



TECHNICAL REPORT

**Human Factors (HF);
Functional needs of people with cognitive disabilities
when using mobile ICT devices for an improved user
experience in mobile ICT devices**

Reference

DTR/HF-00151

Keywords

accessibility, ageing, cognitive, disability, ICT, inclusive design,
mobile, usability, usage needs**ETSI**650 Route des Lucioles
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Contents

Contents	3
Intellectual Property Rights	5
Foreword.....	5
Modal verbs terminology	5
Introduction and how to use the present document	5
1 Scope	6
2 References	6
2.1 Normative references	6
2.2 Informative references	6
3 Definitions and abbreviations.....	9
3.1 Definitions	9
3.2 Abbreviations.....	9
4 Background and approach.....	10
5 Cognitive impairments and diagnoses.....	11
5.1 Introduction.....	11
5.2 Dementia and Alzheimer fact sheet	11
5.3 Intellectual impairments fact sheet	14
5.4 Aphasia fact sheet	15
5.5 Speech and Language Impairments fact sheet	15
5.6 Autism Disorder fact sheet	17
5.7 Attention Deficit/Hyperactivity Disorder fact sheet	19
5.8 Dyslexia fact sheet.....	20
5.9 Dyscalculia fact sheet	21
6 Classification of usage needs when using mobile ICT.....	21
6.1 Introduction.....	21
6.2 List of usage needs.....	21
6.3 Attention-related usage needs	23
6.3.1 Introduction	23
6.3.2 Focusing attention: usage with limited ability to focus attention	24
6.3.3 Directing attention: usage with limited ability to direct attention	24
6.3.4 Shifting attention: usage with limited ability to shift attention	24
6.4 Reading-related usage needs.....	25
6.4.1 Introduction	25
6.4.2 Reading: usage with no ability to read	26
6.4.3 Recognising written language: usage with limited ability to recognize written language.....	26
6.4.4 Comprehending written language: usage with limited ability to comprehend written language.....	26
6.5 Writing-related usage needs.....	27
6.5.1 Introduction	27
6.5.2 Writing: usage with no ability to write.....	28
6.5.3 Writing correctly: usage with limited ability to correctly write words and use punctuation	28
6.5.4 Producing written language: usage with limited ability to produce written language	28
6.6 Calculating-related usage needs.....	29
6.6.1 Introduction	29
6.6.2 Calculating: usage with no ability to calculate.....	30
6.6.3 Understanding simple maths: usage with limited ability to understand simple mathematical concepts	30
6.7 Decision making-related usage needs	30
6.7.1 Introduction.....	30
6.7.2 Making choices: usage with limited ability to make a choice among options.....	31
6.7.3 Interpreting effects of choices: usage with limited ability to interpret the effects of choices taken	32
6.8 Usage needs related to undertaking tasks	32
6.8.1 Introduction	32
6.8.2 Initiating a task: usage with limited ability to initiate a task	37

6.8.3	Organising for a task: usage with limited ability to get organised time for a task	37
6.8.4	Carrying out a task: usage with limited ability to carry out a task	37
6.8.5	Completing a task: usage with limited ability to complete a task	38
6.8.6	Managing time: usage with limited ability to manage time	38
6.8.7	Adapting to time demands: usage with limited ability to adapt to time related events and tasks.....	38
6.9	Usage needs related to receiving speech.....	39
6.9.1	Introduction	39
6.9.2	Receiving spoken language: usage with no ability to receive spoken language.....	39
6.9.3	Understanding spoken language: usage with limited ability to understand spoken language	40
6.10	Usage needs related to receiving non-verbal messages	40
6.10.1	Introduction	40
6.10.2	Understanding body gestures: usage with limited or no ability to understand body gestures	41
6.10.3	Understanding symbols: usage with limited or no ability to understand symbols	41
6.10.4	Understanding drawings and photographs: usage with limited or no ability to understand drawings and photographs	42
6.11	Usage needs related to speaking	42
6.11.1	Introduction	42
6.11.2	Speaking: usage with limited or no ability to speak	42
6.12	Usage needs related to producing non-verbal messages	43
6.12.1	Introduction	43
6.12.2	Producing gestures: usage with limited or no ability to produce gestures.....	43
6.13	Usage needs related to memory	44
6.13.1	Introduction	44
6.13.2	Recalling from short-term memory: usage with limited ability to produce short-term memory.....	45
6.13.3	Recalling from long-term memory: usage with limited long-term memory.....	45
6.14	Usage needs related to using communication devices and techniques.....	45
Annex A: ICF-related cognitive activities and functions		47
A.1	Introduction.....	47
A.2	Cognitive-related activities	47
A.2.1	Introduction	47
A.2.2	Learning and applying knowledge	47
A.2.3	General tasks and demands	48
A.2.4	Communication	49
A.3	Cognitive-related functions.....	50
A.3.1	Introduction	50
A.3.2	Global mental functions	50
A.3.3	Specific mental functions	51
Annex B: Bibliography.....		53
History		54

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Human Factors (HF).

Modal verbs terminology

In the present document "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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Introduction and how to use the present document

Individuals with cognitive impairments can benefit significantly with the proper use of ICT mobile devices; however, they can face many challenges when using mobile ICT devices and their applications.

Although there are significant publications (from standardisation bodies as well as from published research) that examine the functional needs of people with physical and sensory impairments on the use of Mobile ICT, there is very limited relevant work on the needs of people with cognitive impairments.

In this respect, the present document aims to describe the functional needs of people with limited cognitive, language and learning abilities in effectively using mobile ICT devices. Research studies and scientific papers along with familiarisation with the cognitive impairments form the basis for identifying relevant usage needs.

The present document contains design guidelines for mobile devices and applications that will enable persons with limited cognitive, language and learning abilities (e.g. people with age-related cognitive impairments) to have an improved user experience when using mobile ICT devices and applications. The usage needs in the present document complement already identified usage needs such as those in documents in the references clause.

The present document supplements ETSI EG 203 350: "Guidelines for the design of mobile ICT devices and their related applications for people with cognitive disabilities" [i.1] that contains design guidelines for mobile devices and applications that will enable persons with cognitive impairments to have an improved user experience when using mobile ICT devices and applications.

1 Scope

The present document contains a classification and analysis of usage needs of persons with limited cognitive, language and learning abilities (generically and historically referred to as "cognitive impairments"). It describes their functional needs for an improved user experience when using mobile ICT devices and applications.

The present document is the basis for the development of design guidelines for mobile ICT devices and applications ETSI EG 203 350: "Human Factors (HF); Guidelines for the design of mobile ICT devices and their related applications for people with cognitive disabilities" [i.1] that enables people with cognitive impairments to obtain the maximum benefit from the use of mobile ICT.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

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3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI EG 201 013 [i.14] and the following apply:

activity: execution of a task or action by an individual

NOTE: Sources: [i.35].

activity limitation: difficulty an individual may have in executing an activity

NOTE: Sources: [i.35].

body function: physiological function of body systems (including psychological systems)

NOTE: Sources: [i.35].

cognitive disability: activity limitations or participation restrictions that occur when factors in the environment contain barriers for persons with cognitive impairments

cognitive impairment: substantial limitation in person's capacity to think, including conceptualizing, planning, and sequencing thoughts and actions, remembering, interpreting subtle social cues, and understanding numbers and symbols

NOTE: Sources: [i.9].

Information and Communication Technology (ICT): technology, equipment, or interconnected system or subsystem of equipment for which the principal function is the creation, conversion, duplication, automatic acquisition, storage, analysis, evaluation, manipulation, management, movement, control, display, switching, interchange, transmission, reception, or broadcast of data or information

NOTE: Examples of ICT are electronic content, telecommunications products, computers and ancillary equipment, software, information kiosks and transaction machines, videos, IT services, and multifunction office machines which copy, scan, and fax documents.

mobile ICT: ICT that uses mobile technologies

NOTE: Mobile technologies include, but are not limited to, mobile phones, smartphones, tablets, smart watches and services accessed through these devices.

participation restriction: problem an individual may have in involvement in life situations

NOTE: Sources: [i.35].

usage need: specific support needed by an individual to overcome an activity limitation

NOTE 1: Defining usage needs from activities allows a "design for all" approach to be followed, as the usage needs are based on supporting users doing activities they have trouble with (reading, speaking, organising, etc.) without the need to consider the reasons (the impairments or diagnoses) for those limitations.

NOTE 2: The usage needs in the present document are those that are relevant when individuals are interacting with mobile ICT.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ADHD	Attention-Deficit/Hyperactivity Disorder
APA	American Psychiatric Association
ASD	Autism Spectrum Disorder
DfA	Design for All
DSM	Diagnostic and Statistical Manual

ICD	International Classification of Diseases
ICD-10	International Classification of Diseases 10th Revision
ICF	International Classification of Functioning, Disability and Health
ICF-CY	International Classification of Functioning, Disability and Health for Children and Youth
ICT	Information and Communication Technology
LD	Learning Disability
MCI	Mild Cognitive Impairment
WHO	World Health Organization

4 Background and approach

The present document uses a standards-based approach for defining cognitive impairments and usage needs.

Two major sources of information have been used for identifying the major cognitive impairments: the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) [i.17], from the World Health Organization (WHO) and the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) [i.4] from the American Psychiatric Association (APA). Both documents include information about cognitive impairments, as part of a wider collection of mental and behavioural disorders and impairments.

The first step involved the definition and selection of a subset of cognitive impairments based on scientific literature and on two criteria. The first criterion is **prevalence**, that is, how many individuals have a particular cognitive impairment. The second one is **potential use and benefits**, that is, whether persons having a particular cognitive impairment can use mobile technologies, with the support of the required assistive technologies. Based on this approach, the following cognitive impairments have been defined and selected:

- Dementia and Alzheimer's disease
- Intellectual impairments including Down syndrome
- Aphasia
- Speech and Language Impairments
- Autism
- Attention-Deficit/Hyperactivity Disorder - ADHD
- Dyslexia
- Dyscalculia

The second step was to relate and describe further the identified cognitive impairments mainly based on the activities (execution of tasks or actions by an individual) and if necessary - but also limited - on body functions (physiological functions of body systems, including psychological ones) by using the vocabulary of the WHO ICF-CY, the International classification of functioning, disability and health, children and youth version [i.35].

A broad range of ICF activities and functions was derived from the cognitive impairments listed above. However, it is not only persons who have these cognitive impairments that experience limitations in relation to these activities or impairments in the functions. Similar limitations and impairments may be experienced by most people in situations of high stress or cognitive overload (e.g. when attempting to multi-task). This means that any guidelines derived from the usage needs described in the present document are likely to be of benefit to a much wider range of people and situations than those directly associated with the cognitive impairments and diagnoses listed above.

The third step was to define a new set of usage needs that are based on the related ICF activities and in some cases also on ICF functions. The outcomes from this step are described in clause 6.

NOTE 1: Defining usage needs from activities allows a "design for all" approach to be followed, as the usage needs are based on supporting users doing activities they have trouble with (reading, speaking, organising, etc.) without the need to consider the reasons (the impairments or diagnoses) for those limitations.

NOTE 2: The approach applied in the present document is to identify activities that are relevant when individuals are interacting with mobile ICT, and then to define usage needs for those activities.

NOTE 3: In some cases, it may be necessary to refer in addition to ICF functions, either because there is no relevant ICF activity (as it is the case with memory) or because the functions can provide additional details to activities (as is the case with attention).

NOTE 4: Each usage need has a unique identifier to enable cross-referencing.

5 Cognitive impairments and diagnoses

5.1 Introduction

Clause 5 outlines the nine selected cognitive impairments that fall within the scope of the present document and resulted mainly from the first two steps in the approach. Each relevant cognitive impairment is outlined in a table in a form of a "fact sheet".

5.2 Dementia and Alzheimer fact sheet

Table 1: Dementia and Alzheimer's disease fact sheet

Name of disorder	Dementia and Alzheimer's disease
DSM-5 Classification [i.4]	Dementia: Neurodevelopmental Disorders (31)/Intellectual Disabilities (33) Alzheimer's disease: Neurocognitive Disorders (591)/ Major or Mild Neurocognitive Disorder Due to Alzheimer's disease (611)
ICD-10 Classification [i.17]	Dementia: <ul style="list-style-type: none"> • F00 Dementia in Alzheimer disease • F01 Vascular Dementia • F02 Dementia in other diseases classified elsewhere • F03 Unspecified dementia Alzheimer's disease: <ul style="list-style-type: none"> • G30 Alzheimer disease
Description	Dementia: Dementia is a syndrome in which there is deterioration in memory, thinking, behaviour and the ability to perform everyday activities. Although dementia mainly affects older people, it is not a normal part of ageing. Alzheimer's disease is the most common cause of dementia and may contribute to 60 - 70 % of cases. Dementia is one of the major causes of disability and dependency among older people worldwide. It affects memory, thinking, orientation, comprehension, calculation, learning capacity, language, and judgment. Consciousness is not affected. Dementia is caused by a variety of diseases and injuries that primarily or secondarily affect the brain, such as Alzheimer's disease or stroke. It is one of the major causes of disability and dependency among older people worldwide. It is overwhelming not only for the people who have it, but also for their caregivers and families. Sources: [i.30]
Diagnosis/Main symptoms	Dementia Signs and symptoms: The symptoms linked to dementia can be understood in three stages. Early stage: forgetfulness, losing track of the time, becoming lost in familiar places. Middle stage: becoming forgetful of recent events and people's names, becoming lost at home, having increasing difficulty with communication, needing help with personal care, experiencing behaviour changes, including wandering and repeated questioning. Late stage: becoming unaware of the time and place, having difficulty recognizing relatives and friends, having an increasing need for assisted self-care, having difficulty walking, experiencing behaviour changes that may escalate and include aggression.

<p>Name of disorder</p>	<p>Dementia and Alzheimer's disease</p> <p>Common forms: Alzheimer's disease is the most common form of dementia and may contribute to 60 % - 70 % of cases Sources: [i.30]</p> <p>Alzheimer's disease signs and symptoms: First symptoms For many, decline in non-memory aspects of cognition, such as word-finding, vision/spatial issues, and impaired reasoning or judgment, may signal the very early stages of Alzheimer's disease.</p> <p>Mild Alzheimer's disease: As Alzheimer's disease progresses, people experience greater memory loss and other cognitive difficulties. Problems can include wandering and getting lost, trouble handling money and paying bills, repeating questions, taking longer to complete normal daily tasks, and personality and behaviour changes.</p> <p>Moderate Alzheimer's disease: Memory loss and confusion grow worse, and people begin to have problems recognizing family and friends. They may be unable to learn new things, carry out multistep tasks such as getting dressed, or cope with new situations. In addition, people at this stage may have hallucinations, delusions and paranoia, and may behave impulsively.</p> <p>Severe Alzheimer's disease: People with severe Alzheimer's cannot communicate and are completely dependent on others for their care. Sources: [i.2] and [i.3]</p>
<p>Prevalence- How many people are affected?</p>	<p>Dementia: Worldwide, 47,5 million people have dementia and there are 7,7 million new cases every year, with just over half (58 %) living in low- and middle-income countries. Every year, there are 7,7 million new cases.</p> <p>The estimated proportion of the general population aged 60 and over with dementia at a given time is between 5 to 8 per 100 people.</p> <p>The total number of people with dementia is projected to 75,6 million in 2030 and almost triple by 2050 to 135,5 million. Sources: [i.30].</p> <p>Alzheimer's disease: The prevalence of overall dementia rises steeply with age. In high-income countries, it ranges from 5 % to 10 % in the seventh decade to at least 25 % thereafter. The percentage of dementias attributable to Alzheimer's disease ranges from about 60 % to over 90 %, depending on the setting and diagnostic criteria. Mild dementia due to Alzheimer's disease is likely to represent a substantial fraction of Mild Cognitive Impairment (MCI) as well. Sources: [i.2] and [i.3]</p>
<p>Potential use and benefits</p>	<p>Dementia and Alzheimer's disease: If in a late phase of the disease, people become too unfocused and forgetful, they may not be able to actively use mobile technology or take in information presented from an electronic device. They may, however, benefit indirectly from the passive use of such devices, e.g. for location and communication purposes (help button, "baby phone" functionality).</p> <p>In all phases of the disease, people benefit from using mobile technologies, e.g. for reminding them of regular or special events or for leading them home if they get lost. Mobile technology may also support caregivers.</p>

Name of disorder	Dementia and Alzheimer's disease
Related ICF Activities and Participation, Sources: [i.35] and [i.26]	<p>Learning and Applying Knowledge: d110 Watching, d115 Listening, d130 Copying, d135 Rehearsing, d1550 Acquiring basic skills, d1551 Acquiring complex skills, d160 Focusing attention, d163 Thinking, d166 Reading, d170 Writing, d172 Calculating, d175 Solving Problems, d1750 Solving simple problems, d1751 Solving complex problems, d177 Making decisions.</p> <p>General Tasks and Demands: d210 Undertaking a single task, d2100 Undertaking a simple task, d2101 Undertaking a complex task, d2102 Undertaking a single task independently, d2103 Undertaking a single task in a group, d220 Undertaking multiple tasks, d2200 Carrying out multiple tasks, d2201 Completing multiple tasks, d2202 Undertaking multiple tasks independently, d2203 Undertaking multiple tasks in a group, d230 Carrying out daily routine, d2301 Managing daily routine, d2302 Completing the daily routine, d2303 Managing one's own activity level.</p> <p>Communication: d310 Communicating with - receiving - spoken messages, d315 Communicating with - receiving - nonverbal messages, d3150 Communicating with - receiving - body gestures, d3151 Communicating with - receiving - general signs and symbols, d3152 Communicating with - receiving - drawings and photographs, d325 Communicating with - receiving - written messages, d330 Speaking, d335 Producing nonverbal messages, d3350 Producing body language, d3351 Producing signs and symbols, d3352 Producing drawings and photographs, d345 Writing messages, d3500 Starting a conversation, d3501 Sustaining a conversation, d3502 Ending a conversation, d3503 Conversing with one person, d3504 Conversing with many people, d355 Discussion, d3550 Discussion with one person, d3551 Discussion with many people, d360 Using communication devices and techniques.</p> <p>Mobility: d440 Fine hand use (picking up, grasping).</p>
Additional ICF Body Functions for complementing ICF Activities. Sources: [i.35] and [i.27]	Mental Functions: b140 Attention functions, b1400 Sustaining attention, b1401 Shifting attention, b1402 Dividing attention, b144 Memory functions, b1440 Short-term memory, b1441 Long-term memory, b1442 Retrieval of memory.
NOTE: The description of dementia says that it involves problems in almost all cognitive functions: memory, language, thinking, orientation, calculating, communicating, etc. For this reason the list of ICF items related to dementia includes so many functions and activities.	

5.3 Intellectual impairments fact sheet

Table 2: Intellectual Impairments (including Down Syndrome) fact sheet

Name of disorder	Intellectual Impairments including Down Syndrome
DSM-5 Classification [i.4]	Intellectual Disabilities (33)
ICD-10 Classification [i.17]	F70-F79 Mental retardation (see note)
Description	Intellectual disability is a disability characterized by significant limitations in both intellectual functioning and inadaptive behaviour, which covers many everyday social and practical skills. Sources: [i.34] Down Syndrome is a type of intellectual disability and more specifically it is a mental retardation caused by genetic abnormalities. Sources: [i.31]
Diagnosis/ Main symptoms	Intellectual disability involves impairments of general mental abilities that impact adaptive functioning in three domains, or areas. These domains determine how well an individual copes with everyday tasks Sources: [i.33] <ul style="list-style-type: none"> • The conceptual domain or area addresses skills in language, reading, writing, math, reasoning, knowledge, and memory. • The social domain or area addresses empathy, social judgment, interpersonal communication skills, the ability to make and retain friendships, and similar capacities. • The practical domain or area addresses self-management in areas such as personal care, job responsibilities, money management, recreation, and organizing school and work tasks. Each person with intellectual disability, including Down syndrome, has individual intellectual and developmental problems that range from severe to moderate. Sources: [i.20] and [i.32]
Prevalence- How many people are affected?	It has been estimated that persons with intellectual disability comprise from 1 percent - 3 percent of populations around the world; While this rough estimate provides a wide range and is subject to incomplete ascertainment, this would still mean that there are an estimated 200 million people with intellectual disability in the world. Sources: [i.35] and [i.36]
Potential Use and Benefits	Persons with intellectual disability may be severely limited in their cognitive abilities and the complexity the commercial off-the-shelf products may well be beyond their reach. The chances of beneficial experiences may be bigger with dedicated devices and services / applications. Persons with intellectual disability benefit from using mobile technologies, e.g. for getting reminded of regular or special events or for leading them home if they get lost. Simpler functions and use of pictures in the use of mobile devices can improve the use of mobile devices by people with intellectual disabilities. Mobile technology may also support caregivers.
Related ICF Activities and Participation [i.35] and [i.26]	Learning and Applying knowledge: d160 Focusing attention, d163 Thinking, d166 Reading. General Tasks and demands: d2401 Handling stress, d2402 Handling crisis. Communication: d310 Communicating with - receiving - spoken messages, d315 Communicating with - receiving - nonverbal messages, d3150 Communicating with - receiving - body gestures, d325 Communicating with - receiving - written messages, d330 Speaking, d335 producing nonverbal messages, d3350 Producing body language, d3500 Starting a conversation, d3501 Sustaining a conversation, d3502 Ending a conversation, d3503 Conversing with one person, d3504 Conversing with many people, d3601 Using writing machines.
Additional ICF Body Functions for complimenting ICF Activities [i.35]	Mental Functions: b1400 Sustaining attention, b1401 Shifting attention, b1402 Dividing attention, b1403 Sharing attention, b1440 Short-term memory.
NOTE: Better use the DSM-5 Classification that is Intellectual Disabilities (33) Q90 Down syndrome.	

5.4 Aphasia fact sheet

Table 3: Aphasia fact sheet

Name of disorder	Aphasia
DSM-5 Classification [i.4]	Communication Disorder (41) / Language Disorder (315.39)
ICD-10 Classification [i.17]	F80 Specific developmental disorders of speech and language
Description	Aphasia is a disorder that results from damage to portions of the brain that are responsible for language. The disorder impairs the expression and understanding of language as well as reading and writing. Aphasia may co-occur with speech disorders such as dysarthria or apraxia of speech, which also result from brain damage. Sources: [i.29]
Diagnosis/Main symptoms	Diagnosis is based on the person's ability to speak, express ideas, converse socially, understand language, read, and write, as well as the ability to swallow and to use alternative and augmentative communication. Sources: [i.29]
Prevalence- How many people are affected?	Anyone can acquire aphasia, including children, but most people who have aphasia are middle-aged or older. Men and women are equally affected. Sources: [i.29] and [i.5]
Potential use and benefits	People with Aphasia will have problems using mobile technology and accepting services and applications that support them in their daily lives. Suitable applications may help them naming objects and expressing thoughts.
Related ICF Activities and Participation Sources: [i.35] and [i.11]	<p>Learning and Applying Knowledge: d110 Watching, d115 Listening, d130 Copying, d160 Focusing attention, d163 Thinking, d166 Reading, d170 Writing, d172 Calculating, d175 Solving problems.</p> <p>General Tasks and Demands: d210 Undertaking a single task, d220 Undertaking multiple tasks, d230 Carrying out daily routine, d240 Handling stress and other psychological demands.</p> <p>Communication: d310 Communicating with - receiving - spoken messages, d315 Communicating with - receiving - nonverbal messages, d3150 Communicating with - receiving - body gestures, d3151 Communicating with - receiving - general signs and symbols, d3152 Communicating with - receiving - drawings and photographs, d325 Communicating with - receiving - written messages, d330 Speaking, d335 Producing nonverbal messages, d3351 Producing signs and symbols, d3352 Producing drawings and photographs, d345 Writing messages, d350 Conversation, d3500 Starting a conversation, d3501 Sustaining a conversation, d3502 Ending a conversation, d3503 Conversing with one person, d3504 Conversing with many people, d3550 Discussion with one person, d3551 Discussion with many people.</p>
Additional ICF Body Functions for complementing ICF Activities. Sources: [i.35] and [i.11]	Mental Functions: b140 Attention functions, b144 Memory functions.

5.5 Speech and Language Impairments fact sheet

Table 4: Speech and language impairments fact sheet

Name of disorder	Speech and Language Impairments
DSM-5 Classification [i.4]	Communication Disorder (41) / Language Disorder (315.39)
ICD-10 Classification [i.17]	F80 Specific developmental disorders of speech and language
Description	<p>A speech impairment usually indicates that someone has trouble producing certain sounds accurately. In that case, young children who are learning how to speak will probably substitute, leave out or distort normal speech sounds. For example, it's not unusual for 3-year-olds to use the <i>f</i> sound for "th" in their speech: "I'm firsty (thirsty)." But that pronunciation would be considered an articulation error in a 5-year-old. This is a speech problem.</p> <p>On the other hand, language impairments deal with processing the meaning of words. A child with a language impairment may have a difficult time either understanding the meaning of what's being said (a receptive language disorder), or he may have trouble communicating his own thoughts (an expressive language disorder).</p>

Name of disorder	Speech and Language Impairments Imagine a child who has good speech and pronounces words correctly. He can still have poor language-trouble putting words together to express himself or trouble understanding what's being said to him. Speech and language impairments may occur separately. Or an individual may have both kinds of impairments at the same time. Sources: [i.37]
Diagnosis/Main symptoms	<p>A. Persistent difficulties in the acquisition and use of language across modalities (i.e., spoken, written, sign language, or other) due to deficits in comprehension or production that include the following:</p> <ol style="list-style-type: none"> 1. Reduced vocabulary (word knowledge and use). 2. Limited sentence structure (ability to put words and word endings together to form sentences based on the rules of grammar and morphology). 3. Impairments in discourse (ability to use vocabulary and connect sentences to explain or describe a topic or series of events or have a conversation). <p>B. Language abilities are substantially and quantifiably below those expected for age, resulting in functional limitations in effective communication, social participation, academic achievement, or occupational performance, individually or in any combination.</p> <p>Sources: [i.4] For example, here are some symptoms/signs that may imply speech or language impairments for a person that:</p> <ul style="list-style-type: none"> • Does not understand his name, the word <i>no</i>, or simple commands by age 1 • Is not saying words by 14 to 16 months of age • Cannot answer basic "wh" questions (what, where, who) by age 3 • Has difficulty being understood by people outside the family after age 3 • Has noticeable hesitations or repetitions in speech past age 5 • Cannot tell a sequential story (a story with a beginning, middle and end) by age 5 • Shows limited development of vocabulary <p>Sources: [i.36]</p>
Prevalence- How many people are affected?	<ul style="list-style-type: none"> • Speech-Sound Disorder: The most widely cited summary of speech sound disorder prevalence is a systematic review conducted by Law, Boyle, Harris, Harkness, & Nye. They reported prevalence estimates ranging from 2 % to 25 % of children aged 5 to 7 years. Sources: [i.8] • Stuttering: Approximately 5 % of people will stutter during some part of their lives. However, in a review of recent research, Yairi and Ambrose concluded that the lifetime incidence of stuttering may be higher. Sources: [i.6] • Social (pragmatic) communication disorder: There are no reliable data on incidence and prevalence of social communication disorders, at least partly as a result of inconsistency of definitions across sources. <p>Sources: [i.7]</p>
Potential use and benefits	<p>The category of Speech and Language Impairments is very heterogeneous. It includes people with problems in producing speech (but otherwise no cognitive impairments) as well as people struggling with understanding language and concepts. It is likely that most of them will welcome any support facilitating their daily lives.</p> <p>Suitable applications may help them naming objects and expressing thoughts.</p>

Name of disorder	Speech and Language Impairments
Related ICF Activities and Participation [i.35] and [i.21]	<p>Learning and applying knowledge: d140 Learning to read, d145 Learning to write, d166 Reading, d170 Writing.</p> <p>Communication: d310 Communicating with - receiving - spoken messages, d3150 Communicating with - receiving - body gestures, d3151 Communicating with - receiving - general signs and symbols, d3152 Communicating with - receiving - drawings and photographs, d325 Communicating with - receiving - written messages, d330 Speaking, d3350 Producing body language, d3351 Producing signs and symbols, d3352 Producing drawings and photographs, d345 Writing messages, d3500 Starting a conversation, d3501 Sustaining a conversation, d3502 Ending a conversation, d3503 Conversing with one person, d3504 Conversing with many people, d3550 Discussion with one person, d3551 Discussion with many people.</p>
Additional ICF Body Functions for complementing ICF Activities [i.35] and [i.21]	Mental Functions: b1401 Shifting attention. b167 Mental functions of language

5.6 Autism Disorder fact sheet

Table 5: Autism Disorder fact sheet

Name of disorder	Autism
DSM-5 Classification [i.4]	Autism Spectrum Disorder (50)
ICD-10 Classification [i.17]	F84 Pervasive developmental disorders
Description	<p>Autism Spectrum Disorder (ASD) is a range of complex neurodevelopment disorders, characterized by social impairments, communication difficulties, and restricted, repetitive, and stereotyped patterns of behaviour. Autistic disorder, sometimes called autism or classical ASD, is the most severe form of ASD, while other conditions along the spectrum include a milder form known as Asperger syndrome, and childhood disintegrative disorder and pervasive developmental disorder not otherwise specified (usually referred to as PDD-NOS).</p> <p>Sources: [i.22]</p>
Diagnosis/Main symptoms	<p>The hallmark feature of ASD is impaired social interaction. As early as infancy, a baby with ASD may be unresponsive to people or focus intently on one item to the exclusion of others for long periods of time. A child with ASD may appear to develop normally and then withdraw and become indifferent to social engagement.</p> <p>Children with an ASD may fail to respond to their names and often avoid eye contact with other people. They have difficulty interpreting what others are thinking or feeling because they cannot understand social cues, such as tone of voice or facial expressions, and do not watch other people's faces for clues about appropriate behaviour.</p> <p>Many children with an ASD tend to start speaking later than other children. Children with an ASD do not know how to play interactively with other children. Some speak in a sing-song voice about a narrow range of favourite topics, with little regard for the interests of the person to whom they are speaking.</p> <p>Later indicators include: impaired ability to make friends with peers, impaired ability to initiate or sustain a conversation with others, absence or impairment of imaginative and social play, stereotyped, repetitive, or unusual use of language, restricted patterns of interest that are abnormal in intensity or focus, preoccupation with certain objects or subjects, inflexible adherence to specific routines or rituals.</p> <p>Sources: [i.22]</p> <p>According to "Theory of Mind" concept, people with autism experience the inability to understand that someone else sees things differently to the way that they see things. People with autism can be sympathetic if they understand the distress that the other person is feeling (typically if they have had similar feelings themselves in similar circumstances). Sources: [i.38]</p>

Name of disorder	Autism
Prevalence- How many people are affected?	Although ASD varies significantly in character and severity, it occurs in all ethnic and socioeconomic groups and affects every age group. Experts estimate that 1 out of 88 children age 8 will have an ASD. Males are four times more likely to have an ASD than females. Sources: [i.22]
Potential use and benefits	People with ASD may have extended phases of limited or no communications with others (this may include interaction with communications devices). Suitable applications may help them re-engage with others and things outside their immediate surroundings.
Related ICF Activities and Participation [i.35], [i.15], [i.16], [i.12] and [i.10]	<p>Learning and applying knowledge: d110 Watching, d120 Other purposeful sensing, d130 Copying, d131 Learning through actions with objects, d132 Acquiring information, d134 Acquiring additional language, d137 Acquiring concepts, d140 Learning to read, d145 Learning to write, d150 Learning to calculate, d155 Acquiring skills, d160 Focusing attention, d161 Directing attention, d163 Thinking, d166 Reading, d170 Writing, d172 Calculating, d177 Making decisions.</p> <p>General Tasks and Demands: d210 Undertaking a single task, d2103 Undertaking a single task in a group, d220 Undertaking multiple tasks, d2203 Undertaking multiple tasks in a group, d230 Carrying out daily routine, d2305 Managing one's time, d240 Handling stress and other psychological demands, d250 Managing one's own behaviour.</p> <p>Communication: d310 Communicating with - receiving - spoken messages, d315 Communicating with - receiving - nonverbal messages, d3150 Communicating with - receiving - body gestures, d330 Speaking, d335 producing nonverbal messages, d3350 Producing body language, d350 Conversation, d3500 Starting a conversation, d3501 Sustaining a conversation, d3502 Ending a conversation, d3503 Conversing with one person, d3504 Conversing with many people, d3550 Discussion with one person, d3551 Discussion with many people, d710 Basic interpersonal interactions, d720 Complex interpersonal interactions, d750 Informal social relationships.</p>
Additional ICF Body Functions for complimenting ICF Activities [i.35], [i.15], [i.16], [i.12] and [i.10]	Mental Functions: b140 Attention Functions, b1401 Shifting attention, b1402 Dividing attention, b1403 Sharing attention, b144 Memory functions.

5.7 Attention Deficit/Hyperactivity Disorder fact sheet

Table 6: Attention Deficit/Hyperactivity Disorder fact sheet

Name of disorder	ADHD
DSM-5 Classification [i.4]	Attention-Deficit/Hyperactivity Disorder (59)
ICD-10 Classification [i.17]	<ul style="list-style-type: none"> F90 Hyperkinetic disorders
Description	Attention-Deficit/Hyperactivity Disorder (ADHD) is a common neurobiological condition that is characterized by developmentally inappropriate levels of inattention, impulsivity, and hyperactivity. Sources: [i.23]
Diagnosis/Main symptoms	<p>ADHD predominantly inattentive type (ADHD-I):</p> <ul style="list-style-type: none"> • Fails to give close attention to details or makes careless mistakes. • Has difficulty sustaining attention. • Does not appear to listen. • Struggles to follow through on instructions. • Has difficulty with organization. • Avoids or dislikes tasks requiring sustained mental effort. • Loses things. • Is easily distracted. • Is forgetful in daily activities. • Is a slow starter, has problems to start an activity. <p>ADHD predominantly hyperactive-impulsive type (ADHD-HI):</p> <ul style="list-style-type: none"> • Fidgets with hands or feet or squirms in chair. • Has difficulty remaining seated. • Runs about or climbs excessively. • Difficulty engaging in activities quietly. • Acts as if driven by a motor. • Talks excessively. • Blurts out answers before questions have been completed. • Difficulty waiting or taking turns. • Interrupts or intrudes upon others. <p>ADHD combined type (ADHD-C):</p> <ul style="list-style-type: none"> • Individual meets both sets of inattention and hyperactive/impulsive criteria. <p>Sources: [i.23]</p>
Prevalence- How many people are affected?	ADHD is a common neurobiological condition affecting 5 - 8 percent of school age children with symptoms persisting into adulthood in as many as 60 percent of cases (i.e. approximately 4 % of adults). Sources: [i.23]
Potential use and benefits	Children with ADHD may find it difficult to turn their attention to one activity for a longer period of time. Any application of mobile technology attempting to support children with ADHD should take this into account. Mobile devices for example can support the sense of time and space and give reminders. Mobile applications can attempt to support the behaviour management techniques that are part of the treatment.
Related ICF Activities and Participation [i.35], [i.28] and [i.10]	<p>Learning and applying knowledge: d135 Rehearsing, d160 Focusing attention, d166 Reading, d175 Solving problems, d1750 Solving simple problems, d1751 Solving complex problems, d177 Making decisions.</p> <p>General Tasks and Demands: d210 Undertaking a single task, d2101 Undertaking a complex task, d2103 Undertaking a single task in a group, d220 Undertaking multiple tasks, d2200 Carrying out multiple tasks, d2201 Completing multiple tasks, d2202 Undertaking multiple tasks independently, d2203 Undertaking multiple tasks in a group, d230 Carrying out daily routine, d2301 Managing daily routine, d2302 Completing the daily routine, d2303 Managing one's own activity level, d240 Handling stress and other psychological demands, d2400 Handling responsibilities, d2401 Handling stress, d2402 Handling crisis, d250 Managing one's own behaviour.</p>
Additional ICF Body Functions for complementing ICF Activities [i.35], [i.28] and [i.10]	<p>Mental Functions: b1400 Sustaining attention, b1401 Shifting attention, b1402 Dividing attention, b1440 Short-term memory.</p>

5.8 Dyslexia fact sheet

Table 7: Dyslexia fact sheet

Name of disorder	Dyslexia
DSM-5 Classification [i.4]	Specific Learning Disorder (66)
ICD-10 Classification [i.17]	F81 Specific developmental disorders of scholastic skills
Description	<p>Dyslexia is an alternative term used to refer to a pattern of learning difficulties characterized by problems with accurate or fluent word recognition, poor decoding, and poor spelling abilities.</p> <p>Dyslexia is a language-based learning disability. Dyslexia refers to a cluster of symptoms, which result in people having difficulties with specific language skills, particularly reading. Students with dyslexia usually experience difficulties with other language skills such as spelling, writing, and pronouncing words.</p> <p>Sources: [i.18]</p>
Diagnosis/Main symptoms	<p>The problems displayed by individuals with dyslexia involve difficulties in acquiring and using written language. Spelling can look quite jumbled at times because students have trouble remembering letter symbols for sounds and forming memories for words. Other problems experienced by people with dyslexia include the following:</p> <ul style="list-style-type: none"> • Learning to speak • Learning letters and their sounds • Organizing written and spoken language • Memorizing number facts • Reading quickly enough to comprehend • Persisting with and comprehending longer reading assignments • Spelling • Learning a foreign language • Correctly doing math operations. <p>Sources: [i.18]</p>
Prevalence- How many people are affected?	<p>About 13 - 14 % of the school population has a handicapping condition that qualifies them for special education. Current studies indicate that one half of all the students who qualify for special education are classified as having a Learning Disability (LD) (6 - 7 %). About 85 % of those students have a primary learning disability in reading and language processing. Nevertheless, many more people- perhaps as many as 15 - 20 % of the population as a whole-have some of the symptoms of dyslexia, including slow or inaccurate reading, poor spelling, poor writing, or mixing up similar words.</p> <p>Sources: [i.18]</p>
Potential use and benefits	<p>Dyslexic people are likely to be aware of their impairment and willing to accept any support that improves their condition.</p> <p>Which options exist for supporting dyslexic people through mobile technologies is subject to further study but the use of apps for scanning, speech synthesizer, voice input instead of writing, spell-checking, the use of the camera as a note pad are some of the mobile device uses that can benefit people with dyslexia</p>
Related ICF Activities and Participation [i.35] and [i.25]	<p>Learning and applying knowledge: d140 Learning to read, d145 Learning to write, d150 Learning to calculate, d166 Reading, d170 Writing, d172 Calculating, d1750 Solving simple problems, d1751 Solving complex problems.</p> <p>Communication: d310 Communicating with - receiving - spoken messages, d325 Communicating with - receiving - written messages, d330 Speaking, d345 Writing messages.</p>
Additional ICF Body Functions for complimenting ICF Activities [i.35] and [i.25]	Mental Functions: b140 Attention Functions, b1402 Dividing attention.

5.9 Dyscalculia fact sheet

Table 8: Dyscalculia fact sheet

Name of disorder	Dyscalculia
DSM-5 Classification [i.4]	Specific Learning Disorder (66)
ICD-10 Classification [i.17]	F81.2 specific disorder of arithmetic skills
Description	Dyscalculia is "a difficulty in mathematical performance resulting from impairment to those parts of the brain that are involved in mathematical processing, without a concurrent impairment in general mental function". Sources: [i.24]
Diagnosis/Main symptoms	<ul style="list-style-type: none"> • seeming to have no "sense of number" • having trouble learning error-free counting, memorising arithmetical facts, following procedures, or executing strategies • can do the above task(s), but very slowly • exhibiting dislike of or anxiety towards maths, or avoidance behaviours Sources: [i.24]
Prevalence- How many people are affected?	The prevalence of specific learning disorder across the academic domains of reading, writing, and mathematics is 5 % - 15 % among school-age children across different languages and cultures. Prevalence in adults is unknown but appears to be approximately 4 %. Sources: [i.4]
Potential use and benefits	People with learning impairments in the domain of mathematics are likely to be aware of their impairment and willing to accept any support that improves their condition. Which options exist for supporting people with learning impairments in the domain of mathematics through mobile technologies is subject to further study but mini calculators, apps for scanning numbers and the use of the camera as a notepad are a few examples of the use of a mobile device that can benefit people with dyscalculia.
Related ICF Activities and Participation [i.35] and [i.25]	Learning and applying knowledge: d150 Learning to calculate, d172 Calculating, d1750 Solving simple problems, d1751 Solving complex problems.
Additional ICF Body Functions for complimenting ICF Activities [i.35] and [i.25]	Mental Functions: b140 Attention Functions, b144 Memory functions.

6 Classification of usage needs when using mobile ICT

6.1 Introduction

The usage needs are explicitly related to the cognitive impairments described in clause 5 and are based on the related ICF activities and in some cases also on ICF functions that have been identified in clause 5. The outcomes from this step are described in this clause. Each usage need has a unique short name to enable cross-referencing.

For harmonisation purposes, each usage need below has been mapped, where possible, to the relevant user needs of ISO/IEC TR 29138-1 [i.19].

Clause 6.2 below collects the list of all the identified usage needs. The rationale for each user need and their detailed descriptions are in clauses 6.3 to 6.14.

6.2 List of usage needs

- **Focusing attention: usage with limited ability to focus attention.** Some users need an environment in which there are no stimuli unrelated to their current task.
- **Directing attention: usage with limited ability to direct attention.** Some users need specific support for maintaining attention on their current task.

- **Shifting attention: usage with limited ability to shift attention.** Some users need strong and multimodal stimuli to shift their attention from one task to another.
- **Reading: usage with no ability to read.** Some users need alternatives to the presentation of written language in the form of letters or characters.
- **Recognising written language: usage with limited ability to recognize written language.** Some users need the written language (in the form of letters or characters) to be presented in a way that makes it easier to recognize letters and words.
- **Comprehending written language: usage with limited ability to comprehend written language.** Some users need the written language to be worded using an easy to read style.
- **Writing: usage with no ability to write.** Some users need alternatives to the input of written language.
- **Writing correctly: usage with limited ability to correctly write words and use punctuation.** Some users need specific support for correctly writing words and using punctuation.
- **Producing written language: usage with limited ability to produce written language.** Some users need support to express their ideas using written language.
- **Calculating: usage with no ability to calculate.** Some users need alternatives to the input of the result of calculations.
- **Understanding simple maths: usage with limited ability to understand simple mathematical concepts.** Some users need alternatives to the presentation of mathematical concepts.
- **Making choices: usage with limited ability to make a choice among options.** Some users need specific support for making choices among options.
- **Interpreting effects of choices: usage with limited ability to interpret the effects of choices taken.** Some users need specific support for interpreting the effects of the choices that they have taken.
- **Initiating a task: usage with limited ability to initiate a task.** Some users need specific support for initiating a task.
- **Organising for a task: usage with limited ability to organise for a task.** Some users need specific support for organising time, space and materials for a task.
- **Carrying out a task: usage with limited ability to carry out a task.** Some users need specific support for carrying out the current task.
- **Completing a task: usage with limited ability to complete a task.** Some users need specific support for completing a task.
- **Managing time: usage with limited ability to manage time.** Some users need specific support for planning time and managing time when carrying out tasks.
- **Adapting to time demands: usage with limited ability to adapt to time demands.** Some users need specific support for adapting their task performance when time limits change.
- **Receiving spoken language: usage with no ability to receive spoken language.** Some users need alternatives to the presentation of spoken language.
- **Understanding spoken language: usage with limited ability to understand spoken language.** Some users need the spoken language to be worded using an easy to understand style.
- **Understanding body gestures: usage with limited or no ability to understand body gestures.** Some users need alternatives to the presentation of body gestures.
- **Understanding symbols: usage with limited or no ability to understand symbols.** Some users need alternatives to the presentation of symbols.
- **Understanding drawings and photographs: usage with limited or no ability to understand drawings and photographs.** Some users need alternatives to the presentation of drawings and photographs.

- **Speaking: usage with limited or no ability to speak.** Some users need alternatives to the input of spoken language.
- **Producing gestures: usage with limited or no ability to produce gestures.** Some users need alternatives to the input of gestures.
- **Recalling from short-term memory: usage with limited ability to recall from short-term memory.** Some users need alternatives to the use of short-term memory.
- **Recalling from long-term memory: usage with limited long-term memory.** Some users need alternatives to the use of long-term memory.

6.3 Attention-related usage needs

6.3.1 Introduction

There are two ICF activities related to attention:

d160 Focusing attention. Intentionally focusing on specific stimuli, such as by filtering out distracting noises.

d1600 Focusing attention on the human touch, face and voice. Intentionally attending to features of other persons, such as their face, touch or voice.

d1601 Focusing attention to changes in the environment. Intentionally attending to some element of the environment, such as changes in the quality, quantity or intensity of physical or social stimuli.

d161 Directing attention. Intentionally maintaining attention to specific actions or tasks for an appropriate length of time.

Exclusions: sustaining attention (b1400); undertaking a single task (d210); undertaking a complex task (d220)

In addition, there are several mental functions related to attention:

b140 Attention functions. Specific mental functions of focusing on an external stimulus or internal experience for the required period of time.

Inclusions: functions of sustaining attention, shifting attention, dividing attention, sharing attention; concentration; distractibility

Exclusions: consciousness functions (b110); energy and drive functions (b130); sleep functions (b134); memory functions (b144); psychomotor functions (b147); perceptual functions (b156)

b1400 Sustaining attention. Mental functions that produce concentration for the period of time required.

b1401 Shifting attention. Mental functions that permit refocusing concentration from one stimulus to another.

b1402 Dividing attention. Mental functions that permit focusing on two or more stimuli at the same time.

b1403 Sharing attention. Mental functions that permit focusing on the same stimulus by two or more people, such as a child and a caregiver both focusing on a toy.

There are three main attention-related problems when using mobile ICT:

- Persons who have trouble filtering out non-relevant stimuli (ADHD primarily). This is related to activity d160.
- Persons who have trouble maintaining their focus on the current task, even without external stimuli (ADHD primarily). This is related to activity d161.
- Persons who have trouble in shifting the attention from the current activity to another one (Autism, ADHD, intellectual disabilities primarily). This seems mainly related to the function b1400 (there is no related ICF activity).

As a result there are three proposed usage needs related to attention:

- Focusing attention: usage with limited ability to focus attention
- Directing attention: usage with limited ability to direct attention
- Shifting attention: usage with limited ability to shift attention

6.3.2 Focusing attention: usage with limited ability to focus attention

Some users need an environment in which there are no stimuli unrelated to their current task.

NOTE 1: Related ICF activities: d160 Focusing attention.

NOTE 2: Related ICF functions: b1400 Sustaining attention.

NOTE 3: Related user need in ISO/IEC TR 29138-1: 7-4 [i.19].

NOTE 4: Related diagnoses of cognitive impairments: ADHD, Dementia (including Alzheimer's disease), intellectual disabilities, Aphasia.

NOTE 5: This usage need contradicts Shifting attention: usage with limited ability to shift attention.

NOTE 6: The distracting stimulus can be in any modality: visual, auditory, tactile, etc.

6.3.3 Directing attention: usage with limited ability to direct attention

Some users need specific support for maintaining attention on their current task.

NOTE 1: Related ICF activities: d161 Directing attention.

NOTE 2: Related ICF functions: b1400 Sustaining attention.

NOTE 3: Related user need in ISO/IEC TR 29138-1: 7-4 [i.19].

NOTE 4: Related diagnoses of cognitive impairments: ADHD.

NOTE 5: This usage need contradicts Shifting Attention: usage with limited ability to shift attention.

NOTE 6: The distracting stimulus can be in any modality: visual, auditory, tactile, etc.

6.3.4 Shifting attention: usage with limited ability to shift attention

Some users need strong and multimodal stimuli to shift their attention from one task to another.

NOTE 1: Related ICF activities: none found.

NOTE 2: Related ICF functions: b1401 Shifting attention.

NOTE 3: Related user need in ISO/IEC TR 29138-1 [i.19]: none found.

NOTE 4: Related diagnoses of cognitive impairments: Autism, Dementia (including Alzheimer's disease), intellectual disabilities.

NOTE 5: This usage need contradicts Focusing attention: usage with limited ability to focus attention and Directing attention: usage with limited ability to direct attention.

NOTE 6: Stimuli provided in more than one modality at a time supports this usage need.

6.4 Reading-related usage needs

6.4.1 Introduction

There is one main ICF activity related to reading:

d166 Reading. Performing activities involved in the comprehension and interpretation of written language (e.g. books, instructions, newspapers in text or Braille), for the purpose of obtaining general knowledge or specific information.

Inclusion: Comprehension and interpretation of written language in standard form of letters or characters as well as text created with unique symbols such as icons.

Exclusion: learning to read (d140)

d1660 Using general skills and strategies of the reading process. Recognizing words by applying phonetic and structural analysis and using contextual cues in reading aloud or in silence.

d1661 Comprehending written language. Grasping the nature and meaning of written language in reading aloud or in silence.

An related activity is learning to read, which is excluded by ICF from "reading":

d140 Learning to read. Developing the competence to read written material (including Braille and other symbols) with fluency and accuracy, such as recognizing characters and alphabets, sounding out written words with correct pronunciation, and understanding words and phrases.

d1400 Acquiring skills to recognize symbols including figures, icons, characters, alphabet letters and words. Learning elementary actions of deciphering letters and symbols, characters, and letters and words.

d1401 Acquiring skills to sound out written words. Learning elementary actions of sounding out letters, symbols and words.

d1402 Acquiring skills to understand written words and phrases. Learning elementary actions to grasp the meaning of written words and texts.

And there is one communication activity related to reading:

d325 Communicating with - receiving - written messages. Comprehending the literal and implied meanings of messages that are conveyed through written language (including Braille), such as following political events in the daily newspaper or understanding the intent of religious scripture

The activity "learning to read" is out of scope because an ICT dealing with that activity would be a tutoring system that teaches how to read. The usage needs derived from "learning to read" would be, in consequence, specific to one type of software application.

Therefore, the proposed usage needs for reading should derive from the activity d166 (reading). That would also support activity d325 (receiving written messages). There are three different groups of users:

- **Persons who are totally unable to read.** These users require alternative presentations of information (symbols, icons, speech). Examples of these persons are people with severe language impairments (aphasia in some cases, later stages of dementia, severe and moderate intellectual disabilities, etc.). This is related to d166, as an extreme impairment.
- **Persons who have difficulties with properly identifying letters and words.** These users benefit from specific formatting (clear fonts, good colour contrast, bigger than normal line spacing, etc.) Examples of these users are persons with dyslexia. This is related to d1660.
- **Persons who can read letters and words but have trouble understanding the content.** These users benefit from "easy to read" rules (active voice, short sentences, simplified vocabulary). Examples of these persons are individuals with intellectual disabilities or persons with autism (who can imagine of hundreds of different meanings for a single sentence). This is related to d1661.

As a result there are three proposed usage needs related to reading:

- Reading: usage with ability to read
- Recognising written language: usage with limited ability to recognize written language
- Comprehending written language: usage with limited ability to comprehend written language

6.4.2 Reading: usage with no ability to read

Some users need alternatives to the presentation of written language in the form of letters or characters.

NOTE 1: Related ICF activities: d166 Reading, d325 Communicating with - receiving - written messages.

NOTE 2: Related ICF functions: b16701 Reception of written language.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 1-1, 13-7, 13-14, 14-2, 14-10, 14-12.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), intellectual disabilities, Speech and language impairments.

NOTE 5: This usage need does not contradict another usage need.

6.4.3 Recognising written language: usage with limited ability to recognize written language

Some users need the written language (in the form of letters or characters) to be presented in a way that makes it easier to recognize letters and words.

NOTE 1: Related ICF activities: d1660 Using general skills and strategies of the reading process, d325 Communicating with - receiving - written messages.

NOTE 2: Related ICF functions: b16701 Reception of written language.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 1-3, 7-1, 13-8, 14-1, 14-13.

NOTE 4: Related diagnoses of cognitive impairments: speech and language impairments, dyslexia.

NOTE 5: This usage need does not contradict another usage need.

6.4.4 Comprehending written language: usage with limited ability to comprehend written language

Some users need the written language to be worded using an easy to read style.

NOTE 1: Related ICF activities: d1661 Comprehending written language, d325 Communicating with - receiving - written messages.

NOTE 2: Related ICF functions: b16701 Reception of written language.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 5-12, 7-1, 13-2, 13-8, 14-1, 14-2, 14-10, 14-13, 14-14.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), intellectual disabilities, aphasia.

NOTE 5: This usage need does not contradict another usage need.

6.5 Writing-related usage needs

6.5.1 Introduction

There is one main activity related to writing:

d170 Writing. Using or producing symbols or language to convey information, such as producing a written record of events or ideas or drafting a letter.

Exclusion: learning to write (d145)

d1700 Using general skills and strategies of the writing process. Applying words which convey appropriate meaning, employing conventional sentence structure.

d1701 Using grammatical and mechanical conventions in written compositions. Applying standard spelling, punctuation and proper case forms, etc.

d1702 Using general skills and strategies to complete compositions. Applying words and sentences to convey complex meaning and abstract ideas.

Exclusion: learning to write (d145)

An additional activity is learning to write, which is excluded by ICF from "writing":

d145 Learning to write. Developing the competence to produce symbols that represent sounds, words or phrases in order to convey meaning (including Braille writing and other symbols), such as spelling effectively and using correct grammar.

d1450 Acquiring skills to use writing implements. Learning elementary actions of writing down symbols or letters, such as holding a pencil, chalk or brush, writing a character or a symbol on a of piece paper, using a brailler, keyboard or peripheral device (mouse).

d1451 Acquiring skills to write symbols, characters and alphabet. Learning elementary skills to transpose a sounded or a morpheme into a symbol or a character grapheme.

d1452 Acquiring skills to write words and phrases. Learning elementary skills to transpose spoken words or ideas into written words or phrases.

And there is one communication activity associated with writing:

d345 Writing messages. Producing the literal and implied meanings of messages that are conveyed through written language, such as writing a letter to a friend

As in the case of "reading", the activity "learning to write" is out of scope because an ICT dealing with that activity would be a tutoring system that teaches how to write. The usage needs derived from "learning to write" would be, in consequence, specific to one type of software application.

Therefore, the proposed usage needs for writing should derive from the activity d170 (writing), that also implies support to the activity d345 (writing messages). There are three different groups of users relevant for the present document:

- **Persons who are totally unable to write.** These users require alternative input methods (speech input, symbol-based input such as concept keyboards...). Examples of these persons are people with severe language impairments (aphasia in some cases, later stages of dementia...). This is related to d170, as an extreme impairment.
- **Persons who have difficulties with correctly writing words and punctuation.** These users benefit from orthography checkers/correctors. Examples of these users are persons with dyslexia or more specifically dysorthographia. This is related to d1701.
- **Persons who have trouble producing written content.** These persons may have difficulties to find words with appropriate meaning, and to write sentences using conventional sentence structures. They would benefit from grammar checkers, dictionaries... Examples of these persons could be persons with intellectual disabilities, persons with autism (who might find it difficult to choose appropriate wording for their intended meaning) and persons with aphasia. This is related to d1701.

There could be an additional group of persons having difficulties with writing long compositions (related to activity d1702). But this group is outside the scope as usually ICT interaction only requires short written input.

As a result there are three proposed usage needs related to writing:

- Writing: usage with no ability to write.
- Writing correctly: usage with limited ability to correctly write words and use punctuation.
- Producing written language: usage with limited ability to produce written language.

6.5.2 Writing: usage with no ability to write

Some users need alternatives to the input of written language.

NOTE 1: Related ICF activities: d170 Writing, d345 Writing messages.

NOTE 2: Related ICF functions: b16711 Expression of written language.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 6-21, 7-2, 12-1.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), Intellectual disabilities, Speech and language impairments.

NOTE 5: This usage need does not contradict another usage need.

6.5.3 Writing correctly: usage with limited ability to correctly write words and use punctuation

Some users need specific support for correctly writing words and using punctuation.

NOTE 1: Related ICF activities: d1701 Using grammatical and mechanical conventions in written compositions, d345 Writing messages.

NOTE 2: Related ICF functions: b16711 Expression of written language.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 6-21, 7-2, 9-1, 9-2, 12-1.

NOTE 4: Related diagnoses of cognitive impairments: Speech and language impairments, dyslexia (Dysorthographia).

NOTE 5: This usage need does not contradict another usage need.

6.5.4 Producing written language: usage with limited ability to produce written language

Some users need support to express their ideas using written language.

NOTE 1: Related ICF activities: d1700 Using general skills and strategies of the writing process, d345 Writing messages.

NOTE 2: Related ICF functions: b16711 Expression of written language.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 6-21, 7-2, 9-1, 9-2, 12-1.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), Intellectual disabilities, Aphasia.

NOTE 5: This usage need does not contradict another usage need.

6.6 Calculating-related usage needs

6.6.1 Introduction

In ICF there is one main activity related to calculation:

d172 Calculating. Performing computations by applying mathematical principles to solve problems that are described in words and producing or displaying the results, such as computing the sum of three numbers or finding the result of dividing one number by another.

Exclusion: learning to calculate (d150)

d1720 Using simple skills and strategies of the calculation process. Applying concepts of numeracy, operations and sets to perform calculations.

d1721 Using complex skills and strategies of the calculation process. Applying mathematical procedures and methods such as algebra, calculus and geometry to solve problems.

In addition, there is the activity for learning to calculate, that is excluded from d172.

d150 Learning to calculate. Developing the competence to manipulate numbers and perform simple and complex mathematical operations, such as using mathematical signs for addition and subtraction and applying the correct mathematical operation to a problem.

d1500 Acquiring skills to recognize numerals, arithmetic signs and symbols. Learning elementary skills to recognize and use numbers, arithmetic signs and symbols.

d1501 Acquiring skills of numeracy such as counting and ordering. Learning elementary skills to acquire the concept of numeracy and concepts of the sets.

d1502 Acquiring skills in using basic operations. Learning arithmetic skills to use operations of addition, subtraction, multiplication.

As in the case of "reading" and "writing", the activity "learning to calculate" is out of scope because an ICT dealing with that activity would be a tutoring system that teaches how to calculate. The usage needs derived from "learning to calculate" would be, in consequence, specific to one type of software application.

There is one exception, and it would be the case for persons who are unable to understand mathematical concepts (numbers, sets, etc.). These would be related to activities d1500 and d1501.

Therefore, the proposed usage needs for writing should derive from the activity d172 (calculating) and the two activities related to understanding mathematical concepts (d1500 and d1501). There are two group of users relevant for the usage of mobile ICT:

- **Persons who are totally unable to calculate.** These users require alternative dialogue methods that do not require the user to calculate (for instance, alternatives to calculation-based CAPTCHA). The main example of these persons are people with severe dyscalculia. Other persons with dementia (and Alzheimer's) and aphasia may also be unable to calculate. This is related to d172, as an extreme impairment.
- **People who are unable to understand basic mathematical concepts.** These users require alternative presentations of numbers (such as graphs). The main example of these persons are some people with dyscalculia. This is related to activities d1500 and d1501.

Persons with difficulties that perform simple calculations (related to d1720) can be considered, but there is not a general need for ICT to support people in doing their calculations, except in specific apps.

The same reasoning applies for persons with difficulties to perform complex mathematical operations (related to d1721).

As a result, there are two usage needs related to calculation.

- Calculating: usage with no ability to calculate.
- Understanding simple maths: usage with limited ability to understand simple mathematical concepts.

6.6.2 Calculating: usage with no ability to calculate

Some users need alternatives to the input of the result of calculations.

NOTE 1: Related ICF activities: d172 Calculating.

NOTE 2: Related ICF functions: b172 Calculation functions.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: none found.

NOTE 4: Related diagnoses of cognitive impairments: Dyscalculia, Dementia (including Alzheimer's disease), Aphasia, Autism.

NOTE 5: This usage need does not contradict another usage need.

EXAMPLE: CAPTCHA systems that require the user to write the result of a calculation are examples of ICT systems that ask for the input of the result of calculation.

6.6.3 Understanding simple maths: usage with limited ability to understand simple mathematical concepts

Some users need alternatives to the presentation of mathematical concepts.

NOTE 1: Related ICF activities: d1500 and d1501.

NOTE 2: Related ICF functions: b172 Calculation functions.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: none found.

NOTE 4: Related diagnoses of cognitive impairments: Dyscalculia, Dementia (including Alzheimer's disease), Aphasia, Autism.

NOTE 5: This usage need does not contradict another usage need.

EXAMPLE: One application presents a user data with the number "40 %". An example of alternative presentations could be the use of a pie chart or a sentence ("less than half").

6.7 Decision making-related usage needs

6.7.1 Introduction

There is one activity in ICF related to decision making:

D177 Making decisions. Making a choice among options, implementing the choice, and evaluating the effects of the choice, such as selecting and purchasing a specific item, or deciding to undertake and undertaking one task from among several tasks that need to be done.

Exclusions: thinking (d163); solving problems (d175)

In addition, there are two related activities that are explicit exclusions from making decisions: thinking and solving problems:

d163 Thinking. Formulating and manipulating ideas, concepts, and images, whether goal-oriented or not, either alone or with others, with types of thinking activities, such as pretending, playing with words, creating fiction, proving a theorem, playing with ideas, brainstorming, meditating, pondering, speculating or reflecting.

Exclusions: solving problems (d175); making decisions (d177)

d1630 Pretending. Engaging in make-believe activities involving imaginary persons, places, things or events. **d1631 Speculating.** Manipulating ideas, concepts or images by guessing or assuming something based on incomplete facts or information. **d1632 Hypothesizing.** Manipulating ideas, concepts or images involving the use of abstract thought to state assumptions or to test unproven facts.

d175 Solving problems. Finding solutions to questions or situations by identifying and analysing issues, developing options and solutions, evaluating potential effects of solutions, and executing a chosen solution such as in resolving a dispute between two people.

Inclusions: solving simple and complex problems

Exclusions: thinking (d163); making decisions (d177)

d1750 Solving simple problems. Finding solutions to a simple problem involving a single issue or question, by identifying and analysing the issue, developing solutions, evaluating the potential effects of the solutions and executing a chosen solution.

d1751 Solving complex problems. Finding solutions to a complex problem involving multiple and interrelated issues, or several related problems, by identifying and analysing the issue, developing solutions, evaluating the potential effects of the solutions and executing a chosen solution.

Given the above definitions, thinking (d163) is not an activity where the design of general-purpose mobile ICT can have any impact. There might be therapy-oriented apps to improve or train thinking abilities, but these would be out of scope of the present document.

In the case of solving problems (d177), it is more related to planning and undertaking tasks (see clause 6.8).

In consequence, the usage needs below are derived from the activity "making decisions" (d177). The definition of the activity implies three steps: (1) making a choice among options, (2) implementing the choice and (3) evaluating the effects of the choice. The first step is the one that is more relevant to general-purpose mobile ICT.

There are three different groups of users in relation with making choices:

- **Persons who are totally unable to make a choice among options.** These persons are unable to make decisions and they would require the mobile ICT to make decisions for them (this is called "anticipatory design", see [i.39]). Examples of these persons would be persons with later stages of dementia (and Alzheimer's). This group reflects the total lack of capacity of performing activity d177.
- **Persons who have difficulties in making a choice among options.** These persons can benefit from the mobile ICT reducing the number of items to choose from or by reducing the number of decisions the user has to make (to reduce "decision fatigue"). Examples of this user group include persons with dementia (and Alzheimer's), autism and ADHD. This group is related to activity d177.
- **Persons who have difficulties in interpreting the effects of their choices.** These persons have difficulties in interpreting what has happened in the system after their actions, and will need specific support to clearly identify the results of actions. Examples of this user group include persons with dementia (and Alzheimer's), autism, ADHD and Intellectual disabilities. This group is related to activity d177.

A general-purpose mobile ICT should be cautious on the concept of "anticipatory design" and make decisions on behalf of their users. For the present document, two usage needs have been identified for decision making:

- Making choices: usage with limited ability to make a choice among options.
- Interpreting effects of choices: usage with limited ability to interpret the effects of choices taken.

6.7.2 Making choices: usage with limited ability to make a choice among options

Some users need specific support for making choices among options.

NOTE 1: Related ICF activities: d177 Making decisions.

NOTE 2: Related ICF functions: b1645 Judgement.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 13-11.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), severe and moderate intellectual disabilities, Autism, ADHD.

NOTE 5: This usage need does not contradict another usage need.

EXAMPLE: An example of support for making choices would be a system which provides a two-option menu with one choice that shows the option most used by the user (based on the user's history) and another one that allows the full menu to be opened.

6.7.3 Interpreting effects of choices: usage with limited ability to interpret the effects of choices taken

Some users need specific support for interpreting the effects of the choices that they have taken.

NOTE 1: Related ICF activities: d177 Making decisions.

NOTE 2: Related ICF functions: b1645 Judgement.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 13-11.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), Autism, ADHD, Intellectual disabilities.

NOTE 5: This usage need is related to the fact that some users have difficulties to interpret the results of their actions in the user interface.

EXAMPLE: An example of support for interpreting choices would be clear and multimodal result messages to explain the user what has happened after their actions.

NOTE 6: This usage need does not contradict another usage need.

6.8 Usage needs related to undertaking tasks

6.8.1 Introduction

ICF contains several activities related to undertaking tasks, activities that imply being able to plan actions and then perform them. These are undertaking single tasks, undertaking complex tasks, and carrying out daily routine:

d210 Undertaking a single task. Carrying out simple or complex and coordinated actions related to the mental and physical components of a single task, such as initiating a task, organizing time, space and materials for a task, pacing task performance, and carrying out, completing and sustaining a task.

Inclusions: undertaking a simple or complex task; undertaking a single task independently or in a group

Exclusions: acquiring skills (d155); solving problems (d175); making decisions (d177); undertaking multiple tasks (d220)

d2100 Undertaking a simple task. Preparing, initiating and arranging the time and space required for a simple task; executing a simple task with a single major component, such as building a toy tower, putting on a shoe, reading a book, writing a letter, or making one's bed.

d2101 Undertaking a complex task. Preparing, initiating and arranging the time and space for a single complex task; executing a complex task with more than one component, which may be carried out in sequence or simultaneously, such as making up a place for playing, using several toys in make believe play, arranging the furniture in one's room or completing an assignment for school.

d2102 Undertaking a single task independently. Preparing, initiating and arranging the time and space for a simple or complex task; managing and executing a task on one's own and without the assistance of others, such as in solitary play involving sorting small objects, setting a table or building with blocks.

d2103 Undertaking a single task in a group. Preparing, initiating and arranging the time and space for a single task, simple or complex; managing and executing a task with people who are involved in some or all steps of the task, such as playing hide-and-seek, playing cards or board games with rules, or playing instruments together.

d2104 Completing a simple task. Completing a simple task with a single major component, such as building a toy tower, putting on a shoe, reading a book, writing a letter, or making one's bed.

d2105 Completing a complex task. Completing a complex task with more than one component, which may be carried out in sequence or simultaneously, such as making up a place for playing, using several toys in make believe play, arranging the furniture in one's room or completing an assignment for school.

d220 Undertaking multiple tasks. Carrying out simple or complex and coordinated actions as components of multiple, integrated and complex tasks in sequence or simultaneously.

Inclusions: undertaking multiple tasks; completing multiple tasks; undertaking multiple tasks independently and in a group

Exclusions: acquiring skills (d155); solving problems (d175); making decisions (d177); undertaking a single task (d210)

d2200 Carrying out multiple tasks. Preparing, initiating and arranging the time and space needed for several tasks, and managing and executing several tasks, together or sequentially, such as dressing oneself completely for a cold day or making arrangements for a party.

d2201 Completing multiple tasks. Completing several tasks, together or sequentially, such as getting up and getting ready to leave for school, shopping and completing errands for a friend while shopping.

d2202 Undertaking multiple tasks independently. Preparing, initiating and arranging the time and space for multiple tasks, and managing and executing several tasks together or sequentially, on one's own and without the assistance of others.

d2203 Undertaking multiple tasks in a group. Preparing, initiating and arranging the time and space for multiple tasks, and managing and executing several tasks together or sequentially with others who are involved in some or all steps of the multiple tasks.

d2204 Completing multiple tasks independently. Completing multiple tasks independently, such as completing several assignments for homework, giving food and water to pets, setting the table and preparing dinner for the family.

d2205 Completing multiple tasks in a group. Completing multiple tasks in a group, such as planning the time and place for a sporting event, inviting participants, securing the necessary sports equipment for participation and arranging transportation to and from the activity.

d230 Carrying out daily routine. Carrying out simple or complex and coordinated actions in order to plan, manage and complete the requirements of day-to-day procedures or duties, such as budgeting time and making plans for separate activities throughout the day.

Inclusions: managing and completing the daily routine; managing one's own activity level

Exclusion: undertaking multiple tasks (d220)

d2300 Following routines. Responding to the guidance of others in engaging in basic daily procedures or duties.

d2301 Managing daily routine. Carrying out simple or complex and coordinated actions in order to plan and manage the requirements of day-to-day procedures or duties.

d2302 Completing the daily routine. Carrying out simple or complex and coordinated actions in order to complete the requirements of usual day-to-day procedures or duties, such as fulfilling the daily routines of awakening, getting dressed, eating breakfast, leaving for school or work and returning home at the end of the day.

d2303 Managing one's own activity level. Carrying out actions and behaviours to arrange the requirements in energy and time day-to-day procedures or duties.

d2304 Managing changes in daily routine. Making appropriate transitions in response to new requirements or changes in the usual sequence of activities such as finding another way to travel to school or work when public transport is unavailable.

d2305 Managing one's time. Managing the time required to complete usual or specific activities, such as preparing to depart from the home, taking medications, and accessing assistive technology and supports.

d2306 Adapting to time demands. Carrying out actions and behaviours appropriately in the required sequence and within the time allotted, such as running to the station when in danger of missing the train.

In addition to these task-related activities, a related activity is problem-solving:

d175 Solving problems. Finding solutions to questions or situations by identifying and analysing issues, developing options and solutions, evaluating potential effects of solutions, and executing a chosen solution such as in resolving a dispute between two people.

Inclusions: solving simple and complex problems

Exclusions: thinking (d163); making decisions (d177)

d1750 Solving simple problems. Finding solutions to a simple problem involving a single issue or question, by identifying and analysing the issue, developing solutions, evaluating the potential effects of the solutions and executing a chosen solution.

d1751 Solving complex problems. Finding solutions to a complex problem involving multiple and interrelated issues, or several related problems, by identifying and analysing the issue, developing solutions, evaluating the potential effects of the solutions and executing a chosen solution.

This complex set of activities requires a detailed analysis to identify which activities (or steps inside activities) are relevant in the context of general-purpose mobile ICT. First, doing tasks is divided into several **steps**:

- 1) Initiating a task
- 2) Organizing time, space and materials for a task
- 3) Carrying out the task, while pacing task performance
- 4) Completing and sustaining a task.

In addition, in ICF there are different **types of situations**, depending on several criteria:

- Complexity of the task:
 - **Simple task:** a task with a single major component (building a tower, putting on a shoe, reading a book, writing a letter, or making one's bed).
 - **Complex task:** a task with more than one component, which may be carried out in sequence or simultaneously (making up a place for playing, using several toys in make believe play, arranging the furniture in one's room or completing an assignment for school).
- Number of tasks:
 - **Single task:** the person only carries out one task.
 - **Multiple tasks:** the person has to carry out several tasks, either in sequence or simultaneously.
- Coordination with others:
 - **Undertaking a task independently:** carrying on the task on one's own and without the assistance of others.
 - **Undertaking a task in a group:** carrying on the task with people who are involved in some or all steps of the task.

Finally, there is the issue of **time management**, which is divided into two activities:

- **Managing one's time:** managing (preparing for) the time required to complete activities.
- **Adapting to time demands:** completing activities in the time allotted.

The classification of the task-related activities in ICF, according to the steps of task management, the types of situations and time management is summarized in table 9.

Before identifying usage needs an analysis has been made on the relevance of the: steps in undertaking tasks, types of situations and time management considerations. The idea is to identify which ones are relevant for general-purpose mobile ICT:

- Steps in a task:
 - **Initiating a task.** A mobile ICT platform could provide support to users having problems with initiating tasks, by suggesting the next app to open or the next thing to do.
 - **Organizing time, space and materials for a task.** Mobile ICT can provide support to users having problems with element organisation inside applications by automatically labelling, organising or archiving the contents to be used (files, videos, photos, etc.). Mobile ICT can also provide search functionality instead of asking the users to classify contents.
 - **Carrying out the task, while pacing task performance.** Mobile ICT can support users having problems with carrying out the task, by providing clear explanations of what is the next step of a process or by providing orientation information to help the user know where the current step fits in the whole process.
 - **Completing and sustaining a task.** Mobile ICT can support users having problems with knowing when the task current has been completed, by providing clear messages.
- Types of situations:
 - **Complexity of the task:** the experts have not identified additional specific support that the Mobile ICT can provide to persons that perform complex tasks, beyond what is already defined for the steps of a task.
 - **Number of tasks:** the experts have not identified additional specific support that the Mobile ICT can provide to persons that perform multiple tasks, beyond what is already defined for the steps of a task.
 - **Coordination with others:** the experts have not identified additional specific support that the Mobile ICT can provide to persons that perform tasks individually or in a team, beyond what is already defined for the steps of a task (or other communication-related issues that are considered in other usage needs).
- Time management:
 - **Managing time.** Mobile ICT can provide support to persons that have problems with managing their time. For example, the system could present information about the remaining time, or the next event in a calendar.
 - **Adapting to time.** Mobile ICT can provide support to persons that have problems with adapting to changes in time requirements, by presenting clear information about when and why the time limit has changed.

Table 9: Analysis of characteristics of task-related activities in ICF

	Steps in a task				Type of situation			Time management	
	Initiating	Organizing	Carrying on	Completing	Complexity	Number of tasks	Coordination	Managing time	Adapting to time
d2100 Undertaking a simple task	✓	✓	✓	-	Simple	Single	-	-	-
d2101 Undertaking a complex task	✓	✓	✓	-	Complex	Single	-	-	-
d2102 Undertaking a single task independently	✓	✓	✓	-	-	Single	Indep.	-	-
d2103 Undertaking a single task in a group	✓	✓	✓	-	-	Single	Group	-	-
d2104 Completing a simple task	-	-	-	✓	Simple	-	-	-	-
d2105 Completing a complex task	-	-	-	✓	Complex	-	-	-	-
d2200 Carrying out multiple tasks	✓	✓	✓	-	-	Multiple	-	-	-
d2201 Completing multiple tasks	-	-	-	✓	-	Multiple	-	-	-
d2202 Undertaking multiple tasks independently	✓	✓	✓	-	-	Multiple	Indep.	-	-
d2203 Undertaking multiple tasks in a group	✓	✓	✓	-	-	Multiple	Group	-	-
d2204 Completing multiple tasks independently	-	-	-	✓	-	Multiple	Indep.	-	-
d2205 Completing multiple tasks in a group	-	-	-	✓	-	Multiple	Group	-	-
d2305 Managing one's time	-	-	-	-	-	-	-	✓	-
d2306 Adapting to time demands	-	-	-	-	-	-	-	-	✓

This analysis leads to the conclusion that mobile ICT can provide support to each of the four steps of carrying out tasks, plus the two activities related to time management. The following groups of users can be identified, based on the assumption that the complete absence of a task-related ability cannot be supported by generic-purpose mobile ICT:

- Persons who have difficulties to initiate a task
- Persons who have difficulties to get organised time, space and materials for a task
- Persons who have difficulties to carry out the task
- Persons who have difficulties to complete a task
- Persons who have difficulties to manage time
- Persons who have difficulties to adapt to time changes

This lead to a set of six task-related usage needs:

- Initiating a task: usage with limited ability to initiate a task
- Organising for a task: usage with limited ability to get organised time for a task

- Carrying out a task: usage with limited ability to carry out a task
- Completing a task: usage with limited ability to complete a task
- Managing time: usage with limited ability to manage time
- Adapting to time demands: usage with limited ability to adapt to time demands

6.8.2 Initiating a task: usage with limited ability to initiate a task

Some users need specific support for initiating a task.

NOTE 1: Related ICF activities: d2100 Undertaking a simple task, d2101 Undertaking a complex task, d2102 Undertaking a single task independently, d2103 Undertaking a single task in a group, d2200 Carrying out multiple tasks, d2202 Undertaking multiple tasks independently, d2203 Undertaking multiple tasks in a group.

NOTE 2: Related ICF functions: b1641 Organization and planning.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 7-3.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), intellectual disabilities, Aphasia, Autism, ADHD.

NOTE 5: This usage need does not contradict another usage need.

EXAMPLE: An example of support for initiating a task can be a mobile platform that suggests the user the next application to open, based on the usage history.

6.8.3 Organising for a task: usage with limited ability to get organised time for a task

Some users need specific support for organising time, space and materials for a task.

NOTE 1: Related ICF activities: d2100 Undertaking a simple task, d2101 Undertaking a complex task, d2102 Undertaking a single task independently, d2103 Undertaking a single task in a group, d2200 Carrying out multiple tasks, d2202 Undertaking multiple tasks independently, d2203 Undertaking multiple tasks in a group.

NOTE 2: Related ICF functions: b1641 Organization and planning.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 7-3.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), intellectual disabilities, Aphasia, Autism, ADHD.

NOTE 5: This usage need does not contradict another usage need.

EXAMPLE: An example of support for organising a task can be a system that automatically labels, organises or archives the contents (files, videos, photos, etc.) to be used for a task. Mobile ICT can also provide search functionality instead of asking the users to classify contents by themselves.

6.8.4 Carrying out a task: usage with limited ability to carry out a task

Some users need specific support for carrying out the current task.

NOTE 1: Related ICF activities: d2100 Undertaking a simple task, d2101 Undertaking a complex task, d2102 Undertaking a single task independently, d2103 Undertaking a single task in a group, d2200 Carrying out multiple tasks, d2202 Undertaking multiple tasks independently, d2203 Undertaking multiple tasks in a group.

NOTE 2: Related ICF functions: b1641 Organization and planning.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 13-8, 13-10.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), intellectual disabilities, Aphasia, Autism, ADHD.

NOTE 5: This usage need does not contradict another usage need.

EXAMPLE: An example of support for carrying out a task could be a system that provides clear explanations of what is the next step of a process or that provides orientation information to help the user know where the current step fits in the whole process.

6.8.5 Completing a task: usage with limited ability to complete a task

Some users need specific support for completing a task.

NOTE 1: Related ICF activities: d2104 Completing a simple task, d2105 Completing a complex task, d2201 Completing multiple tasks, d2204 Completing multiple tasks independently, d2205 Completing multiple tasks in a group.

NOTE 2: Related ICF functions: b1641 Organization and planning.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 13-8, 13-10.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), intellectual disabilities, Aphasia, Autism, ADHD.

NOTE 5: This usage need does not contradict another usage need.

EXAMPLE: An example of support for completing a task could be a mobile ICT that provides clear and simple messages to let the user know when the current task has been completed.

6.8.6 Managing time: usage with limited ability to manage time

Some users need specific support for planning time and managing time when carrying out tasks.

NOTE 1: Related ICF activities: d2305 Managing one's time.

NOTE 2: Related ICF functions: b1140 Orientation to time, b1600 Pace of thought, b1642 Time management.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 7-1, 7-2, 7-4.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), Aphasia, Autism, ADHD, Intellectual disabilities.

NOTE 5: This usage need does not contradict another usage need.

EXAMPLE: An example of support for time management could be a system presenting clear information about the remaining time, or a system presenting information about the next event in the user's calendar.

6.8.7 Adapting to time demands: usage with limited ability to adapt to time related events and tasks

Some users need specific support for adapting their task performance when time limits change.

NOTE 1: Related ICF activities: d2306 Adapting to time demands.

NOTE 2: Related ICF functions: b1140 Orientation to time, b1600 Pace of thought, b1642 Time management.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 7-1, 7-2, 7-4.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), Aphasia, Autism, ADHD, Intellectual disabilities.

NOTE 5: This usage need does not contradict another usage need.

EXAMPLE: An example of support for problems in adaptation to time limit changes can be a system that presents clear information about when and why a time limit has changed. Another example can be a system allowing the user to extend time limits as necessary.

6.9 Usage needs related to receiving speech

6.9.1 Introduction

There is one main activity in ICF related to receiving (and understanding) speech:

d310 Communicating with - receiving - spoken messages. Comprehending literal and implied meanings of messages in spoken language, such as understanding that a statement asserts a fact or is an idiomatic expression, such as responding and comprehending spoken messages.

d3100 Responding to the human voice. Responding to the human voice in a very basic manner reflected by changes in breathing patterns, or with gross or fine body movements.

d3101 Comprehending simple spoken messages. Responding appropriately in actions or with words to simple spoken messages (2-3 words) such as requests (e.g. give me) or commands (e.g. no, come here).

d3102 Comprehending complex spoken messages. Responding appropriately in actions or with words to complex spoken messages (complete sentences), such as questions or instructions.

There is one ICF function related to reception of speech:

b16700 Reception of spoken language. Mental functions of decoding spoken messages to obtain their meaning.

In the case of the use of ICT, the persons having limitations with these activities would have problems with the speech output of an ICT system. In that context, the inability to respond to the human voice (d3100) does not seem to be relevant.

The other two activities are related to understand simple or complex spoken messages. If one person has difficulties to understand very simple spoken messages, then that person will probably be unable to understand the speech output of an ICT. This would put them in the same group as users that are totally unable to understand speech (activity d310). The group of users having troubles with complex speech is a different group, as they would benefit from clear language.

In conclusion there are two different groups of users:

- **Persons who are totally unable to receive spoken language.** These users do not understand speech and would require alternative presentations of information (mainly visual information, such as text, captions, pictograms...). Examples of these persons are people with severe language impairments (persons with aphasia in some cases, later stages of dementia, speech and language impairments/language disorders, etc.). This is related to d310 and d3101, as an extreme impairment.
- **Persons who have difficulties to understand spoken language.** These users would benefit from "easy to understand" spoken language, that could be based on grammar-related rules for "easy to read" written language. Examples of these persons could be persons with intellectual disabilities, persons with autism (who can imagine of hundreds of different meanings for a single sentence), persons with aphasia or also persons with speech and language impairments (language disorder). This is related to d3102.

As a result there are two proposed usage needs related to reading.

- Receiving spoken language: usage with no ability to receive spoken language
- Understanding spoken language: usage with limited ability to understand spoken language

6.9.2 Receiving spoken language: usage with no ability to receive spoken language

Some users need alternatives to the presentation of spoken language.

NOTE 1: Related ICF activities: d310 Communicating with - receiving - spoken messages, d3101 Comprehending simple spoken messages.

NOTE 2: Related ICF functions: b16700 Reception of spoken language.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: none found.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), severe intellectual disabilities, Aphasia, Speech and language impairments.

NOTE 5: This usage need does not contradict another usage need.

6.9.3 Understanding spoken language: usage with limited ability to understand spoken language

Some users need the spoken language to be worded using an easy to understand style.

NOTE 1: Related ICF activities: d3102 Comprehending complex spoken messages.

NOTE 2: Related ICF functions: b16700 Reception of spoken language.

NOTE 3 Related user needs in ISO/IEC TR 29138-1 [i.19]: 13-2, 13-3.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), Intellectual disabilities, Aphasia, Speech and language impairments.

NOTE 5: This usage need does not contradict another usage need.

6.10 Usage needs related to receiving non-verbal messages

6.10.1 Introduction

There is one main activity related to the reception and understanding of non-verbal messages, d315. This excludes the reception of formal sign languages, such as the ones used by some deaf persons.

d315 Communicating with - receiving - nonverbal messages. Comprehending the literal and implied meanings of messages conveyed by gestures, symbols and drawings, such as realizing that a child is tired when she rubs her eyes or that a warning bell meaning that there is a fire.

Inclusions: communicating with - receiving - body gestures, general signs and symbols, drawings and photographs

d3150 Communicating with - receiving - body gestures. Comprehending the meaning conveyed by facial expressions, hand movements or signs, body postures, and other forms of body language.

d3151 Communicating with - receiving - general signs and symbols. Comprehending the meaning represented by public signs and symbols, such as traffic signs, warning symbols, musical or scientific notations, and icons.

d3152 Communicating with - receiving - drawings and photographs. Comprehending the meaning represented by drawings (e.g. line drawings, graphic designs, paintings, three-dimensional representations, pictograms), graphs, charts and photographs, such as understanding that an upward line on a height chart indicates that a child is growing.

There is one related body function:

b16703 Reception of gestural language. Mental functions of decoding messages in non-formalized gestures made by hands and other movements in order to obtain their meaning.

When using ICT, the three sub-activities of d315 are relevant. First, an ICT might be presenting animated characters, and that would require the ability to comprehend body gestures (d3150, b16703). Second, ICT usually rely on icons to convey commands, and this require the ability to understand the icons (d3151). Finally, the ICT might present photographs or graphics, which require the user to be able to understand them (d3152).

Taking this into account, three groups of users can be identified:

- **Persons who are unable or have difficulties to understand body gestures.** These users do not understand or might have difficulties to understand the body gestures of animated avatars generated by ICT. They would require alternative presentations of information (such as a text or speech description of the meaning of the gestures). These persons mainly include persons with Autism, but also some cases of Dementia (including Alzheimer's disease), Aphasia and Speech and Language Impairments.
- **Persons who are unable to, or have difficulties to, understand the meaning represented by images (including icons, line drawings, paintings, three-dimensional representations, pictograms and photographs) presented by the ICT.** They would require alternative presentations of information (such as a text or speech labels for icons) or even the possibility to change the image for another that is easier for the user to understand. These persons include people with intellectual disabilities, persons with aphasia and some cases of Dementia (including Alzheimer's disease).
- **Persons who are unable or have difficulties to understand drawings and photographs.** These users do not understand or might have difficulties to understand drawings (including graphs) and photographs presented by ICT. They would require alternative presentations of information (such as a text or speech descriptions that explain the meaning of the drawing or photograph). These persons include some cases of Dementia (including Alzheimer's disease), Aphasia and Speech and Language Impairments.

As a result there are three proposed usage needs related to receiving non-verbal messages.

- Understanding body gestures: usage with limited or no ability to understand body gestures
- Understanding symbols: usage with limited or no ability to understand symbols
- Understanding drawings and photographs: usage with limited or no ability to understand drawings and photographs

6.10.2 Understanding body gestures: usage with limited or no ability to understand body gestures

Some users need alternatives to the presentation of body gestures.

NOTE 1: Related ICF activities: d3150 Communicating with - receiving - body gestures.

NOTE 2: Related ICF functions: b16703 Reception of gestural language.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: none found.

NOTE 4: Related diagnoses of cognitive impairments: Autism, Dementia (including Alzheimer's disease), Aphasia and Speech and Language Impairments.

NOTE 5: This usage need does not contradict another usage need.

EXAMPLE: An example of meeting this usage need would be an ICT presenting an animated character, which also presents speech output describing the emotions shown by the animated character.

6.10.3 Understanding symbols: usage with limited or no ability to understand symbols

Some users need alternatives to the presentation of symbols.

NOTE 1: Related ICF activities: d3151 Communicating with - receiving - general signs and symbols.

NOTE 2: Related ICF functions: none found.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 13-2, 13-3, 13-9, 14-14.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), Aphasia and Speech and Language Impairments.

NOTE 5: This usage need does not contradict another usage need.

EXAMPLE: An example of meeting this usage need would be an ICT presenting labels associated to icons.

6.10.4 Understanding drawings and photographs: usage with limited or no ability to understand drawings and photographs

Some users need alternatives to the presentation of drawings and photographs.

NOTE 1: Related ICF activities: d3152 Communicating with - receiving - drawings and photographs.

NOTE 2: Related ICF functions: none found.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 1-1, 14-2.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), Aphasia and Speech and Language Impairments.

NOTE 5: This usage need does not contradict another usage need.

EXAMPLE: An example of meeting this usage need would be an ICT providing textual descriptions of the contents of drawings of photographs. These textual descriptions would then be presented as text or as speech.

6.11 Usage needs related to speaking

6.11.1 Introduction

In ICF there is one activity related to speaking:

d330 Speaking. Producing words, phrases and longer passages in spoken messages with literal and implied meaning, such as expressing a fact or telling a story in oral language.

And there is one related mental function:

b16710 Expression of spoken language. Mental functions necessary to produce meaningful spoken messages.

When using ICT, this is only an issue if the ICT is expecting speech input produced by the user. This is a need that has been recognized in ETSI EN 301 549 [i.13], as the functional performance statement 4.2.6:

Usage without vocal capability. Where ICT requires vocal input from users, some users will need the ICT to provide at least one mode of operation that does not require them to generate vocal output.

For the use of ICT there is no clear difference between users that are completely unable to produce speech and users who have limited ability to produce speech, given the current state of speech recognition systems. Thus, in this case, there is one group of users:

- **Persons who are unable or have difficulties to produce speech.** These persons need alternatives to speech input, such as typing, or tapping on icons. Groups of cognitive impairments that present this usage need include Dementia (and Alzheimer's disease), Intellectual disabilities, Aphasia, Speech and Language impairments, and Autism.

In consequence, there is only one usage need related to speaking. i.e.:

- Speaking: usage with limited or no ability to speak

6.11.2 Speaking: usage with limited or no ability to speak

Some users need alternatives to the input of spoken language.

NOTE 1: Related ICF activities: d330 Speaking.

NOTE 2: Related ICF functions: b16710 Expression of spoken language.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 6-5.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), Intellectual disabilities, Aphasia, Speech and language impairments, and Autism.

NOTE 5: This usage need is the same as the functional performance statement 4.2.6 (Usage without vocal capability) of ETSI EN 301 549 [i.13].

NOTE 6: This usage need does not contradict another usage need.

6.12 Usage needs related to producing non-verbal messages

6.12.1 Introduction

The ICF activities related to the production of non-verbal messages follow:

d335 Producing nonverbal messages. Using gestures, symbols and drawings to convey messages, such as shaking one's head to indicate disagreement or drawing a picture or diagram to convey a fact or complex idea.

Inclusions: producing body gestures, signs, symbols, drawings and photographs

d3350 Producing body language. Conveying messages by intentional movements of the body, such as facial gestures (e.g. smiling, frowning, wincing), by arm and hand movements, and by postures (e.g. embracing to indicate affection or pointing to receive attention or an object).

d3351 Producing signs and symbols. Conveying meaning by using signs and symbols (e.g. icons, Bliss board, scientific symbols) and symbolic notation systems, such as using musical notation to convey a melody.

d3352 Producing drawings and photographs. Conveying meaning by drawing, painting, sketching, and making diagrams, pictures or photographs, such as drawing a map to give someone directions to a location.

There is one mental function related to producing non-verbal communication:

b16713 Expression of gestural language. Mental functions necessary to produce messages in non-formalized gestures made by hands and other movements.

In the context of using mobile ICT, the main problem is the inability (or difficulty) to produce gestures, which are essential in today's mobile interactions. That is linked to the main activity (d335) or even more specifically to the mental function (b16713 Expression of gestural language) and not to the detailed sub-activities of d335.

Thus, there is only one group of users having specific needs related to the production of non-verbal messages:

- **Persons who are unable or have difficulties to produce gestures.** These persons cannot produce (or have difficulties to produce) meaningful gestures and need alternative forms of input when interacting with ICT. Groups of users include some cases of Dementia (including Alzheimer's disease), Aphasia and Autism.

The result of this analysis is one usage need.

- Producing gestures: usage with limited or no ability to produce gestures

6.12.2 Producing gestures: usage with limited or no ability to produce gestures

Some users need alternatives to the input of gestures.

NOTE 1: Related ICF activities: d335 Producing nonverbal messages.

NOTE 2: Related ICF functions: b16710 Expression of spoken language.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: none found.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), Intellectual disabilities, Aphasia and Autism.

NOTE 5: This usage need does not contradict another usage need.

EXAMPLE: An example of meeting this usage need is an ICT system that provides modes of operation that do not require the input of gestures (for instance, by providing keyboard or speech access).

6.13 Usage needs related to memory

6.13.1 Introduction

There are no memory-related activities in ICF, due to the fact that memory functions are basic mental functions that need to be used to perform many of the ICF activities.

ICF defines the following mental functions related to memory.

b144 Memory functions. Specific mental functions of registering and storing information and retrieving it as needed.

Inclusions: functions of short-term and long-term memory, immediate, recent and remote memory; memory span; retrieval of memory; remembering; functions used in recalling and learning, such as in nominal, selective and dissociative amnesia.

Exclusions: consciousness functions (b110); orientation functions (b114); intellectual functions (b117); attention functions (b140); perceptual functions (b156); thought functions (b160); higher-level cognitive functions (b164); mental functions of language (b167); calculation functions (b172).

b1440 Short-term memory. Mental functions that produce a temporary, disruptable memory store of around 30 seconds duration from which information is lost if not consolidated into long-term memory.

b1441 Long-term memory. Mental functions that produce a memory system permitting the long-term storage of information from short-term memory and both autobiographical memory for past events and semantic memory for language and facts.

b1442 Retrieval and processing of memory. Specific mental functions of recalling information stored in long-term memory and bringing it into awareness.

There might be persons with no memory at all who would probably be completely unable to use mobile ICT. Therefore the groups of users who have specific needs related to their use of memory will be persons with limitations in producing short-term memory, producing long-term memory and retrieving information from long-term memory. The two last groups can probably be combined into one, related to the use of long-term memory, as from the interaction viewpoint it is believed to be very similar to support the user to produce memory and to support the user to retrieve it.

In consequence, there are two groups of users with difficulties with memory:

- *Persons who have difficulties to produce short-term memory.* These persons have difficulties to remember menu items or even short sequences of numbers or letter. They need the ICT to always present relevant information so that they do not need to store it in short-term memory during an activity. Persons in this group include persons with Dementia (and Alzheimer's disease), persons with intellectual disabilities, persons with aphasia and persons with ADHD.
- *Persons who have difficulties with long-term memory.* These persons have difficulties to memorize how a system works or they have troubles retrieving that information from their long-term memory. That may cause problems because they will not remember the system functioning after a period of time without using the system. Persons in this group mainly include persons with Dementia (or Alzheimer's disease).

The result of this analysis is a set of two usage needs.

- Recalling from short-term memory: usage with limited ability to produce short-term memory

- Recalling from long-term memory: usage with limited long-term memory

6.13.2 Recalling from short-term memory: usage with limited ability to produce short-term memory

Some users need alternatives to the use of short-term memory.

NOTE 1: Related ICF activities: There are a lot of activities related to short-term memory, such as reading, writing, sustaining a conversation, speaking, calculating, etc.

NOTE 2: Related ICF functions: b1440 Short-term memory.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 14-1, 14-10.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease), Intellectual disabilities, and ADHD.

NOTE 5: This usage need does not contradict another usage need.

EXAMPLE: An example of meeting this usage need is an ICT system that groups the input of a credit card number into groups of 4 digits, to make it easier to copy the number from the physical card.

6.13.3 Recalling from long-term memory: usage with limited long-term memory

Some users need alternatives to the use of long-term memory.

NOTE 1: Related ICF activities: none.

NOTE 2: Related ICF functions: b1441 Long-term memory, b1442 Retrieval and processing of memory.

NOTE 3: Related user needs in ISO/IEC TR 29138-1 [i.19]: 14-1, 14-10.

NOTE 4: Related diagnoses of cognitive impairments: Dementia (including Alzheimer's disease).

NOTE 5: An example of meeting this usage need is an ICT system that always shows the actions that are available in one screen as clearly labelled buttons, instead of only relying on gestures. This is because gestures need to be memorized and remembered.

NOTE 6: This usage need does not contradict another usage need.

6.14 Usage needs related to using communication devices and techniques

In ICF there is a set of activities related to communication devices and techniques:

d360 Using communication devices and techniques. Using devices, techniques and other means for the purposes of communicating, such as calling a friend on the telephone.

Inclusions: using telecommunication devices, using writing machines and communication techniques

d3600 Using telecommunication devices. Using telephones and other machines, such as facsimile or telex machines or computers (e-mail) as a means of communication.

d3601 Using writing machines. Using machines for writing, such as typewriters, computers and Braille writers, as a means of communication.

d3602 Using communication techniques. Performing actions and tasks involved in techniques for communicating, such as reading lips.

Of these activities, the usage of telecommunication devices as a whole (d3600) is the purpose of the present document, and thus cannot be used to derive specific usage needs. Secondly, the use of human-to-human communication techniques (d3602), such as lip-reading, is outside the scope of the present document.

This only leaves one group of users, the ones having difficulties to writing using machines. This is slightly different to having limited writing abilities (see clause 4) and has more to do to the inability of using writing devices such as keyboards. That means that a person could be able to write, but unable to type in a keyboard.

Even in that case, it is highly probable that the needs of these persons would be completely covered by the more generic "usage with no ability to write" usage need (Writing) described in clause 4 of the present document.

In consequence, there are no new defined usage needs for using ICT that can be directly derived from ICF.

Annex A: ICF-related cognitive activities and functions

A.1 Introduction

This annex mainly lists those activities and functions related to the selected cognitive impairments according to the International Classification of Functioning, Disability and Health Model of World Health Organisation [i.35].

A.2 Cognitive-related activities

A.2.1 Introduction

In the ICF, the activities that are of relevance to the present document are divided into three categories:

- Learning and applying knowledge.
- General tasks and demands.
- Communication.

A.2.2 Learning and applying knowledge

Below is a subset of ICF activities related to "learning and applying knowledge" that are of relevance to the present document. For each activity, the ICF code, name and definition are provided.

- **d130 Copying.** Imitating or mimicking as a basic component of learning, such as copying a gesture, a sound or the letters of an alphabet.
- **d135 Rehearsing.** Repeating a sequence of events or symbols as a basic component of learning, such as counting by tens or practising the recitation of a poem.
- **d140 Learning to read.** Developing the competence to read written material (including Braille) with fluency and accuracy, such as recognizing characters and alphabets, sounding out words with correct pronunciation, and understanding words and phrases.
- **d145 Learning to write.** Developing the competence to produce symbols that represent sounds, words or phrases in order to convey meaning (including Braille writing), such as spelling effectively and using correct grammar.
- **d150 Learning to calculate.** Developing the competence to manipulate numbers and perform simple and complex mathematical operations, such as using mathematical signs for addition and subtraction and applying the correct mathematical operation to a problem.
- **d1550 Acquiring basic skills.** Learning elementary, purposeful actions, such as learning to manipulate eating utensils, a pencil or a simple tool.
- **d1551 Acquiring complex skills.** Learning integrated sets of actions so as to follow rules, and to sequence and coordinate one's movements, such as learning to play games like football or to use a building tool.
- **d160 Focusing attention.** Intentionally focusing on specific stimuli, such as by filtering out distracting noises.
- **d163 Thinking.** Formulating and manipulating ideas, concepts, and images, whether goal-oriented or not, either alone or with others, such as creating fiction, proving a theorem, playing with ideas, brainstorming, meditating, pondering, speculating, or reflecting.
- **d166 Reading.** Performing activities involved in the comprehension and interpretation of written language (e.g. books, instructions or newspapers in text or Braille), for the purpose of obtaining general knowledge or specific information.

- **d170 Writing.** Using or producing symbols or language to convey information, such as producing a written record of events or ideas or drafting a letter.
- **d172 Calculating.** Performing computations by applying mathematical principles to solve problems that are described in words and producing or displaying the results, such as computing the sum of three numbers or finding the result of dividing one number by another.
- **d1750 Solving simple problems.** Finding solutions to a simple problem involving a single issue or question, by identifying and analysing the issue, developing solutions, evaluating the potential effects of the solutions and executing a chosen solution.
- **d1751 Solving complex problems.** Finding solutions to a complex problem involving multiple and interrelated issues, or several related problems, by identifying and analysing the issue, developing solutions, evaluating the potential effects of the solutions and executing a chosen solution.
- **d177 Making decisions.** Making a choice among options, implementing the choice, and evaluating the effects of the choice, such as selecting and purchasing a specific item, or deciding to undertake and undertaking one task from among several tasks that need to be done.

A.2.3 General tasks and demands

Below is a subset of ICF activities related to "general tasks and demands" that are of relevance to the present document. For each activity, the ICF code, name and definition are provided.

- **d2100 Undertaking a simple task.** Preparing, initiating and arranging the time and space required for a simple task; executing a simple task with a single major component, such as reading a book, writing a letter, or making one's bed.
- **d2101 Undertaking a complex task.** Preparing, initiating and arranging the time and space for a single complex task; executing a complex task with more than one component, which may be carried out in sequence or simultaneously, such as arranging the furniture in one's home or completing an assignment for school.
- **d2102 Undertaking a single task independently.** Preparing, initiating and arranging the time and space for a simple or complex task; managing and executing a task on one's own and without the assistance of others.
- **d2103 Undertaking a single task in a group.** Preparing, initiating and arranging the time and space for a single task, simple or complex; managing and executing a task with people who are involved in some or all steps of the task.
- **d2200 Carrying out multiple tasks.** Preparing, initiating and arranging the time and space needed for several tasks, and managing and executing several tasks, together or sequentially.
- **d2201 Completing multiple tasks.** Completing several tasks, together or sequentially.
- **d2202 Undertaking multiple tasks independently.** Preparing, initiating and arranging the time and space for multiple tasks, and managing and executing several tasks together or sequentially, on one's own and without the assistance of others.
- **d2203 Undertaking multiple tasks in a group.** Preparing, initiating and arranging the time and space for multiple tasks, and managing and executing several tasks together or sequentially with others who are involved in some or all steps of the multiple tasks.
- **d2301 Managing daily routine.** Carrying out simple or complex and coordinated actions in order to plan and manage the requirements of day-to-day procedures or duties.
- **d2302 Completing the daily routine.** Carrying out simple or complex and coordinated actions in order to complete the requirements of day-to-day procedures or duties.
- **d2303 Managing one's own activity level.** Carrying out actions and behaviours to arrange the requirements in energy and time day-to-day procedures or duties.
- **d2400 Handling responsibilities.** Carrying out simple or complex and coordinated actions to manage the duties of task performance and to assess the requirements of these duties.

- **d2401 Handling stress.** Carrying out simple or complex and coordinated actions to cope with pressure, emergencies or stress associated with task performance.
- **d2402 Handling crisis.** Carrying out simple or complex and coordinated actions to cope with decisive turning points in a situation or times of acute danger or difficulty.

A.2.4 Communication

Below is a subset of ICF activities related to "communication" that are of relevance to the present document. For each activity, the ICF code, name and definition are provided.

- **d310 Communicating with - receiving - spoken messages.** Comprehending literal and implied meanings of messages in spoken language, such as understanding that a statement asserts a fact or is an idiomatic expression.
- **d3150 Communicating with - receiving - body gestures.** Comprehending the meaning conveyed by facial expressions, hand movements or signs, body postures, and other forms of body language.
- **d3151 Communicating with - receiving - general signs and symbols.** Comprehending the meaning represented by public signs and symbols, such as traffic signs, warning symbols, musical or scientific notations, and icons.
- **d3152 Communicating with - receiving - drawings and photographs.** Comprehending the meaning represented by drawings (e.g. line drawings, graphic designs, paintings, three-dimensional representations), graphs, charts and photographs, such as understanding that an upward line on a height chart indicates that a child is growing.
- **d325 Communicating with - receiving - written messages.** Comprehending the literal and implied meanings of messages that are conveyed through written language (including Braille), such as following political events in the daily newspaper or understanding the intent of religious scripture.
- **d330 Speaking.** Producing words, phrases and longer passages in spoken messages with literal and implied meaning, such as expressing a fact or telling a story in oral language.
- **d3350 Producing body language.** Conveying meaning by movements of the body, such as facial gestures (e.g. smiling, frowning, wincing), arm and hand movements, and postures (e.g. such as embracing to indicate affection).
- **d3351 Producing signs and symbols.** Conveying meaning by using signs and symbols (e.g. icons, Bliss board, scientific symbols) and symbolic notation systems, such as using musical notation to convey a melody.
- **d3352 Producing drawings and photographs.** Conveying meaning by drawing, painting, sketching, and making diagrams, pictures or photographs, such as drawing a map to give someone directions to a location.
- **d345 Writing messages.** Producing the literal and implied meanings of messages that are conveyed through written language, such as writing a letter to a friend.
- **d3500 Starting a conversation.** Beginning a dialogue or interchange, such as by introducing oneself, expressing customary greetings, and introducing a topic or asking questions.
- **d3501 Sustaining a conversation.** Continuing and shaping a dialogue or interchange by adding ideas, introducing a new topic or retrieving a topic that has been previously mentioned, as well as by taking turns in speaking or signing.
- **d3502 Ending a conversation.** Finishing a dialogue or interchange with customary termination statements or expressions and by bringing closure to the topic under discussion.
- **d3503 Conversing with one person.** Initiating, maintaining, shaping and terminating a dialogue or interchange with one person, such as in discussing the weather with a friend.
- **d3504 Conversing with many people.** Initiating, maintaining, shaping and terminating a dialogue or interchange with more than one individual, such as in starting and participating in a group interchange.

- **d3550 Discussion with one person.** Initiating, maintaining, shaping or terminating an argument or debate with one person.
- **d3551 Discussion with many people.** Initiating, maintaining, shaping or terminating an argument or debate with more than one individual.
- **d3600 Using telecommunication devices.** Using telephones and other machines, such as facsimile or telex machines, as a means of communication.
- **d3601 Using writing machines.** Using machines for writing, such as typewriters, computers and Braille writers, as a means of communication.

A.3 Cognitive-related functions

A.3.1 Introduction

In the ICF, the functions that are of relevance to the present document are the "mental functions". These are a subset of the category body functions. Mental functions are the functions of the brain. They include global mental functions, such as consciousness, energy and drive, and specific mental functions, such as memory, language and calculation mental functions.

A.3.2 Global mental functions

Below is a subset of ICF global mental functions that are referenced and used in clause 6. For each function the ICF code, name and definition are provided.

- **b1102 Quality of consciousness.** Mental functions that when altered effect changes in the character of wakeful, alert and aware sentience, such as drug-induced altered states or delirium.
- **b1140 Orientation to time.** Mental functions that produce awareness of day, date, month and year.
- **b1141 Orientation to place.** Mental functions that produce awareness of one's location, such as one's immediate surroundings, one's town or country.
- **b11420 Orientation to self.** Mental functions that produce awareness of one's own identity.
- **b11421 Orientation to others.** Mental functions that produce awareness of the identity of other individuals in one's immediate environment.
- **b117 Intellectual functions.** General mental functions, required to understand and constructively integrate the various mental functions, including all cognitive functions and their development over the life span.
- **b122 Global psychosocial functions.** General mental functions, as they develop over the life span, required to understand and constructively integrate the mental functions that lead to the formation of the interpersonal skills needed to establish reciprocal social interactions, in terms of both meaning and purpose.
- **b1262 Conscientiousness.** Mental functions that produce personal dispositions such as being hard-working, methodical and scrupulous, as contrasted to mental functions producing dispositions such as in being lazy, unreliable and irresponsible.
- **b1263 Psychic stability.** Mental functions that produce a personal disposition that is even-tempered, calm and composed, as contrasted to being irritable, worried, erratic and moody.
- **b1264 Openness to experience.** Mental functions that produce a personal disposition that is curious, imaginative, inquisitive and experience-seeking, as contrasted to being stagnant, inattentive and emotionally inexpressive.
- **b1266 Confidence.** Mental functions that produce a personal disposition that is self-assured, bold and assertive, as contrasted to being timid, insecure and self-effacing.
- **b1300 Energy level.** Mental functions that produce vigour and stamina.

- **b1301 Motivation.** Mental functions that produce the incentive to act; the conscious or unconscious driving force for action.
- **b1304 Impulse control.** Mental functions that regulate and resist sudden intense urges to do something.

A.3.3 Specific mental functions

Below is a subset of ICF specific mental functions that are of relevance to the present document. For each function the ICF code, name and definition are provided.

- **b1400 Sustaining attention.** Mental functions that produce concentration for the period of time required.
- **b1401 Shifting attention.** Mental functions that permit refocusing concentration from one stimulus to another.
- **b1402 Dividing attention.** Mental functions that permit focusing on two or more stimuli at the same time.
- **b1403 Sharing attention.** Mental functions that permit focusing on the same stimulus by two or more people, such as a child and a caregiver both focusing on a toy.
- **b1440 Short-term memory.** Mental functions that produce a temporary, disruptable memory store of around 30 seconds duration from which information is lost if not consolidated into long-term memory.
- **b1441 Long-term memory.** Mental functions that produce a memory system permitting the long-term storage of information from short-term memory and both autobiographical memory for past events and semantic memory for language and facts.
- **b1442 Retrieval of memory.** Specific mental functions of recalling information stored in long-term memory and bringing it into awareness.
- **b1520 Appropriateness of emotion.** Mental functions that produce congruence of feeling or affect with the situation, such as happiness at receiving good news.
- **b1521 Regulation of emotion.** Mental functions that control the experience and display of affect.
- **b1522 Range of emotion.** Mental functions that produce the spectrum of experience of arousal of affect or feelings such as love, hate, anxiousness, sorrow, joy, fear and anger.
- **b1560 Auditory perception.** Mental functions involved in discriminating sounds, tones, pitches and other acoustic stimuli.
- **b1561 Visual perception.** Mental functions involved in discriminating shape, size, colour and other ocular stimuli.
- **b1564 Tactile perception.** Mental functions involved in distinguishing differences in texture, such as rough or smooth stimuli, detected by touch.
- **b1565 Visuospatial perception.** Mental function involved in distinguishing by sight the relative position of objects in the environment or in relation to oneself.
- **b1600 Pace of thought.** Mental functions that govern speed of the thinking process.
- **b1601 Form of thought.** Mental functions that organize the thinking process as to its coherence and logic.
- **b1602 Content of thought.** Mental functions consisting of the ideas that are present in the thinking process and what is being conceptualized.
- **b1603 Control of thought.** Mental functions that provide volitional control of thinking and are recognized as such by the person.
- **b1640 Abstraction.** Mental functions of creating general ideas, qualities or characteristics out of, and distinct from, concrete realities, specific objects or actual instances.
- **b1641 Organization and planning.** Mental functions of coordinating parts into a whole, of systematizing; the mental function involved in developing a method of proceeding or acting.

- **b1642 Time management.** Mental functions of ordering events in chronological sequence, allocating amounts of time to events and activities.
- **b1643 Cognitive flexibility.** Mental functions of changing strategies, or shifting mental sets, especially as involved in problem-solving.
- **b1644 Insight.** Mental functions of awareness and understanding of oneself and one's behaviour.
- **b1645 Judgement.** Mental functions involved in discriminating between and evaluating different options, such as those involved in forming an opinion.
- **b1646 Problem-solving.** Mental functions of identifying, analysing and integrating incongruent or conflicting information into a solution.
- **b16700 Reception of spoken language.** Mental functions of decoding spoken messages to obtain their meaning.
- **b16701 Reception of written language.** Mental functions of decoding written messages to obtain their meaning.
- **b16702 Reception of sign language.** Mental functions of decoding messages in languages that use signs made by hands and other movements, in order to obtain their meaning.
- **b16710 Expression of spoken language.** Mental functions necessary to produce meaningful spoken messages.
- **b16711 Expression of written language.** Mental functions necessary to produce meaningful written messages.
- **b16712 Expression of sign language.** Mental functions necessary to produce meaningful messages in languages that use signs made by hands and other movements.
- **b1672 Integrative language functions.** Mental functions that organize semantic and symbolic meaning, grammatical structure and ideas for the production of messages in spoken, written or other forms of language.
- **b1720 Simple calculation.** Mental functions of computing with numbers, such as addition, subtraction, multiplication and division.
- **b1721 Complex calculation.** Mental functions of translating word problems into arithmetic procedures, translating mathematical formulas into arithmetic procedures, and other complex manipulations involving numbers.
- **b176 Mental function of sequencing complex movements.** Specific mental functions of sequencing and coordinating complex, purposeful movements.
- **b1800 Experience of self.** Specific mental functions of being aware of one's own identity and one's position in the reality of the environment around oneself.
- **b1802 Experience of time.** Specific mental functions of the subjective experiences related to the length and passage of time.

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History

Document history		
V1.1.1	December 2016	Publication