
**Software ergonomics for multimedia user
interfaces —**

**Part 3:
Media selection and combination**

*Ergonomie des logiciels pour les interfaces utilisateur multimédias —
Partie 3: Sélection et combinaison des médias*
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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 14915 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 14915-3 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 4, *Ergonomics of human-system interaction*.

ISO 14915 consists of the following parts, under the general title *Software ergonomics for multimedia user interfaces*:

- Part 1: *Design principles and framework* [ISO 14915-3:2002](#)
- Part 2: *Multimedia navigation and control* <https://standards.iteh.ai/catalog/standards/sist/9493a4c8-51ff-4407-80ae-cc06c5f4c6bc/iso-14915-3-2002>
- Part 3: *Media selection and combination*

Annexes A to D of this part of ISO 14915 are for information only.

Introduction

The design of user interfaces for multimedia applications typically involves a much wider range of design and evaluation issues than that of conventional user interfaces based only in textual and graphical format. Many different techniques and design options are available. Multimedia user interfaces incorporate, integrate and synchronize different media (static media such as text, graphics, images, and dynamic media such as audio, animation, video or other sensory modalities). Within each medium, further distinctions can be made. Graphics, for instance, can be presented either in two- or three-dimensional format and audio can be further categorized according to the level of sound quality or with respect to mono, stereo or surround sound.

Ergonomic design enhances the ability of users to operate multimedia applications effectively, efficiently and with satisfaction (see ISO 9241-11). This can be achieved by careful design of multimedia applications with respect to the tasks they are intended to fulfil (e.g. for work, education or performance support), user characteristics and the environment in which the system will be used. Multimedia applications are often used for communicative purposes. An ergonomic design of multimedia user interfaces can also improve the safety of operating a system (e.g. delivering an alarm in both visual and auditory media).

The range of media available and the interaction of these media have a variety of perceptual, cognitive and other ergonomic implications for the users of multimedia applications. Multimedia can potentially impose on users a high perceptual load, structural and semantic complexity, or a large volume of information to be conveyed through the system. Manipulation of data or information presented in multimedia applications is also often part of the user's activity.

This part of ISO 14915 provides guidance on the selection, combination and integration of media. The focus is primarily on presentational aspects of multimedia (i.e. from system to user) as opposed to control and navigation issues, which are addressed in ISO 14915-2. This part of ISO 14915 starts from information requirements, which are stated in logical terms, and addresses the design issues concerning which media combinations to choose for the information requirements. This is followed by guidance on how the user's reading/viewing sequence can be directed by design effects to ensure that the user acquires the desired information. Supplementary design guidance for different media combinations and integration are presented in informative annexes A to D.

Software ergonomics for multimedia user interfaces —

Part 3: Media selection and combination

1 Scope

This part of ISO 14915 gives recommendations for, and guidance on, the design, selection and combination of interactive user interfaces that integrate and synchronize different media. It addresses user interfaces for applications that incorporate, integrate and synchronize different media. This includes static media such as text, graphics, images; and dynamic media such as audio, animation, video or media related to other sensory modalities. Detailed design issues within a single medium (e.g. the graphical design of an animation sequence) are only addressed as far as they imply ergonomic consequences for the user.

This part of ISO 14915 applies to

- presentational techniques for computer-based multimedia applications in general, including stand-alone and networked applications when the prime goal is to support the user's work task or provision of information,
- the design of the software user interface, and
- training and tutorial multimedia insofar as its recommendations bear on effective delivery of information.

This part of ISO 14915 does not deal with pedagogical design issues for tutorial applications and does not address hardware issues, such as input or output devices. The recommendations in this part do not specifically address applications whose primary purpose is entertainment, such as games. The focus of this part of ISO 14915 is on multimedia presentation issues; multimodal input which uses different media, such as speech, in combination with pointing for entering information is not considered in the recommendations provided.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 14915. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 14915 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 14915-1:2002, *Software ergonomics for multimedia user interfaces — Part 1: Design principles and framework*

ISO 14915-2:—¹⁾ *Software ergonomics for multimedia user interfaces — Part 2: Multimedia navigation and control*

1) To be published.

3 Terms and definitions

For the purposes of this part of ISO 14915, the following terms and definitions apply.

3.1

medium, sing.

media, plur.

different specific forms of presenting information to the human user

EXAMPLES These include text, video, graphics, animation, audio.

[ISO 14915-1:2002]

3.2

multimedia

combinations of static and/or dynamic media which can be interactively controlled and simultaneously presented in an application

EXAMPLES These include combinations of text and video, or audio and animation.

[ISO 14915-1:2002]

3.3

static medium

medium in which the presentation to the user does not change over time

EXAMPLES These include text and pictures.

NOTE Adapted from ISO 14915-1:2002.

3.4

dynamic medium

medium in which the presentation to the user changes according to time

EXAMPLES These include video, music, animation, simulations.

NOTE Adapted from ISO 14915-1:2002.

3.5

content

information to be communicated by means of a multimedia application from the originator to the user according to certain communication goals

[ISO 14915-1:2002]

3.6

information type

media-neutral description of information categories that constitute the content and components

NOTE Information types can be used to specify a message to be delivered in a multimedia application. As with media types, information types embed dimensions and categories. An approach to classifying information components with information types is given in informative annex A, which provides a decision tree (Figure A.1) that focuses first on whether a component is physical or conceptual, then whether it is static (not changing) or dynamic and finally the category for the information content.

3.6.1

causal information

information describing the cause and effect of an event, including a sequence of events that describe causation

EXAMPLES Heat causing a liquid to boil. Behaviour of an algorithm that results in the desired goal.

3.6.2**conceptual information**

facts, opinions or information about objects which do not have a physical existence

EXAMPLES Taxonomic classes of animals and plants. Opinions about politics.

3.6.3**continuous action information**

information describing movement and other activity that is perceived to occur over a period of time

EXAMPLES Making a meal. Driving a car.

NOTE Continuous actions are normally described in the present continuous tense in English.

3.6.4**descriptive information**

information which describes an object, entity, or agent

EXAMPLES Red apples, texture of stone.

NOTE This can include states and histories of objects.

3.6.5**discrete action information**

information describing movement and other activity that is perceived to occur at a point in time

EXAMPLES Switching a computer on. Closing a door.

NOTE Discrete actions are a set of steps.

3.6.6**event information**

information about a state change, message indicating the occurrence of an action or conveying a significant change in the world

EXAMPLES Telephone rings. E-mail message arrives, is sent.

NOTE Events may emanate from the environment as well as from objects.

3.6.7**physical information**

information about phenomena which have a concrete existence; objects, agents or scenes that have a physical existence

EXAMPLES Chair, table, landscape.

3.6.8**procedural information**

information about a sequence of actions organized to achieve a goal or task

EXAMPLE Instructions to assemble a bookshelf from ready-made components.

3.6.9**relationship information**

information about an association between objects or agents

EXAMPLES Seat and legs are part of a chair. A product is manufactured in a factory.

3.6.10

spatial information

information about the spatial properties of the world, such as dimensions of structures, pathways, spatial distribution, location

EXAMPLES Layout of furniture in a room. Directions to the metro station.

3.6.11

state information

properties of the environment, objects or agents that remain constant during a period of time

EXAMPLES The music is being played. A person is sleeping.

3.6.12

value information

quantitative information describing properties of an object

EXAMPLE Person's height 1,80 m.

NOTE Relationships between many values may be shown by graphs and charts (see 3.6.9).

3.7

media type

categories of media that are used to present information to the user

NOTE Media types reflect the psychological properties of a medium as perceived by the user. Figure A.2 and the decision tree (Figure A.3) in informative annex A help to classify media using the following definitions of media sub-types:

3.7.1

audio medium

any medium which can be heard (received by an audio channel)

EXAMPLES Dog barking, music, traffic noise, speech.

3.7.2

language-based medium

medium with content based on natural or formal languages

EXAMPLES Alphanumeric text. Spoken language. Symbols interpreted in language-based terms, such as hieroglyphics, mathematical equations, and chemical formulae.

3.7.3

moving image medium

visual medium that is delivered at a rate that is judged by the human viewer to be a continuous image

EXAMPLES Video, film, animated diagrams, simulations.

NOTE For example, at a frame refresh rate above or near the flicker fusion frequency of 30 frames per second.

3.7.4

non-realistic medium

medium that is perceived by the user as not faithfully representing the natural world

EXAMPLES Diagrams, graphs, cartoons.

3.7.5

realistic medium

medium perceived by the user to faithfully represent the natural world

EXAMPLES Natural sounds. Photographic images. Film showing people and natural scenes.

NOTE Realistic media may be designed to create the illusion of the natural world, e.g. realistic animations of dinosaurs.

3.7.6

still-image medium

visual medium that is not presented continuously, although frames may be shown in a sequence either controlled by the user or by the system with a time delay

EXAMPLES Photographs, drawings, graphs.

3.8

agent

person or machine which carries out actions and creates events

EXAMPLES User, designer, computer program.

3.9

concurrent media

two or more media that are juxtaposed/used simultaneously during a certain period when presented

EXAMPLE A voice-over describes action in a video.

3.10

direct contact point

thematic link between two media implemented with a designed effect in both the source and destination medium

EXAMPLE A text caption is linked by an arrow to an image component that is highlighted.

3.11

indirect contact point

thematic link between two media that is implemented with a designed effect only in the source medium

EXAMPLE The text refers to a diagram with the instruction "see Figure 1".

3.12

media combination

sequential or concurrent combination of two or more media

EXAMPLES A video is presented in a window embedded in another window containing a still image. Speech introduces a video which is then played.

3.13

sequential presentation

arrangement of two or more media that are represented one after another but do not overlap in time

EXAMPLE A video is shown, followed by a text summary.

3.14

thematic link

requirement to direct the users' reading/viewing sequence between two media

NOTE For implementation, see contact points 3.10 and 3.11.

4 Application of this part of ISO 14915

4.1 Intended user groups

The following groups are the intended users of this part of ISO 14915:

- user interface and multimedia designers who will apply this part of ISO 14915 during the development process;
- evaluators responsible for quality assurance who will ensure that products meet the recommendations of this part of ISO 14915;
- potential buyers in selecting appropriately designed multimedia products;
- designers of multimedia development tools to be used by user interface and multimedia developers.

4.2 Applying the recommendations

The design guidelines provided in this part of ISO 14915 extend the principles described in ISO 14915-1. Multimedia user interfaces should be designed according to both the principles of ISO 14915-1 and the guidelines described in this part of ISO 14915. For certain contexts (e.g. certain tasks or user groups), the designer may be forced to follow one guideline at the expense of another in order to achieve the optimal design.

4.3 Reporting conformance to this part of ISO 14915

If a claim of product or application conformity with this part of ISO 14915 is made, the procedure used in establishing requirements for developing and/or evaluating the multimedia user interface shall be specified. The level of specification of the procedure is a matter of negotiation between the involved parties. ISO 14915 is a multi-part standard and therefore claims of conformity are related to the individual parts and not to the International Standard as a whole.

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5 General guidelines for media selection and combination

5.1 General

This clause contains general guidelines for media selection and combination followed by more specific guidelines that map information types to appropriate media types for effective delivery. The principles in ISO 14915-1 provide a basis for interpreting the following guidelines. Two or more media are considered combined if their presentation is concurrent. Media are also considered to be combined or contiguous where the content is closely related or where the media are explicitly grouped in a display in adjacent windows or displayed sequentially; for example, presenting a picture followed by a text description.

Combining media can have advantages for the user. First, interfaces can be created that present information in a way similar to the real world. Depending on the context of use, this can make users' tasks easier, or more natural, especially where features of the information match the users' experiences of the real world. For example, a picture of a beach presented together with the sound of waves provides a better evocation of the subject than the picture or the sound alone. Combining media can also help accommodate user preferences for information in a particular format. For example, presenting text as well as pictures can accommodate users with a preference for either.

5.2 Supporting user tasks

Media should be selected and combined to support the user's tasks.

EXAMPLE To compare two views, an architect's drawings with corresponding photographs showing the side and front elevation of a building are placed side by side.

NOTE Some tasks benefit more from combination than others. If the task involves learning, or drawing attention to specific information, the users can benefit from media combination that presents information redundantly. If, however, the task is focused predominantly on one medium, for example visual inspection of diagrams, there can be considerably less benefit from combination. The characteristics of the user's task can also influence the sequence/concurrency of presentation; for instance, if comparison is required, two images can be presented concurrently.

5.3 Supporting communication goals

Media should be selected to achieve the communication goal in the application.

EXAMPLES In an application that is critical for safety, the communication goal is to warn the users and protect them from danger. In an aircraft emergency evacuation demonstration, speech is used for the instructions, with a diagram to show the evacuation route.

5.4 Ensuring compatibility with the users' understanding

Media should be selected to convey the content in a manner compatible with the user's existing knowledge.

EXAMPLES A radiation symbol is used to convey danger to users who have the appropriate knowledge. An architectural diagram is used to convey the structural layout of a building to architects and design engineers.

The user's ability to understand the message conveyed by a particular medium should influence selection. This is particularly important for non-realistic image media (diagrams, graphs) when interpretation is dependent on the users' knowledge and culture.

5.5 Selecting media appropriate for the users' characteristics

The characteristics of the user population should be considered when selecting media.

EXAMPLE Text is substituted by speech for blind users. Large point size text is accompanied by spoken representation of the text for older users.

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[ce06c5f4c6bc/iso-14915-3-2002](https://standards.iteh.ai/catalog/standards/sist/9493a4c8-51ff-4407-80ae-)

NOTE Users can be categorized as visualizers or verbalizers using psychologically based questionnaires. This information can be used to aid selection of image- or language-based media.

5.6 Supporting users' preferences

If appropriate to the task, users should be provided with alternative media from which they can select a preferred medium or suppress certain media.

EXAMPLES The user chooses to display text captions on a picture rather than a speech commentary, or suppresses an audio dialogue in a noisy environment. A blind user selects speech rather than text.

NOTE Some users can prefer to interact with systems using a particular medium. The abilities of the users and properties of the users' machine are important, so users may be given the option of low- or high-resolution graphics displays.

5.7 Considering the context of use

Selection and combination of media should be appropriate in the context of use.

EXAMPLES An inappropriate combination is the presentation of auditory as well as visual display of bank-account details which could compromise the user's privacy. A training video depicting an action accompanied by the speech "This is not correct" could be missed if the speech is inaudible in a noisy environment.

NOTE Certain environments can impede accurate perception of information presented in a specific medium; for example, an auditory warning might not be heard if it is presented in a noisy environment.

5.8 Using redundancy for critical information

If important information is to be presented then the same subject matter should be presented in two or more media.

EXAMPLE Displaying an alarm-clock function visually as well as aurally. In a language-learning application, words are spoken and displayed in text.

NOTE Effective redundant combinations present similar but not identical content on different media. Redundant representation is useful for training and educational applications.

5.9 Avoiding conflicting perceptual channels

The same perceptual channel (e.g. hearing or vision) should not be used in concurrently presented dynamic media, if the user needs to extract information from both media.

EXAMPLE Playing two or more videos with unrelated content is avoided because these will interfere with each other and distract attention.

NOTE Concurrent presentation of two or more dynamic media makes it difficult for the user to perceive information from each individual source unless the information is easy to integrate. Exceptions to this guideline occur in entertainment applications, such as playing two unrelated videos in popular-music promotions.

5.10 Avoiding semantic conflicts

Presentation of conflicting information in any combination of media should be avoided.

EXAMPLE Avoid aural presentation of the word "Press the blue button" while the visual display shows a black and white image.

NOTE Users cannot comprehend or gain an integrated understanding of conflicting information from different media, especially in concurrent presentations.

5.11 Designing for simplicity

Minimal combination of media should be used to convey the information necessary for the user's task.

EXAMPLE In a musical tutorial, the sound of music is combined with textual representation of the musical score. Adding a video of a concert performance gives little extra information and distracts the user.

NOTE As the number of media used increases, the user's effort required to attend to and process each medium also increases, as does the effort in cross-referencing media. The trade-off between simplicity and more complex combinations will depend on the user and task (see clause 5.2 and 5.3).

5.12 Combining media for different viewpoints

Wherever appropriate to the task, different views on the same subject matter should be provided by media combination.

EXAMPLES Musical notation in a diagram gives the composer's structural view of a symphony, speech commentary gives the musician's view of the structure, and music on the sound channel provides the aesthetic view. Two movies are played in separate windows to show different viewpoints on the same scene, one showing a long-shot context of a football game, the other a close up of a foul between two players in the long shot.

NOTE Presenting different views by media combination helps the user to assimilate information that is related to the same topic or theme.

5.13 Choosing media combinations to elaborate information

Whenever appropriate to the task, media combinations should be selected to extend the information content.

EXAMPLE Showing a diagram of planets revolving around the sun with speech explaining forces of gravity and momentum.

NOTE Media combination is used to add information to an existing topic, whereas combining media for different viewpoints presents different aspects of the same topic.

5.14 Guarding against degradation

Technical constraints should be considered when selecting media delivery to avoid degraded quality or unacceptable response times.

EXAMPLES To avoid delay in downloading a web page, moving images are segmented into storyboard stills and displayed as a slide show. The display area of a moving image is reduced rather than slowing the frame rate. Simple images with lower bandwidth requirements are used rather than photographic quality images. Users are warned of transmission delays.

NOTE Visual media, especially moving images, are more prone to degradation if there are bandwidth or network constraints in distributed multimedia. Degradation can result in poor image quality, slower than acceptable frame rates for moving images, and poor audio quality.

5.15 Previewing media selections

If appropriate for the task, the media available for selection should be viewable by the user in a preview facility.

EXAMPLE A web link to video allows the user to view miniature samples of the video before it is downloaded.

NOTE When control over media selection is given to the user, previewing can be combined with controls to choose the way media are downloaded in high or low resolution. Guidance on controls is given in ISO 14915-2.

5.16 Using static media for important messages

A still image and text should be used for important information other than time-critical warnings.

EXAMPLE Key points in an engine assembly task are shown with still images and bullet points in text.

NOTE Very little detail is remembered from video and speech. Dynamic media can be used to alert the user and direct their attention to important messages which are conveyed in static media.

6 Media selection for information types

6.1 General

This clause gives recommendations on media selection. Information requirements can be defined logically, without reference to the physical medium that conveys them, to make the user's requirement explicit.

One way to approach media selection is as follows:

- segment the content into information components according to the task and users' requirements;
- assign information types to information components using the decision trees in Figures A.1 and A.2 in informative annex A and the definition in 3.6;
- choose media types for information types using Table 1 and the guidelines in 6.2 to 6.4.

In many cases, multiple media types may be selected for one information type. Table 1 provides examples to illustrate the possible combinations of media for a particular information type. The guidelines in 6.2 to 6.4 give the major mapping between an information type and media types with other, possible mappings in the notes. Table 1 illustrates the selection guidelines expressed in the order: preferred selection, other possible media-type selections.