DRAFT INTERNATIONAL STANDARD

ISO/DIS 24620-3

ISO/TC **37**/SC **4**

Secretariat: **KATS**

Voting begins on:
2020-04-03

Voting terminates on:
2020-06-26

Language resource management — Controlled human communication (CHC) —

Part 3:
Basic principles and methodology for controlled oral communication (COralCom)

Gestion des ressources linguistiques — Communication humaine contrôlée (CHC) —

Partie 3: Principes de base et méthodologie de la communication orale contrôlée (COralCom)

ICS: 01.140.20

This document is circulated as received from the committee secretariat.

Reference number
ISO/DIS 24620-3:2020(E)

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 37, *Language and terminology*, Subcommittee SC 4, *Language resource management*.

ISO 24620 consists of the following parts, under the general title *Language resource management — Controlled human communication (CHC)*:

— *Part 1: Basic concepts and principles*

— *Part 2: Basic principles and methodology for controlled written communication (CWC)*

— *Part 3: Basic principles and methodology for controlled oral communication (COralCom)*

Overview

The standard proposed provides basic principles and a methodology to establish a normative specification for designing and constructing a formally defined, or controlled, system of oral communication that avoids or filters out phonetic interferences (for more information see informative Annex H) and confusions between words of the same language and between languages.

The basic acoustic processes involved in speech production are the generation of sound sources and the filtering of these sources by the vocal tract. The sources are generated by the modulation of airflow through narrow constrictions produced at the larynx or in the vocal tract above the larynx, airflow that is usually the result of action of the respiratory system. The filtering of the sources is controlled by manipulating the shape of the vocal tract airway above the larynx, including the opening between the oral portion of the vocal tract and the nasal cavity. The acoustic properties of the sources and of the filtering of these sources can be varied by manipulating a number of different articulatory parameters relating to the laryngeal configuration, the positions and shapes of the lips, the tongue blade, the tongue body and other structures, and the stiffness of particular structures. Some of these manipulations lead to relative stable acoustic properties that are perceptually distinctive. These particular manipulations play a role in the selection of inventories of sounds consisting of discrete units such as features, segments, and words in terms of which language is structured (see Reference [19] in the Bibliography).

Sounds of languages are described as sets of phonemes (see also Reference [28] in the Bibliography). All phonemes can be distinguished by at least one (acoustic or articulatory) feature. Every language takes a limited number of articulatory/acoustic features from a virtually unlimited number of possibilities. For most known languages the inventory contains thirteen to seventy-five phonemes (see also Reference [21] in the Bibliography). The phonetic characteristics of individual members of the inventory are, as a rule, given through matrices showing articulatory or acoustic features. A universal phonemic inventory has been provided (see Reference [22] and [24] in the Bibliography). A phoneme system is the overall pattern of characteristics and relationships of the phonemes in the phonemic inventory of a given language. The phonological characteristics of the phonemes and their allophones are described by articulatory or acoustic features, the interrelationships between phonemes through oppositions. For a discussion between the importance of acoustics vs articulatory features, a formant chart of the vowels of standard French and the neutrality of distinctive features between production and perception with an illustration (see Reference [23] in the Bibliography).

Human beings recognise in their own language a phoneme and its variants which allows them to understand a word. In phonetics sound variants that belong to one and the same phoneme are called allophones which are based on their distribution and their phonetic similarity. A phonetic relationship in complementary distribution is, as a rule, a criterion for considering two sound variants as belonging to one and the same phoneme.

Considering that there are norms in languages, or that a language is a system of norms, of audible signs formed by the human organs and serving the purpose of communication, theses norms can fulfil their task of serving communication only if both speaker and hearer relate to them within the same speech community. They are valid for the formation as well as for the perception of those signs.

The phonological system of a language is like a sieve through which everything that is said passes. Each person acquires the system of their mother tongue. But when they hear another language spoken, they intuitively use the familiar 'phonological sieve' of their mother tongue to analyse what has been said. However, since this sieve is not suited for the foreign language, numerous mistakes and misinterpretations are typically the result. The sounds of the foreign language receive an incorrect phonological interpretation since they are strained through the 'phonological sieve' of one's own mother tongue (see Reference [20] in the Bibliography). Speakers and hearers are concerned by this 'phonological sieve'.

Nevertheless, this document deals with and only with oral communication between native speakers, or non-native speakers, or a native speaker and a non-native speaker who can be disturbed due to different phenomena such as phoneme confusion, phonetic interferences and confusions between words (for example: homophony, quasi-homophony or co-articulation (see informative Annex I)) of the same language and/or different languages and the resulting ambiguities due, for example, to multilingual communication or situations of stress. The present document deals with speakers and listeners without speech or hearing impediments (see also Reference [18] in the Bibliography), and does not include sign languages which have a phonological system equivalent to the system of sounds in spoken languages (see Reference [25] in the Bibliography).

Many specialists (with PhDs) have been involved in the material in this document, these from different domains (linguists, otorhinolaryngologists who are physicians specialised in ENT (ear, nose and throat) medicine, phoneticians, orthophonists, physicists, computer scientists, and specialists in speech and signal processing). Tests have been undertaken, for example, with air pilots of diverse nationalities, in the maritime and telecommunication domains, and also in university classes (Bachelors, Masters and European Erasmus Mundus Masters Course).

Introduction

No human is expected to master and speak several languages with the same level of competence as his/her own mother tongue. Faced with rapidly increasing multilingual situations, misunderstandings and confusion arise in daily communications, very often causing accidents and casualties. Industry and other business sectors as well as different domains dealing with safety critical applications such as emergency services (police, fire, ambulance, maritime, etc.) require a precise and concise language to supplement the common use of natural human languages. Uncontrolled, these languages would allow non-parallel and non-comparable grammatical constructions, possessing inherent semantic ambiguities of variously phonetic, phonological, morphological, lexical or syntactic types.

Human communication is primarily oral, making use of the spoken medium of language.

Oral communication between native speakers, or non-native speakers, or a native speaker and a non-native speaker can be disturbed due to different phenomena such as phoneme confusion and the ambiguities resulting due, for example, to multilingual communication or situations of stress. For an early study focussing on perceptual confusion among some consonants (see Reference [13] in the Bibliography) and also, concerning sources of variability in consonant perception, for a more recent study (see Reference [14] in the Bibliography). For a study and system on interferences in the domain of aeronautics and others (see Reference [8] and Reference [9] in the Bibliography).

However, whatever the disturbance is, the impaired communication results in confusion between distinctive phonetic features, phonemes and words including the problem of co-articulation. For early studies in the domain where phoneme confusion and interferences, and archiphonemes (see informative Annex J), norms, variants and common properties of all variants, distribution of variants as a norm as well as distinctive features of a phoneme are presented and detailed (see Reference [15], Reference [16] and Reference [17] in the Bibliography).

The present document deals with confusion and variable pronunciation or interpretation of distinctive phonetic features (including accents, stresses, and tones or lengths) and phonemes, but also homophones, homographs, and quasi-homophones and quasi-homographs.

The standard proposed provides basic principles and a methodology to establish a normative specification for designing and constructing a formally defined, or controlled, system of oral communication that avoids or filters out phonetic interferences and confusions between words of the same language and between languages. The system is both abstracted from and contextually situated in the domains of industry, business or other technologies.

This particular International Standard is the third part in a planned series of International Standards on CL, the introductory part being ISO/TS 24620-1:2015 Language resource management -- Controlled natural language (CNL) -- Part 1: Basic concepts and principles

Language resource management – Controlled human communication (CHC) - Part 3: Basic principles and methodology for Controlled oral communication (COralCom)

1 Scope

This document specifies the basic principles and the methodology to be used for the design and construction of a controlled oral communication system that avoids or filters out phonetic interferences and confusions between words of the same language and between languages.

The applications are essentially for safety critical applications using human oral communication. This document is also applicable to other domains involving, for example, training and evaluation procedures.

2 Normative references

ISO/TS 24620-1:2015 *Language resource management -- Controlled natural language (CNL) -- Part 1: Basic concepts and principles*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
controlled language
CL
system that limits language, written or spoken, to a set number of core vocabulary words, and usually, a set of writing guidelines for grammar and style

3.2
distinctive feature
class of phonetically defined components of phonemes that function to distinguish meaning

Note 1 to entry: In contrast to redundant features, distinctive features constitute relevant phonological features

3.3
assimilation
articulatory adaptation of one sound to a nearby sound within a word or at the junction between words with regard to one or more features

3.4
phoneme
smallest recognizable unit of speech in a given natural language

[SOURCE: ISO 8253-3:2012, 3.6]

3.5
homophone
one of two or more words that are pronounced the same but differ in meaning, origin, and sometimes spelling

[SOURCE: ISO 19104:2016, 4.15]

3.6
phoneme confusion
confusion due to a phoneme approximately or incorrectly pronounced, and interpreted as another phoneme according to the mother tongue of the receptor

Note 1 to entry: Phonemes could also exist in one language and not in other languages.

Note 2 to entry: Phonemes could be also pronounced (spoken, emitted) with multiple accentuations and listened to by receptors (listeners) not necessarily receptive to the same phonetic and phonological systems.

3.7
quasi-homophones
words which differ by one or two phonemes

Note 1 to entry: There could be one phoneme more or less in one of the two quasi-homophones (e.g.: *aft-after*), one different phoneme (e.g.: *check-deck*, *feed-feet*), or 2 different phonemes (e.g.: *flap-slat*).

3.8
paronym
word for which the writing or pronunciation is very close to another word but which has a different lexical meaning

3.9
interference
influence of one linguistic system on another in either (a) the individual speaker or (b) the speech community

[SOURCE: Routledge Dictionary of Language and Linguistics, Hadumod Bussmann, 1996, p. 235]

3.10
synonym
one of a set of different terms that refer to the same entity

[SOURCE: ISO/IEC 2382:2015, 21215233]

4 Motivation for controlled human communication

Globalisation, with the suppression of national borders and the pervasion of modern technology, necessitates that languages in the widest sense (including dialects) cohabit in everyday usage. Certain domains and especially those which are safety critical need to block interferences between languages. Consider for example the situation where an air pilot listens to the co-pilot who reads out loud to him/her instructions which enable him/her to react to a problem during a flight. If the pilot's mother tongue is different from the co-pilot's, and as well as this, the messages are in American English, one can well appreciate the complexity of the problem. Confusions due to misunderstanding can at first sight seem anodyne; however, as history shows, they have been at the origin of serious accidents.

The 1977 Tenerife air catastrophe is a convincing example of interference. The Dutch pilot of an aircraft, in declaring “we are at take-off”, because he made reference to a similar structure in Dutch he believed that he was indicating that he was about to take off, while in fact he was only indicating that he was ready to take off. He thus then incorrectly interpreted the control tower air traffic controller's approval as an authorisation for take-off. 583 persons lost their lives.

A few years later in 1983, after the crash of an aircraft, the black box revealed the last words of the Chinese co-pilot: “What does 'pull-up' mean?”

Examples of phonetic confusion which are of interest for the controlled oral communication system:

(1) from ATC (a) to pilot (b):

(a) “Pass to the *left* of the tower”. (b) “Pass to the *west* of the tower”.

The confusion was due to the fact that *west* and *left* meant two different sides of the tower.

(2) to a Thai pilot:

“descend to flight level two nine zero”. The pilot read back: “descend to flight level two five zero”.

In this situation the controlled language indicates that the digit *niner* replaces *nine* which has not been done here and led to a confusion with *five.*

To avoid these sorts of problems, industry uses controlled languages (see definition in Subclause 3.1).

Different domains are interested in controlled languages such as aircraft, meteorology, emergency services (police, fire, ambulance, maritime, etc.), etc. (see Figure 1, and for more information see also informative Annex D).

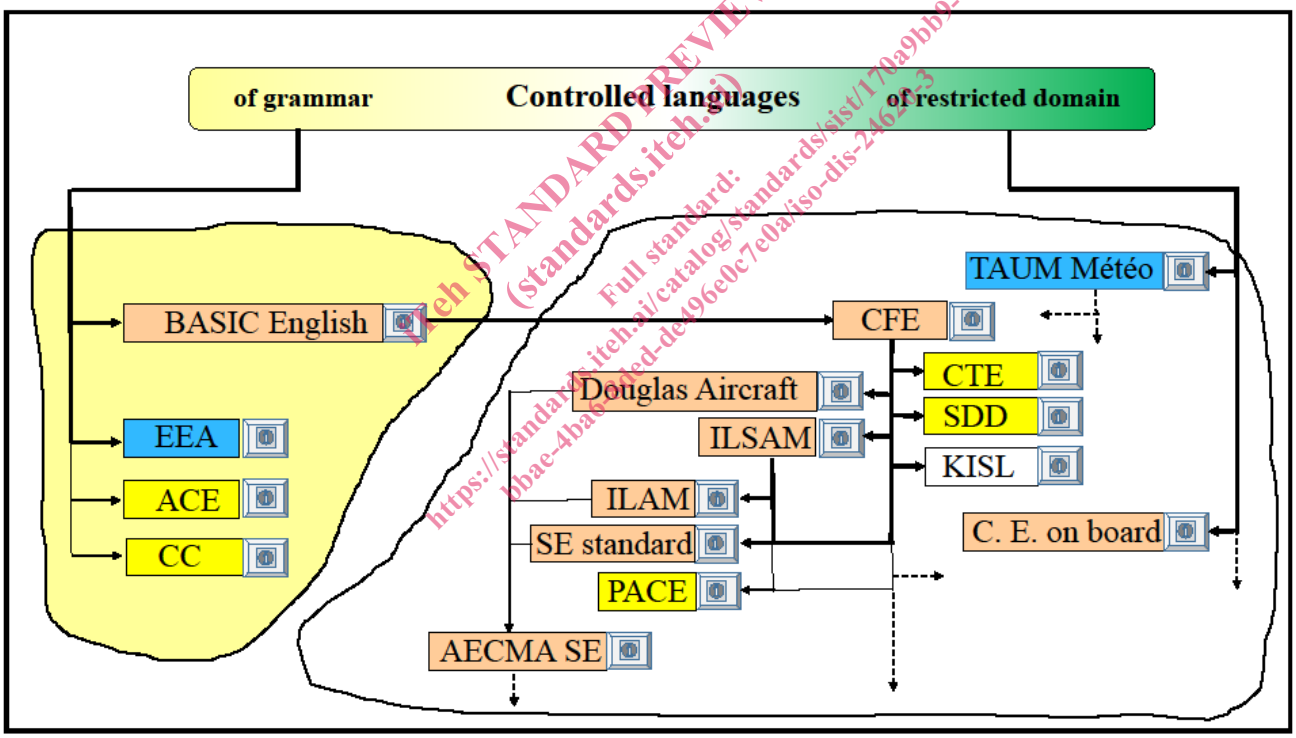

Figure 1 — Controlled languages (see Reference [1] in the Bibliography)

Controlled languages (CLs) are of vital interest (for safety and economic reasons, etc.) for industry. Indeed, they have been created in order to resolve:

– problems of readability
(CLs reduce the complexity of syntactic structures of a text in order to increase its readability),

– problems of comprehensibility
(CLs do not accept lexical ambiguities; they thus increase the comprehensibility of a text) and

– problems of translatability
(their syntactic and semantic control facilitates the shift between two languages).