

PAS 901:2025

Vocal accessibility in system design – Code of practice



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Foreword

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This PAS draws heavily on PD ISO/IEC Guide 71 and BS ISO/IEC 29138-1, both of which are publicly available free of charge, and PD IEC/TR 63481 Ed.1 PW TR 100-41¹⁾.

¹⁾ Currently in development

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Users may substitute any of the recommendations in this PAS with practices of equivalent or better outcome. Any user claiming compliance with this PAS is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

The provisions of this document are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the *Shorter Oxford English Dictionary* is used (e.g. "organization" rather than "organisation").

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0 Introduction

This PAS presents a modern way for producers of products, services and systems to approach accessibility and record accessibility of products, services or systems with a focus on vocal accessibility.

Vocal accessibility is becoming increasingly important as technology becomes ever more capable in automatic processing of vocal input, and as interacting with products vocally, both controlling a product and consuming vocal responses, becomes more common.

While the potential scope for services and products interacting vocally is enormous, vocal delivery can receive inadequate attention when being commissioned and at the service specification/implementation level. Vocal services have at times been seen as an alternative, possibly cheaper option, to visual and other modalities, and been designed as an afterthought, adaptation or alternative. However, vocal content can stand alone as a genre, with its own alternative modalities.

It is becoming increasingly common for people to interact vocally with devices and services across many areas of life, such as interacting with home control services (for example, switching on lights, locking doors or controlling a heating system), using an app to navigate an unknown city on foot or conversing across different languages using a live translation app. Voice interaction with such systems is improving all the time but is not without challenges. Environmental noise, dialects, multiple embedded spoken languages, speech that may be considered to be impaired or unusual all present challenges for a system to understand spoken input and for a person to be understood. The impacts of these challenges are particularly severe for people whose access needs exclude them from most or all other mechanisms to interact with a system.

Vocal and related auditory modalities have at times been viewed as adaptations of content for users with particular needs (for example, when screen-readers render written text vocally for vision-impaired users). However, there are many contexts in which written text cannot be properly consumed by people who are not vision-impaired (for example, when operating potentially-dangerous machinery). It is advantageous in such contexts to be able to render text vocally, but addressing vocal content solely as an alternative to visual text can miss its many advantages and overlook many users, needs and delivery contexts. Adoption of this PAS is expected to improve the accessibility of services and products for all people, including many disabled users in many contexts, for which it can often be critical, but it is not limited to disabled users and this PAS does not categorize people.

Addressing accessibility from the outset of a project and maintaining an accessibility perspective throughout production and maintenance as a product is revised has many advantages for producers, including expanding the market reach of a product in national and international markets and in many jurisdictions that require products be accessible to the widest range of users. It can improve customer satisfaction and the relationship with customers and where required to do this it is cheaper to do so from the beginning and throughout than to retro-fit it after the product has been designed. Doing so results in improved product design, and experience shows that customers appreciate this.

All users have needs which:

- vary over time and according to the context for the user at the time; and
- can be complex, and many different needs can occur together²⁾.

²⁾ A user might simultaneously have several needs of a product and those needs sometimes conflict, which is a reason to give users the facility to select the modalities delivered so that they can select what works optimally for them. Additionally, one user's needs might conflict with another user's needs, meaning that it can be close to impossible to deliver a system that is optimal for every user unless customization of what is delivered to each user is provided – doing so is called personalization or individualization.

For these reasons, it is vital that systems, content or products support interaction with as wide a range of needs as possible³⁾. The modern system will work with multi-modal content and deliver content, operation and interaction adapted to a user's needs or preferences in particular contexts rather than a one-size-fits-all experience.

This PAS combines design guidelines focussed mainly on vocal accessibility written for this PAS with a goals and user needs approach to documenting accessibility of products, services and systems building on BS ISO/IEC 29138-1:2018. The design guidelines are illustrated with examples taken from the user needs but this intertwining is a partial mapping. Not all user needs relating to each specific guideline are referenced. User needs relating to language and vocality augmenting BS ISO/IEC 29138-1:2018 have been identified and listed separately. Additionally, the PAS includes an exemplar (see Annex A) demonstrating how the user needs for accessibility might be used to document the accessibility that will be implemented for one example product, for its use in one context, by one typical company, and provides some guidelines for procurement.

In detail, this PAS provides:

- general design guidelines for vocal accessibility illustrated with user needs;
- a process for documenting which user accessibility needs a product, system or service addresses or will address, including an exemplar showing what needs one company intends to meet for one product in one context;
- additional user accessibility needs to improve the accessibility of product design where vocal accessibility is involved; and
- practices for the use of accessibility goals and user accessibility needs in commissioning/ procurement of products, systems or services.

Whilst this PAS is aimed to be used in the development of new products or services, there would be considerable benefit in applying its recommendations to existing products or services, either retrospectively or at maintenance.

³⁾ This is usually by provision of multiple modalities of consumption or being able to interact with the product or system using differing modalities of operation.

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1 Scope

This PAS provides recommendations for the design of products and services to be vocally accessible to people with diverse needs and abilities, including those who:

- a) consume and control vocal content and content bundled with vocal content;
- b) interact with devices and services by voice;
- c) seek information by voice; and/or
- d) any combination(s) of a) to c).

It covers the use and fairness of diverse languages and dialects. This PAS gives recommendations for systems that deliver media or offer control mechanisms that can involve diverse modalities which include vocal.

This PAS gives recommendations for:

- 1) how vocal accessibility is addressed when a voice-related service is designed or delivered;
- 2) mitigation measures to prevent societal exclusion potentially arising from limitations of voice recognition services; and
- 3) addressing the challenges for individuals with “non-standard” voices, impaired speech and different accents, as well as non-native language speakers.

This PAS also gives recommendations for the documentation of user needs for accessibility, particularly but not exclusively related to vocality, addressed by a product, service or system or required by a commissioning or procurement process.

The position this PAS takes is that many systems need to handle multimodality, by conversion or translation from one modality to another or by selection of modality, in order to deliver an optimal personalized experience to each individual user.

***NOTE** By taking a user needs approach, this PAS provides both a general approach supporting needs that are often not met optimally by systems, products and services, and also indirectly provides critical support for a wide range of disabilities, including visual, auditory, physical, speech, cognitive, language, learning, and neurological, as well as support for individuals with changing abilities due to aging or other causes.*

This PAS does not cover:

- i) systems with no potential for delivering vocal content or control (e.g. medical devices supporting vision improvement);

***NOTE** Many of the provisions might be used for such systems though.*

- ii) technical aspects of voice recording and/or speech capture;
- iii) data standards for the storage and transmission of speech; or
- iv) spoken languages that do not have a written or symbolic physical representation.

v) This PAS is intended for:

- product or service designers;
- commissioners of products, services, systems or environments⁴⁾;
- implementors of vocal systems, including interface designers;
- management and policy implementers;
- event designers and organizers; and
- organizations that:
 - supply and maintain voice-activated services;
 - design and manufacture voice-related technology, including software;
 - provide voice-activated services or who take content from voice-operated services; and
 - specialize in design and usability of services.

While this PAS is not intended to cover the use of sound other than vocal sound, there are needs that apply both to vocal environments and other sound environments, and there is a degree of overlap.

The PAS might also be of interest to:

- consumer groups;
- accessibility and disability advocacy groups; and
- organizations and academics with expertise in inclusive design.

⁴⁾ “Environments” include terminals inside buildings and rooms; factors such as temperature, exposure to chemical solvents; physical aspects such as whether a room can be navigated to and is accessible to wheelchairs and the furniture works for wheelchairs; and external factors such as weather, traffic and routes. This is further detailed in BS ISO/IEC 29138-1:2018 with the needs listed under goal 4 Approachability.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document⁵⁾. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

PD ISO/IEC Guide 71:2014, *Guide for addressing accessibility in standards*, available as CEN-CENELEC GUIDE 6 Edition 2, 2014-12 – *Guide for addressing accessibility in standards*⁶⁾

BS ISO/IEC 29138-1:2018, *Information technology – User interface accessibility – Part 1: User accessibility needs*⁷⁾

BS ISO/IEC 30071:2019, *Information technology – Development of user interface accessibility – Part 1: Code of practice for creating accessible ICT products and services*

⁵⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

⁶⁾ PD ISO/IEC Guide 71:2014 and CEN-CENELEC GUIDE 6 have identical content. CEN-CENELEC Guide 6 is available free of charge at <https://www.cencenelec.eu/media/Guides/CEN-CLC/cenclcguid6.pdf>

⁷⁾ BS ISO/IEC 29138-1:2018 is freely available at https://standards.iso.org/ittf/PubliclyAvailableStandards/c071953_ISO_IEC_29138_1_2018.zip

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

3.1.1 accessibility

extent to which products, systems, services, environments and facilities can be used by people from a population with the widest range of user needs, characteristics and capabilities to achieve identified goals in identified contexts of use

NOTE Context of use includes direct use or use supported by assistive technologies.

[SOURCE: BS EN ISO 9241-112:2017, 3.15]

3.1.2 accessibility goal

policy goal to which an organization subscribes for a specific product, system, service or event with the purpose of making that item accessible to people with diverse needs and abilities in the context of use for which the product, system or service is intended

3.1.3 audio description

audiovisual content described in an audio modality

NOTE The term can also be used to describe locations, directions and objects, as well as sounds not easily identified or coming from an unknown source or location.

[SOURCE: PD ISO/IEC TS 20071-25:2017, 3.2.3]

3.1.4 context of use

physical and social environments in which a system is used, including users, tasks, equipment and materials

[SOURCE: PD ISO/IEC Guide 71:2014, 2.1]

NOTE 1 This PAS uses context, context of use and environment interchangeably.

NOTE 2 Outside of this PAS, this term is used in two different ways:

- a) by a producer in identifying the contexts for which a product is designed to be operated; and*
- b) by a user in specifying the context they are actually in and in which user needs apply.*

In this PAS the term refers to the context of use of a product as defined by the product producer. However, the use of a user needs approach can bridge the gap between these two perspectives and the degree to which the perspectives match can determine whether a system is usable at all to every person in a specified environment or the degree to which it is usable.

3.1.5 disability

obstacle to the use of a product, service or system experienced because of a mismatch between the needs of a user and the product, service or system in the context in which a person wishes to use it

NOTE 1 A disability might be permanent, temporary or changing and might not be visible or apparent to an observer (for example, a hearing impairment or cognitive disability). Different disabilities might occur together and disabilities are experienced by a user as unmet needs in a context.

NOTE 2 Many communities describe a disability as being a physical or cognitive impairment.

3.1.6 electrolarynx

handheld, battery-operated device used by individuals who have lost their voice box, typically due to laryngectomy, producing vibrations that the user shapes into speech using their mouth and tongue

NOTE The device is placed against the neck or can have an oral tube for intraoral use. Although it generates a mechanical sounding voice, it significantly aids in communication for those unable to speak otherwise.

[SOURCE: PD ISO/IEC Guide 71:2014, 2.1]

3.1.7 impaired speech

condition where an individual has difficulty producing speech sounds, affecting their ability to communicate

NOTE This can include articulation disorders, fluency disorders like stuttering, and voice disorders.

3.1.8 inclusive design

design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible without the need for special adaptation or specialized design

[SOURCE: BS 7000-6:2005, 3.11]

3.1.9 media

electronic or physical means by which information is conveyed

3.1.10 modality

one or more modes of interaction referring to the human senses

NOTE 1 The three modalities most commonly used in information and communication technology are visual, auditory and tactile/haptic. Emerging modalities include gesture, body movement, facial expression and movement. Other modes of interaction that could be considered to be modalities in some contexts include eye tracking.

NOTE 2 Modalities are used in interactions between users (3.1.17) and systems (3.1.15).

NOTE 3 The term is often confusingly used to indicate a delivery format such as captions (text for visual) for which there is no agreed term.

[SOURCE: BS EN ISO 9241-112:2017, 3.11]

3.1.11 persona

model of a user with defined characteristics, based on research

NOTE This can also be referred to as "tailored personality".

[SOURCE: BS ISO/IEC/IEEE 26515:2018, 3.12]

3.1.12 speech disfluency

interruption in the flow of spoken language

NOTE These interruptions can include stuttering, hesitations, fillers like "um" or "uh," repeated words or sounds, false starts, and prolongations. Disfluencies are common and occur in everyday speech, often increasing under stress or fatigue. While normal disfluencies are part of typical speech development, especially in children, excessive disfluencies can indicate a speech disorder like stuttering.

3.1.13 usability

extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use

[SOURCE: BS EN ISO 9241-11:2018, 3.1.1, modified – Notes 1 and 2 removed]

3.1.14 user

individual who accesses or interacts with a system

[SOURCE: PD ISO/IEC Guide 71:2014, 2.2]

3.1.15 user need

prerequisite identified as necessary for a user, or a set of users, to achieve an intended outcome, implied or stated within a specific context of use

EXAMPLE 1 A presenter (user) needs to know how much time is left (prerequisite) in order to complete the presentation in time (intended outcome) during a presentation with a fixed time limit (context of use).

EXAMPLE 2 An account manager (user) needs to know the number of invoices received and their amounts (prerequisite) in order to complete the daily accounting log (intended outcome) as part of monitoring the cash flow (context of use).

NOTE 1 A user need is independent of any proposed solution for that need.

NOTE 2 User needs are identified based on various approaches, including interviews with users, observations, surveys, evaluations and expert analysis.

NOTE 3 User needs often represent gaps (or discrepancies) between what should be and what is.

NOTE 4 User needs are transformed into user requirements by taking into account the context of use, user priorities, trade-offs with other system requirements and constraints.

[SOURCE: ISO/IEC 25064:2013, 4.19]

3.1.16 user accessibility need

user need related to features or attributes that are necessary for a system to be accessible

NOTE 1 User accessibility needs vary over time and across contexts of use.

[SOURCE: PD ISO/IEC Guide 71:2014, 2.4]

NOTE 2 User accessibility needs are transformed into user requirements considering the context of use, user priorities, trade-offs with other system requirements and constraints.

[SOURCE: BS ISO/IEC 29138-1:2018, 3.10]

3.1.17 vocal

linguistic sound produced by a human or a machine-generated system usually for aural consumption but can be converted to other forms

NOTE Machine-generated speech includes, for example, speech generated by an electrolarynx, which is a device implanted in the throat of persons whose larynx has been medically removed that enables speech to be generated and other mechanical voice generators.

3.2 Abbreviated terms

For the purposes of this PAS, the following abbreviations apply.

API Application Programming Interface

TR Technical Report

WCAG Web content accessibility guidelines

4 Goals and user accessibility needs approach

COMMENTARY ON CLAUSE 4

Further guidance on how to use goals and accessibility needs to record the accessibility properties of a product, system or service, as recommended by this clause, are given in Annex A. This annex gives guidance on how to use a goals and user needs approach to describe accessibility properties of systems, products and environments and includes such a statement for one product for one context from a typical company showing how to do it.

4.1 Accessibility properties statement

At product conception and throughout the product life cycle, a goal and user accessibility needs approach should be adopted to inform the development of a product, system or service.

An accessibility properties statement should be prepared by:

- a) identifying and describing in detail each context in which the product, system or service will or might be used;
- b) preparing an accessibility goals statement (see 4.2) and an accessibility needs statement (see 4.3);
- c) identifying context, indicating for each goal and need whether the product does or is to meet that need in the use of the product; and
- d) documenting whether the product meets or can meet each goal and need and, if not, provide a simple rationale for this.

4.2 Accessibility goals statement

Decisions should be taken about whether the product, service or system meets, or is intended to meet, each of the accessibility goals set out in PD ISO/IEC Guide 71:2014 as augmented by additional goal "12. Language and Vocality" in Annex C. This should be at product or system specification, during design, and afterwards in product evaluation.

In particular, at the beginning of any project, decisions should be taken as to the applicability and level of importance of each goal, taking account of the intended contexts of use for the product or system.

NOTE 1 *For example, a product intended for use by a single user in a single context (bespoke design) might not need to take account of suitability for the widest range of users; a product designed only to be used inside a moving vehicle might not need to be designed to be used in the open air; educational content designed to be delivered across the internet to a specific pupil age-range might treat suitability for the widest range of users as applying only within the age range for which the product is designed. All of the goals are relevant to some users in some contexts and for most systems all of the goals apply in some way.*

The relevance and importance of each goal should be documented in a form throughout the project. In particular, circumstances where the goal is not considered relevant by the producer should be recorded, with reasons given for this decision.

NOTE 2 *The goals can provide a means to evaluate the success or otherwise of system, product or service design in terms of the experiences of users with it. While the goals are a useful conceptual and design consideration guide, they are also a route to user accessibility needs. This can provide detailed guidance relating to how accessibility is implemented in a system.*

NOTE 3 *When considering if and how a product meets a specific accessibility goal, the aim is to achieve effectiveness, efficiency and satisfaction for each user. This might not always be possible.*

4.3 User accessibility needs statement

The user accessibility needs set out in BS ISO/IEC 29138-1:2018, as augmented by the needs described under “12. Language and Vocality” in Annex B, should be reviewed during the whole of a product or service life cycle, i.e. at each stage of development, including development of initial product or system requirements, during development and during post-launch maintenance.

A decision should be taken as to the applicability and level of importance of each accessibility need, taking account of the intended contexts of use for the product or system. This should involve consulting and addressing aspects as laid out in the description, instances and examples for that particular need, in the contexts in which the product, system or service is intended to be used. This process should be documented in a way that is transparent within and outside of the organization⁸⁾.

The relevance and importance of each accessibility need should be documented in an accessibility log (see 4.6) throughout the project. A rationale should be provided for any product that does not meet a particular need.

NOTE 1 An example of a completed accessibility needs statement for a product is given in Annex A.

The use of user needs for accessibility does not remove the need to follow other standards, such as W3C Accessibility Guidelines, but should rather provide an overarching framework to making a product or service accessible⁹⁾. When implementing a need in a particular context, any other standards that apply to that context and that jurisdiction should also be followed to address the need in that context. When designing an accessible website the recommendations in the WCAG 2.2 AA accessibility standard [1] should be followed; for example, when designing for a context involving building access appropriate building standards where applicable should be met.

NOTE 2 Attention is drawn to the statutory guidance on access to and use of buildings [2].

4.4 Practices for procurement

Organizations requesting a supply of products, systems or services should ask tendering organizations to supply accessibility goals and user accessibility needs statements that the supplied goods meet in accordance with 4.2 and 4.3 of this PAS.

Organizations soliciting tenders should follow scenarios supporting a request for tenders as described in Annex B.

4.5 General design recommendations

The general design recommendations listed in Clause 5 should be reviewed during the whole of a product or service life cycle, i.e. at each stage of development, including development of initial product or system requirements, during development and during post-launch maintenance.

4.6 Accessibility log

An accessibility log should be opened at the start of the project and be used in accordance with BS ISO/IEC 30071-1 to record details about the accessibility of a product, system or service. The accessibility log should be updated at each product change or product release cycle and should incorporate a statement of each user accessibility need met or not met by the product in accordance with the goals and user accessibility needs method.

NOTE 1 See Annex A.

⁸⁾ Where it is feasible to do so, co-design with the end-user community can provide useful insights into the level of applicability of each accessibility need from lived experience.

⁹⁾ Many standards are requirements in specific jurisdictions. Many standards are needed in particular contexts and designed for use in those contexts but do not necessarily provide an overarching approach or model.