Universal Design Report:
Development of A New Cordless Phone (KX-TG2386)

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INTRODUCTION

Nowadays, “Universal Design” is a key word for all developers that respond to customers. The word symmetrical to “Universal Design” is “Accessibility”. These words are essentially same, but “Accessibility” is the demand of users for product design, and “Universal Design” is one solution by manufacturers. We now realize that accessibility should not only consider disabled people, but also consider the needs of elderly people.

Advanced countries all over the world are facing the graying of society. The aged society is defined by the percentage of elderly people. We use 7% as the threshold. In Japan, the percentage of elderly people was over 7% in 1970 and it has kept on increasing. The percentage rises to over 23% now. Sooner or later, all countries will become aged societies.

As our main market is America, we researched the social graying situation in America. Between the end of World War II and 1964, 78 million baby boomers were born and now are part of the "Boomers" generation. Boomers are now entering middle age and changing the demographics of the total population. Four out of ten head of households are between ages 35 to 54 and the numbers of household heads ages 45 to 54 has increased 20 percent from year 1995 to year 2000. Now, every 6 seconds a Baby boomer turns 50 years old. In America, the percentage of elderly people is expected to exceed 12% by 2010.

PRODUCT

Purpose of Development

As a manufacturer of telephones that must be used for daily communication by everyone, we have to respond to accessibility demands and create really accessible products. In the past, “Accessible” products were designed specially for disabled people. Almost always, these products are lumbering and shaped ruggedly. These products considered only

functionality. These products did not care about the daily life of the product user. We think these products are not true Universal Design.

On the other hand, people who need accessible products are not only disabled people, but also elderly people. Traditionally, almost all accessible products improved accessibility by adjusting the shape and size of things. “Big Button” Telephone is a typical example. The traditional design of accessible products makes elderly people feel uncomfortable to use such products. We believe true Universal Design must be stylish, looking like normal products as possible.

Traditionally, we have stressed functionality by the shape and size of things. This is one factor. We now wish to consider more strongly two other factors: (a) Value-added features (such as Text To Speech and Amplified Handset volume), and (b) appearance. We believe that Universal Design must achieve a balance of these three factors. Our new telephone is our first attempt at this.

Research

In order to develop accessible products as never before, we need to find a completely new way. We have started to study a new kind of cordless phone that will satisfy the desires of people who really need accessible products. We researched the Internet, Magazines and many other channels. We considered products other than telephones because we believe that many accessibility features are common to all category products. Finally, we found three key words for all accessible products. Here are the three key words:

1. Visibility font size, font type, printing contrast

2. Audibility sound clarity, sound volume

3. Operationality button size, button position, configuration process

The above factors are general demands from all people. On the other hand, we should consider the distinctive demands of disabled people. In terms of our findings, we found that blind people need voice guidance and sound indication. And hearing-impaired people need visual information (such as “Flashing LED” to indicate an incoming call).

Development

To begin with, we made an internal commitment to develop a strongly accessibility-conscious product --- just for internal analysis. We had meetings to discuss

and decide the specification of our accessibility product that will be the new Universal Design product based on the research mentioned above. In the process of development, we need to consider the final cost to the customer. If the product is expensive, the customer will be displeased. So we considered how to maximize our in-house technology to develop Universal Design products at reasonable cost.

Finally, we decided to adopt eleven accessible features.

1. Amplified Volume Handset

Handset receiver volume can be adjusted up to 117 dB. See Figure 1. We added a circuit that amplifies the receiver volume and changed the receiver to a superior type. This feature is friendly to hearing-impaired people. Vertical line is handset receiver output level (dB), and horizontal axis is telephone line input level. Handset volume is set at maximum. This figure shows that output volume depends on the input level. If the input level gets bigger and bigger, the output level converges. But when the line input level is low, the KX-TG2386 has amplified volume level. Also, the user can set the handset receiver volume by volume key while in conversation. The volume level will return to default level because the amplified volume may irritate the user.

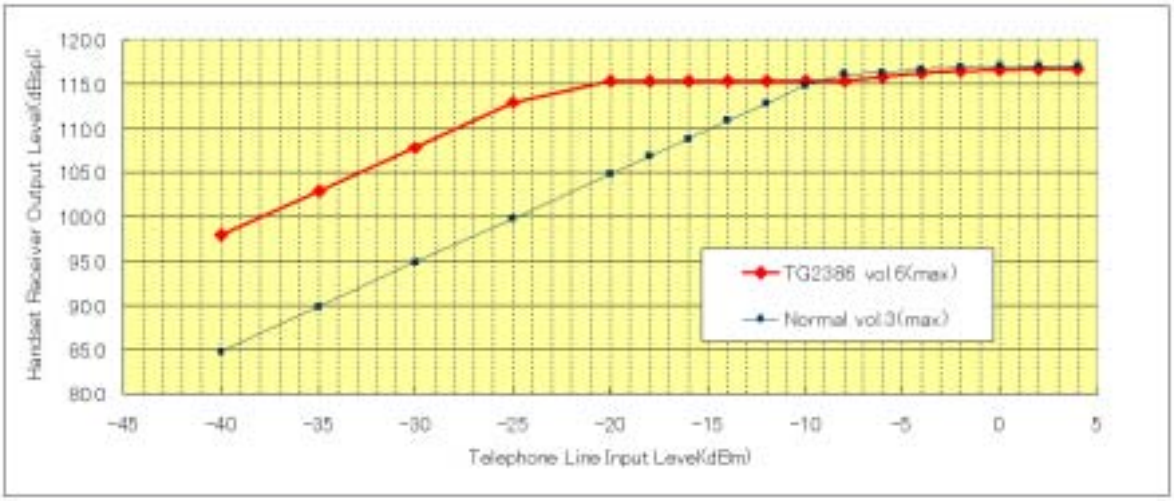

Figure 1. Receiver Volume, receiver output vs. line input

2. Talking Caller ID

Using TTS (Text To Speech) technology, this phone announces the caller's name when a call arrives. This is good for visually impaired persons and useful for normal

persons too. There is no need to go to the telephone. You can hear it anywhere in a room.

3. Talking Phone Book

Using TTS technology, this phone announces the name or phone number stored in its phone book when user scrolls the phone book data. If the name is stored, this phone will announce the name, and if the stored data is a phone number only, this phone will announce the phone number. This feature is good for visually impaired persons.

4. Talking Caller ID List

Using TTS technology, this phone announces Caller ID log when the user reviews it. This feature also is good for visually impaired persons.

5. Talking Key Pad

This feature provides audio confirmation for dial keypad pressing. On the base unit and Handset, this phone will say the number that the user presses. This feature will help visually impaired persons. Additionally, we have provided a nib on the “5” key as a tactile indicator.

6. Voice Enhancer

On normal telephone lines, audio signal bandwidth is limited. Humans can hear from 20 Hz to roughly 20,000 Hz. And human speech ranges from 100Hz to about 8,000Hz. But the telephone line passes only 300Hz ~ 3500Hz. Because of this limited bandwidth, voice over regular phone lines sounds hollow. Using our digital signal processing technology, this telephone model can recover the vanished bandwidth signals. See Figure 2.

(a) Human voice before transmission over the phone line.
(b) Human voice on the Telephone Line. The human voice has been diminished, from 100Hz-8000Hz to 300Hz-3500Hz.
(c) Human voice extracted by Voice Enhancer Technology. Upper band (from 3,500Hz to 6,000Hz) is recovered. This sounds much more like natural speech.

Regardless of age, any human can better understand speech if the full human voice bandwidth is provided.

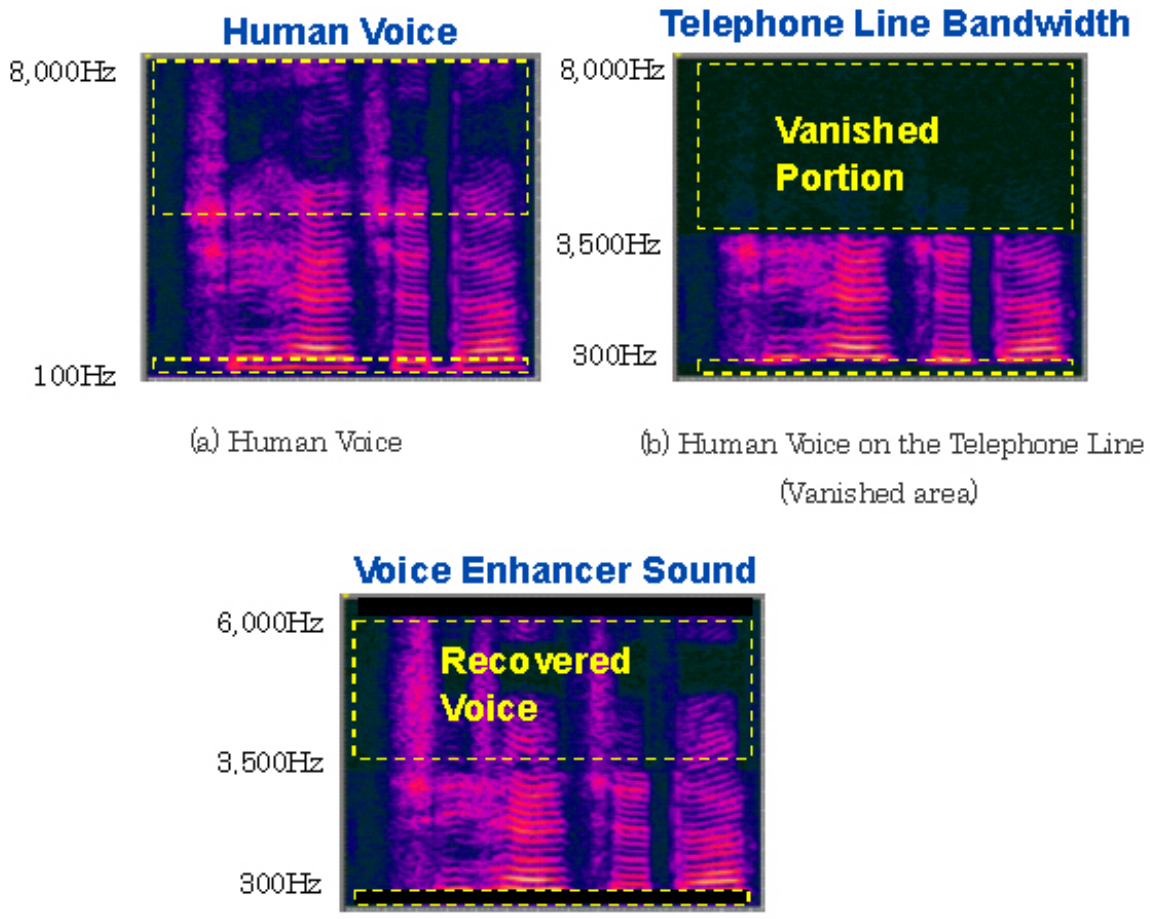

Figure 2. Voice Enhancer

7. Light-up Antenna with Ringer/Message Alert

To indicate incoming calls and message waiting, the tip of the antenna flashes rapidly to indicate an incoming call and flashes slowly to let the user know that the user has a new message recorded on the answering system. We concluded that the antenna tip is the best position to alert users, because the user can see antenna tip from all directions (360 degrees).

8. Slow Talk Message Playback

For easier comprehension of recorded messages, this phone can slow down the message playback speed by 30% without degrading the sound quality. From our experience, the number of errors made in transcribing information from recorded messages is reduced when the playback is slower.

9. Larger fonts and better contrast of printed characters

We used larger characters on the cabinet, handset, and buttons. To improve the contrast, we use black-color components and metallic-gold-color printing that will not spoil the design but make the telephone appear more high quality. Also, we investigated what would be the most effective font. As our conclusion, we used the StoneSans Semibold font instead of the Helvetica 55 Roman font that we normally use. The following Figures are Normal View and Cataract View. See Figure 3 and Figure 4. The normal view is what a normal person would see. The cataract view is what a person with cataracts might see.

(a) Normal model (b) KX-TG2386

Figure 3. Dial keypad (Normal View)

(a) Normal model (b) KX-TG2386

Figure 4. Dial keypad (Cataract View)

10. Hearing Aid Noise Reduction

Our digital cordless phones use TDD (Time Division Duplex) technology at the RF (Radio Frequency) Unit. The RF Unit affects T-Coil Hearing Aids and will cause noise in some hearing aids. Using original Panasonic technology, we were able to substantially reduce this noise.

11. Shoulder Rest

Shoulder Rest is an attachment that is designed to fit between the cheek and shoulder. For normal people, this attachment is only a shoulder rest. But this attachment is useful for physically disabled people who cannot easily hold a handset.

However, this shoulder rest can be used in another way. Because the backside of the shoulder rest is flat, the user can rest the handset on a flat surface. This allows the user to press the keypad easily – he does not have to hold the handset. Without this attachment, it is very hard to use the keypad because the back of the handset is curved. The handset would not be stable for dialing. See Figure 5.

(a) Face up view (b) Side view

Figure 5. Shoulder Rest

Assessment

Of course we are always uncertain whether the market will accept our product, as we have never introduced into the market this kind of new design. To get a better understanding of market needs, we have asked for third-party evaluation. IVR (Interactive Voice Response) Accessibility Forum is an industry forum that we belong to. One member firm of this forum has been auditing our telephone products since 2000. By this annual audit, we can improve product accessibility year by year. This audit is based on the FCC (Federal Communications Commission) Section 255. FCC is a regulatory agency of the United States government. For more information about FCC Section 255, please see the Panasonic USA Web site (http://www.panasonic.com/accessibility/fcc255.html).

The following is a subsection of this website.

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Section 255 of the Telecommunications Act of 1996 requires telecommunications products and services to be accessible to people with disabilities to the extent that it is readily achievable. Panasonic has taken steps to ensure that our telecommunications products are designed, developed, and fabricated to be accessible to and usable by people with disabilities. These steps include employing Universal Design Principles and including people with disabilities in product tests. (The rest is omitted.)

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Based on these annual audits, we constantly make improvements to our telephone products. From the accessibility point of view, we are making steady progress.

Unfortunately, at the time of this writing, we have not received the results of the audit for this telephone model. But, we are going to keep on requesting audits of our products and we will exploit them so that our Universal Design products get better and better.

CONCLUSION

The KX-TG2386 is a new product in our strategy to make telephones that are far more attractive to users from the accessibility point of view. In order to get feed back information from users, we ship product with a questionnaire. We have to listen to the voice of our users to confirm whether our concept, Universal Design, an attempt to balance smart style with accessibility, is a good idea. This model is the first step of in the long process to realize Universal Design. There is much room for improvement. We shall keep on studying the market situation and the market demand for products with enhanced accessibility.