Global or regional HFT standardization: That is the Question 3/2

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Abstract

The increased complexity of telecommunication calls for increased professional attention to human factors telecom standards - notwithstanding the, also increased, world-wide competition. The modern, multi-functional cell phone has become the battleground for this competition. Since the interval between new cell phones for the average user now is measured in months, not years, every new phone presents the challenge of discovering anew how to use even the most useful and common features. This is an opportunity for standardization. Standardized operating procedures, and perhaps standard labels, can help users find and operate the most widespread and useful features when they start out with a new cell phone.

The global forum for establishing telecommunications standardization is the ITU-T. Presently, the human factors oriented standardization work of ITU-T is concentrated in one of the so-called Questions of ITU-T Study Group 2, Question 3/2: "Human factors related issues for improvement of the quality of life through international telecommunications". This paper includes two examples of studies undertaken by the predecessors of Question 3/2 to find and validate standard solutions: for new symbols, and for tactile identifiers on ID-1 cards.

Key words: telecom standards, telecom symbols, human factors, tactile identifiers for cards

1. Introduction

'Technical' standards, that for example specify measures of parts that need to fit together, exist since at least the times of the old Egyptian culture; such standards are directed at the **possibility to use** the artefacts made from these parts. 'Human factors standards' were created much later; they aim to ensure **ease of use** of the products or systems concerned. In the area of telecommunication we also know technical as well as human factors standards; this paper mainly deals with the latter.

As to the 'geographical extension' of such standards, the world knows national, regional and global telecommunication standards. For instance, in Japan the CIAJ, Communication and Information Network Association of Japan, has created Japanese telecommunication standards; in Europe, ETSI, the European Telecommunication Standards Institute provides European ("regional") Norms and Technical Standards, ETSI Standards, Guides and Technical Reports; and ITU-T, the International Telecommunication Union – Telecommunication Standardization Sector, makes Recommendations that have a global validity. ETSI, with its 'home base' here in Sophia Antipolis, has a well-organized Technical

Committee Human Factors, TC HF, that is active in standardization concerning human factors issues in telecommunication. Presently, the human factors oriented standardization work of ITU-T is concentrated in one of the so-called Questions of ITU-T Study Group 2: "Operational aspects of service provision, networks and performance", Question 3/2: "Human factors related issues for improvement of the quality of life through international telecommunications".

ETSI TC HF created, for example, standards on the use of characters on the telephone keypad, and a generic spoken command vocabulary – for use in Europe, i.e., for European languages and characters. In the modern world, with its ever expanding global trade and communication, it would seem useful to have world-wide agreement on such matters, to be achieved through agreements, and possibly experiments, in other continents than Europe. However, this can only be accomplished if a sufficient number of people participate in the human factors oriented standardization work of ITU-T; and this is a delicate issue.

2. Modern Telecommunications

2.1 Increased complexity

The increased complexity of telecommunication calls for increased professional attention to human factors telecom standards - notwithstanding the, also increased, world-wide competition. When work began on human factors standards in the ITU, telecommunications services were much simpler than today. In the earliest work, there was emphasis on finding ways to overcome difficulties encountered by subscribers trying to dial their own international calls, without the intervention of an operator. Other efforts were aimed at international travelers, for instance, helping them find and operate public payphones. Today the simple telephone call has not been replaced but supplemented by a host of new communications services, including voicemail, short message service (SMS), email, instant messaging and the like. Public payphones are declining in importance as people travel internationally with their cell phones. These cell phones are modern marvels. They offer not only phone calls, but a host of other features and services including some that are essentially unrelated to communications. These include voice control of stored personal directories, digital cameras, electronic games, text messaging services, information services via a built-in internet browser, and (who knows) next year maybe a pencil sharpener. The contrast between the modern cell phone and the simple telephone of the mid twentieth century could scarcely be overstated.

2.2 Competition

Another important trend in telecommunications has been the spread of competition to all parts of the industry. Fifty years ago, telephone services were provided, like postal services, directly by the national government or by pervasively regulated private monopolies. Today we witness both the advantages and drawbacks of vigorous competition. It is a fair guess that the multitude of features in those little cell phones is a product of competition among vendors to attract customers.

2.3 Opportunities for standardization

All that complexity in a small package leads inevitably to human interface design challenges. How is the user interface designer to make all of those features easy to use and understandable? It is well known that adding features to a product may risk making existing features harder to understand and use. At some level of complexity, some features may suffer disuse because the user is unable, or lacks sufficient patience, to discover how to make use of them. This point has surely been reached with some modern cell phones. The rapid pace of change in the cell phone industry magnifies this problem. The interval between new cell phones for the average user is measured in months, not years, and every new phone presents the challenge of discovering anew how to use even the most useful and common features.

This is an opportunity for standardization. Standardized operating procedures, and perhaps standard labels, can help users find and operate the most widespread and useful features when they start out with a new cell phone. There may, however, be industry resistance to standards in this area. The user interface has been seen as an area in which a competitive advantage can be attained. Good user interface design should attract customers. Standards in this area must be voluntary in today's competitive environment and can be successful only if the main cell phone makers help to develop them. They should at first be developed in a voluntary forum (for instance, ISO, perhaps ITU) where vendor participation is routine.

2.4 Where to start?

Experience in the development of international human factors standards suggests an important role for empirical studies. International studies can both guide the direction of standardization and ensure that the resulting standards are appropriate despite differences in language, culture and traditions. The ITU-T work on international direct dialling began with surveys in various countries aimed at identifying difficulties that subscribers experienced in dialling their own international calls. That step could be repeated now with cell phones. A survey, conducted in as many different countries as possible, could be used to identify what cell phone features are going unused, despite their perceived usefulness, because they are too difficult to find or operate. Such a survey could be followed by a series of focused studies of potential design solutions to particular difficulties. Indeed, the balance of this paper includes examples of the use of such studies to find and validate standard solutions.

3. Design, evaluation and selection of nine new symbols to be standardized

3.1 Overview

At the January-February 2001 meeting of ITU-T Study Group 2, Q.4/2, the immediate predecessor of the present Q.3/2, considered a proposal from Japan to standardize symbols for 13 telecommunications functions. It was decided to follow the procedure outlined in ITU-T Recommendation F.910 for testing such symbols to determine their suitability for the envisaged purpose. A total of 17 symbols were tested, the 13 originally proposed by Japan plus 4 others subsequently submitted for two of the functions. Not all of the symbols scored satisfactorily, i.e., were easy to understand as representing the intended function, easy to remember and unlikely to be confused with other symbols from the test - or indeed, other, already existing symbols. In fact nine new symbols were judged as having passed the test, and were added to ITU-T Recommendation E.121: "Pictograms, symbols and icons to assist users of the telephone service".

3.2 Methodology

The test consisted of three parts. In part 1, the participants were given, one at a time, descriptions of the 13 functions. For each function, they were asked to select the symbol from a sheet of alternatives that they felt best represented the function. The sheet of alternatives contained 17 symbols. These comprised the 13 symbols originally proposed by Japan, plus 4 others subsequently submitted as alternative designs. These 4 included 3 alternatives for the function 'cancel number notification' and 1 alternative for the function 'hooking'. This part of the test was intended to determine whether these symbols naturally suggested the function they were designed to represent.

In part 2 of the test, the participants were shown which symbols were intended to represent each function, and were asked several questions about each of the symbols. These questions were meant to determine whether any of these symbols were already familiar, and whether the participants felt they would be easy to remember and use. This part of the test also served to provide the participants a chance to learn the meaning of each of the symbols.

In part 3 of the test, the participants were shown each of the 17 symbols, one at a time, and asked to identify the function each was intended to represent. The definitions of all 13 functions were available on a separate sheet of paper. This part of the test required the participants to associate the symbol with its meaning in much the same way they would do in use, when confronted for example with a piece of telecommunications equipment using these symbols as labels. It therefore provided a test of how easy these symbols are to learn and use.

A total of 85 participants, 17 in each of five countries, completed the test. The five countries were: Germany, Japan, The Netherlands, Norway and USA, thus representing three continents. Each participant completed all three parts of the test. The order of presentation of symbols and descriptions varied from one participant to the next to avoid bias.

3.3 Results

The results of this study comprise a number of different types of information for each symbol and function. A key measure is the percent of the participants who chose each symbol as the best for representing the function (part 1 of the test), the percent who correctly identified the meaning of the symbol (part 3 of the test), and the averages of the responses to the subjective questions of part 2. Also interesting is the identity of the other symbols that were confused with the given symbol in parts 1 and 3. These results, then, provide at least some information about each of the questions one might ask about the suitability of a symbol for a particular function, namely whether it will be easily recognized and understood in the presence of other symbols with which it might be confused, whether it will be easily remembered, and whether it seems suitable to users.

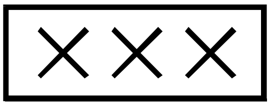
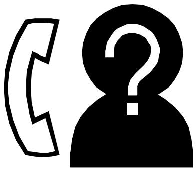
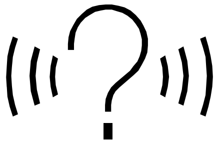
In part 2, the participants responded yes or no to the first question, and rated the other four questions on a 5-point scale. For questions 2, 3 and 4, the scale ranged from 1=very difficult to 5=very easy. For question 5, the scale ranged from 1=very unlikely to 5=very likely. The specific questions were:

1. Have you seen this symbol, or one very much like it, before participating in this experiment?
2. Do you think the symbol's meaning is easy to understand?
3. Do you think that the <u>appearance</u> of this symbol will be easy to remember?
4. Do you think that the <u>meaning</u> of this symbol will be easy to remember?
5. Do you think it is likely that you will confuse this symbol with others you have seen in this session?

For questions 2 through 5 a Mean Opinion Score was calculated for each symbol by averaging the (numerical) ratings provided by the participants. These Mean Opinion Scores provide information on the subjective reaction of the participants to the symbols, as distinct from the more objective performance measures from the other parts of the study.

Space does not permit a full display of the results of these tests here. It is sufficient for present purposes to give an example of the results for just one of the symbols. In this study, symbols were designated by numbers (1 through 17) and the functions by letters (A through M). Below are the results for the function B, “cancel number notification.” This function was defined as “On telecommunications equipment, to identify the control and the indication that the sender prevents the receiver from displaying the sender’s number.” This function proved a difficult concept to convey graphically. A total of four different symbols (shown below) were proposed to represent this function.

Table 1. Test results for function B, "Cancel number notification".

Symbol 2	**Symbol 15**	**Symbol 8**	**Symbol 9**
			
Percent of participants who chose symbol for this function in part 1			
38%	20%	21%	9%
Percent of participants who correctly identified the function of symbol in part 3			
72%	85%	83%	63%
Other functions associated with symbol by at least 3 participants (number of participants)			
D (10), K, L, E, (3 each)	C (4), L (4)	C, J, L, (3 each)	F (12), H (9), D (3), L (3)

Other symbols chosen for this function by at least 3 participants	none

Part 2 results					
Symbol	Ques. 1: Have you seen it before? (% yes)	Ques. 2: Easy to understand? (5=very easy)	Ques. 3: Appearance easy to remember? (5=very easy)	Ques. 4: Meaning easy to remember? (5=very easy)	Ques. 5: Likely to confuse this symbols with others in this test? (5=very likely)
2	15%	3.1	3.7	3.3	2.3
15	8%	2.9	3.4	3.1	3.4
8	5%	2.9	3.4	3.2	3.4
9	6%	2.6	3.4	2.8	3.0

Results like these led the originators of this work to agree to add nine of the symbols to Rec. E.121. The full results of this study are described in Wattenbarger (2002).

4. Tactile identifiers for use with telecommunication and other cards

4.1 Introduction

Machine readable ID-1 cards, MRCs, can be observed regularly to give positioning problems to their users – generally being the owners of these MRCs – up to the present day, regardless of the quality of these owners' eyesight. It is clear that the problems are much larger for visually impaired users; they must have some help for orienting their MRCs. A tactile identifier for recognition of a card's position is an obvious candidate for providing such help and had indeed already been put in production in some places when a group of researchers from Norway published, first to ETSI TC HF and half a year later to ITU-T's Q.18/1, the results of a study on user testing of tactile identifiers on ID-1 cards.

4.2 Two user tests of tactile identifiers on ID-1 cards

This study (Balfour, A., Helmersen, P. and Nordby, K., 1993), comprised of two tests, the first done by 75, the second by 92 subjects. Of the 92 subjects from the second test 17 were blind and 33 partially sighted. The other 42 subjects included both older and young people, and some with mental retardation.

Test 1 consisted of re-stacking two stacks of 20 ordinary, graphically marked ID-1 cards that were randomly oriented. The cards in one of the stacks were not only graphically marked, but also had a tactile mark, a cut-off corner. The cards in the first stack had to be re-ordered by the subjects as fast as possible by orienting their graphical markings the same way; the cards in the second stack had to be re-ordered by placing their 'missing corners' on top of each other. In addition to their re-ordering task subjects were asked for their preference, for cards with or without tactile identifier.

The results of Test 1 showed that a tactile marker significantly aided *all* subjects in orienting the cards, in terms of time needed and errors made. Moreover, *all* subjects preferred the cards with tactile marks for orienting. Not surprisingly, 15 of the 17 blind, i.e., visually strongly impaired, subjects could not orientate the stack of cards without tactile marking (their data were not included in the results). However, they could all completely orientate the stack of cards with tactile markings.

The study then continued with Test 2, to investigate type, place and size of the tactile identifier on an ID-1 card. Seven different tactile identifiers were used, and stacks of 20 white cards with each of the seven identifiers were made. Each stack was first randomly oriented and then had to be ordered by the subjects, by placing the tactile markings in the cards on top of each other. Speed and errors were measured, and the subjects were asked to rank the seven types in terms of their preference for them. Although the cut-off corner (the "Italian phone card") turned out to be best for tactile orientation, it could not be recommended because of technical reasons. The same held for two other investigated types: a hole in the card and an embossed Braille arrow on it. The remaining four types all were arc-shaped notches, of differing size, in the short or long edges of the cards. When comparing the results for these four types, they clearly show that the more prominent the tactile marker is, the better. Hence the recommendation that came out of Test 2: use a notch of 2.0 mm deep to help orientate the card. This can be done without compromising technical properties such as optical memory capacity too much.

4.3 Other arguments and applications

In the mid-nineties of the last century an effort began to achieve one single standard for tactile identifiers on ID-1 cards, for applications in telecommunications as well as banking cards to operate Automatic Teller Machines, ATMs. However, the card readers used in ATMs depended on precisely checking the width of the banking cards, along their long sides, so that these sides in the case of banking cards could not be 'damaged' by a 2 mm notch. Unfortunately, the one card possessing a 2 mm notch that was used in Test 2 happened to have this notch on one of its **long** sides. As such this seemed advantageous, since the notch then could impossibly damage one of the ends of the magnetic stripe that was running over the whole length of these cards.

In order to check whether such a 2 mm deep notch could also be put on one of the **short** sides of a card without compromising its tactile identification properties, specially manufactured cards with their 2.00 mm "ETSI notch" on the long side were compared, by 13 blind and partially sighted subjects, with similar cards, but with their 2.00 mm, proposed "CEN notch" on one of the short sides (CEN/TC 224/WG 6 Doc. N 195, by T. Cloke). The comparison consisted of a similar card stack re-orientation process as in the earlier described Tests 1 and 2. It turned out that performance was practically as good for both types of notches, and that the subjects' preference for the long or short side depended on the imagined direction that the card would have to be inserted: if the card needed to be inserted short side first 77 % of the participants would prefer the notch on the trailing short edge – and if it needed to be inserted long side first 54 % would prefer the notch on the trailing long edge. The notch should always be on the trailing edge, therefore, understandably.

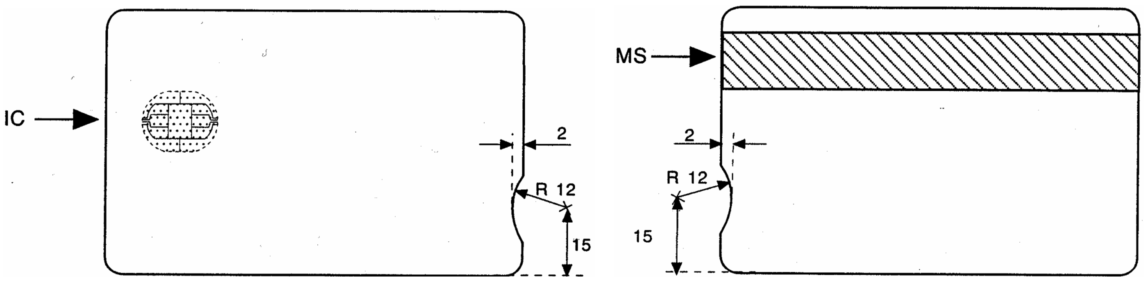


Figure 1. Position and geometry of tactile identifier for ID-1 cards: left, front side; right, rear side. IC = integrated circuit, MS = magnetic stripe.

This evaluation led to the recommendation to put a 2.00 mm deep arc-shaped notch on the short side of an ID-1 card, if this could be inserted 'short side first' into the card reader. Because this did not seem objectionable, and to prevent conflicting standards on tactile identifiers, both ETSI and ITU-T agreed on this location originally proposed by CEN. It is shown in Figure 1.

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