and operation confirmation tasks.

The graph in **Fig. 5** shows how many utterances were made by the test subjects in these experimental

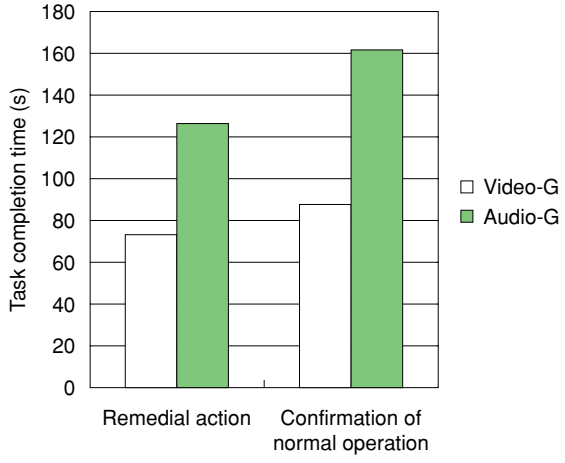

Fig. 4. Average task completion time.

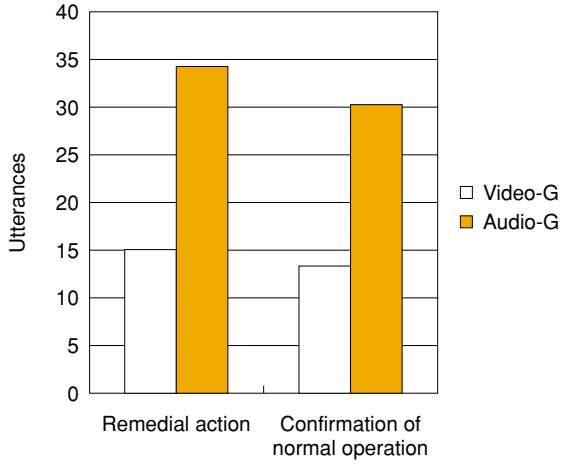

Fig. 5. Average number of utterances.

tasks. The number of utterances made by the operator is not included in the figure. The vertical axis shows the number of times the test subjects spoke during each task, and the horizontal axis shows the type of task being performed. As this figure shows, the use of video resulted in a (statistically significant) reduction in the number of times the test subjects spoke while performing problem-solving tasks and operation confirmation tasks. This suggests that communication through video can compensate for the lack of knowledge and terminology that characterizes inexperienced users and can improve the efficiency of the telephone conversation while alleviating the stress that the test subjects feel about speaking (when words do not come out as expected). We have thus found that the use of video communication in technical support aimed at novices can achieve efficient communication with a low psychological load.

6. Future prospects

To implement efficient, high-quality user support, the most important thing is to understand the characteristics of user behavior. In the future, to implement efficient support that provides a high level of customer satisfaction, we will continue our efforts to clarify the behavioral characteristics of users during telesupport and use this knowledge to facilitate the work of support centers.

References

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